

Physical **Physical** EDUCATION **EDUCATION**

Class XII

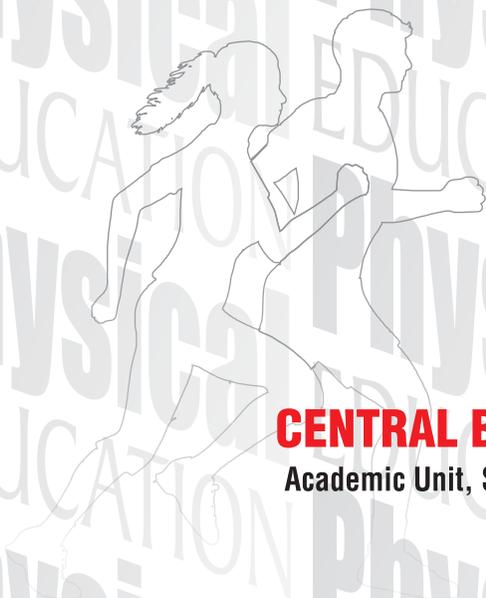


CENTRAL BOARD OF SECONDARY EDUCATION

Academic Unit, Shiksha Sadan, 17, Rouse Avenue, New Delhi-110 002

Physical EDUCATION

Class XII



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Physical Education

Class XII

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THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a ¹**[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the² [unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

1. Subs, by the Constitution (Forty-Second Amendment) Act, 1976, sec. 2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs, by the Constitution (Forty-Second Amendment) Act, 1976, sec. 2, for "unity of the Nation" (w.e.f. 3.1.1977)

THE CONSTITUTION OF INDIA

Chapter IV A

FUNDAMENTAL DUTIES

ARTICLE 51A

Fundamental Duties - It shall be the duty of every citizen of India-

- (a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
- (b) to cherish and follow the noble ideals which inspired our national struggle for freedom;
- (c) to uphold and protect the sovereignty, unity and integrity of India;
- (d) to defend the country and render national service when called upon to do so;
- (e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
- (f) to value and preserve the rich heritage of our composite culture;
- (g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;
- (h) to develop the scientific temper, humanism and the spirit of inquiry and reform;
- (i) to safeguard public property and to abjure violence;
- (j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;
- ¹(k) who is a parent or guardian to provide opportunities for education to his/her child or, as the case may be, ward between age of six and fourteen years.

1. Ins. by the constitution (Eighty - Sixth Amendment) Act, 2002 S.4 (w.e.f. 12.12.2002)

भारत का संविधान

उद्देशिका

हम, भारत के लोग, भारत को एक सम्पूर्ण¹ प्रभुत्व-संपन्न समाजवादी पंथनिरपेक्ष लोकतंत्रात्मक गणराज्य बनाने के लिए, तथा उसके समस्त नागरिकों को:

सामाजिक, आर्थिक और राजनैतिक न्याय,
विचार, अभिव्यक्ति, विश्वास, धर्म

और उपासना की स्वतंत्रता,
प्रतिष्ठा और अवसर की समता

प्राप्त कराने के लिए
तथा उन सब में व्यक्ति की गरिमा

²और राष्ट्र की एकता और अखंडता
सुनिश्चित करने वाली बंधुता बढ़ाने के लिए

दृढ़संकल्प होकर अपनी इस संविधान सभा में आज तारीख 26 नवम्बर, 1949 ई० को एतद्वारा इस संविधान को अंगीकृत, अधिनियमित और आत्मार्पित करते हैं।

1. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977) से “प्रभुत्व-संपन्न लोकतंत्रात्मक गणराज्य” के स्थान पर प्रतिस्थापित।
2. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977) से “राष्ट्र की एकता” के स्थान पर प्रतिस्थापित।

भाग 4 क

मूल कर्तव्य

51 क. मूल कर्तव्य - भारत के प्रत्येक नागरिक का यह कर्तव्य होगा कि वह -

- (क) संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्रध्वज और राष्ट्रगान का आदर करे;
- (ख) स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाले उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे;
- (ग) भारत की प्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण रखे;
- (घ) देश की रक्षा करे और आह्वान किए जाने पर राष्ट्र की सेवा करे;
- (ङ) भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे जो धर्म, भाषा और प्रदेश या वर्ग पर आधारित सभी भेदभाव से परे हों, ऐसी प्रथाओं का त्याग करे जो स्त्रियों के सम्मान के विरुद्ध हैं;
- (च) हमारी सामासिक संस्कृति की गौरवशाली परंपरा का महत्त्व समझे और उसका परिरक्षण करे;
- (छ) प्राकृतिक पर्यावरण की जिसके अंतर्गत वन, झील, नदी, और वन्य जीव हैं, रक्षा करे और उसका संवर्धन करे तथा प्राणी मात्र के प्रति दयाभाव रखे;
- (ज) वैज्ञानिक दृष्टिकोण, मानववाद और ज्ञानार्जन तथा सुधार की भावना का विकास करे;
- (झ) सार्वजनिक संपत्ति को सुरक्षित रखे और हिंसा से दूर रहे;
- (ञ) व्यक्तिगत और सामूहिक गतिविधियों के सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत प्रयास करे जिससे राष्ट्र निरंतर बढ़ते हुए प्रयत्न और उपलब्धि की नई उंचाइयों को छू ले;
- ¹(ट) यदि माता-पिता या संरक्षक है, छह वर्ष से चौदह वर्ष तक की आयु वाले अपने, यथास्थिति, बालक या प्रतिपाल्य के लिये शिक्षा के अवसर प्रदान करे।

1. संविधान (छयासीवां संशोधन) अधिनियम, 2002 की धारा 4 द्वारा प्रतिस्थापित।



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- Procedure to Draw Fixtures - Knock-Out (Bye & Seeding) & League (Staircase & Cyclic)
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Note to the User

Importance of Physical Education

Let us, at the outset, determine what Physical Education means. Physical Education is a systematic training of an individual to achieve the objectives of developing physical abilities and motor skills and of making a healthy lifestyle a habit. Physical Education has moved from being an extra-curricular part of school syllabus to being an integral part of the curriculum since UN Convention on the Rights of the Child on May 1st 2012, brought in through Article 31 "The child's right to play". In India, too, with the focus on "Swasth Bharat", the primary thrust is on wellness, preventive health care and awareness. This makes it essential that health and physical fitness issues are addressed at different levels of schooling. With this objective, CBSE has made Physical Education compulsory in schools and is in the process of developing textbooks on Health and Physical Education for Classes XI and XII to train children for a healthier lifestyle.

A sound Sports Policy must regulate the implementation of school sports consistently for all learners, irrespective of ability, across all schools in an age appropriate way based on the principle of equity. This policy applies to all the schools affiliated to CBSE. Keeping in mind the need for inclusion and the right for each child to good health, there is a chapter on Physical Education and Sports for Children with Special Needs that deals with the meaning and importance of adapted physical education and the role of special educators for Children with Special Needs (CWSN)..

As an essential part of education, Physical Education helps the learners acquire skills that improve their performance, sharpen knowledge of strategy and tactics, and helps them to transfer knowledge from one context to another, including sports and recreational and outdoor activities. Participation in sports and games builds confidence, teaches the necessary knowledge and skills for working with and relating to others, and provides the learning opportunities to develop skills like qualities of leadership and teamwork skills. This learning is transferred to other learning areas, when, for example, students cooperate and work together in groups in other subjects in the school setting and in their lives outside of school. As students learn 'in, through, and about' movement, they gain an understanding that movement is integral to human expression and can enhance their lives. By demonstrating the benefits of an active life style, they encourage others to participate in sports, dance, exercise, recreation, and adventure pursuits.

Physical Education provides a solid foundation in preparing citizens to live a healthy life by involving them in an active lifestyle. As a discipline, it prepares students for higher studies in fields related to movement and the body, including social and health sciences, recreation, and tourism. It provides a pathway into the many careers that involve working with people, in diverse areas as education, health, justice, and the social services.





As a subject of study, this textbook of Physical Education highlights a holistic understanding of health, focussing on the importance of exercise, games and sports, nutrition and the environment. This book also discusses the psycho-social and mental health related issues of not just sportspersons, but also children at large and collective responsibilities for healthy community living.

About the Book

The Text Book has a **goal-oriented, activity-based and investigative approach**. Learning Outcomes are laid out before each chapter listing the desired assessment standards and expected levels of learning that children should achieve for that Lesson. These outcomes can be used as check points to assess formative learning and would help teachers to understand the learning levels of children in their respective classes individually as well as collectively.

Holistic Learning refers not only to an all-round development of the learner, but also to a cross-curricular approach. It also means learning must be related to life. The **Discussion section** that precedes each chapter encourages the learner to examine existing knowledge and to relate what he is learning to his/her life. The learning thereby becomes more meaningful to the child.

Physical education engages and energises students. It provides authentic contexts in which to learn. Given the **multidisciplinary nature of this subject**, cross references have also been integrated into the curriculum. There is a chapter on Anatomy and Physiology and on Psychology. Students challenge themselves to develop their physical and interpersonal skills.

The approach towards learning is **Experiential or learning through experience**. This is distinct from rote or didactic learning, in which the learner plays a comparatively passive role. Experiential learning entails a hands-on approach to learning that moves away from just the teacher at the front of the room imparting and transferring their knowledge to students. It makes learning an experience that moves beyond the classroom and strives to bring a more involved way of learning.

The **Do You Know** sections provide useful related information that may be used by the learner in Project work or activities.

Extension Activities are an integral part of the Book and students learn as they research, conduct surveys, debate, discuss, write and draw cartoons and design posters. They experience movement and understand the role that it plays in their lives.

Art Integration section includes activities from all major spheres of Art, i.e. music, dance, visual and verbal arts, theatre and culinary arts to provide an outlet for the child's creative expression and an opportunity for development of life skills.

The **Case Study Activity** with each Unit provides the student an opportunity to understand and practice writing analytical answers based on a given verbal/visual input.





UNIT-I: PLANNING IN SPORTS

Content

- Meaning and Objectives of Planning
- Various Committees and their Responsibilities (pre; during and post)
- Tournament – Knock-Out, League or Round Robin and Combination
- Procedure to Draw Fixtures – Knock-Out (Bye and Seeding) and League (Staircase and Cyclic)
- Intramural and Extramural – Meaning, Objective and Significance
- Specific Sports Programme (Sports Day, Health Run, Run for Fun, Run for Specific Cause and Run for Unity)

Learning Objective

After completing the study of the unit, you will be able to:

- Describe the concept of planning in sports
- Classify the committees and its responsibilities in sports event
- differentiate the different type of tournament
- prepare fixtures of knock out and league
- distinguish between intramural and extramural
- design sports program in their school

Discussion
Discuss with your group

List down the essential areas that you need to plan if you are organizing a sports event in your school.

Q. Have you heard about fixture in sports? Discuss in your group and share your views with the class.





1.1.1 Planning

Planning is the foremost function in sports as it gives a view of future course of action. To be effective, a plan should be specific, logical, flexible and complete in all aspects and should assist in controlling future events. A plan must comprehend all the other functions of management like organising, staffing, directing and controlling in order to achieve the predetermined goals.

In sports and sports events, planning plays important role to make the event run smoothly, effectively and remain free from conflict. Effective planning must clearly define aims, goals and objectives of the event. It should also explain the procedure or method to achieve the target in simple and easy to understand language. A sports plan should be prepared in a professional manner incorporating the elements of commitment, enjoyment and voluntary effort.

Do You Know?

Functions of Management:-

Planning: It is the process of creating a comprehensive action plan to achieve organizational goal(s). Planning is an ongoing step, and can be highly specialized based on organizational goals, division goals, departmental goals, and team goals.

Organizing: This includes distributing resources and organizing personnel in order to achieve the goals established in the planning function.

Staffing: This refers to identifying key staff positions, and to ensuring that the proper talent is serving that specific job duty in order to achieve the aims and objectives of an organization.

Directing: Directing personnel is a leadership quality, and includes letting staff know what needs to be done, and also by when. It includes supervision of personnel while simultaneously motivating them.

Controlling: Controlling refers to all the processes that leaders create to monitor success. It involves establishing performance standards, measuring actual performance and comparing them irregularities.

According to Koontz and O' Donnell, "Planning is an intellectual process, conscious determination of course of action, the basing of decision on purpose, facts and considered estimates."¹

McFarland has defined Planning as "a concept of executive action that embodies the skills of anticipating, influencing and controlling the nature and direction of change."²





Planning is the process of deciding in advance what is to be done, Who is to do it, How it is to be done and When it is to be done.³

Planning is the aspect of managing which establishes aims, targets, goals and objectives, and identifies the methods by which these targets can be achieved.⁴

The planning function includes defining organizational goals and determining the appropriate means by which to achieve these desired goals.⁵

Peter Drucker defined as “planning is the continuous process of making present entrepreneurial decisions systematically and with best possible knowledge their futurity, organizing systematically the efforts needed to carry out these decisions and measuring the results of these decisions against the expectation through organised systematic feedback.”⁶

Thus, planning is an intellectual activity, which involves selection of the most viable processes from among the alternatives. It is a systematic attempt to anticipate the future course of action and decide the most suitable one.

1.1.2 Objectives of Planning

As discussed above, planning is a process that involves selection of the most viable processes from many given alternatives. In order to anticipate the future course of action systematically, and to decide the best option, it is essential to understand the important objectives of planning in sports.

Goal oriented: Planning is a goal-oriented activity, i.e., it gives direction and vision to the conducting of sports events. Without determining the goal, a plan cannot be executed. Planning aims at realistic goal settings and their attainment. For example, if the physical education department of the school desires to conduct an intramural tournament in the month of January next year, they must plan well in advance. Before setting an objective for a sports event, an individual must have full knowledge of the event and its various aspects, must conduct scientific study regarding the conduct of the event, should collect information related to the event to be conducted such as level of the tournament. It must be decided well in advance, for example, Will the event be Intramural or Extramural?, where (venue)?, when (time)? and how many events (as per interest, feasibility, infrastructure, number of participants) etc.

Policy: Development of a policy is very important to set boundaries for overall conduct of the event. This will serve as a guide and assist in decision making. Policy specifies the broad areas or limits in which decisions can be taken to achieve aims and objectives like decisions on finance or on technical issues, defining content of organizing, formation of committees etc.

Economy: Planning helps in cost reduction, as it increases coordination and financial control. Budget should be prepared in quantitative terms, covering all aspects of the sports events





which are to be conducted. It should focus on the quantum of funds involved, details of income and expenditure under different heads and various stages of approvals and disbursal.

Defining the course of action: Good planning fixes the procedure. Procedure describes the steps to be taken to accomplish a task keeping in view the policies and predetermined objectives. It helps in standardizing the work of committees, heads or individuals. It helps in structured achievement of the task at hand. In a nutshell, it is all about how policies will be implemented, or, who, how, when and what an individual will do as per the plan.

Rules and regulations: Guidelines comprising rules and regulations of games or tournament should be prepared and published well in advance to keep the scope for subjectivity and bias in judgement very low. It makes the process independent and self-sustainable.

Extension Activity

Working in your group, plan in detail the Interclass / Interhouse Basketball matches to be held in your school.

Share your plan with the class. Vote for the best plan.

Conduct a small tournament within your school keeping in mind the plan you have created.

Strategy: It provides the way through which an organisation can successfully achieve its goals, i.e., successfully conduct the event. To achieve long term goals the organisation must draw a strategic plan and rigorously follow the same. It provides direction in identification of resources, event requirements, and selection of personnel to meet with environmental threats or unforeseen risks. The organization can prove to be stronger, more capable and efficient by defining how its members can support the overall strategy. Strategic planning considers changes or anticipated changes in the environment that suggest more radical moves away from current practices. It helps to predict the future direction and provides the roadmap for achieving predetermined goals.

I. Tick the correct option

Q1. The basic function of management is:

- (a) Controlling
- (b) Budgeting
- (c) **Planning**
- (d) Organising

Q2. A good plan should **NOT** be:





- (a) specific
- (b) logical
- (c) **autocratic**
- (d) flexible

Q3. In planning, defining procedure means:

- (a) setting goals
- (b) making a policy
- (c) laying down rules and regulations
- (d) **defining course of action**

II. Answer the following questions briefly

Q1. Define Planning

Q2. Explain objective of planning related to budget.

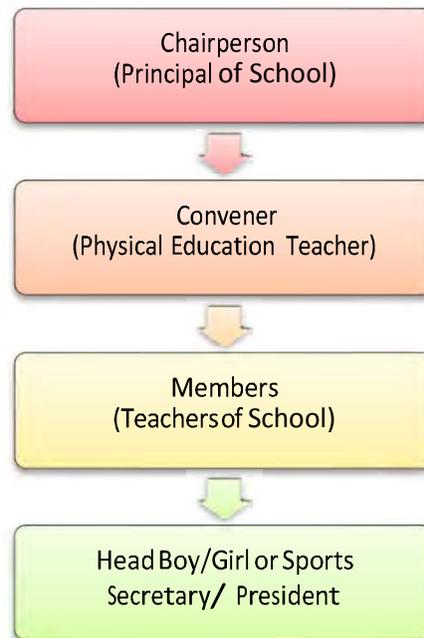
1.2.1 Formation of Committees

To organise any sports event, various committees are formed for its systematic and smooth conduct. As we have discussed earlier, to conduct sports events lots of professional planning and preparation is required. Formation of committees should be based on three levels of management – top, middle and lower levels. Depending upon the level or area of the sports event, people are chosen to appropriate committees. For example, for an intramural event, members of the governing body or the Principal will remain the top level of management, whereas in an extramural event, the Director/Deputy Director/Supervisor of the state/ zone may be at the top level of management.

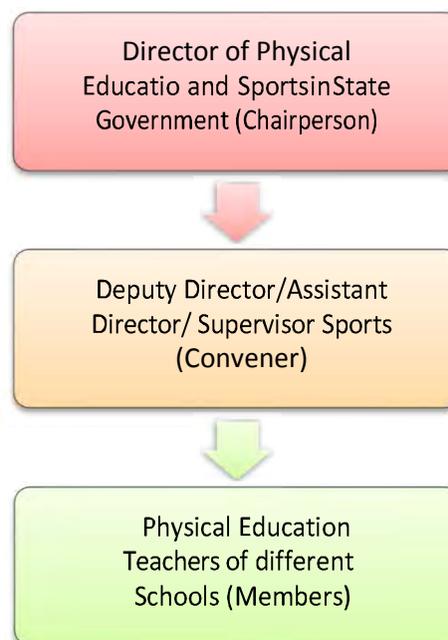
They prepare policies or aims and objectives of the sports event. Middle level of management consists of department heads, physical education teachers etc, to execute policies and achieve aims and objectives. The Lower level of management consists of teachers, administrators, finance officers etc. They implement the orders and directives of the top level.

Hierarchy of Organising Committee to conduct Intramural Event in School/ institution



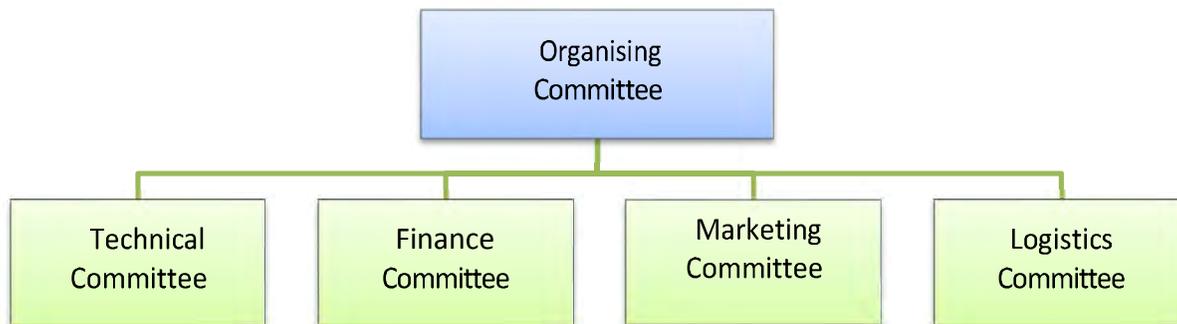


Hierarchy of Organising Committee to conduct Extramural Event in Schools/ institutions



There is no fixed number of committees to be constituted to organise a sports event; it depends on the number of participants, level of event, area of specialization, dedication of volunteers etc. By and large we can formulate 4 committees under an organising committee. Look at the following chart to study their details of work and their responsibilities:





1.2.2 Technical Committee

This committee covers the technical aspect of the events like requisitions to procure sports equipment, conducting matches on time through selected officials (referees, umpires, judges, timekeepers etc.) for their respective games/sports.

Pre-sports event/ tournament: Before the event, it is the job of the Technical Committee to put forward a requisition to purchase equipment, invitation and confirmation from officials to conduct sports event, cleaning and layout of the fields, arrangement of equipment and stationery, preparation of fixtures, rules and regulation of the sports event.

During sports event/ tournament: While the tournament is in progress, the Technical Committee is responsible for conducting matches, presence of the jury, cleaning and layout of the fields, collection of score sheets and other related papers from officials, preparation of merit list, etc.

Post sports event/ tournament: After the event is over, the Technical Committee arranges for the cleaning and layout of the fields, maintenance of the field, and placing of all equipment back to store.

1.2.3 Logistics Committee

This committee has a wider scope of work ranging from transportation, boarding and lodging to refreshment, decoration and conducting ceremonies that form a part of the event. This committee may have various sub-committees as per requirement. The Logistics Committee looks after the Opening Ceremony, hires photographer/ videographer, makes arrangements for the Victory Ceremony and the Closing Ceremony including arrangement of refreshment, decoration, reception, entertainment, light and sound, Medical aspect etc.





Pre sports event/ tournament: It is the duty of the Logistics Committee to look after Placement/Arrangement/Requisition of purchase of stationery, chairs, tables, souvenirs, light and sound equipment, bouquets, sending invitations to stakeholders including other schools/ institutions and VIP guests, requisition of purchase of medals and certificates, arrangement of refreshments, arrangement of boarding and lodging, selection of volunteers, preparation of first aid kit and arrangement of medical facilities.

During sports event/ tournament: While the event is in progress, the Logistics Committee is responsible for the conduct of the Opening and Closing Ceremonies, checking registration, distribution of refreshment, management of spectators, handing over of medals and certificates, transportation of players/participants from place of stay to the field and back.

Post sports event/ tournament: After the event, the Logistics Committee supervises cleaning of the venue, and placing of the items back in their appointed places.

1.2.4 Finance Committee

The role of the Finance Committee is primarily to provide financial oversight for the event. It is involved in all aspects related to the finances of the sports event like planning, accounting, decision-making etc. Finalization of sponsorship, keeping an eye on inflow and outflow of finances, purchase of equipment and other items required for conducting the event, settling payments of officials are key areas of focus of the committee. It is the backbone of the sports tournament. It pitches to different companies and attracts them for sponsorships for the event.

Pre sports event/ tournament: Before the event, It is the responsibility of Finance Committee to prepare the budget, to purchase sports equipment, stationery, medals, certificates, and other requirements as desired by the other committees, as well as preparing and finalizing the MoU with sponsors.

During sports event/ tournament: During the course of the event, the Finance Committee keeps a check on the outflow and inflow of finances including payment and remuneration to officials.

Post sports event/ tournament: Once the event is over, the Finance Committee examines all records related to settlement of the bills and accounts, and prepares the financial report.





1.2.5 Marketing Committee

The Marketing Committee develops plans and strategies to place the event in the market with the purpose of generating publicity and sponsorships. Publicity can be done through various modes like social media, print media, TV, e-mail etc. and sponsorship can be generated in terms of cash or kind by making media partners, food partners, drink partners etc. through calling on, meeting various companies etc. Marketing Committee also organises campaigns related to the event.

Pre sports event/ tournament: The Marketing Committee prepares a strategy for arranging for sponsorships, publicity of the event, arranging meetings or calling on sponsors, preparation of MoUs for sponsorships etc.

During sports event/ tournament: The Marketing Committee issues press release(s), works with media, manages methods of communication, fulfils the requirements of sponsors as per MoUs, arrangement for telecast of event etc.

Post sports event/ tournament: Once the event is over, the Committee issues a press release, and may arrange for a re-telecast of the event.

Art Integration

Your School is hosting CBSE Regional Sports Meet. Plan and present a Folk Art for the Opening Ceremony.

Do You Know?

Check list to organising a sports event

1. Formation of Organising Committees
2. Establishment of Objectives
3. Theme of the event
4. Date of the event
5. Place of the event
6. Budget
7. Sponsorship
8. Marketing (Campaign)
9. Invitations to teams and guests
10. Conformation of teams
11. Logistics (Accommodations, Refreshments, Transportation, Medical Staff, Water, table, chairs, flags, notice board)
12. Checking on the sponsors





13. Drawing Fixtures and layout of field
14. Rules and Regulations
15. Arrangement of Equipment and score sheets
16. Arrangement of Referees and Prizes
17. Direction to the stadium (Sign posts)
18. Briefing of Volunteers and staff
19. Decorations
20. Practice and warm up Area
21. Security
22. Photographers
23. Approvals License and NOCs

Extension Activity

Working in groups, write a Press Release to be issued by your school regarding the District Badminton Championship hosted by your school.

I. Tick the correct option

- Q1. The Committee responsible for liaison with Print media is
- (a) Technical
 - (b) Logistics
 - (c) **Marketing**
 - (d) Finance
- Q2. Purchase of sports equipment is a work of _____ committee:
- (a) Technical
 - (b) Logistics
 - (c) Marketing
 - (d) **Finance**
- Q3. Publication of rules and regulations should be done:
- (a) **Pre event**
 - (b) During event
 - (c) Post event
 - (d) Any time during the event

[10]





II. Answer the following questions briefly:

- Q1. What should be the role of technical committee while organizing the event.
- Q2 Explain the role of marketing committee during the event.

1.3.1 Tournament

In sports, an individual generally supports a particular team or player to win the game. Winning helps that team or player reach the next round, and after a specified number of matches, a player or a team wins the Championship. While watching a tournament, you would have seen sometimes a player or team lose a game, and get eliminated from the tournament. However, in some tournaments they remain in the game despite losing. Why is this so? Basically, there are different types of tournament based on duration, cost, manpower, level, interest etc. that you will study here.

Thus, Tournament is a series of games or matches played among players or teams to determine the winner. It provides an opportunity to demonstrate skills, evaluate one's performance and motivate players to perform well, attract people towards sports to make sports popular and provide healthy entertainment.

A contest of many persons in some sport or game in which the competitors play a series of games.⁷

A series of contest between a number of competitors.⁸

A contest of skill in which players compete in a series of games.⁹

A series of games or contests that make up a single unit of competition of a professional tour or the championship play-offs of a league or conference.¹⁰

A competition for teams or single players in which a series of games is played, and the winners of each game play against each other until only one winner is left.¹¹

1.3.2 Types of Tournaments

There are various types of tournament formats based on advancement or elimination criteria of players or teams. Study the three tournament formats listed below.

Knock – Out Tournament: In a Knock-Out Tournament a player or team continues to play matches until it is defeated. In this type of format, players or teams have to consistently give their best performance to avoid elimination. Such a tournament saves cost and time and makes each match intensive because of fear of elimination. Since fixtures are drawn on the basis of





lots, there is the possibility of a match between two good teams or players even in the early stages. In this system a good team can be eliminated even at the earliest stage due to getting defeated by chance or by accident.

League or Round Robin: In League or Round Robin Tournament, a player or team will play the matches that are allotted before the start of the tournament. Fixed number of matches are given to players and teams, and losing one or all can put them out of the tournament. Players or teams will get equal chance to play with each other. Thus, the true winner emerges from this format and ranking can be prepared for all participating players or teams. However, this format involves more money, time and facilities as compared to the Knock-Out Tournament and there is no provision of seeding for extraordinary teams and players.

Combination: They are the combination of Knock-Out and League format. Depending upon the need and importance of the tournament, Combination Tournaments can be Knockout- League, League-Knockout, Knockout-League-Knockout etc. These tournaments are conducted when there are (a) a large number of participants, (b) participants are spread in different areas, (c) venues are in different zones/places etc. In this format some of the demerits of Knockout and League Tournaments can be eliminated.



I. Tick the correct option

Q1. After losing a match, a team will be eliminated from the_____.

- (a) Knockout tournament
- (b) League tournament
- (c) Round Robin tournament
- (d) None of above

Q2. Which of the following tournament helps save time?

- (a) Knockout tournament
- (b) League tournament
- (c) Combination tournament
- (d) Round Robin tournament





II. Answer the following questions briefly:

- Q1. Differentiate between knockout and league tournament.
Q2. Write merits of league tournament.

1.4.1 Fixtures, Byes and Seeding

We have learned about three types of tournaments, Now we will study how we can draw the fixtures. In sports, the term **fixtures** refers to the programme listing which team (Team A) will play whom (Team B), where (venue), and when (time).

Definitions:

a sports event or its date¹²

“A sports match that has been arranged for a particular time and place”¹³

‘Fixture is a process of arrangement the team in systematic order in various groups for competitive fights for physical activity’.¹⁴

Thus, tie or fixture or heat include multiple and progressive matches. In athletics and swimming the term **Heats** is used, in Tennis, badminton and other games we frequently use the terms **Ties** or **Fixtures**. For any tournament, unbiased draws of fixtures is a road towards the success. First, let us understand the words “bye” and “seed”.

Bye - means a team is not required to participate in the primary round due to allotment of draws. It should be given to any participating team through random lottery system. In a tournament, bye is generally assigned to teams by the organizing committee not to play a round due to one of the several reasons:

- Uneven distribution of teams in tournament (In knock out tournament, number of teams equals to power of two [e.g., 8, 16, 32, 64,] and in League tournament, if there is an odd number of teams.
- Separate pooling of previous winners in same group to create even competition,
- to avoid one team from playing more matches on a single day than the other, so creating disadvantage for some.

Definitions:

The position of a participant in a tournament who is not paired with an opponent, usually in the first round, and advanced to the next round without playing.¹⁵

Some thing aside from the main course or consideration.

OR





A sportsman in a tournament who is without an opponent.¹⁶

The right to proceed to the next round of a competition without contesting the present round, often through nonappearance of an opponent.¹⁷

Seeding - is a process in which teams will be placed in such a manner that good teams that have a ranking or previous year's position etc. do not meet another team at an early stage of the tournament. This procedure is generally implemented to reduce the chance of elimination of good teams at an early stage. Procedure of allotting seeding is the same as given for byes.

Definitions:

The process or result of seeding players for competition.¹⁸

To arrange or schedule, as competitive teams or players, so that the most skilled are matched in the later rounds of play.¹⁹

To scatter or distribute (the names of players) so that the best players do not meet in the early part of a tournament.²⁰

To rank a player according to the perceived likelihood of his or her winning a specific tournament.²¹

1.4.2 Procedure for Drawing Knock - Out Fixture

Step 1

To determine the total number of teams that will participate in the Knockout tournament.

If the number of teams is: 2, 4, 8, 16, 32, 64, 128, (Number being a multiple of Two) then there is no need of byes. You may see the procedure in Illustration : 1 and 2. If the number of teams is other than the given numbers, then byes will be given as per draw of lot.

Step 2

To determine the total number of matches to be played in the tournament, following formula will be used:

Total Number of Matches = Number of teams – 1 In case of 8 teams then

$8-1= 7$ matches (not including third place match)

If number of teams are 12 then

$12-1= 11$ matches (not including third place match) In case of 15 teams then

$15-1=14$ (not including third place match)





Step 3

The total number of teams are to be divided into two halves, namely Upper Half and Lower Half.

If the total number of participating teams are **even in numbers** the Formula will be:

$$\frac{\text{Number of teams}}{2} = \text{Teams in Upper Half or Lower Half}$$

If total number of teams is 12 then, $\frac{12}{2} = 6$, i.e., 6 teams will be placed in Upper Half and the remaining 6 will be placed in Lower Half.

If total number of participating teams are **odd in numbers** then Formula will be

$$\frac{\text{Number of teams} + 1}{2} = \text{Teams in Upper Half}$$

$$\frac{\text{Number of teams} - 1}{2} = \text{Teams in Lower Half}$$

If number of teams is 15 then

$$\frac{15 + 1}{2} = 8 \text{ Teams in Upper Half}$$

$$\frac{15 - 1}{2} = 7 \text{ Teams in Lower Half}$$

Thus, 8 teams will be placed in Upper Half and remaining 7 will be placed in Lower Half.

Step 4

After determining Upper and Lower Half Teams, byes will be given. We can determine the byes by finding the difference between the number of teams participating in the Tournament and next power of 2 of participating Teams in the Tournament. For example, if total number of Teams is 12, then next power of 2 will be 16.

16-12= 4 Byes. For **even numbers** byes will be placed in Upper and Lower Half.

$$\frac{4}{2} = 2$$

If total number of Teams is 19, then next power will be 32. 32-19 = 13 byes

For **odd numbers** byes will be placed in Upper Half = $\frac{13-1}{2} = 6$ and Lower Half = $\frac{13+1}{2} = 7$

Step 5

Allotment of byes in the fixture should be given in following order:

First bye will be given to last team of Lower Half,

Second bye will be given to first team of Upper Half,

Third bye will be given to last team of Upper Half,





Fourth bye will be given to first team of Lower Half

Same pattern will be followed after fourth bye till the remaining byes have been given.

OR

First bye will be given to last team of Lower Half,

Second bye will be given to first team of Upper Half,

Third bye will be given to first team of Lower Half,

Fourth bye will be given to last team of Upper Half

Same pattern will be followed after fourth bye till the remaining byes have been given.

Step 6

Write the serial number (number of participants) in vertical order.

Divide into two halves as per Step 3.

Then place byes as per step 5.

Now place remaining teams through random lottery system from top to bottom or same pattern used to allot byes.

Teams having byes will not play their first-round matches.

Put Date, Time, Venue in front of the matches in fixture.

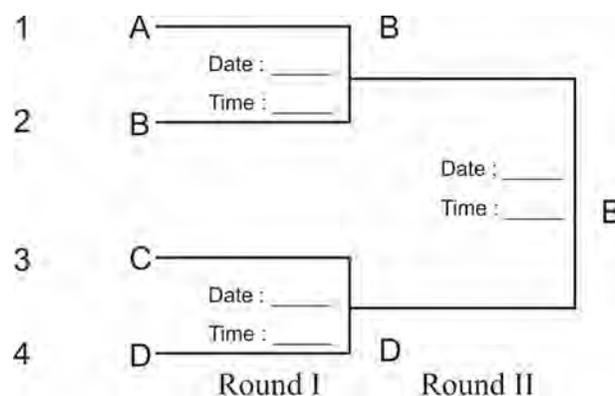
Illustration – 1

Total Number of Teams = 4

Total Number of Matches = $4-1 = 3$

Total Number of Byes= since Number having power of Two, no need of bye Number of team in Upper Half = $\frac{4}{2} = 2$

Number of team in Lower Half = $\frac{4}{2} = 2$





Round I Matches

First match between A Vs B and won by B

Second Match between C Vs D won by D

Round II match or Finals

Third match Finals between B Vs D won by B

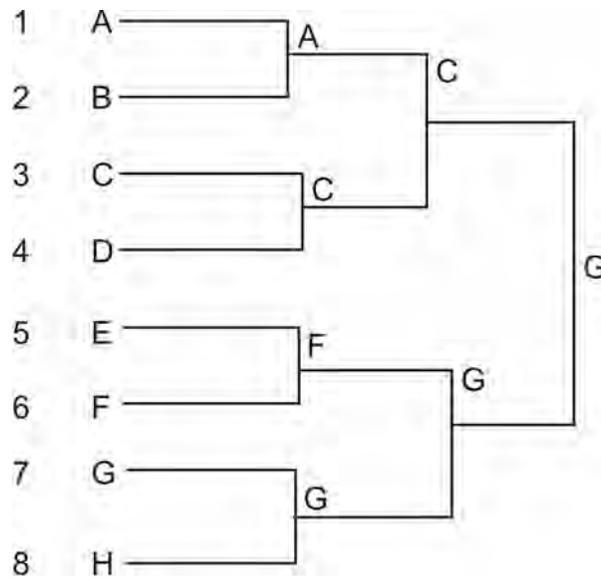
Illustration – 2

Total Number of Teams = 8

Total Number of Matches = $8-1=7$

Total Number of Byes= since Number having power of Two, no need of bye
Number of team in Upper Half = $\frac{8}{2} = 4$

Number of team in Lower Half = $\frac{8}{2} = 4$



Round I Matches

First match between A Vs B won by A

Second match between C Vs D won by C

Third match between E Vs F won by F

Fourth match between G Vs H won by G

Round II Matches

Fifth match between A Vs C won by C





Sixth match between F Vs G won by G

Round III or Finals

Seventh match Final between C Vs G won by G

Illustration – 3

Total Number of Teams = 11

Total Number of Matches = $11-1=10$

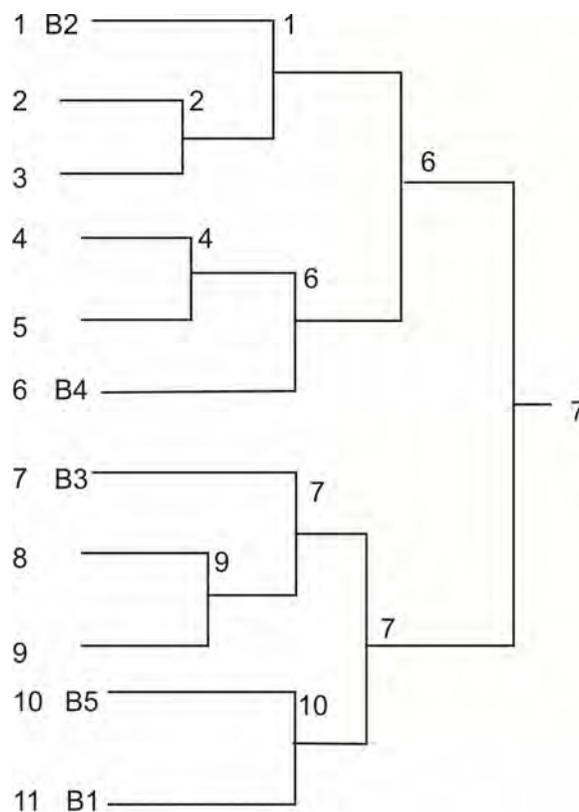
Total Number of Byes = $16-11= 5$

Total Number of Byes in Upper half = $\frac{5-1}{2} = 2$

Total Number of Byes in Lower half = $\frac{5+1}{2} = 3$

Number of team in Upper half = $\frac{11+1}{2} = 6$

Number of team in Lower half = $\frac{11-1}{2} = 5$



Round I Matches

First match between 2 Vs 3 won by 2

Second match between 4 Vs 5 won by 4





Third match between 8 Vs 9 won by 9

Round II Matches

Fourth match between 1 Vs 2 won by 1

Fifth match between 4 Vs 6 won by 6

Sixth match between 7 Vs 9 won by 7

Seventh match between 10 Vs 11 won by 10

Round III Matches (semi-finals)

Eighth match between 1Vs 6 won by 6 Ninth match between 7 Vs 10 won by 7

Round IV or Final

Tenth match between 6 Vs 7 won by 7

1.4.3 Procedure to Draw League or Round Robin Fixture

In League or Round Robin Tournament each team has to play once with all the remaining teams of the tournament.

Step 1

Determine the number of matches by applying following formula:

Number of teams = n

$$\text{Total number of matches} = \frac{n(n-1)}{2}$$

$$\text{If teams are 6 then } \frac{6(6-1)}{2} = \frac{36-6}{2} = \frac{30}{2} = 15$$

This means, 15 numbers of matches will be played in league tournament. If teams are 7 then 21 numbers of matches will be played in league tournament

Step 2

Here, we will study two types of methods to fix the team in league tournament namely Cyclic Method and Stair Case Method:

Cyclic Method

In Cyclic Method, one team will be fixed in position and the other will be placed in rotation to complete the cycle. In this method, two situations may arise, first if teams are even numbered, second situation if teams are odd numbered. Let's see how to set fixtures in these two situations.



Even number of teams in tournament does not require giving of any bye to any team and to find out number of rounds, formula will be number of teams – 1.

Total number of teams= 6 Total number of rounds = 6-1 = 5

I	II	III	IV	V
Round	Round	Round	Round	Round
6 → 1 5 → 2 4 → 3	5 1 4 6 3 2	4 1 3 5 2 6	3 1 2 4 6 5	2 1 6 3 5 4

In order to draw fixture for **odd number of teams** one bye will be given to one team in one round and in next round another team will get a bye. Rounds in the tournament will remain the same.

Total number of teams = 7 Total number of rounds = 7

I	II	III	IV	V	VI	VII
Round	Round	Round	Round	Round	Round	Round
7 Bye 6 → 1 5 2 4 3	6 Bye 5 7 4 1 3 2	5 Bye 4 6 3 7 2 1	4 Bye 3 5 2 6 1 7	3 Bye 2 4 1 5 7 6	2 Bye 1 3 7 4 6 5	1 Bye 7 2 6 3 5 4

Staircase Method

In Staircase Method, one team will be fixed on the highest step, and that team will play with all the teams of the tournament and in next step down, the next team will be fixed to play with other remaining teams and so on.

Total number of Teams= 7

A Vs B						
A Vs C	B Vs C					
A Vs D	B Vs D	C Vs D				
A Vs E	B Vs E	C Vs E	D Vs E			
A Vs F	B Vs F	C Vs F	D Vs F	E Vs F		
A Vs G	B Vs G	C Vs G	D Vs G	E Vs G	F Vs G	

[20]



**Details of Matches**

Match No	Team A	Vs Team B	Date	Time	Venue	Result

Step 3

Determining the winner/merit in League Tournament.

In League or Round Robin Tournament winner/merit will be decided on the basis of points awarded to the teams. Example Winner = 5, Draw =3, Loser = 0. Points tally may be as follows:

S. No.	Teams	Match Played	Match Win	Match Loss	Match Draw	Total Points	Ranking
1	A	5	4	0	1	23	I
2	B	5	3	1	1	18	II
3	C	5	1	2	2	11	IV
4	D	5	0	4	1	3	V
5	E	5	1	2	2	11	IV
6	F	5	0	0	5	15	III

Tournament organising must fame the rules in regards to tie before the start of the tournament.

1.4.4 Procedure to Draw Combination Fixture

These fixtures are the combination of Knockout and League Tournaments. Same steps will be followed as are followed in Knockout and League fixtures. To draw League-Knockout fixtures, the following process will be executed:





League-Knockout

$$\text{Team} = 8 \text{ Matches} = \frac{8(8-1)}{2} = \frac{64-8}{2} = \frac{56}{2} = 28$$

Rounds in league = 7

League

Round 1	Round 2	Round3	Round4	Round 5	Round 6	Round 7
1-8	7-8	6-8	5-8	4-8	3-8	2-8
2-7	1-6	7-5	6-4	5-3	4-2	3-1
3-6	2-5	1-4	7-3	6-2	5-1	4-7
4-5	3-4	2-3	1-2	7-1	6-7	5-6

S. No.	Teams	Match Played	Matches Won	Matches Lost	Matches Drawn	Total Points	Ranking
1	1	7	5	2	0	25	I(Q)
2	2	7	2	3	2	16	V
3	3	7	2	2	3	16	V
4	4	7	2	4	1	13	VI
5	5	7	3	2	2	21	II(Q)
6	6	7	4	2	1	23	III(Q)
7	7	7	1	4	2	11	VII
8	8	7	3	3	1	18	IV(Q)

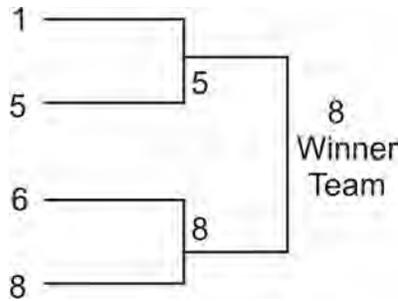
Winner = 5, Draw =3, Loser = 0

Top four teams namely 1, 5, 6 and 8 qualify for knockout rounds

Tournament committee should form rules regarding placement of teams at semifinals before the tournament. Here we placed teams as per their ranking. Other patterns are

1. first team may play with third and second may play with fourth ranked team or
2. first ranked team may play with fourth ranked team and second ranked team may play with third ranked team or
3. draw of lots may be another choice.





First semi-final match played between 1 vs 5 and won by 5

Second semi-final match played between 6 vs 8 and won by 8

Final match played between 5vs 8 and won by 8

Third place match may be played between 1 vs 6

Team 8 winner of the League-Knockout tournament

Team 5 is runner up of the tournament.

Do You Know?

FIFA World cup is world largest event in term of viewership in the world. In Football World Cup League-Knockout combination fixtures are drawn. Starting rounds are based on League system, there are eight groups from A to H, each group consists of four teams. Every team in the group has to play with the other three teams in the group. Top two teams from each group qualify for pre-quarterfinals based on the points table and then the knockout round starts till the finals.

1.5.1 Intramural

The meaning of the word 'intramural' is "within the walls". In context of sports, it refers to a tournament conducted within the walls of a single institution/ school/ community. Intramural competitions/tournament are conducted within players of one institution. The tournament may be an event/ game /more than one games and sports conducted in one day or more or in a month or a year, eg., Sports Day, Sports Festival, Athletics Meet, Swimming Meet, Badminton Tournament conducted among Houses, Classes, Hostels, Residents etc. of a school/institution.

1.5.2 Objectives of Intramural Tournaments

Intramurals are common and an integral part of educational organisation and communities, where teams are made among classes, houses or groups and competitions are conducted for engaging children and youth for deriving various types of benefits to the participants. Lets understand few important objective of intramural tournaments.

1. To encourage mass participation in sports in an institution.
2. To focus on all-round development of children.





3. To develop values like fair play, respect, friendship through sports.
4. To provide first opportunity to compete in a controlled environment.
5. To focus on fitness, wellness and health aspects of children.
6. To promote curricular integration through sports.
7. To help children to develop personality (first stage of leadership, control of emotions, corporation etc.)

Extension Activity

As the Sports Captain of your school, you are involved in the selection of students for participating in District/Region/Zone matches subsequently.

List out the criteria you will employ for selection of

- (a) Individual Games/Sports
- (b) Team Games/Sports

1.5.3 Significance of Intramural Tournaments

With all the above discussed objectives of intramural tournaments being implemented successfully, it surely brings lots of benefit to the participants. Such competitions conducted in a controlled environment with enough scope of all round development delivers enough significance to the event. Lets discuss few essential significance of intramural tournaments.

Selection for extramural: Intramural Tournaments provide an opportunity to select a player or team to participate in Extramural Tournaments. Players demonstrate skill and fitness in events which becomes the base for selection of a player or team.

Group cohesion: This is an opportunity where students from different Classes or Houses come together in a team, share their experiences, display cooperation and coordination and lead the team to win the game. Students from different background, and communities come together as a group and gain self-confidence, develop social relations, tolerance in culture etc.

Professional experience: As per the interest of students and need of institution, students become a helping hand in conducting the tournament which gives them good experience of officiating, in event management etc. In future, this experience helps them in professional and personal aspects.

Health: It helps in developing healthy and active lifestyle. Children enjoy the sports events because it is another medium to display their desired skills. It helps them to stay fit and healthy. Intramurals help in contributing to the physical, mental, social and spiritual well-being of children.





Recreation: Joy and entertainment are the outcome of Intramural physical activities. The elements of happiness and enjoyment are always there because activities are not so competitive, which makes intramural events successful.

Mass participation: Such activities are meant for all the students of the institution not only for sportspersons or players.

1.5.4 Extramural Tournaments

The word 'extramural' means "outside the boundary or walls". In Sports Extramural Tournaments are the tournaments conducted outside or beyond the walls of the organising unit that may be a school/college/institution. Such tournaments are conducted between two or more players/teams of different schools/colleges/ institutions. For example, Zonal, Inter-District, State, National or International Tournaments.

1.5.5 Objectives of Extramural Tournaments

Extramural tournaments are very popular and an essential part of educational organisation, and communities, where a common team represents a school, colleges or group and promote participating or organising various inter institution competitions for engaging children and youth into various types of benefits. Lets understand few important objective of intramural tournaments.

1. To achieve high performance at highest level of the tournament.
2. To develop the feeling of integration with other institutions
3. To provide opportunities for choosing a career in sports
4. To promote social, cultural, economic development through sports.

1.5.6 Significance of Extramural Tournaments

With all the above discussed objectives of extramural tournaments being implemented successfully, it surely brings lots of benefit to the participants. Participation and organisation of such inter competitions focusing to showcase talent and explore potentials among talented athletes delivers enough significance to the event. Lets discuss few essential significance of intramural tournaments.

Progression in performance: Extramural Tournament helps to lift the level of performance through the athletes and sportspersons gaining experience, learning to prepare tactics and strategies, developing fitness, psychological preparation etc.

Psychological factors: Extramural events help to balance psychological factors like stress, confidence, self-esteem, emotions, and promote qualities like leadership, team building, in students.





Level of fitness: As the level of tournament increases, gradually the level of fitness improves, that make an individual physically as well as mentally strong to compete at higher levels.

Socialization: Such tournaments held among different communities, regions, countries etc. increase cross cultural exchange, inter community association etc. in which individuals get a chance to know and understand different places, cultures, etc. which leads to closer ties.

1.5.6 Specific Sports Programmes (Sports Day, Health Run, Run for Fun Run for Specific Cause and Run for Unity)

Specific Sports Programme are programmes which are conducted for specific purposes. They may be conducted frequently depending on purpose like the Annual Sports Day of a school where the purpose is to demonstrate the skills and abilities of children. It is not necessary that such programmes be conducted frequently. eg., a company can conduct a run to promote its product, but after it has acquired publicity, the company may discontinue the run or they may continue it for a social cause like promotion of health and charity. The important point is, such specific sports programmes must be conducted by a team of professionals including personnel from physical education and sports. Chances of any mishap during the event may increase due to unprofessional or inexperienced people.

Sports Day- is one of the important programmes that feature in the annual calendar of most schools. It is an event to showcase children's abilities and prowess on the sports field to parents. It also reflects the organisational strength of the institution. To celebrate Sports Day at school the focus should not only be participation sports person, but the institution should aim at putting on a display of skills of all the students. Activities may be competitive in nature and highlight students' abilities. Major focus should be maximum engagement and involvement of students, parents, teachers and other stakeholders.

In recent times, Government of India is celebrating National Sports Day on 29th August on the occasion of birth anniversary of Major Dhyan Chand, a hockey legend.

Do you Know?

Fit India Movement was launch on 29th August 2019 on the occasion of birth anniversary of Major Dhyan Chand by Shri Narendra Modi, the Prime Minister of India. The purpose of the movement is to promote physical activities and sports in masses so that they stay fit and healthy and keep away from lifestyles diseases. He said "*Swasth vyakti, swasth parivar aur swasth samaj, yahi naye Bharat ko shresth Bharat banane ka raasta hai.*"

Health Run: Such kind of run is generally conducted for the purpose of improving the health standards in society and creating awareness about the importance of physical activities for maintaining good health or for raising charity. In this run, the purpose of the runners is not to





win, but to participate in the events. To get its full impact, a large number of registrations are required. There is no age bar for participants; it is not a professional race so there is no need to run a long distance. Such a run can be conducted by NGOs or health departments to spread awareness about health-related issues.

Run for Fun: The purpose of this run is to spread message of staying fit and healthy among the masses. Sometimes such races may be conducted to raise funds for a specific purpose. In schools such races attract children and their parents. These are friendly races and may be conducted for any age. However, the physical education teacher must be careful and plan meticulously to avoid any kind of accident or mishap. Age, mobility, types of movement involved should be taken care of. Examples of such races are lemon and spoon race, sack race, three-legged race, parent and child race, teacher and child race, banana race, road running etc.

Run for Specific Cause: This event is generally conducted to spread awareness about social issues like cleanliness, promoting green environment etc. The purpose of such events is to spread awareness among the masses for a definite cause or to generate charity. eg., the specific cause may be cancer, AIDS, gender inequality etc.

Run for Unity: In such a type of run the purpose is to promote the feeling of integrity and brotherhood in community, state, nation or among different religions. Such events help to develop bonding and a sense of togetherness among people.

Case Study

In the beginning of the annual academic planning for the school, a physical education committee meeting was held which included of the school Principal, teachers and student, alumni and parents. The agenda of discussion was to plan for comprehensive program for Physical Education and Sports for all age-groups and prepare a schedule of events along with recommendation for various sub-committees to conduct sports events. The team released the schedule of the events to be conducted in the current academic year.

As per interest and capabilities of students and teachers, various sub-committees were recommended. The sub-committee consisting of house teachers and students provided feedback about concerns regarding draws and fixtures in intramural school tournament where the best teams competed again each other in the initial rounds itself. The students also felt that sometimes the teams were not cohesive and did not display sportsmanlike behaviour on or off the field. They felt such situations were unseemly and could be avoided through a systematic process. There was also a need to increase the coordination among the committees with more defined roles and responsibilities of each member. To provide exposure to the potential athletes and for talent development, a proposal was put forward for hosting a state-level inter-school competition at school. To this end, the committees would need human resource, technical support and financial assistance. A new feature to the annual physical education programme, was the conducting of a mass run for crowd funding





and to promote integrity and peace. This could be sponsored by various NGOs and government agencies.

1. A suitable and systematic process for fixtures would be
 - (a) Round robin
 - (b) Bye to top teams
 - (c) Draw of lots
 - (d) Choice
 2. Responsibility for Distribution of certificate should be the role of
 - (a) Logistics Committee
 - (b) Marketing Committee
 - (c) Finance Committee
 - (d) Technical Committee
 3. The purpose for conducting a community run is for
 - (a) Talent identification
 - (b) Run for Publicity
 - (c) Sports training
 - (d) Crowd Funding
- Q. What are the tips that you, as the Sports Captain, will give your teams regarding good sportsmanship?

I. Tick the correct option

- Q1. National Sports Day is celebrated on
- (a) 19th August
 - (b) **29th August**
 - (c) 9th August
 - (d) 28th August
- Q2. Which of the races is run “to promote brotherhood”?
- (a) Run for Fun
 - (b) Run for specific cause
 - (c) **Run for Unity**
 - (d) Health Run





II. Answer the following questions briefly.

- Q1. Write any two types of Run.
Q2. Write the objectives of Intramural.
Q3. Write the significance of Extramural Tournaments.

III. Answer the following questions in 150-200 words.

- Q1. How would you plan for an Intramural Tournament? Highlight any two problems you may encounter. How will you deal with them?
Q2. Discuss a method you would choose to spread health awareness and harmony in your area. Support your answer with reasons.

Art Integration

Prepare a report on the Annual Sports Day of your school for publishing in a National daily.

Suggested Reading:

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- ¹⁸ Webster, M. (1976). *Webster's Sports Dictionary*. US: Merriam Webster.
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UNIT-II: SPORTS AND NUTRITION

Content

- Balanced Diet and Nutrition: Macro and Micro Nutrients
- Nutritive and Non- Nutritive Components of Diet
- Eating for Weight control – A Healthy Weight, The Pitfalls of Dieting, Food Intolerance and Food Myths

Learning Outcomes

After studying this unit, the students will be able to:

- understand the concept of balanced diet and nutrition
- classify Nutritive and Non-Nutritive components of Diet
- identify the ways to maintain healthy weight
- know about foods commonly causing food intolerance
- recognize the pitfalls of dieting and food myths

Discussion

Find out and complete the worksheet in groups.

Vitamins	Benefits of Vitamins	Sources
A	Needed for healthy eyes, skin, nervous, respiratory, digestive systems	
B	Needed for better metabolism process	
C	Needed for teeth, bones and healing purpose	
D	Needed for bones	
E	Needed for restoration of cell membrane and body structure	
K	Needed for blood clotting	





2.1.1 Nutrition

It is well known that food is essential for survival. Food refers to any substance that nourishes our body or in other words, it is anything that we can digest, absorb and utilize, for various physiological functions of the body including growth and development. Since the time of conception in the mother's womb, providing energy for our sustenance, regulating activities of the body and repairing day to day wear and tear, the role of food is enormous. Food provides nutrition to the body. Hence, Nutrition is the science of food and a study of the process that includes everything happens to food from the time it is eaten until it is used for various functions in the body. It is the scientific study of foods and the nutrients therein; their action and interaction and balance, in health and diseases. It is the study of ingestion, digestion, absorption, utilisation and assimilation of nutrients present in food.

When we see any food product we recognise it as chapatti, rice, dhal, ladyfinger, apple etc. but as the food enters our mouth it starts breaking down and our body identifies it as different chemicals present therein. These chemical substances which are present in food are called **nutrients**. Nutrients include carbohydrates, proteins, fats, vitamins, minerals, water and fibre (roughage). Different food stuffs contain these nutrients in different amounts and proportions and our body needs each nutrient in a certain specific amount for various physiological functions and overall growth and development.

Nutrients, as mentioned earlier are those chemical substances in foods that are required by the body for energy, growth and maintenance. Nutrients can be broadly classified as macro- and micro-nutrients depending upon their daily requirements by the body. Some nutrients are needed in larger amounts, these are called **macronutrients**. Nutrients like Carbohydrates, proteins and fats along with water are macronutrients. Other nutrients like vitamins and minerals are required in small amounts and are called **micronutrients**. Although these are required in smaller amounts but they are all equally essential for our health. Each of these nutrients plays a significant role in the body.

Macronutrients are required by the body in relatively large amounts. Carbohydrates, proteins and fats are macronutrients and are also called 'proximate principles' because they form the main bulk of the diet. In Indian meals, they contribute to the total energy intake in the following proportion: carbohydrates: 55-60%; protein: 10-15% and fats: 20-30%. Water does not provide energy but is a vital nutrient required in large quantity for functioning of metabolic processes in the body and various regulatory functions. Therefore, it is also considered a macronutrient.

2.1.2 Carbohydrates

Carbohydrates are organic compounds made up of Carbon, Hydrogen and Oxygen. Carbohydrates are a major source of energy and provide 4kcal per gram. Carbohydrates are found in abundance in plant foods. There are three types of carbohydrates- **monosaccharides**, **disaccharides** and **polysaccharides**. Monosaccharides are simple single





units of sugars like glucose, fructose and galactose. Disaccharides are when two monosaccharides are combined together; these are maltose (glucose + glucose), lactose (glucose + galactose) and sucrose (glucose + fructose). **Simple sugars** (mono and disaccharides) are found in fruits (sucrose, glucose and fructose), milk (lactose) and sweets that are produced commercially and added to foods to sweeten, prevent spoilage, or improve structure and texture.

Polysaccharides are more than two units of monosaccharides joined together. These are starches and fibre (cellulose). These are also called **complex sugars** and are found in whole grain cereals, rice, oats, potatoes, bread, legumes, corn and flour.

All these carbohydrates have to be broken down to the smallest unit ie., glucose to get absorbed and utilised in the body. However, cellulose and other large carbohydrate molecules cannot be digested in the human digestive tract, and are termed as fibre or non-available carbohydrates. Sugars and starches can be digested and utilised for various bodily functions, hence are known as **available carbohydrates**. Diets rich in complex carbohydrates are healthier than low-fibre diets based on refined and processed food.

Sources of carbohydrates are pasta, rice, cereal grains, breads, milk, fruit, root vegetables, sugar and products that are sweetened like jams, jellies etc., honey, jaggery. Fibre is present in whole grains cereal (whole wheat atta), whole pulses, green leafy vegetables, peas, carrot, beans and other vegetables, fruits like guava, apple, orange, pineapple etc.

Do you Know?

Carbohydrates are essential in the diet to prevent ketosis

Diets for weight-loss usually recommend avoiding carbohydrates. It is however, essential to have at least 50-100gm of carbohydrate per day for complete oxidation of fat and avoidance of excessive production of ketone bodies. Inadequate supply of carbohydrates causes break down of body fat reserves for energy. This not only supplies energy but also produces ketone bodies. Some ketone bodies are used by muscle and other tissues for energy, but when produced in excess they accumulate in blood and cause ketosis (disturbance of normal acid- base balance). This condition is generally seen in Diabetics and is a life- threatening situation.

Summary - Macronutrients, their functions and sources

Nutrient	Function	Sources
Carbohydrates	Carbohydrates provide energy needed by the body and the nervous system, brain and red blood cells; spare proteins for their important functions (if enough carbohydrates are not available, proteins are used for energy-giving);	Fruits, cereal grains, milk, suger, rice, vegetables, pasta, breads





	enable proper utilisation of fat by providing substrates for fat metabolism.	
Roughage	Dietary fibre or roughage provides feeling of fullness i.e., one does not feel hungry soon after having a meal: provides bulk to the diet, helps in smooth elimination of stool or faeces; prevents diseases like cancer, diabetes and heart disease, has cholesterol lowering effect; Provides energy (4Kcal/gm)	Whole grain cereals (whole wheat atta), whole pulses, GLVs, peas, beans and other vegetables, fruits like guava, orange, pineapple
Proteins	Proteins build and repair body cells; form part of various enzymes, hormones, and antibodies; Provide energy (4 Kcal/ gm)	Milk and milk products, vegetables, grains, fish, eggs, poultry, meat, legumes
Fats	Fats provide energy (9kcal/g); carry fat-soluble vitamins; are part of cell membranes, membranes around nerves, hormones, bile (for fat digestion)	Meat, poultry, fish, milk and milk products, nuts and seeds, vegetable oils, <i>desi ghee, vanaspati ghee</i> , butter, margarine, cheese

2.1.3 Proteins

List of Essential and Non-Essential Amino Acids

Essential	Nonessential
Histidine	Alanine
Isoleucine	Arginine
Leucine	Asparagine
Lysine	Aspartate
Methionine	Cysteine
Phenylalanine	Glutamate
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine





Proteins are organic compounds containing nitrogen, besides, carbon, oxygen and hydrogen. Protein molecules have a complex structure, and are made up of nitrogen containing amino acids. Amino acids are linked together in chains to make different type of proteins in the body. From hair to nails, muscles to skin, organs to blood, hormones to enzymes, protein is a major structural and functional component of our body. There are around 20 amino acids joined together in varying sequences to form different kinds of proteins. There are nine amino acids which cannot be synthesized by the body; these are called Essential Amino Acids (EAA). These have to be supplied in the diet. Others are non-essential amino acids as these can be synthesized in the body.

Depending on the availability of these essential amino acids in foods, they are classified as **complete protein foods, partially complete protein foods** and **incomplete protein foods**. Complete protein foods are those which contain all essential amino acids in adequate amounts. These food sources include foods from animal sources like eggs, milk and milk products, meat and meat products and a plant source, soybean, that contains all essential amino acids. Protein quality is determined by the presence of complete protein foods in the diet; it improves the absorption and utilization of protein in the body. Partially complete protein foods are those which are lacking in any one essential amino acid eg., cereals and pulses. Cereals lack lysine and pulses lack methionine. To improve the protein quality, cereals and pulses can be taken together in a meal or can be combined with sources of complete protein foods. Incomplete proteins are those which are lacking in more than one EAA. An example of this protein is maize protein.

Do you Know?

Protein requirement for Indian adults is 1 g/kg body weight (according to RDA 2010; ICMR). Thus, for a man weighing 60 kg, the protein requirement would be 60g/day. In terms of percentage of total energy intake, protein intake should be between 10-15% of total energy consumed. In no case, it should exceed 35% of total energy intake. Protein requirement, however, may increase to up to 2 g/kg body weight during sports and exercise depending upon the type of sports and duration and intensity of training. Too little, or, excess intake of protein have health implications, hence proteins should be consumed as required and recommended.

2.1.4 Fats (Lipids)

Lipids or Dietary Fats a broader term used for both oils and fats. Oils are basically liquid at room temperature and fats are solid at room temperature. It is the presence of different types of fatty acids which make them liquid or solid.

Fatty acids are the building blocks of fats and oils. Fatty acids are classified as Saturated or Unsaturated Fats depending upon the presence of double bond in their chemical structure.





Saturated fatty acids (SFA) contain no double bonds, monounsaturated fatty acids (MUFA) contain one, and polyunsaturated fatty acids (PUFA) contain more than one double bond. When the percentage of saturated fatty acids is higher, the fat is solid at room temperature and when the percentage of unsaturated fatty acids (MUFA or PUFA) is higher the lipid is liquid at room temperature and is called oil.

Saturated fats which are also called as animal fats are associated with increased health risks. They can increase risk of heart disease by increasing total and LDL ("bad") cholesterol. It has been recommended that the intake of saturated fats be kept less than 7% of total calories. *Desi ghee*, butter, cheese, cream, red meats, baked products, and other full-fat dairy products are the main sources of saturated fats in most diets. Coconut and palm oils also contain saturated fats.

Monounsaturated and polyunsaturated fatty acids are unsaturated fats. When they replace saturated fats in the diet, they help to reduce blood cholesterol levels and thus lower the risk of heart disease. Canola, olive, peanut, palm olein, rice bran and *til* (sesame) oils and other nuts like walnuts are rich in monounsaturated fats. Sources of PUFA include vegetable oils, mustard, soybean, corn, safflower and sunflower oils and flaxseed.

Dietary fat can be attained from visible as well as invisible sources. Visible sources are *ghee*, butter, cooking oil etc. while invisible sources include nuts, cereals, pulses, milk, eggs, meat etc. Invisible fat contributes significantly to the total fat and essential fatty acid content of diet depending on the food stuffs present in the diet. The total fat (visible + invisible) should provide between 15-30% of total calories required and contribution of visible fat should be restricted to 20-30g per day depending upon the physical activity levels of the individual.

Do you know?

It has been recommended that total fat intake should be 20-30% of calories for adults to meet daily energy and nutritional needs while minimizing risk of chronic diseases. The intake of saturated fats should be less than 7% of calories, cholesterol should be less than 300 mg/day, and trans fatty acid consumption should be as low as possible. Consumption of certain fatty acids (MUFA and PUFA) are encouraged because of their positive health effects, like oils from foods such as vegetable oils, nuts, rice bran and fish because of their healthy attributes. In view of this, an ideal quality fat for good health is one which maintains a balance between SFA, MUFA and PUFA. This can be maintained by combined use of various oils for example, mustard oil with sunflower oil, or safflower oil with palm oil etc.

Cholesterol is a fat-like substance which is synthesized in the body. It is necessary in many physiological processes such as: it is a component of cell membranes, it is required in the production of bile acids (which aid in food digestion), and in the production of sex hormones. An excess of cholesterol in the blood, however, can lead to deposits in the walls of blood vessels and reduce blood flow to major arteries, which can lead to a heart attack.





Dietary cholesterol is found only in animal foods such as egg yolks, butter, organ meats, beef and chicken. Vegetable oils are cholesterol-free. Excess intake of dietary cholesterol increases blood cholesterol levels, but not as much as saturated and trans-fats do.

Trans-fatty acids are basically produced by the process called hydrogenation. It is the process of adding hydrogen molecules directly to unsaturated fatty acids such as those found in vegetable oil to make it saturated or solid. Hydrogenated oils contribute important textural and stability properties in food.

Trans-fatty acids occur naturally in beef, lamb, and dairy products. However, the main sources of trans fats are foods such as cookies, biscuits, *mixtures*, *namkeens*, pastries and other fried foods. Trans-fatty acids are similar to saturated fats and dietary cholesterol with regard to their effect on blood low-density lipoprotein (LDL – which is a “harmful” or “bad”) cholesterol. Trans-fats may also lower high-density lipoprotein (HDL – which is a good) cholesterol.

2.1.5 Vitamin

Vitamins are the chemicals which our body needs in small amounts to function properly. They work in a variety of ways, mostly as ‘helpers’ eg., many of the B-vitamins help the body use protein, fats, and carbohydrates.

Do you know?

Each red blood cell contains haemoglobin which is the iron-containing protein that transports oxygen from the lungs to other parts of the body. In haemoglobin, each subunit contains a heme group; each heme group contains an iron atom that is able to bind to one oxygen molecules.

Vitamins are divided into two categories:

1. **Water-soluble vitamins** include all the B vitamins and vitamin C. The amount of water-soluble vitamins that body doesn't use passes through the kidneys and leaves the body as urine or stool.

The body needs water-soluble vitamins in frequent, small doses, and they are unlikely to reach toxic levels.

2. **Fat-soluble vitamins** include vitamins A, D, E, and K. Fat-soluble vitamins are stored in the body cells and are not passed out of the body as easily as water-soluble vitamins. They are more likely to reach toxic levels if a person takes in too much of these vitamins.

The table-2.i and 2.ii lists the water-soluble and fat-soluble vitamins; their functions and their sources in the foods we eat.



**Table 2.i - Water-soluble vitamins**

Nutrient	Function	Sources
Thiamine (vitamin B1)	Works as coenzyme-(Thiamine pyrophosphate-TPP) needed for energy metabolism; important for nerve function; needed for DNA and RNA synthesis	Whole-grain cereals, pulses, peanuts and seeds, mushrooms, green peas, beans, egg yolk and meat
Riboflavin (vitamin B2)	Act as two coenzymes- Flavin mononucleotide (FMN) and Flavin adenine dinucleotide (FAD) needed for energy metabolism; important for normal vision and skin health	Milk and milk products; animal products like eggs, liver, kidney; green leafy vegetables eg., broccoli; whole-grain cereals; legumes
Niacin (vitamin B3)	Part of an coenzymes- Nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP) needed for energy metabolism; important for nervous system, digestive system, and skin	whole-grain cereals, pulses, meat, poultry, fish, vegetables (especially mushrooms, asparagus, and green leafy vegetables), peanuts and peanut butter. Eggs and milk and milk products lack niacin but are rich sources of EAA-tryptophan which can be converted to niacin in the body when required. 60 mg of tryptophan can be converted to provide 1 mg niacin.
Vitamin B6 (Pyridoxal, pyridoxine and pyridoxamine)	Part of coenzyme pyridoxal phosphate needed for protein and amino acid metabolism and also involved in activity of many enzymes required for carbohydrate, fat and protein metabolism. It also helps in making white blood cells and heme in haemoglobin.	Meat, Poultry, fish, Nuts, sunflower seeds, pulses, whole grains, spinach, bananas, potatoes.





Biotin	Functions as coenzyme in metabolic reactions.	Widespread in foods like organ meats, such as liver or kidney; egg yolk; nuts, such as almonds, peanuts, and walnuts; soybeans and other legumes; whole grains; bananas; cauliflower, mushrooms; also produced in intestinal tract by bacteria
Pantothenic acid	Part of co-enzyme A (CoA) needed for energy metabolism	Widespread in foods: milk, meat, peanuts, eggs
Folic acid /Folate	Part of an enzyme needed for making DNA and new cells, especially red blood cells, formation of neurotransmitters, needed for maintenance of normal blood pressure and reducing risk of cancer	Green leafy vegetables particularly spinach, pulses, oranges and orange juice, and liver. Other vegetables like cabbage, cauliflower, broccoli are also good sources
Cobalamin (vitamin B12)	Part of two coenzymes methyl cobalamin and 5- deoxy adenosyl cobalamin, needed for making new cells; important to nerve function	Meat, poultry, fish, seafood, eggs, milk and milk products; not found in plant foods
Ascorbic acid (vitamin C)	Antioxidant, role in collagen formation hence in wound healing, part of an enzyme needed for protein metabolism; important for immune system, helps in iron absorption	Found in fruits and vegetables, especially citrus fruits, fresh vegetables in the cabbage family, sprouts, amla and guava

Fat-soluble vitamins

Fat-soluble vitamins are stored in the body's cells and are not excreted as easily as water-soluble vitamins. Intake of high amounts of fat-soluble vitamins could become toxic. A balanced diet usually provides enough fat-soluble vitamins.



**Table 2.ii - Fat-soluble vitamins**

Nutrient	Function	Sources
Vitamin A (Retinol and its precursor*, beta-carotene) *A precursor is converted by the body to the vitamin.	Needed for vision in dim light, healthy skin and mucous membranes, growth of skeletal and soft tissues, immune system health	Vitamin A from animal sources (retinol): milk, cheese, cream, butter, egg yolk, liver Beta-carotene (from plant sources): dark green leafy vegetables; red and yellow fruits and vegetables (carrots, pumpkin, mangoes, papaya)
Vitamin D	Needed for proper absorption of calcium and phosphorus; deposition of calcium and phosphorus in bones	Egg yolks, liver, fatty fish, fortified foods. When exposed to sunlight, the skin can make vitamin D.
Vitamin E	Antioxidant; protects cell walls	Polyunsaturated plant oils (soybean, corn, cottonseed, safflower); green leafy vegetables; wheat germ; whole-grain products; liver; egg yolks; nuts and seeds
Vitamin K	Needed for proper blood clotting	green leafy vegetables and cabbage; milk; also produced in intestinal tract by bacteria

2.1.6 Minerals

Minerals are inorganic elements which are required by the body needs for various physiological functions. There are minerals required in larger amounts called macro-minerals and those required in smaller amounts are called micro-minerals (trace minerals).

Tables 3.i and 3.ii list important macro- and micro-minerals, their functions and their sources in the foods we eat.

Table 3.i - Macro-minerals

Mineral	Function	Sources
Sodium	Needed for proper fluid balance, regulating alkalinity and acidity of body	Table salt, soy sauce; large amounts in processed foods; small





	fluids, nerve transmission, and muscle contraction	amounts in milk, breads, green leafy vegetables, and unprocessed meats
Chloride	Needed for proper fluid balance, stomach acid	Table salt, soya sauce; large amounts in processed foods; small amounts in milk, meats, breads, and vegetables
Potassium	Needed for proper fluid balance, nerve transmission, and muscle contraction	Meats, milk, fresh fruits and vegetables, whole grains, pulses
Calcium	Important for healthy bones and teeth; helps muscles relax and contract; important in nerve functioning, blood clotting, blood pressure regulation, immune system health	Milk and milk products; fish with bones (eg., sardines); fortified soya milk; greens (broccoli, mustard leaves); pulses
Phosphorus	Important for healthy bones and teeth; found in every cell; part of the system that maintains acid-base balance	Meat, fish, poultry, eggs, milk, processed foods
Magnesium	Found in bones; needed for making protein, muscle contraction, nerve transmission, immune system health	Nuts and seeds; pulses; leafy, green vegetables; seafood; chocolate
Sulphur	Found in protein molecules	Occurs in foods as part of protein in meats, poultry, fish, eggs, milk, pulses, nuts

Trace minerals (micro-minerals)

The body needs trace minerals in very small amounts. Although iron is considered to be a trace mineral, the amount needed is somewhat more than for other micro-minerals.

Table 3.ii - Trace minerals

Mineral	Function	Sources
Iron	Iron is a mineral found in every cell of the body. Iron is considered an essential mineral because it is found in red blood cells as part of haemoglobin that carries oxygen to every cell in the body; part of myoglobin needed for muscle contraction,	Organ meats; red meats; fish; poultry; egg yolks; whole pulses and whole grain cereals; dried fruits; dark green leafy vegetables (mustard greens, bathua);





	needed for energy metabolism, hence crucial in helping perform physical work	iron-enriched breads and cereals; and fortified cereals
Zinc	Part of many enzymes needed for synthesizing protein and genetic material; has a function in taste perception, wound healing, normal foetal development, production of sperm, normal growth and sexual maturation, important for immune system	Meats, fish, poultry, whole grains, vegetables
Iodine	Found in thyroid hormone, which helps regulate growth, development, and metabolism	Seafood, foods grown in iodine-rich soil, iodized salt, bread, dairy products
Selenium	Antioxidant	Meats, seafood, grains
Copper	Part of many enzymes; needed for iron metabolism	Pulses, nuts and seeds, whole grains, organ meats, drinking water
Manganese	Part of many enzymes	Widespread in foods, especially plant foods
Fluoride	Involved in formation of bones and teeth; helps prevent tooth decay	Drinking water (either fluoridated or naturally containing fluoride), fish, and most teas
Chromium	Works closely with insulin to regulate blood sugar (glucose) levels	Organ meats especially liver, whole grains, nuts, cheese
Molybdenum	Part of some enzymes	Pulses, breads and grains; green leafy vegetables, milk; liver

Other trace nutrients known to be essential in tiny amounts include nickel, silicon, vanadium, and cobalt.

2.1.7 Water

Water is essential for life. Water is an inorganic compound made up of hydrogen and oxygen. Water is a major component of our body and it makes up to 60% of the total weight





of an individual. It is the medium of all body fluids including blood, saliva, digestive juices, urine, faeces, sweat and perspiration.

Water plays an important role in the regulation of body temperature. It is also a universal solvent. Water bathes the body cells and keeps them moist. Hence, it acts as a lubricant. It is also an important lubricant for the joints.

Our body gets water mainly by ingestion of water in the form of liquids; water taken as such or in the form of beverages like tea, coffee, fruit juices and aerated drinks. In other foods like vegetables, fruits, milk, cereals and pulses, water is present in invisible form. It is important that clean, safe and wholesome water is consumed in order to avoid water-borne diseases such as diarrhoea, dysentery and cholera.

2.1.8 Balanced Diet

Depending on the presence of nutrients in different food stuffs, foods have been divided into different **food groups**. These are:

1. **Cereals and Millets:** Cereals and millets include foods like wheat, rice, jowar, bajra, ragi etc. Majorly provide **carbohydrates**. Cereals also provide protein (protein quality can be improved by consuming it with pulses), B-vitamins, iron (bajra) and calcium (ragi).
2. **Pulses:** Pulses include all whole and washed *dhals* like red gram (*lobia*), Bengal gram (*chana*), lentils, green gram (*moong*) etc. Pulses provide **protein** (protein quality is improved by combining it with cereals). They are also a fair source of carbohydrates and B-vitamins especially thiamine and niacin. Whole pulses also provide iron and fibre; sprouts provide vitamin C.
3. **Milk and Milk Products:** This group includes foods like milk, curd, cheese, paneer, khoa etc. The major nutrient it gives is good quality **protein**, besides providing other nutrients like carbohydrates, fat (whole milk), calcium and riboflavin. Milk and milk products are generally sources of all nutrients except iron and vitamin C.
4. **Meat and Meat Products:** These include foods like meat, fish, chicken, egg and products made with these. This group is a major source of good quality protein. Other nutrients supplied by this group are B-vitamins, retinol (liver) and calcium (fish). Eggs particularly are good sources of most nutrients.
5. **Nuts and Oil Seeds:** Nuts and oil seeds eg., groundnuts, almonds, cashew nuts, *til* seeds, pistachio etc. are a good source of fat. They also provide protein, B-vitamins, calcium and other minerals.





6. **Green Leafy Vegetables (GLVs):** These include vegetables like mustard (*sarson*), *bathua*, fenugreek leaves (*methi*), spinach (*palak*). Green leafy vegetables are a good source of **carotene** (vitamin A, B-vitamins (especially riboflavin and folic acid), iron (especially *sarson* and *bathua*) and **fibre**. They are also a source of calcium, but presence of oxalates in GLVs bind calcium and make most of it unavailable for absorption and utilisation. Fresh GLVs provide vitamin C.
7. **Root Vegetables:** These include potato, colocasia, sweet potato, yam etc. Major nutrient supplied by root vegetables is **carbohydrate**. Carotene is provided only by yellow yam.
8. **Other Vegetables:** All other vegetables like brinjal, ladyfinger (okra), beans, cauliflower etc. provide **fibre**, vitamins, some amount of minerals.
9. **Fruits:** Wide variety of fruits is available in the market. Different fruits are sources of different nutrients; hence a combination of various fruits should be included in the balanced diet. Fruits like mangoes, apricots, oranges, papaya are rich in **carotene**, citrus fruits like orange, *mausambi*, *amla* and guavas are good sources of **vitamin C**, dried fruits like dates and raisins are rich in iron. **Fibre** is provided by most fruits.
10. **Sugar and Jaggery:** These are simply **carbohydrates**. Jaggery also has iron.
11. **Fats and Oils:** Include *ghee*, oil, butter etc. are a rich source of **fat**. Vitamin D also is provided by butter/fortified oils.

Food groups can also be classified according to their **functions**:

Group 1. **Energy giving foods**- This category includes foods rich in carbohydrate and fat

1. Cereals and roots and tubers
2. Sugar and jaggery
3. Fats and oils

Group 2. **Body building group** – this category includes foods rich in protein

1. Milk and milk products
2. Meat and meat products, fish, egg or poultry
3. Pulses
4. Nuts and oilseeds

Group 3. **Protective or regulatory foods** – This group include foods providing vitamins and minerals

- I, Fruits-
 - (a) yellow and orange fruits (mango, papaya)
 - (b) citrus fruits (lemon, orange, *mausambi*)
 - (c) others (apple, banana etc.)





II. Vegetables

- (a) Green leafy vegetables (spinach, mustard, fenugreek etc.)
- (b) Yellow and orange vegetables (carrot, pumpkin)
- (c) Others (beans, okra, cauliflower etc.)
- (d) Root vegetables- potatoes and yam (*arvi*) are rich in carbohydrates

It is important to consume a **balanced diet** in order to get all the nutrients in right amounts and right proportions. This means that in any given meal, foods from all the food groups should be included in such a manner that all the nutrients are supplied in adequate quantities. One has to ensure that each and every meal includes foods from the energy-giving, body building and protective/regulatory groups. eg., For breakfast include one source from energy giving foods (bread- 2 slices; jam), one food from body building foods (egg for non-vegetarians or *paneer* or sprouts for vegetarians along with milk) and any one or two foods from protective group (fruit/fruit juice). Similarly, for lunch and dinner different foods from these food groups can be chosen in a variety of combinations. This way, the diet would provide all essential nutrients and would become balanced.

Thus, a balanced diet can be defined as one which contains different types of foods in such quantities and proportions that the need for calories, minerals, vitamins and other nutrients is adequately met and a small provision is made for extra nutrients to withstand the period of leanness ie., when adequate food or a particular nutrient is not consumed.

Moreover, the action and interaction of the nutrients should be considered. Foods promoting absorption of certain nutrients or hindering absorption of nutrients should also be kept in mind. For example, consuming tea along with meals hampers the absorption of iron while taking sources of vitamin C with meals increases the absorption of iron. Imbalance of nutrients sometimes does not allow proper absorption and utilisation of another nutrient. eg., calcium is needed for building of bones and teeth and phosphorus is also needed for the same. Excess amount of phosphorus in the diet does not allow body to utilise calcium properly and affects bone and teeth formation. Therefore, these two nutrients should be supplied in correct proportions and adequate amounts.

Extension Activity

Working in groups, prepare diet plans for the following:-

Name of the Activity.	
Diet plan for building muscle for a vegetarian athlete.	





Diet plan for building muscle for a non-vegetarian athlete.	
Eating strategies for a person who wants to lose 15kg.	
Eating strategies for a person who wants to gain 10kg.	

I. Tick the correct option.

Q1. Which is NOT a Micronutrient?

- (a) Minerals
- (b) Vitamins
- (c) Water
- (d) **Protein**

Q2. Which of the following is a water-soluble vitamin?

- (a) Vitamin A
- (b) **Vitamin B**
- (c) Vitamin D
- (d) Vitamin K

Q3. Iron is a part of

- (a) **trace minerals**
- (b) macro minerals
- (c) vitamins
- (d) carbohydrate

Q4. Fats and oils come under:

- (a) protective or regulatory foods
- (b) **energy giving foods**
- (c) bodybuilder group
- (d) routine foods

Q5. 1 gram of fat provides

- (a) 3 kcal





(b) 4 Kcal

(c) 5 Kcal

(d) 9 Kcal

II. Answer the following questions briefly.

1. What are macronutrients?
2. Explain the importance of fluid intake during a competition.
3. Write the source of 3 micro and 3 macro minerals.
4. What should be the basic nutrient in a weightlifter's diet? Why?

III. Answer the following questions in 150-200 words.

1. What do you understand by a balanced diet?
2. Explain different types of nutrients and their sources.
3. List the essential nutrients, their sources and functions.
4. Critically explain the use of dietary supplements in heavy dose for longer duration. Justify your answer with suitable examples.

2.2.1 Nutritive and Non-Nutritive Components of Diet

Food is the basic requirement of every individual which develops our body. It provides sufficient energy for workout and helps in the growth and development of individual. The food which we eat contains various nutrients which are essential for our body. There are a large number of nutrients required in our balanced diet. Some of them are "Nutritive components" like Carbohydrates, Fats, and Proteins, whereas some other components of diet have no nutritive value.

2.2.2 Non-Nutritive Components of Diet

Foods we eat contain a wide range of organic chemical compounds some of which have nutritive value as discussed above, while some have no nutritional value. Chemical compounds in foods with no specific nutritional function are called as non-nutritive components of foods. Some of these components act as anti-nutritional factors like phytate while some have various benefits like those of phytochemicals. Some materials with no nutritional value are added to food and beverage products to make the food smell better, taste better, last longer, and/or look better. Some of the non-nutritive components are discussed below.





2.2.3 Non-Nutritive Factors that Interfere with Nutrient Absorption

Anti-Nutritional Factors (ANFs), or non-nutritive factors that interfere with nutrient absorption, are those biological compounds present in human or animal foods that reduce nutrient utilization or food intake, thereby contributing to impaired gastrointestinal and metabolic performance. These include:

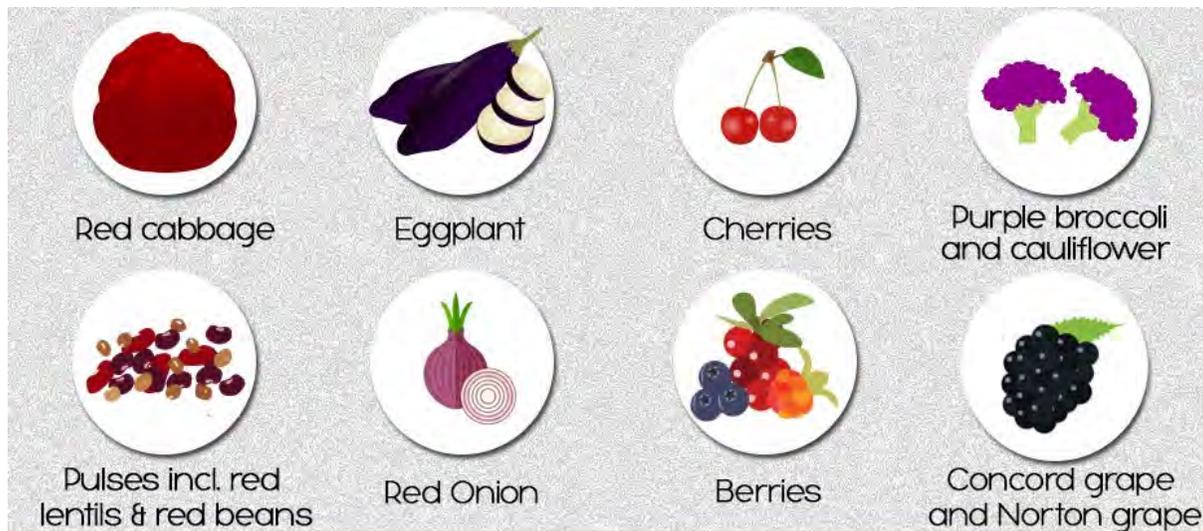
1. **Phytates** - These are abundantly found in unrefined cereals and millets. These phytates bind iron, zinc, calcium and magnesium and make these nutrients unavailable for digestion. On germination the phytate content is reduced.
2. **Tannins**- These are present in legumes, millets like *bajra*, *ragi*, spices, tamarind, tea, turmeric and in certain vegetables and fruits. Tannins interfere with iron and protein absorption.
3. **Trypsin Inhibitors**- These inhibit the activity of trypsin in the gut and interfere with digestibility of dietary proteins and reduce their utilisation. These are present in soya bean, duck egg white. Heat treatment inactivates trypsin inhibitors.
4. **Oxalates**- These are present in green leafy vegetables and some legumes. These interfere with calcium absorption.
5. **Goitrogens**- These are also known as anti-thyroid substances as these interfere with iodine uptake by thyroid gland and may contribute to development of iodine deficiency disorders when iodine intakes are marginal. These are present in cabbage, cauliflower, turnips, soybean, bajra, peanuts, lentils.

2.2.4 Beneficial Non-Nutritive Factors of Foods

1. **Phytochemicals**- Phytochemicals are chemical compounds produced by plants, generally to help them thrive or thwart competitors, predators, or pathogens. The name comes from Greek *phyton*, meaning 'plant'. They are found in fruits, vegetables, grains, beans, and other plants. Some of these phytochemicals are believed to act as antioxidants and protect cells from damage that could lead to cancer.

Risk of cancer can be reduced by eating more colourful vegetables, fruits, and other plant foods that have certain phytochemicals in them. Some of these phytochemicals are Beta carotene and other carotenoids in yellow, red, green vegetables and fruits, flavonoids in green tea, isothiocyanates in cruciferous vegetables (cabbage, broccoli, kale, mustard greens, turnip greens, and cauliflower).





Picture source¹

- 2. Anthocyanins:** Anthocyanins give grapes, blueberries, cranberries, and raspberries their dark colour. They have been shown in the laboratory to have anti-inflammatory and anti-tumour properties.
- 3. Flavonoids or isoflavones:** These are found in vegetables, fruits and grains like soybeans, chickpeas and may act a little bit like oestrogen. The oestrogen-like compounds in these plants are called phytoestrogens. These help in lowering the risk of osteoporosis, heart disease, breast cancer and symptoms of menopause.
- 4. Artificial Sweeteners:** These are synthetic compounds that duplicate the taste of sugar, but contain less energy, and, therefore, are often added to diet foods and beverages. The reason is to maintain the desired taste, but reduce the caloric value. Because artificial sweeteners are considered additives, they are often regulated. Therefore, their identifications and concentrations must be determined.
- 5. Preservatives:** These are compounds that have the ability to inhibit microbial growth and are often added to food and beverage products to prolong shelf life. Preservatives are considered additives, and are typically regulated. Therefore, their identifications and concentrations must be determined.
- 6. Spices:** A spice is a dried seed, fruit, root, bark or vegetable substance primarily used for flavouring, colouring or preserving food. Sometimes a spice is used to hide other flavours. Spices are distinguished from herbs, which are parts of leafy green plants also used for flavouring or as garnish. A spice may have other uses, including medicinal, religious ritual, cosmetics or perfume production, or as a vegetable. For example, turmeric roots are also consumed as a vegetable and garlic as an antibiotic.





7. **Coffee:** Coffee is a brewed beverage prepared from the roasted or baked seeds of several species of *Coffea*. The two most common sources of coffee beans are *Coffea arabica*, and *Coffea canephora*. Once ripe, coffee berries are picked, processed and dried to yield the seeds inside. The seeds are then roasted to varying degrees, depending on the desired flavour, before being ground and brewed to create coffee. Coffee can have a stimulating effect on humans because of its caffeine content. It is one of the most popular drinks in the world. It can be prepared and presented in a variety of ways.

I. Tick the correct option.

Q1. Anthocyanins give colour to

- (a) roots
- (b) coffee
- (c) wheat
- (d) **grapes**

Q2. Oxalates are presents in

- (a) green leafy vegetables
- (b) *bajara*
- (c) nuts
- (d) spices

II. Answer the following questions briefly.

1. Define Non-Nutritive components of food.
2. Explain the beneficial factors of Non-Nutritive foods.

III. Answer the following questions in 150-200 words.

1. Explain Non-Nutritive components of Diet

2.3.1 Healthy Weight

There are numerous advantages of maintaining healthy weight. Overweight or obese people can gain these health benefits by losing some weight. For most obese or overweight people, health benefits can come with losing the first 5-10% of weight. Conditions such as Type 2 diabetes are less likely to develop if an obese person loses even 10% of their weight. With a healthy body weight there is less likelihood of having heart disease, stroke, or obesity-related cancers all of which can be life-threatening and the chances of living a long and healthier life increase.



**Do you Know?**

Body Mass Index (BMI) is used to broadly categorize a person as underweight, normal weight, overweight, or obese based on tissue mass (muscle, fat, and bone) and height. Overweight or Obesity can lead to a variety of health conditions, such as type 2 diabetes, high blood pressure, and cardiovascular problems. On the other hand, a weight that is too low can increase the risk of malnutrition, osteoporosis, and anaemia.

Waist-to-Hip Ratio (WHR) – or the ratio between the circumference of the waist and the circumference of the hip indicates risk of obesity. Greater circumference of trunk is an indicator of high risk of hypertension and type 2 diabetes.

Girth Circumferences or circumferences of different segments of the body help to document body size and to estimate the percentage of body fat. **Skinfolds** determine body fat quite accurately. The skinfold technique can only be performed by a trained technician using skinfold callipers.

Bioelectrical Impedance Analysis is a commonly used method for estimating body composition, in particular body fat and muscle mass. A weak electric current flows through the body and the voltage is measured in order to calculate impedance (resistance) of the body. It is done using a portable machine, is easy to administer and gives reliable results of body composition.

Hydrostatic Weighing or Underwater weighing is known as the gold standard method to measure mass per unit volume of a living person's body.

There are various ways of assessing healthy body weight that include weight for height charts, Body Mass Index (BMI) or assessment of body fat percentage.

Body Mass Index (BMI) **Quetelet's Index** is a key index for relating weight to height. BMI is derived by taking a person's weight in kilograms (kg) divided by his or her height in meters squared. Now-a-days, BMI is used to define normal weight, overweight, and obesity rather than the traditional height/weight charts.

BMI of 30 or more for either sex indicates Obesity. BMI however, does not measure how much fat mass or muscle mass is there. A very muscular person might get a high BMI without health risks. It is, therefore, less accurate in people such as body builders and pregnant women.

BMI	Classification
< 18.5	Underweight
18.5–24.9	Normal weight
25.0–29.9	Overweight





30.0–34.9	Grade I obesity
35.0–39.9	Grade II obesity
≥ 40.0	Grade III obesity

Intra-abdominal or visceral fat has a particularly strong correlation with cardiovascular disease. Women with abdominal obesity have a cardiovascular risk similar to that of men. This can be evaluated by measuring waist circumference or by calculating waist to hip ratio. A waist circumference of >102 cm (>40 inches) in men and >88 cm (>35 inches) in women or the waist-hip ratio (the circumference of the waist divided by that of the hips of >1.0 for men and >0.85 for women) are used to define central obesity. In those with a BMI under 35, intra-abdominal body fat is related to negative health outcomes independent of total body fat.

Body fat percentage is total body fat expressed as a percentage of total body weight that can be assessed by methods like skinfold measurements, bioelectrical impedance, dual X-ray absorptiometry (DEXA) etc. but to measure body fat percentage, special equipment and technical expertise is needed. There is no generally accepted definition of obesity based on total body fat. Most researchers have used >25% in men, and >32% in women, as cut-points to define obesity and higher health risks.

2.3.2 Eating for Weight Control

Eating right is important to stay at a healthy weight. Maintaining body weight is a balancing act, meaning that the amount of energy we consume should be expended. If we eat more calories than we burn, we gain weight. And if we eat fewer calories than we burn, we lose weight. The balance between the calories intake and calories used or expended is essential to keep the weight maintained. The best way to have energy balance is to make better choices, thus, **choosing foods that are lower in fat and have fewer calories and increasing physical activity are the best ways to reduce body weight.**

We *can* lose weight by making smart choices every day, we can develop new eating habits and preferences that will leave us feeling satisfied and winning the battle of weight loss. **Slow and steady wins the race.** Aim to lose one to two kilos a week to ensure healthy weight loss. Losing weight too fast can take a toll on our mind and body, making us feel sluggish, drained, and sick. Caloric restriction for weight reduction is essential to get results. Dietary modification must be accompanied by moderate amounts of exercise to get effective results in weight loss or weight maintenance. Aerobic exercise increases the daily energy expenditure and is particularly useful for long-term weight maintenance. Exercise





will also preserve lean body mass and partially prevent the decrease in basal metabolic rate which comes when caloric intake is restricted.

Additionally, most of the benefits of exercise come from improvements in body composition, overall fitness and metabolic health, not just weight loss. Risk of cardiovascular diseases, diabetes and other obesity related health problems also lower. Stress also reduces hence, stress related intake of food is also curtailed.

The person should be put in negative energy balance to upto 500-1000 kcal to get ideal reduction in weight of 500g - 1 kg / week. To lose weight, we have to eat fewer calories than what we expend. But that doesn't necessarily mean we have to eat less food. We can fill up our stomach while on a diet, as long as we choose foods wisely.

Modifications in the diet to be made

1. The diet should consist foods from all food groups including, milk and milk products, meat and meat products, cereals, pulses, fruits and vegetables.
2. High-fibre foods are higher in volume and take longer to digest, which makes them filling. High-fibre foods include:
 - **Fruits and vegetables** – Eat whole fruits, salads, and green leafy vegetables of all kinds. Soups and salads can be liberally eaten. The high water and fibre content in most fresh fruits and vegetables makes them hard to overeat. Eat vegetables raw or steamed, not fried or breaded.
 - **Beans** – Select beans of any kind. Add them to soups, salads, and meals.
 - **Whole grains** –High-fibre cereals, oatmeal, brown rice, whole-wheat pasta, whole-wheat or multigrain bread.
3. Add nuts to the daily diet but only in moderation.
4. Switch to fat-free or low-fat milk and milk products. Use low-fat milk in place of cream thereby reducing the overall caloric intake of the day.
5. Baking or grilling foods rather than frying them reduces the calorie count of foods
6. Limit intake of high sugar foods like jams, jellies, sweetened curd etc.
7. Cut on high cholesterol and saturated fat foods like *mixtures*, *mathris*, *namkeens* and bakery products. Instead, choose high fibre biscuits, or *khakhra* type snacks.
8. Eat low-fat proteins like egg whites, fish, lean meats, nuts, and poultry.
9. Serve smaller portions. One easy way to control portion size is by using small plates, bowls, and cups. This will make portions appear larger. Don't eat out of large bowls or directly from the food container or package, which makes it difficult to assess how





much has been eaten. Using smaller utensils, like a teaspoon instead of tablespoon, can slow eating and help feel full sooner.

10. Cooking meals at home allows controlling both portion size and what goes in to the food. Restaurant and packaged foods generally contain a lot more sodium, sugar, fat and calories than food cooked at home—plus the portion sizes tend to be larger.
11. Avoid consuming high salt foods like pickles, *papad* etc. as these foods induce water retention.
12. Be especially careful to avoid high-calorie snacks and convenience foods.
13. Soft drinks (including soda, energy drinks, and coffee drinks) are a huge source of calories in many people's diets. One can of soft drink contains between 10-12 teaspoons of sugar and around 150 calories, so a few soft drinks can quickly add up to a good portion of your daily calorie intake. Instead homemade lemon water, coconut water, *lassi* or *chachh* are better replacements of commercially available juices and soft drinks.
14. Reduce daily calorie intake by replacing soda, alcohol, or coffee with water. Thirst can also be confused with hunger, so by drinking water, one can avoid consuming extra calories.
15. Eating frequently throughout the day (3 small meals and 2-3 snacks) will stimulate metabolism. Skipping meals (including breakfast) can decrease metabolism. Skipping meals usually turns into eating more at the end of the day.

Reducing portion sizes, changing ways of cooking, right food selection would go long way in helping weight management.

2.3.3 The Pitfalls of Dieting

Maintaining a calorie deficit always leads to weight loss. Without exercise, a calorie deficit must be created through a lower calorie intake. The main problem with dieting alone is the sacrifice needed to sustain a very low-calorie intake for a long period of time is too much for most people to handle. On a very low-calorie diet, most people would breakdown and go back to their old habits causing any weight loss to return quickly.

The body's reaction to dieting is also different with a sudden and drastic reduction in calorie intake as starvation and body adjusts its metabolism accordingly. Eating very little calories for a long time would turn body into starvation mode means slowing down metabolic processes which is the body's way of protecting itself against long periods with little or no food. This starvation mode causes body to drastically cut its energy requirements and the person would stop losing weight.





Do you Know?

Anorexia nervosa is an eating disorder characterized by an abnormally low body weight, an intense fear of gaining weight and a distorted perception of weight. People with anorexia place a high value on controlling their weight and shape, using extreme efforts that tend to significantly interfere with their lives.

To prevent weight gain or to continue losing weight, people with anorexia usually severely restrict the amount of food they eat. They may control calorie intake by vomiting after eating or by misusing laxatives, diet aids, diuretics or enemas. They may also try to lose weight by exercising excessively. No matter how much weight is lost, the person continues to fear weight gain.

Diets, especially fad diets or “quick-fix” pills and plans, often lead to failure because diets that cut out entire groups of food, such as carbohydrates or fat, are simply impractical and unhealthy. The key is moderation. Diets that severely cut calories, restrict certain foods, or rely on ready-made meals might work in the short term but don’t include a plan for maintaining our weight, so the weight quickly comes back. Severely restricted diet also lead to deficiency of various other nutrients. Once we start eating normally, we’ll gain weight until our metabolism bounces back. Special shakes, meals, and programmes are not only expensive, but they aren’t practical for long-term weight loss. Hence, instead of dieting alone and looking for miraculous foods to reduce or maintain weight, regular exercise and good eating habits are crucial to health and well-being.

2.3.4 Food Intolerance

Food intolerance is the non-IgE mediated food hypersensitivity or non-allergic food hypersensitivity, which is characterized by difficulty in digesting certain foods. Food intolerance is different from food allergy. Food allergies trigger the immune system, while food intolerance does not. The symptoms of food intolerance generally take longer to emerge, compared to food allergies. In food intolerance, some people suffer digestive problems after eating certain foods. Foods most commonly associated with food intolerance include dairy products, grains that contain gluten, and foods that cause intestinal gas build-up, such as beans and cabbage. Gluten in wheat is one of the most common causes of food intolerance. Some people are intolerant to several groups of foods, making it harder to determine whether it might be a chronic illness or food intolerance. Identifying which foods are the reasons can take a long time.

The symptoms to food intolerance are varied and can include stomach-ache, bloating, nausea, irritable bowel, hives, migraine, mild fever, cough etc. Some types of food intolerance are given below:





Absence of an enzyme: Enzymes are needed to digest foods fully. If some of these enzymes are missing, or are insufficient for digesting a particular foodstuff, proper digestion may be affected. Some food intolerance is caused by the lack of a particular enzyme like lactose intolerance which is caused due to deficiency of lactase enzyme in the body. Hence, the person is unable to digest lactose from milk and gets intolerant to milk and all milk products. People who are lactose intolerant do not have enough lactase, an enzyme that breaks down milk sugar (lactose) into smaller molecules and absorb through the intestine. If lactose remains in the digestive tract, it can cause stomach-ache, spasms, bloating, gas and diarrhoea.

Chemical causes of food intolerance: Certain chemicals in foods and drinks can cause intolerance, including amines in some cheeses, and caffeine in coffee, tea, and chocolates. Some people are more susceptible to these chemicals than others.

Toxins due to Food poisoning: Some foods have naturally-occurring chemicals that can have a toxic effect on humans, causing diarrhoea, nausea, and vomiting. Peanuts or undercooked beans have aflatoxins that can cause extremely unpleasant digestive problems.

Salicylates: Salicylates are derivatives of salicylic acid, which occurs naturally in plants as a defence mechanism against harmful bacteria, fungi, insects, and diseases. Salicylates are present in most plant-sourced foods, including the majority of fruits and vegetables, spices, herbs, tea, and flavour additives. Mint-flavouring, tomato sauce, berries, and citrus fruits have particularly high levels. Salicylate intolerance, also known as salicylate sensitivity, occurs when somebody reacts to normal amounts of ingested salicylate. These chemicals are found in many foods and most people can consume salicylate-containing foods without any adverse effects. However, some people suffer symptoms after eating large amounts. Salicylate intolerant individuals should avoid foods that contain high levels. Processed foods with flavour additives are usually high in salicylates as well.

Gluten intolerance: **Gluten** is a protein found primarily in **wheat**, barley and rye. If a person has a **gluten intolerance**, this protein can cause digestive problems such as gas, abdominal pain or diarrhoea. **Gluten intolerance** is sometimes confused with Celiac disease, or thought of as a food allergy. Anyone who suspects they may have a gluten intolerance should see a doctor before giving up gluten, as cereals can be an important source of various nutrients.

Food additives and intolerance: Additives are used to enhance flavours, make foods look more appealing, and to increase their shelf life. Food additive intolerance has been a steadily- growing problem over the last many years because more and more foods contain additives. Nitrates are known to cause itching and skin rashes. Processed meats are generally high in nitrates and nitrites. MSG (monosodium glutamate) is used as a flavour enhancer known to cause headaches. Some colourings – especially carmine (red) and annatto (yellow) also cause food intolerance.





It is very difficult to determine whether somebody has a food intolerance or allergy because the signs and symptoms often overlap. Patients are advised to keep a diary and write down which foods are eaten, what the symptoms were like, and when they appeared. The data in the diary can help a dietician or doctor identify which foods are causing adverse reactions, and what steps to take. Apart from lactose intolerance and celiac disease, there is no accurate, reliable, and validated test to identify food intolerance. The best diagnostic tool is an exclusion diet, also known as an elimination or diagnostic diet. Exclusion diets are extremely useful in isolating the causative foods. In a typical exclusion diet, the suspected food is removed from the diet for a period of 2 weeks to 2 months. If during this period the adverse reactions do not appear, it becomes more likely that the cause has been recognized. The best current treatment for food intolerance is to either avoid certain foods or eat them less often and in smaller amounts.

2.3.5 Food Myths

The fewer the carbohydrates, healthier you are- Choosing the healthiest carbohydrates, especially whole grains, is important for health and well-being. Refined carbohydrates should be avoided however, choosing whole grains is associated with a decreased risk of chronic diseases and premature mortality.

Oils/Margarine have fewer calories than Ghee/butter- Ghee/Butter and Oils/Margarine have about the same amount of calories. Margarine, which is made from vegetable oils, was seen as a healthier alternative to butter (which contains cholesterol and saturated fat), but later it was found that some margarines are actually healthier because they contain trans-fats, which have even more adverse effects on cholesterol and heart health.

Apples and brinjals are rich in iron because they turn brown when cut- One of the greatest myths about apples and brinjals is that they are good sources of iron. These are an excellent source of fibre but not iron. This change in colour is an enzymatic reaction and has nothing to do with iron.

Case Study

One of the exciting aspects of the field of sports nutrition is individualizing eating plans for athletes. Each athlete is different—there is not a “one-size-fits-all” type of meal plan, training diet, or competition hydration schedule. Certainly the basic sports nutrition concepts and guidelines can be applied universally; however, each athlete will require a unique approach by tweaking those guidelines to fit individual needs. For example, all athletes should consume a combination of carbohydrates and protein after exercise to initiate the repair and rebuilding process. However, one athlete may enjoy *daal, roti* green vegetables and a banana, whereas another athlete may crave an omelet, toast, and orange juice. Both of these meals meet the carbohydrate–protein combination requirement but





also take into consideration personal taste preferences. This individualized approach is much more challenging. Sports nutrition professionals with this philosophy will succeed because of the recognition that their plans are based on solid research and current guidelines while also being practical, easy to implement, and specific to an athlete's sport and lifestyle.

Several factors must be considered when calculating nutrient needs and developing a meal plan for an athlete, including the individual's health history, the bioenergetics of the athlete's sport, total weekly training and competition time, living arrangements, access to food, and travel schedules.

- Q. What do you think the writer means by "one-size-fits-all" type of meal plan?
- Q. What are the essential nutrients needed by an athlete?
- Q. What are the factors to be considered while devising a meal plan for an individual?
- Q. Develop an individualized nutrition plan for a sprinter, who is a vegetarian, keeping in mind the factors mentioned above. You must mention why you made the dietary choices.

Art Integration

Start an awareness campaign in your school regarding importance of nutrition in our life.

You could include the following activities:

- Poster making Competition on the benefits of Healthy Eating and Healthy Lifestyle
- Talk Show by inviting a Dietician.
- Making and screening a video film on dietary imbalances.
- Cooking competition for cooking healthy.
- If possible, develop a school vegetable garden to increase awareness about various vegetables.

I. Tick the correct option.

Q1. What is an ideal weight to be reduced in one week?

- (a) 250 gms to 500 gms
- (b) **500 gms to 1 kg**
- (c) 1 kg to 1.5 kg
- (d) kg to 2 kgs

Q2. BMI between 25.0–29.9 is _____

- (a) under weight





- (b) normal
- (c) **overweight**
- (d) obese

II. Answer the following questions briefly.

1. List the points to be considered for weight maintenance.
2. Point out the pit falls of dieting

III. Answer the following questions in 150-200 words.

1. What is food Intolerance? Enlist the foods which are commonly associated with food intolerance.
2. How you can modify your diet for weight control?
3. Enumerate any five food myths and the related facts.

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UNIT-III: YOGA AND LIFESTYLE

Contents

- Asanas as preventive measures
- Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana
- Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana
- Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana
- Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana
- Back Pain: Procedure, Benefits & Contraindications Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana

Learning Outcomes

At the end of the Unit, you will be able to:

- identify the *asanas* beneficial for different types of ailments and health problems.
- recognize importance of various *asanas* for preventive measures of obesity, diabetes, asthma, hypertension, back pain.
- describe the procedure for performing variety of *asanas* for maximal benefits.
- distinguish the contraindications associated with performing of different *asanas*.
- outline the role of yogic management for various health benefits and preventive measures.

Discussion

Discuss in a Group

- What are the factors that have led to an increase in sedentary behaviour in our modern lifestyle?
- What prompts individuals into developing a particular lifestyle or adopting a particular occupational culture?
- In what way do their different lifestyles and occupations impact their day to day life or health?
- What do you understand by the term lifestyle diseases?
- List some lifestyle diseases.





- What is the meaning of the term “premature mortality”? How do these diseases lead to?

3.1.1 Yoga Asanas as a Preventive Measure

Emerging new technologies such as dependence on the internet and virtual communication networks, have led to faulty eating habits and a wrong sleeping pattern that threatens the physical and mental health of individuals. Yoga plays an important role in helping individuals adopt a healthier lifestyle for improved physical and mental health, which, in turn, results in better productivity. Yoga is therapeutic in modern lifestyle disease like stress, diabetes, hypertension, backache etc. The power of yoga lies in its simplicity, flexibility, and diversity. As a result, Yoga has been the subject of global popularity and research in the past few decades.



Picture source¹

Yoga is a very ancient system of physical, mental, and spiritual practices or disciplines that originated in India. According to Patanjali, **asana** means, *Sthira sukham asanam*, or, **that position which is comfortable and steady**. In *Bhavanopanishad*, “To sit in a comfortable position or posture for everlasting period is called *Asana*”. There are different types of *asanas* Meditative *Asana*, Relaxative *Asana* and Corrective *Asana*.

The modern world is facing a pandemic of lifestyle disorders that require changes to be made consciously by individuals themselves, and *yogasanas* can be preventive measures in fending off lifestyle diseases as they provide physiological advantages. Busy schedule, long





commutes, load of study, late night work leaves little, or no, time for physical activity. This, added to the lifestyle related challenges has led to diseases such as hyperactivity, obesity, hypertension, and diabetes. The following are the blessings of *asanas* for prevention of diseases:

- 1. Strengthening of Bones and Joints:** Yoga *asanas* are performed with postural stability and complete focus on the movement of joints and elasticity of muscles. Yoga is a weight-bearing exercise, which simply means you hold the weight of your body up against gravity. This puts mild stress on the bones and keeps them strong. Unlike other weight-bearing activities, yoga does not damage cartilage or stress the joints. Instead, it helps to strengthen and maintain bone health, relieves stress, improves balance and thereby reduces the likelihood of falls. In 2011, Dr Loren Fishman, a famous Physiatrist, reported that his patients showed increased bone density in their spine and hips through Yoga. The study concluded that practising yoga for just 8-10 minutes every day would raise bone quality. Dr Fishman conducted another study with 741 elderly volunteers over a period of 10 years that concluded in 2015 which proved that yoga is safe, even for people who have suffered significant bone loss. "There are a series of anti-arthritis *asanas* for loosening every joint of the body," says Agarwala². The *Tadasana*, *Tiryak Tadasana* and *Kati Chakrasana* involve three different movements, like upward stretching, lateral stretching and twisting of the spine. Also, the *Trikonasana* helps in developing body structure strength. Backward-bending *asanas*, such as *Bhujangasana*, *Sarpasana* and *Dhanurasana*, are excellent for relieving back pain and strengthening the spine. *Surya Namaskar*, which has 12 positions, is a complete practice for bone strengthening.

Do you know?

Difference between yoga and exercise?

- When *Yogasanas* are performed, respiration and metabolic rates slow down. As a result, consumption of oxygen and body temperature drop. However, during exercise, breathing and metabolism speed up, oxygen consumption rises, and body gets hot.
- *Yoga* postures tend to arrest catabolism whereas exercise promotes it.
- *Asanas* are designed to have specific effects on the glands and internal organs, and to alter electrochemical activity in the nervous system.
- The *asanas* are classified in to three groups- beginners, intermediate, and advanced. Regular practice of a balanced programme, tailored to individual needs is recommended for maximum benefits.

- 2. Improving Blood Circulation:** By performing Yoga regularly, cardiac muscle tissue begins working better, increasing cardiac output. Blood circulation improves and blood





stress normalizes and stabilizes. Regulated breathing oxygenates the blood and assists fresh nutrients to reach all peripheral vessels and capillaries. Improved circulation means that the brain receives more oxygen, resulting in improved alertness, memory, and mood. Other vital organs also receive a steady supply of the nutrients they need for optimal functioning. *Adho Mukha Svanasana* (Down dog), *Virabhadrasana* (warrior pose), *Utthita Trikonasana* (triangle pose), *Urdhva Dhanurasana* (Full wheel), *Ustrasana* (camel pose) are *asanas* to improve blood circulation.

3. **Bolstering Immunity:** Lack of sleep, poor nutrition, and life stress all lead to a weakened immune system and vulnerability to disease. Stress, more than anything, leads to a breakdown in the body's ability to defend itself against bacteria and viruses. When stressed, the hormone cortisol stays in the blood for extended periods of time, leading to increased inflammation. According to *Psychology Today*³, a new research published in the Journal of Behavioural Medicine suggests that yoga can be helpful in boosting the immune system and decreasing inflammation in the body as it lowers stress hormones and strengthens the nervous system, while also stimulating the lymphatic system, which removes toxins from the body. Yoga calms the mind and contributes to deeper, regulated sleep, which is crucial for wellness. *Balasana* (Child pose), *Bhujangasana* (cobra pose), *Dhanurasana* (Bow pose) and *Matsyasana* (Fish pose) are helpful in improving immunity
4. **Improving efficiency of Respiratory Organs:** Respiration is a two-way process: supplying oxygen to every cell in the body and then transporting carbon dioxide, the waste product of respiration, out of the body. Lungs have the important function of drawing in the oxygen, moving it into the blood stream, extracting the carbon dioxide from the blood stream and removing it from the body. Most people are habitual shallow breathers and do not use lungs to their full potential. *Bitilasana* (Cow pose), *Marjaryasana* (cat pose), *Padangusthasana* (Big toe pose) help improve the respiratory system. The size of lungs and chest is also enhanced. Yogic *asanas* and *pranayama* have been shown to lower the resting respiratory rate.
 - Complete breathing gives us more energy. The deeper our breath the more oxygen reaches our cells. At the cellular level oxygen is used for energy release.
 - Complete breathing helps us to think more clearly by supplying more oxygen to the brain.
 - It assists our immune system and helps to lower our heart rate.
 - Complete breathing also relaxes us, giving us a good night's sleep and is a great way to cope with stress.
5. **Complementing Performance of Excretory System:** As you know, food is digested in the digestive tract and nutrients are absorbed in the blood and waste is thrown out of the body. If the excretory system is not functioning properly the waste from the body is not thrown out completely and gets accumulated, leading to problems in the





digestive system, urinary system and excretory system. *Pawanmuktasan* and other loosening movements help in releasing toxins from the joints. All forward bend, backward bend, and twisting *asanas* create pressure and stretch in the abdominal cavity. This improves the blood supply to the organs in the abdominal cavity like stomach, intestine, liver, gall bladder, kidneys and pancreas. As a result, the waste products including lactic acid, acid phosphate, urea, uric acid etc. are excreted. This helps in reducing fatigue. Recommended *asanas* include *Pawanmuktasan*, *Dronasana*, *Bhujangasana*, *Shalabhasana*, *Dhanurasana*, *UttanaVakrasana* and *Trikonasana*. Mudras like *Ashwamudra*, *Ashwinimudra*, *Yogamudra*, *Viparitamudra*, *Sulabhatadagi mudra* have positive effect on this system.

6. **Strengthening Muscular Tissues:** The Musculo-Skeletal system consists of bones, skeletal muscles, joints, tendons, ligaments, nerves and cartilage. It provides a frame to support the body and to enable it to move. Muscles, tendons and ligaments act on the bones to give the body its shape and posture. Yoga *asanas* can help redress problems associated with poor body posture and the effects of structural decay, because they strengthen weak muscles and stretch tight ones. For example, an individual who spends long hours sitting or at a computer can develop shortness of the hip flexors and an imbalance of the hip musculature. Regular Yoga practice strengthens and increases muscle tissue. Fat does not accumulate in the body. Yoga *asanas* and *pranayama* can help by combating and helping to reverse this gradual decay of the body's structure. By taking corrective action, the person's pain, illness or disease can at least be addressed, or in other cases, even ameliorated.

I. **Tick the correct option**

1. *Yogasutra* was compiled by
 - (a) Patanjali
 - (b) Gheranda
 - (c) Shivananda
 - (d) Svatmarma
2. According to Patanjali, the definition of *Asana* is
 - (a) control of sense organs
 - (b) sitting in a cross-legged position
 - (c) sitting in a comfortable position
 - (d) control of diet and water intake.
3. How many types of *Asanas* are there in Yoga?
 - (a) 3





- (b) 4
- (c) 5
- (d) 12

4. Which *Asana* is good for the performance of the Excretory System?

- (a) *Sukhasana*
- (b) *Tadasana*

- (c) *Pawanmuktasana*
- (d) *Virabhadrasana*

II. Answer the following questions briefly.

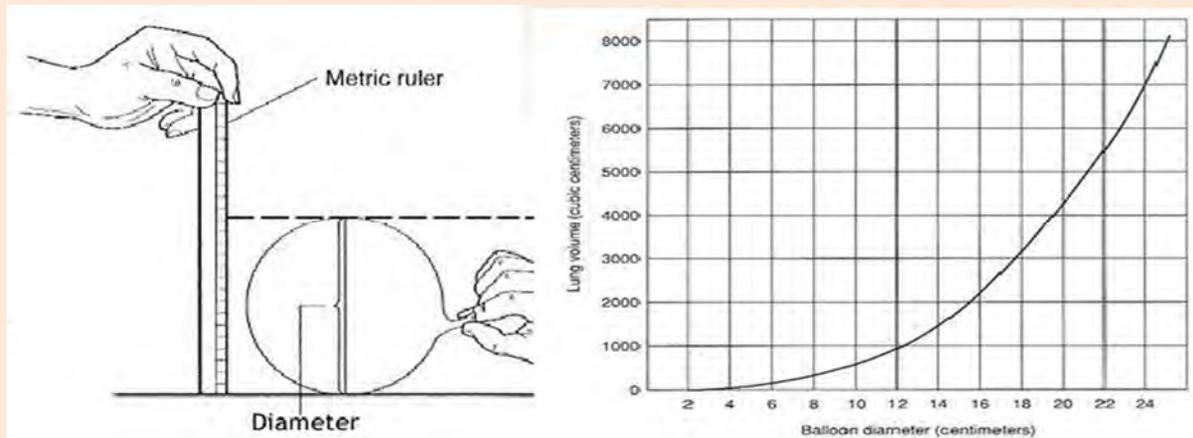
1. How is yoga helpful in improving lifestyle?
2. How do *Asanas* help bones and joint to grow stronger?

III. Answer the following question in 150—200 words

1. Discuss *Asanas* as a preventive measure for disease.

Extension Activity

Take a round balloon and stretch it out. Take a deep breath and then exhale into the balloon. Pinch the end of the balloon and measure its diameter in cm.



How did you feel after five attempts?

Picture source⁴

Measuring breath inhaling and exhaling capacity to understand the functioning capacity of your lungs by using a Balloon





3.2.1 Obesity

Obesity is not a single disorder but a heterogeneous group of conditions with multiple causes each of which is ultimately expressed as obese phenotype. Obesity involves complex etiological links between the genetic, metabolic and neural frameworks on the one hand, and behaviour, food habits, physical activity and socio-cultural factors on the other. Obesity is a condition in which excess body fat accumulates to such an extent that health may be affected. It is commonly defined as a Body Mass Index (BMI) of 30kg/m² or higher. Obesity, in absolute terms, is an increase of body adipose tissue (fat tissue) mass.

Obesity, which was once viewed as the result of lack of will power, or a lifestyle "choice" – the choice to overeat and under exercise, is now being considered more appropriately by the modern world as a chronic disease, which requires effective strategies for its management. There are different methods to measure obesity.

MEASURING OBESITY	DETAILS						
BODY MASS INDEX	<p>BMI is a value derived from the mass (weight) and height of a person. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m², resulting from mass in kilograms, height in metres.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"><p style="text-align: center;">Body Mass Index Interpretation</p><table border="1" style="width: 100%; text-align: center;"><tbody><tr><td>BMI < 18.5: Below normal weight</td></tr><tr><td>BMI ≥ 18.5 and < 25: Normal weight</td></tr><tr><td>BMI ≥ 25 and < 30: Overweight</td></tr><tr><td>BMI ≥ 30 and < 35: Class I Obesity</td></tr><tr><td>BMI ≥ 35 and < 40: Class II Obesity</td></tr><tr><td>BMI ≥ 40: Class III Obesity</td></tr></tbody></table></div> <p>Do you know other methods of measuring obesity?</p>	BMI < 18.5: Below normal weight	BMI ≥ 18.5 and < 25: Normal weight	BMI ≥ 25 and < 30: Overweight	BMI ≥ 30 and < 35: Class I Obesity	BMI ≥ 35 and < 40: Class II Obesity	BMI ≥ 40: Class III Obesity
BMI < 18.5: Below normal weight							
BMI ≥ 18.5 and < 25: Normal weight							
BMI ≥ 25 and < 30: Overweight							
BMI ≥ 30 and < 35: Class I Obesity							
BMI ≥ 35 and < 40: Class II Obesity							
BMI ≥ 40: Class III Obesity							

3.2.2 Asanas to Prevent Obesity

VAJARASANA

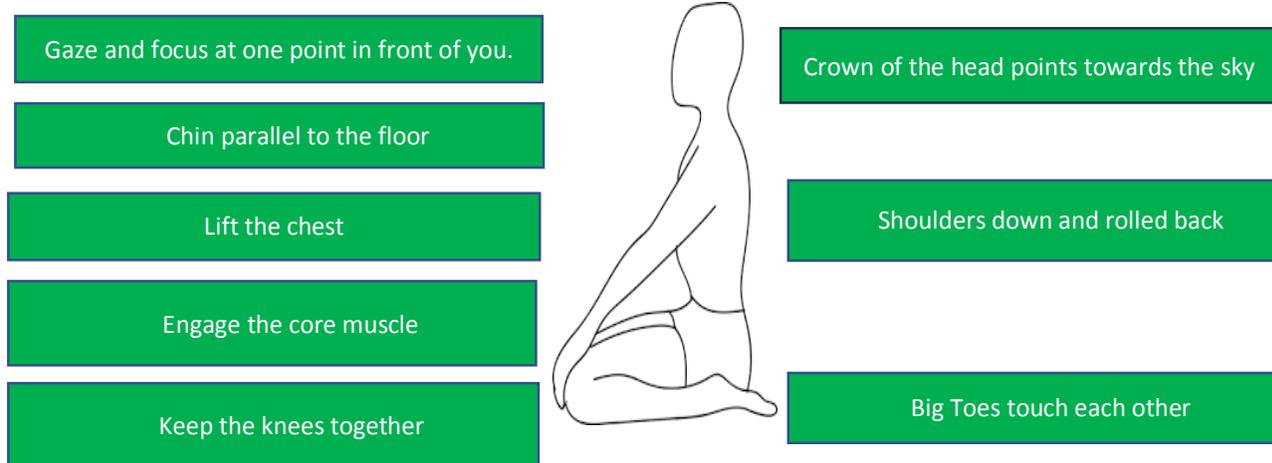
In Sanskrit Vajra means **thunderbolt** and since the final position of this asana looks like thunderbolt, it is called Vajrasana. Vajra is also the major Nadi directly connected to the Genito-Urinary system. Body parts involved in performing Vajarasana are feet, ankles and knees. Garudasana (Eagle pose) and Baddha Konasana (Butterfly pose) are preparatory asanas for Vajarasana.





Procedure

1. Sit with legs extended together, hands by the side, palm resting on the ground, fingers together and pointing forward.
2. Fold the right leg at the knee and place the foot under the right hip.
3. Similarly fold the left foot and place it under the left hip. Feet should touch the sides of hips.



4. Now place your hands on the knees, with the palms resting on the knees.
5. Back and head should be straight but not tense, gaze in front or close your eyes and relax.
6. Avoid excessive backward arching of the spine.
7. Breathe normally and fix the attention on the flow of air passing in and out of the nostrils.
8. While returning to the original position, bend a little towards right side, take out your left leg and extend it.
9. Similarly, stretch out your right leg.

Suggested *Asanas* to relax muscles after *Vajrasana*

Dandasana and *Savasana* to release the stress around the back, legs and the hips.

Advance pose - *Paryakasana* (Couch Pose), *Bhekkhasana* (Frog pose II), *Laghuvajrasana* (Little thunderbolt pose)

Benefits

- (a) *Vajrasana* increases flexibility in the ankles.
- (b) Folding of knees and thighs stretches the quadriceps muscles and improves blood circulation.





- (c) Elevating the spine from the floor, alters the flow of blood in the pelvic region and pelvic muscles are strengthened.
- (d) *Vajrasana* can be practised even after a meal. In fact, it increases the efficiency of the digestive system and aids digestion.
- (e) It increases the blood circulation in the abdominal area.
- (f) This *asana* helps with people suffering from sciatica and sacral infections.
- (g) It is beneficial for those suffering from stomach ailments such as peptic ulcer or hyper acidity.
- (h) It strengthens the pelvic muscles which helps prevent hernia and aids women in childbirth.

Do you know?

Despite initial problems, many of the *asanas* can be performed with certain modifications till the body acquires required flexibility and proficiency.

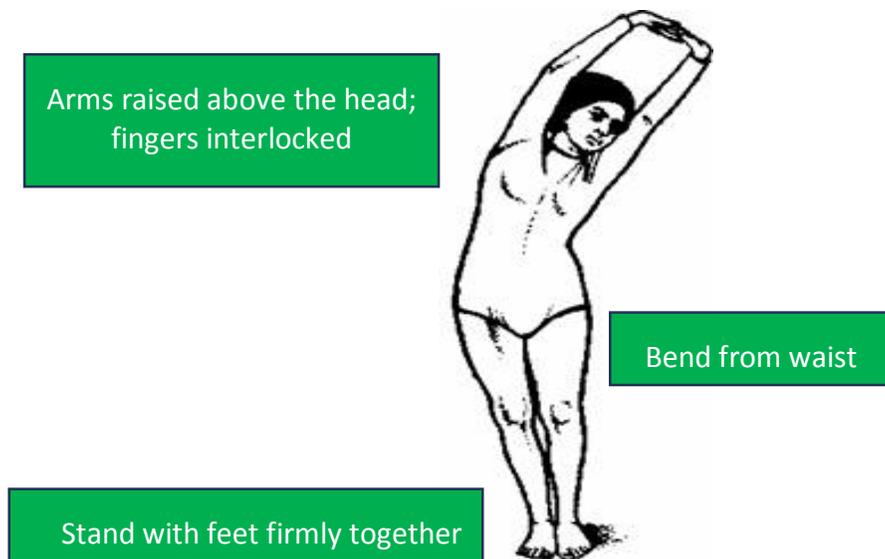
Contraindications

- (a) Person suffering from piles should not practice it.
- (b) This *asana* should not be practised if one is suffering from injured ligaments at the ankles or at the knees.
- (c) Those suffering from hernia or intestinal ulcers should take medical advice and guidance before practicing this *asana* and should perform it under supervision of a trained yoga teacher.
- (d) Runners should avoid this if they have injury in their hamstrings or the calves.
- (e) This *asana* is not to be practised by people who have severe arthritis and pain in the knees.

HASTASANA (HASTOTTANASANA)

The name comes from the Sanskrit words *Hasta* meaning **arms**, *Uttana* meaning **stretched up**, and *asana* meaning **posture**.





Technique

1. Stand on the ground with feet together
2. Inhale and raise arms over the head; interlock the fingers.
3. While exhaling bend from the waist to the left side.
4. Hold the posture for a while and, while inhaling, come back to the centre.
5. Repeat the practice on the right side

Benefits:

1. This *asana* improves curvature of the spine.
2. It exercises back, neck and spinal joints.
3. This *asana* relieves constipation.
4. It makes the waist slim, the chest broad and removes fatty deposits on hips. It also increase height of growing children.

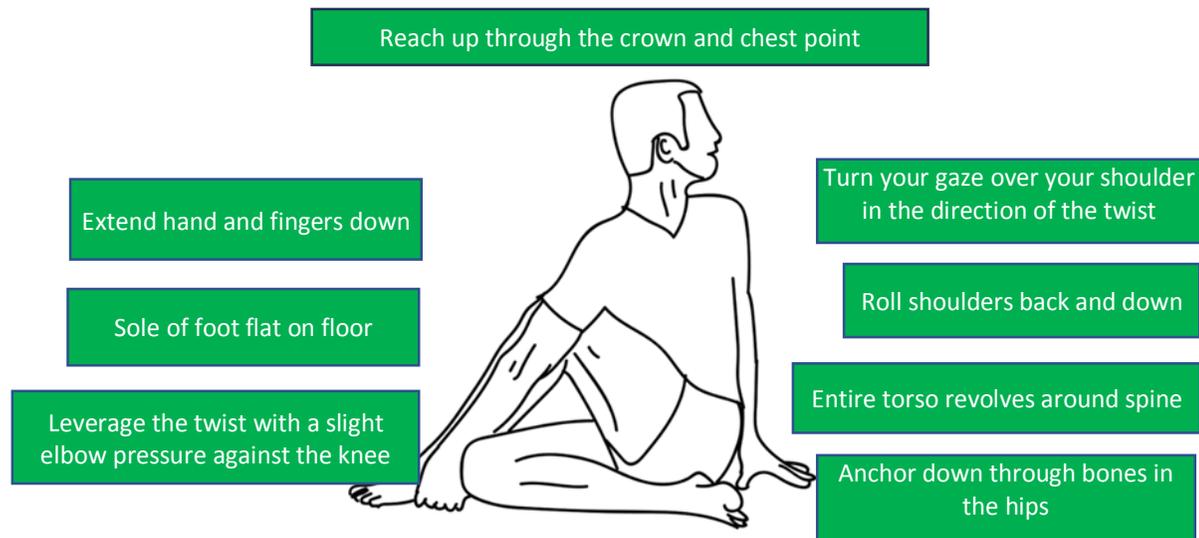
Contraindications:

1. Avoid this *asana* if you are suffering from severe back, neck and shoulder pain.
2. Patients suffering from pain in the Sciatic nerve should also avoid practising this *asana*.





ARDHA MATSYENDRASANA



The name comes from the Sanskrit words Ardha meaning **half**, Matsya meaning **fish**, Eendra meaning **king**, and asana meaning **posture**. The final position of this asana is just like Half-Lord of the Fish that is why it is called Ardha- Matsyendrasana. This posture is also known as “Half Spinal Twist Pose”. Body parts and organs involved in performing this asana are arms, shoulders, lower back, middle back, hamstrings, hips, psoas muscles, stomach, pancreas, small intestine, large intestine, liver, kidney and gall bladder. Dhanurasana, Bhardvajasana and the hand down variation of the Ardhamatsyendrasana are the preparatory asanas which can be practised before. In this position there is a strong twist on the abdomen and spine. The right arm is pressed against the left knee and the left arm is wrapped behind the back, leading to an increased twist on the body. The chest is open and the spine is erect. One side of the abdomen is compressed, and the other side is stretched. The right leg and knee remain on the floor. The left knee should be close to right armpit.

Procedure

1. Sit extending both the legs stretched out. Make sure that your feet are placed together and your spine is absolutely erect. Place your hands by the side, palms resting on the ground, fingers together pointing forward.
2. Bend the right leg at knee such that the heel of the right foot lies next to the left hip.
3. Now folding the left leg, bringing it from above the right knee, placing the left foot on the ground beside the right knee. The left knee should point upwards.
4. Now place the right hand on the left side of the left knee. The left knee should remain at the left side of the right armpit.
5. Straighten the right hand and hold the toe or ankle of the left leg.
6. Twisting the body to the left side, look backwards. Place the left hand bringing it from the back on the right thigh. Gaze should be towards the back.





7. While returning to the original position first release the hand from the thigh and turn head forward.
8. Now bring the back to normal position after loosening the right hand.
9. Bring the left leg to its original position.
10. Bring the right leg also to original position.
11. Repeat it similarly from the other side by folding the left leg first.

Advance Asanas – Full Matsyendrasana

Benefits

1. *Ardh Matsyendrasana* increases lung capacity and improves oxygen supply to the lungs
2. This *asana* increases purification of the blood as well as of the internal organs.
3. It is an *asana* that is useful for diabetics (b-cells and t -cells), with concentration on the pancreas.
4. This *asana* regulates the secretion of bile and adrenaline.
5. It stimulates functioning of the liver and kidneys.
6. *Ardh Matsyendrasana* increases the elasticity of the spine, tones the spinal nerves and improves the functioning of the spinal cord. It also benefits the muscles of shoulder and back.
7. It is an *asana* that is helpful for those suffering from constipation and dyspepsia.
8. This *Asana* improves liver efficiency and removes debility of kidney

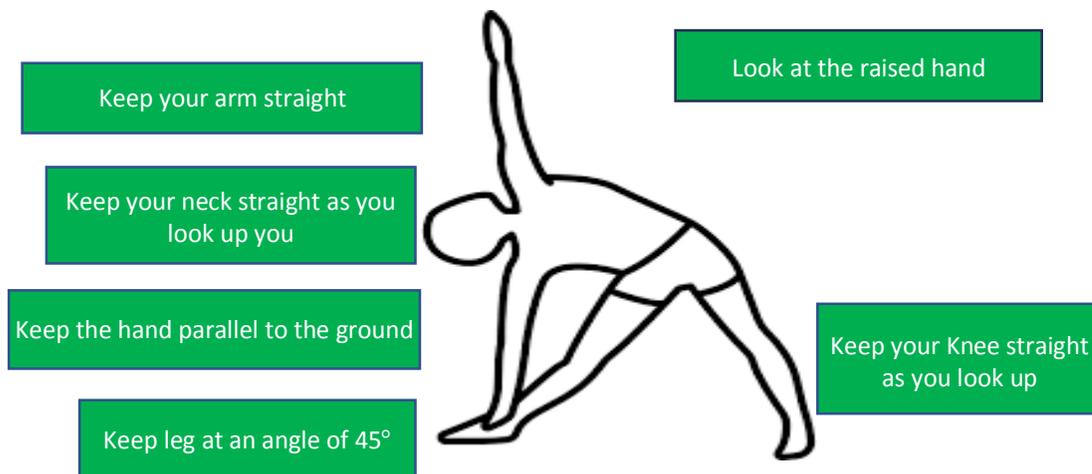
Contraindications

1. This *asana* should be avoided during pregnancy and menstruation due to the strong twist in the abdomen.
2. People who have undergone heart, abdominal or brain surgeries should not practice this *asana*.
3. Care should be taken by those with peptic ulcer or hernia while performing this *asana*.
4. Those with severe spinal problems should avoid the *asana*. While those suffering from mild slipped disc may benefit from it, but in severe cases it should be avoided.





TRIKONASANA



The name *Trikonasana* comes from the Sanskrit words *Trikona* meaning **triangle** and *Asana* meaning **posture**. This is a standing posture using the legs to firmly ground the lower body (creating a triangle with the floor) and through the vertically extended arm stretching the upper body (creating a triangle between the front foot and grounded hand). *Trikonasana* stretches the muscles of the arms, trunk and legs. The primary muscles stretched in this posture are the front leg hamstrings and the abdominal and back muscles. The primary muscles strengthened in this posture are the quadriceps and the gluteal muscles. *Virabhadrasana* (Warrior pose I) and *Virbhadrasana II* (Warrior pose II) are preparatory *asanas* for *Trikonasana*.

Procedure

1. Stand straight with legs together, hands by the side.
2. Spread feet to keep two or two and half feet distance between the legs and raise both arms parallel to the shoulders.
3. Slowly bending laterally towards the right side touch the toe of the left leg with the forefinger and middle finger of the right hand and raise the left hand towards the sky. Fix your gaze towards the left hand. Inhale when you start your pose and exhale when you are going down. Once you are in the *asana* breathe in a very uniform and smooth manner.
4. After maintaining the position for 5 breaths, slowly return to the second position.
5. Now slowly start bending laterally towards the left side and touch the toe of right leg with left hand and Keep right hand pointing towards sky. Fix your gaze towards the raised hand.
6. While returning to the original position bring down your raised hand, and stand erect with legs together.





7. Perform three to five rounds of *Trikonasana*

Relaxation pose - *Uttanasana* (Standing Forward Bend Pose), *Tadasana* (Mountain Pose), *Dandasana* (Staff Pose)

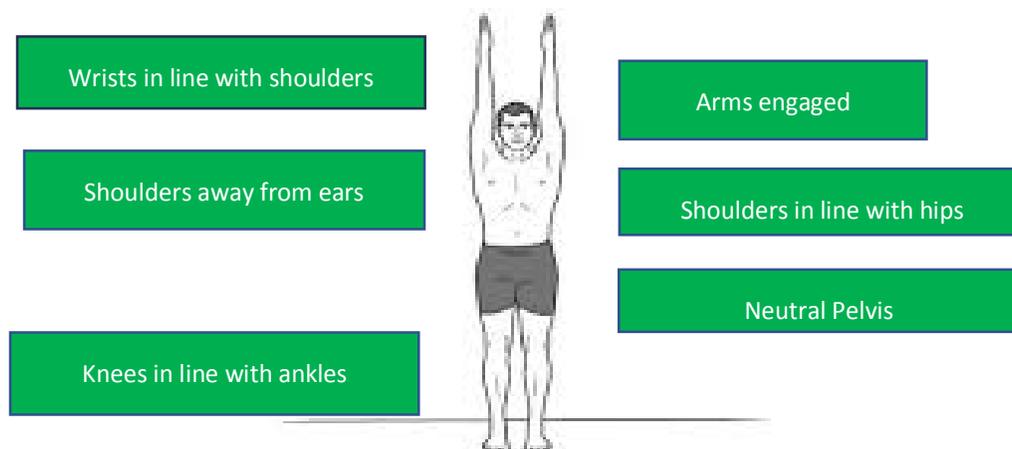
Benefits

1. *Trikonasana* is very important for people who practice activities like walking or cycling as it increases flexibility and movement in the hips. It helps in strengthening the pelvis and legs, and developing balance in your lower body.
2. It strengthens the back and abdominal muscles.
3. It improves the capacity of the heart and improves cardiovascular functioning.
4. *Trikonasana* improves backache and arthritis.
5. This *asana* helps burn fat and is recommended for those suffering from over-weight and obesity

Contraindications

1. Avoid *trikonasana* if suffering from migraine, low or high blood pressure, or neck and back injuries.
2. A person suffering from diarrhoea shouldn't perform this *asana*.
3. Those who experience dizziness shouldn't look down at the floor during the final stage.
4. Those suffering from cervical spondylosis should perform the *asana* with proper precautions.

URDHVA HASTOTTANASANA



The name *Urdhva Hastottanasana* comes from the Sanskrit words *Hasta* meaning **arms**, *Uttana* meaning **stretched up**, and *asana* meaning **posture**. This *asana* is also known as - Palm Tree Pose, Upward Hand Stretch Pose, Upward Salute, Raised Hands Pose, *Tadasana* and *Urdhva Baddhanguliyasana*. It is a standing posture and is considered a warm-up yoga





posture to prepare the body for more intense yoga *asanas*. Arms, shoulders, upper back, neck, psoas muscles are involved in performing *UrdhvaHastotanasana*

Procedure

1. After relaxing the neck muscles with clockwise and anti-clockwise rotation, relax the arms and neck completely.
2. Inhaling deeply, raise arms above your shoulders and head, and interlock fingers.
3. As you exhale, go on to your toes and stretch.
4. Inhale again and stretch arms up. Stretch your legs while firmly rooting toes on the ground and feel the stretch at the shoulders and neck. Remember, the deeper the stretch upwards, the deeper the posture. Try and balance the body on the toes bringing the eyes to focus at any one point straight ahead.
5. Remain stretched upwards for about 8 breaths.
6. Release the posture by stretching the arms backwards and as you exhale bring the arms down and feet firmly on the floor

Benefits

1. The stretch of the spinal bone promotes proper growth and clears up congestion of the spinal nerves at the points at which they emerge from the spinal column. It helps to give control over muscular movement and stimulates the entire nervous system of the body. This *asana* improves curvature of the spine and exercises back, neck and spinal joints.
2. It stretches and tones the abdominal muscles, hence improving digestion.
3. The chest is expanded, giving room for clear passage for breathing from the diaphragm. This in turn relieves asthma and heavy breathing.
4. It relieves constipation.
5. It makes the waist slim, the chest broad; removes fatty deposits on hips and also increase height of growing children.

Advance Pose – *Garudasana* (Eagle Pose), *Anuvittasana* (Standing Back bending pose)

Contraindications

1. Avoid this *asana* if you are suffering from severe back, neck and shoulder pain.
2. Patients suffering from sciatica should also avoid practising this *asana*.





I. Tick the correct option

1. According to WHO the criteria for overweight as per BMI is
 - (a) 18.5 – 24.9
 - (b) 25 -29.9
 - (c) 30 – 34.9
 - (d) 35-39.9
2. Which *asana* improves efficiency of liver?
 - (a) *Vajrasana*
 - (b) *Makrasana*
 - (c) *Ardhamatsyendrasana*
 - (d) *Tadasana*
3. Which *asana* is suggested to relax muscles after performing *Vajarasana*?
 - (a) *Sukhasana*
 - (b) *Savasana*
 - (c) *Sarvangasana*
 - (d) *Virabhadrasana*

II. Answer the following questions Briefly

1. Write the procedure of practicing *Vajarasana*?
2. Explain how *Trikonasana* is helpful in management of obesity?
3. What modification can be done to learn *Ardhamatsyendrasana*

III. Answer the following question in 150—200 words

1. Discuss the Yogic methods to manage obesity in detail.
2. Write down benefits and contraindications of *Tadasana*.
3. Explain procedure and benefits of *Ardhmatsyendrasana*.

Extension Activity

Stand in straight posture on toes, close your eyes, Stretch your arms straight above your head. Maintain this position for 10 seconds. Now, open your eyes and maintain same posture for next ten seconds.

Were you able to maintain your balance?

What difference did you feel in both activities?



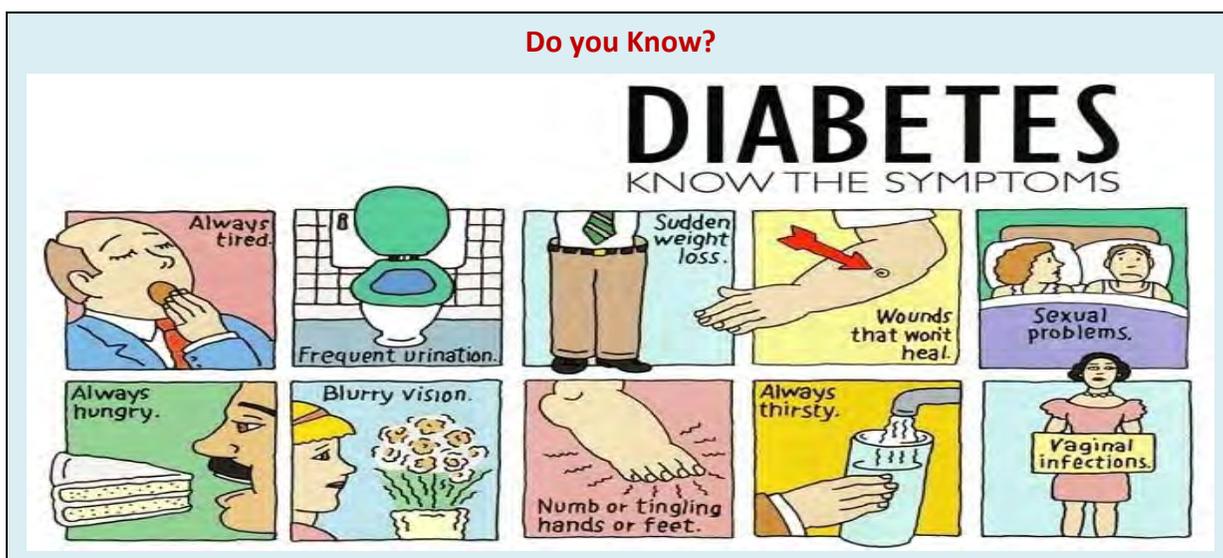


3.3.1 Diabetes Mellitus

Diabetes Mellitus is a metabolic disorder where there is a defect in utilization of sugar by the body. Carbohydrates from the food that we consume are turned to glucose is the main source of energy for all bodily functions. Blood level of glucose is controlled by a hormone called Insulin, which is produced by the pancreas. In some people the quantity or quality of insulin secreted by the pancreas maybe insufficient or ineffective. Hence there is an altered absorption and utilisation of glucose from the blood. This results in an increased level of blood sugar. Another reason for Diabetes mellitus is the cells not using insulin properly, which is known as Insulin resistance.

Clinical Symptoms

- Polyuria: Excessive urination.
- Polydipsia: Excessive thirst.
- Dehydration due to excessive urinary output.
- Polyphagia: Increased appetite.
- Loss of body weight, decreased resistance



Picture Source⁵





Problems, which diabetics encounter more often:

- Heart Attacks.
- Rapid deterioration of vision and blindness.
- Kidney diseases.

Extension Activity

Talk to some people suffering from Type 1 and Type 2 Diabetes. Ask them to describe what it is like to live with the problem and to demonstrate how they manage it.

How many of them are aware of Yogic *asanas* for management of the problem?

Management of Diabetes Mellitus

Dietary management: It varies according to the severity of the disease, activity and metabolic needs. There are certain general principles for all diabetic diets.

- A diabetes diet is a healthy-eating plan that is naturally rich in nutrients and low in fat and calories. Key elements are fruits, vegetables and whole grains.
- High fibre in diet helps in controlling Diabetes by preventing excessive rise in blood glucose. It also helps in decreasing blood cholesterol and triglycerides and assists in reducing weight.

Foods Allowed liberally: Green leafy vegetables, some fruits, clear soups, and lemon water.

Yogic Management

Kriyas: *Kunjla, Vastradhouti, Kapalabhati, Agnisara and Nauli. Suryanamaskara* and selected practices of Yogic *SukshmaVyayama Asanas*

Asanas: *Bhujangasana, Paschimottanasana, Pavanamuktasana, Ardhamateyendrasana.*

Pranayama: *Nadishuddhi, Surabhedana, Bhastrika and Bhramari.*

Extension Activity

Sit on a chair comfortably. Shift towards the front of your chair. Bring the hands behind you and hold onto the seat of the chair with your hands. Start inhaling and roll the chest forward and up. Roll the shoulder back and down. Draw the shoulder toward one another. Look toward the sky.

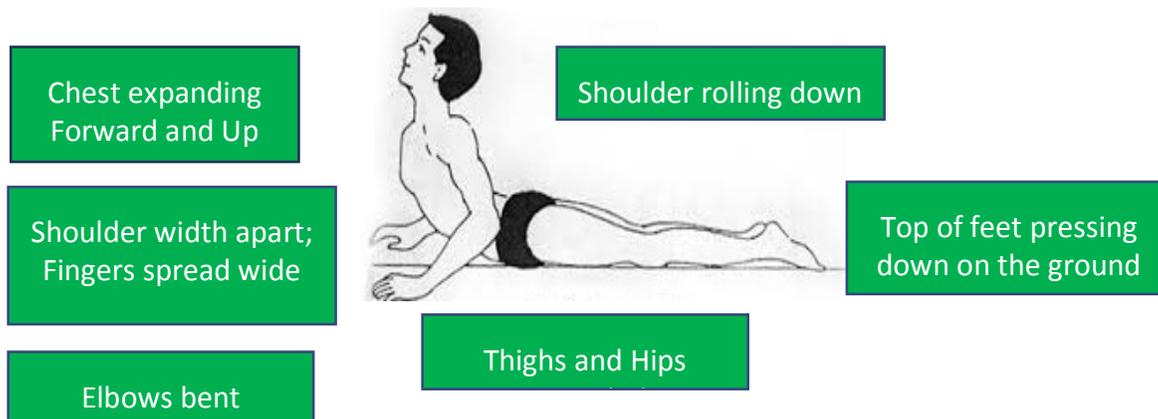
Discuss your understanding of the body muscle movement during the practice of *Asana*.





3.3.2 Asanas to Prevent Diabetes Mellitus

BHUJANGASANA



In Sanskrit the word *Bhujanga* means **Cobra**. Since the final position of this *asana* resembles the 'Hooded Snake' therefore it is called *Bhujangasana*. Body parts used in *Bhujangasana* are lower back, middle back, upper back, biceps and triceps, core (abs), psoas muscles. This *asana* is done in prone position. Preparatory postures for *Bhujangasana* are stretches like Standing Spinal Twists, Standing Side Bend Pose, Standing Backbend, Standing Side Stretch, Standing Pelvic Circle and Standing Forward Fold to open up the arms and lower back.

Procedure

1. Take prone position, legs together, toes together pointing outward, hands by the side of the body, fingers together, palm facing upward and forehead resting on the ground.
2. Fold hands at the elbows, place palms on the ground, on each side of the shoulder, thumb should be under the armpit. Bring chin forward and place it on the ground. Gaze in front.
3. Inhale and raise your body upwards while placing both palms near the upper abdomen on the floor. Exhale once you have expanded the upper body.
4. Raise chin and extend head backward as far as possible. Raise the upper body – thorax – turning spine backward. Caution, raise body only up to the navel; do not raise the navel. Remain in this position, breathing deeply. Gradually move into slow breathing. To stay in this *yoga asana* for a longer time ensure the weight of the body is spread evenly around the shoulders, lower abdomen, thighs, back and elbows. If all the weight is on the lower abdomen, then breathing becomes difficult thus causing you to lose balance.
5. Then slowly lower your body to the ground, starting from upper part of the navel region, thorax, shoulders, and chin and lastly place the forehead on the ground. Place the arms close to your sides and relax.





6. Bring the body to a relaxed stage in *Makarasana* and breathe slowly, focussing the mind on the movement of the spine. With every exhalation contract the spine and release the stress around it.

Relaxation Posture - *Utthita Balasana* (Wide Child's Pose), *Vajarasana*, *Savasana*, *Matsyasana*.

Advance asana - *Salabasana*, *Dhanurasana*, *Ustrasana*.

Benefits

1. The nerves along the spinal column, back and neck are toned, blood circulation is improved and the spine is supple and healthy.
2. The lower abdominal muscles are also toned and strengthened. The pressure on the abdomen aids digestion, stimulates appetite, relieves flatulence and constipation.
3. This *asana* helps burn excess fat deposits around the hips, neck, chest, arms, etc.
4. It relieves migraine.
5. This *yoga asana* is beneficial if suffering from a sluggish liver.
6. Stretching the neck while doing this *asana* improves the functioning of the thyroid gland.
7. It is also said that this *yoga asana* tones the kidneys which helps in purification of blood, removing any stagnant blood and improving the health of the whole body.
8. *Bhujangasana* tones the ovaries and the uterus and helps to remove any disorders in connection to the uterus. Thus, it is also helpful during menstruation.

Contradictions

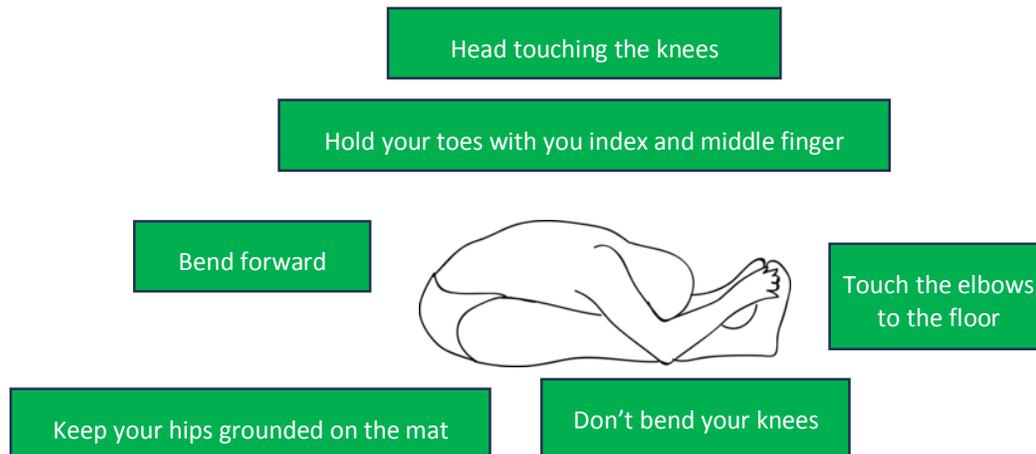
The few don'ts or contraindications for *Bhujangasana* are:

1. Those with severe back problems relating to the spine should avoid this yoga posture.
2. Someone having neck problems relating to spondylitis too should clearly avoid this yoga posture.
3. Those suffering from stomach disorders like ulcers should ensure proper guidance or avoid this yoga posture if discomfort is seen or felt.
4. Pregnant women should avoid this yoga posture as a lot of pressure is placed on the lower abdomen and can also cause injury.
5. Someone suffering from severe asthma should avoid this posture and work on breathing techniques through pranayama before attempting *Bhujangasana*.





PASCHIMOTTASANA



The word *Paschimottasana* comes from the Sanskrit words *Paschima* meaning **west** or **back** or **back of body** and *Uttana* meaning **intense stretch** or **straight** or **extended** and *asana* meaning **posture**. In this posture one has to sit and intensely stretch the back forward. Few preparatory postures are advised before practicing *Paschimotasana* like ankle rotation in sitting position, *Balasana* (child pose) and *Janusirsasana* (Head to Toe pose). *Paschimottanasana* (Seated Forward Bend Pose) is considered as one of the best *asanas* for the overall healing of the entire body right from the head to the tip of toes. **Procedure**

1. Sit, stretching both the legs together in front, hands by the side, palms resting on the ground. Fingers should remain together pointing forward. Take few deep breaths raising the spine up.
2. Inhaling deeply, stretch your arms above your head and, exhaling slowly, bend forward keeping the back straight.
3. Loosen your back muscles and bend the body forward as far as it is possible.
4. Maintaining this position, loosen your hands and place them where they are comfortable. It would be better if they are put on the thighs.
5. After exhaling completely, reach out for your toes and relax the neck placing it between your legs.
6. Practice it daily and keep bending forward little more. Finally hold the big toes of the legs with forefingers of respective hands and place forehead on the knees.
7. After few seconds raise the head, release the big toes and come to the original position.

AdhoMukhaVirasana, *Uttana Shishosana* and *Dandasana* are other postures which are advised to relax the muscles after practicing *Paschimotasana*.





Marchiyasana can be done after getting mastery on *Paschimotasana*.

Breathing pattern - Consciously focussing on breathing while doing this *asana* plays a good role in improving the digestive system and upper respiratory system.

Benefits

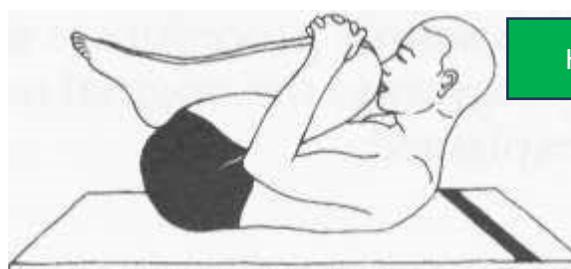
1. This yoga posture stretches the muscles around the spine, lower back and the calf muscles, thus improving blood circulation.
2. As the body moves forward, pressure is put on the digestive organs and pelvic organs thus healing them from within and toning them. Digestion improves and much blocked gas in and around the lower abdomen gets released.
3. Respiration is improved by doing this *asana* as pressure is put on the thorax and abdomen.
4. *Paschimotasana* improves the alignment of the vertebral column.
5. This *asana* is therapeutic for diabetics, or patients with weak liver and kidney.
6. *Paschimotasana* benefits women during menstrual disorders.

Contraindications

Since *Paschimottanasana* puts a lot of pressure on the lower back when the body is bent forward, it should be avoided by those suffering from

1. slipped disc
2. hernia
3. spondylitis
4. enlarged liver and/or spleen
5. Pregnant women should avoid this *asana*

PAWANMUKTASANA



Hands holding knees

Knees close to chest pressing abd

Chin to knee





The name *Pawanmuktasana* comes from the Sanskrit *pawan* or **wind** and *mukta* or **release** or **relieve**. If food is not digested well in the stomach, it can cause accumulation of gas which can bring about a lot of other ailments in our body like acidity, migraine and joint pains to name a few. As its name suggests, this *asana* helps in releasing the accumulated wind in the stomach and intestines.

Procedure

1. Lie on your back with your feet together and arms besides your body and relax, breathing deeply.
2. With a deep inhalation raise your legs to 90° and completely exhale.
3. Now with another inhalation bring both the knees close to your chest and press on the lower abdomen, holding the knees with your hands. Exhale completely.
4. Remain with the bent knees for a few breaths. With every exhalation press the thighs and knees on the abdomen and hold them with your hands.
5. With a deep breath raise your head, neck and chest and bring them close to your knees. If possible, bring your chin in between your knees. Ensure the head moves less and the knees come closer to the face. That way the pressure on the abdominal muscles will help in releasing the unwanted gas/wind around the abdominal organs.
6. Remain in this posture for a few breaths focusing on maintaining the position of the head and neck in place. With every exhalation press the thighs closer and deeper into the chest and face deeper into the knees.
7. Try to maintain the balance while breathing slowly and keeping the body relaxed.
8. Now with an inhalation, release the neck and head and exhale completely. With another inhalation straighten the legs and bring them back to 90° and as you exhale release the leg from 90° to the relaxed posture. With complete exhalation, bring the legs stretched out on the floor and relax the neck.
9. Take a few breaths, and then continue with the next round. The longer you hold in this posture the faster the muscles around the abdomen will loosen.

For relaxation after practicing *Pawanmuktasana*, practice *Supta Baddha Konasana* (Reclining Bound Ankle Pose),

Matsyasana (Fish Pose), *Savasana* (Corpse Pose).

Benefits

1. This *asana* tones the leg, arms and shoulder muscles, strengthens thigh muscles and back, firms abdominal muscles and improves the blood circulation. It helps cure acidity, digestive problems, diabetes, gastric problems, high blood pressure, and cervical spondylosis.





2. It improves digestion.
3. This *asana* helps in releasing the unwanted gas/wind accumulated at various parts around the abdomen thus relieving constipation and flatulence.
4. Joint pains are cured by doing this *asana*.
5. Blood circulation in legs is improved by this *asana*, thus providing relief to someone suffering from varicose veins.
6. Strengthening muscles around the neck and shoulders will help in easing initial stages of spondylitis.
7. Removes excess fat around the lower abdomen, hips, chest and arms.
8. Release of gas helps in healing migraine

Contraindications

To be avoided or performed under guidance by those suffering from

1. severe migraine
2. High or Low Blood Pressure
3. Asthma
4. slip disc
5. advanced stages of spondylitis
6. Girls/Women should avoid this *asana* or take the guidance of the teacher while practicing it during menstrual cycle.

ARDHA MATSYENDRASANA

See in Obesity management

I. Tick the correct option

1. Which gland is associated with Diabetes
 - (a) Endocrine glands
 - (b) Pituitary
 - (c) Pancreas
 - (d) Hypothalamus
2. Polyurea is associated with
 - (a) excessive sweat





- (b) less urination
 - (c) excessive saliva
 - (d) excessive urination
3. *Bhujangasana* is also known as
- (a) Dog posture
 - (b) Child posture
 - (c) Cobra posture
 - (d) Reverse Boat posture
4. Which *asana* can be suggested as preparatory *asana* for *Pawanmuktasana*
- (a) *Tadasana*
 - (b) *Bhujangasana*
 - (c) *Matsyendrasana*
 - (c) *Naukasana*

II. Answer the following questions

1. Draw and label the diagram of *Pawanmuktasana* correctly.
2. Explain the correct breathing pattern while performing *Paschimotasana*.
3. Write in detail the benefits of *Pashchimotasana*.

III. Answer the following questions in 150-200 words.

1. Discuss the technique and benefits of *Bhujangasana*.
2. Explain Diabetes and its symptoms

3.4.1 Bronchial Asthma

Asthma is a disease of the respiratory system where the airways get narrowed, often in response to a “trigger” such as exposure to an allergen, cold air, exercise, or emotional stress. This narrowing causes symptoms such as wheezing, shortness of breath, chest tightness, and coughing. Asthma is a chronic (recurring) inflammatory condition in which the airways develop increased responsiveness to various stimuli, and is characterized by bronchial hyper-responsiveness, inflammation, increased mucus production and intermittent airway obstruction. This broncho-constriction is episodic in character and is reversible through use of bronchodilators. The exact basis of bronchial hyper reactivity is not entirely clear. But bronchial inflammation plays an important role.





Extension Activity

Take a plastic straw and breathe through the straw.

Then bend the straw in the middle and try to breathe through the straw while it is bent.

- What happened when you tried to breathe through the bent straw?
- Was it harder to breathe out than it was to breathe in?
- How did it make you feel?
- Do any of your classmates have asthma or do any of you know someone who has asthma?
- Discuss what it is like to have the breathing problem and how it has affected the life of the person who has the problem.

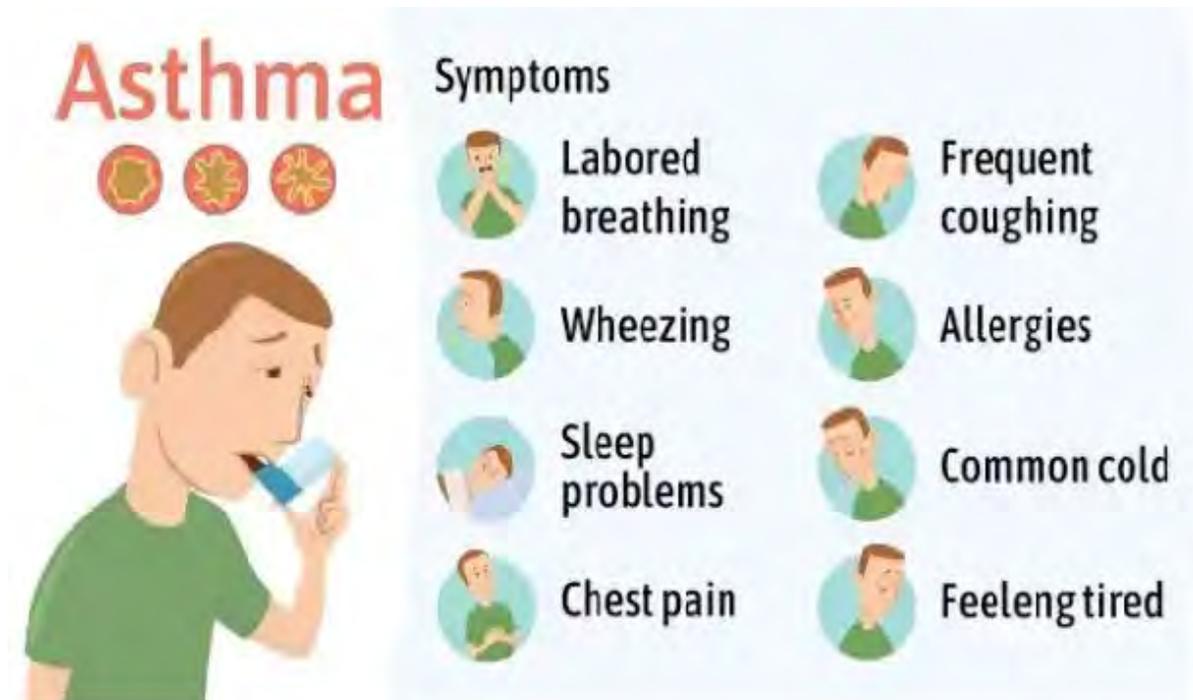
Signs and Symptoms of Asthma

- Asthma is characterized by episodic dyspnea (difficulty in breathing), wheezing and cough.
- There is difficulty in expiration.
- Patient may experience tightness of the chest/discomfort in the chest.
- The attack may last from one to several hours.
- Severe attack, called “status asthmaticus”, is often not responsive to usual therapy. It is a medical emergency and may affect the heart and circulatory system.
- Hypercapnia (increased level of CO₂), acidosis and hypoxia (decreased O₂ level), may occur in Asthma, though these conditions are rare.

Yogic Management

The role of yoga in the management of Bronchial Asthma is well documented now. Aim of the treatment in Asthma should be to reduce broncho-constriction and to tackle the triggering factors.





Picture Source⁶

1. Kriyas: *Jalaneti, Sutraneti, Kapalabhati, Kunjal, Vastradhouti*
2. *Surya Namaskara*
3. Yogasanas: *Gomukhasana, Chakrasana, Parvatasna, Bhujanasana, Sukhasana, Matsyasana, Paschimottanasana*
4. Pranayama: *Nadishodhana Pranayama, Suryabedi Pranayama, Bhramari, Bhastrika.*
5. Special Practice: *Special Practice: Yoganidra*

3.4.2 Asanas to Prevent Bronchial Asthma

SUKHASANA

Sit erect with head, neck and trunk in straight line



Legs crossed at shins

Sukhasana is a relaxing posture which may be practised after a prolonged period of sitting in





Siddhasana or *Padmasana*. The name is derived from the Sanskrit, *sukha*, meaning **pleasure** or **comfort**, and *asana*, meaning **posture**. *Sukhasana* is a meditative posture and is done with sitting cross-legged in the most basic or simple form unlike other meditative postures. This posture is excellent for meditation, pranayama and the beginning of a yoga class or at the end to bring the mind and breath under control. *Sukhasana* is considered a base or a warm-up yoga posture to prepare the body for more intense yoga postures / yoga flow.

Procedure

1. Sit on the mat with legs stretched out in front and the spine straight. Place the hands on the thighs with elbows bent. Take a few breaths, connecting the breath with the body.
2. Inhale and fold the legs. Fold the right foot under the left thigh. And fold the left foot under the right thigh.
3. Cross the legs at the mid shins, and not at the ankles. The pubic bone and the crossed shins should be in one line.
4. Keep ankles flexed a little so that the feet are on their outside edges, perpendicular to the floor. Exhale once the legs are in this position.
5. Keep the head, neck and back straight. Draw your abdomen softly inward and upward.
6. Inhale and place the hands on the knees in any mudra depending on the *pranayama* at practice, or if this posture is only to relax then place the palms one over the other close to the navel. You could place the outer wrists on the closest knee, with the thumb and the index finger joined at the tips. Have the other three fingers stretched out and pointing downwards.
7. Begin slow inhalation and with each inhalation loosen the body and as you exhale expand the spine and move upwards pushing the lower back inside and upper back upwards. Sink the legs and the knees deep into the floor without pushing them. Repeat this and slowly bring the body and mind awareness to the *Pranayama* you are practicing while in this yoga posture and relax your facial muscles.
8. Slowly relax the back and stretch the legs out in front of you and come in *Dandasana* and relax for a few breaths if required.

Benefits

1. *Sukhasana* yoga posture facilitates meditation and *pranayama*.
2. *Sukhasana* improves awareness regarding the body's posture and keeps the spine in an ideal position.
3. If you are mentally stressed or have had a tiring day, this posture will offer peace and mental calm.



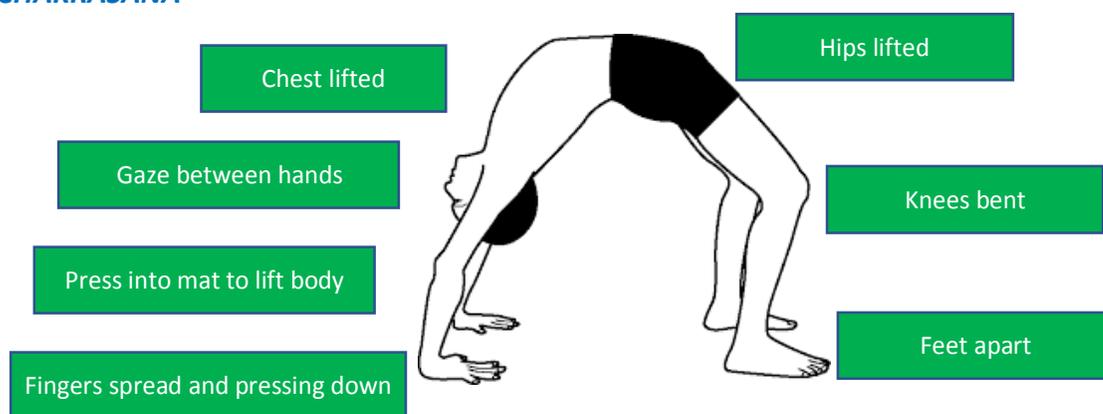


4. This posture is the standard meditative posture and is important to line up the energetic channels within the body to help the flow of *prana*.
5. This posture gives room for improving the flexibility of the waist and the lower region of the body.

Contradictions

1. Individuals suffering from backache shouldn't stay in this position for more than 5 mins.
2. Someone with severe arthritis would find it difficult to sit on the floor as there would be too much pressure at the knees. In such cases, this posture can be avoided or modifications tried.
3. *Sukhasana* should be avoided by individuals who have undergone knee replacement surgery, or are suffering from problems related to the spine or spinal disc problems. They should take the advice of their doctors before doing this *asana*.
4. Someone who suffers from sciatica should avoid *Sukhasana* as the sciatic nerve can get pinched.
5. This posture is practised with the eyes closed and for longer periods, hence those suffering from severe migraine or have anxiety issues may find it difficult to remain in this posture with eyes closed.

CHAKRASANA



The name *Chakrasana* comes from the Sanskrit words *Chakra* or **wheel**, and *asana* or **posture**. *Chakrasana* is an advance level posture and performed in supine position. This *Asana* is also known as *Urdhva Dhanurasana*. This unusual pose and movement of the body brings the energy of the body at ease and builds immense self-confidence. Body parts involved in this *asana* are arms, shoulders, chest, lower back, legs, feet and neck. This *Asana* requires specific strength to divide the weight of the body between the feet and hands equally and is acquired with practice. *Ustrasana* (Camel pose), *Matsyasana* (Fish pose),





Paryankasana (couch pose) and *Setu Bandhasana* (bridge pose) are preparatory poses for *Chakrasana*.

Procedure

1. Lie down on your back with feet stretched and arms besides you. Bring the body in rhythm with the breath and relax. Take a few breaths and focus on the lower back ensuring the entire spine is close to the floor. Follow deep inhalation and slow exhalation.
2. With another deep inhalation bend the knees and place the feet close to your hip. Exhale completely and continue to breathe deeply. Placing the palms inside out at the shoulder level with fingers pointing towards the shoulders and wrists outside. With a deep yet slow inhalation, push the palms and feet downwards towards the floor and raise the lower body upwards and then the middle and upper body upwards aiming for the sky or roof.
3. Exhale completely in this posture. Here the body will be at ease balancing on the feet and the palms which are firm and rooted on the floor while the rest of the body remains in the air. Bring the neck between the shoulders and let it fall gracefully. Bring the breath under control and ensure the body is kept light.
4. The knees and elbows are to be kept straight and strong. Ensure not to bring the ankles and the wrists at a position which may cause pull in the ligaments. The comfort of the legs and the arms gives the support for the back as it is raised up.
5. In this posture the lower back may begin to cause discomfort initially. Focus your mind on deep breathing and loosen the body. Then with exhalation rise higher by rooting the feet and the palms firmly on the floor.
6. With continuous breathing, work on the alignment of the body and its comfort. Try and bring the pelvic area deeper upwards, making it close to being parallel to the floor.
7. While releasing the posture, inhale and while you exhale loosen the upper back, neck and shoulders and bring first the head towards the floor and then the shoulders. Rest the shoulders and then the upper back, middle back and lower back in sequence and then release the arms and place them close to you. Bring the entire body down to the floor and remain with the knees bent ensuring the lower back is close to the floor. Control the breathing as it could be fast and erratic. The slow inhalation will bring this under control.
8. After relaxing in this position, stretch the legs and arms out completely in *Savasana* and relax the body before taking the body into the pose the second time. The more one practices this pose the more the body moves freely in *Chakrasana*.





Relaxing asanas *Supta Baddha Konasana* (Reclining Bound Angle Pose), *ArdhaHalasana* (Half Plough Pose) *Viprit- Karani* (Legs Up the Wall Pose), *Savasana* (Corpse Pose) are the *asanas* advised to relax the muscle after performing *chakarasana*.

Advance posture - *Eka Pada UrdhvaDhanurasana* (One Legged Wheel Pose), *DwiPada Viparita Dandasana* (Two legged Inverted Staff Pose) are advance level postures of *chakarasana*.

Benefits

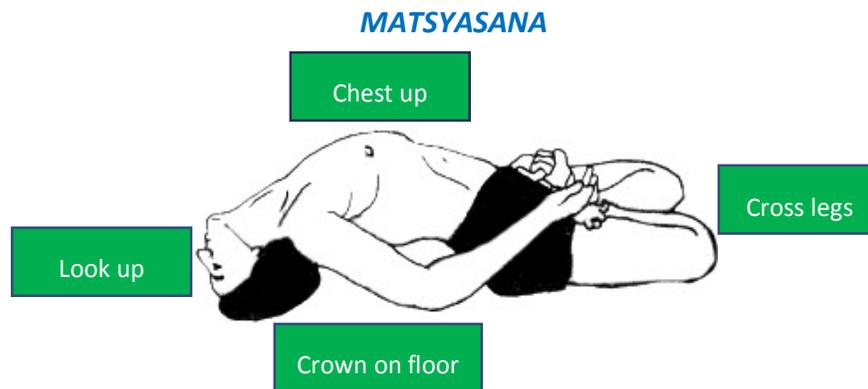
1. The entire body gets stretched with this *asana*, specially the muscles of shoulders, arms, wrists, legs, chest, entire spine and the muscles around the neck, facial muscles, abdominal muscles and thighs.
2. As the abdominal muscles are stretched, the abdominal organs like the kidneys, liver and pancreas are toned. The chest is stretched giving scope for the heart to function well and get the blood circulation going. The lungs too are stretched. The Thyroid and Pituitary glands are stimulated as the neck and head get the fresh flow of blood in this pose. The reproductive organs are strengthened, improving the balancing of the hormones.
3. The digestive system improves and indigestion is cured as a result of this *asana*.
4. Chronic headaches and shoulder pains caused by unhealthy lifestyle are cured.
5. Irritation in the calf muscles with uneasy cramps during menstrual times is healed.
6. *Chakrasana* helps in relieving asthma, back pain, migraine, stress and anxiety.

Contraindications

Chakrasana should not be practised by those who are suffering from

1. a back injury as any form of jerk to the back may not be advisable.
2. Heart problems
3. either High Blood Pressure or Low Blood Pressure
4. Glaucoma or Pressure in Eyes, or has undergone a cataract surgery
5. cervical injury
6. hernia





The Sanskrit word *Matsya* means **fish** and *asana*, meaning **posture**. According to the ancient Yogic texts, *Matsyasana* can restore spinal strength and overall body balance, consequently leading to a better physical and emotional outlook. *Matsyasana* stimulates your spine, cervical muscles, thorax, rib cage, and the lungs, thus relieving your fatigue almost instantly. *Matsyasana* is also known as Fish Pose and Balancing Lotus Pose. Lower back, middle back, core (Abs), chest and neck are the body parts involved in this *asana*. *Setu Bandhasana* (Bridge pose), *Pawanmuktasana* could be performed as preparatory *asanas* for *matsyasana*.

Procedure

1. Begin *Matsyasana* by lying down in *Savasana* (Corpse Pose). Stretch arms and legs out, relax the body and take a few deep breaths.
2. Place your palms under your hips in a way that the palms are facing the ground. Now, bring the elbows closer to each other, placing them close to your waist.
3. Cross your legs so that your feet cross each other at your middle, and your thighs and knees are placed flat on the floor.
4. Breathe in and lift your chest up in a way that your head is also lifted, and your crown touches the floor.
5. Make sure the weight of your body is on your elbows and not on your head. As your chest is lifted, lightly pressurize your shoulder blades.
6. Hold the position only until you are comfortable. Breathe normally.
7. To release from *Matsyasana* gently raise the head up, lowering the chest and head to the floor and bring the hands back along the sides of the body.
8. Ensure the head is at complete rest and the lower spine is close to the floor. Relax in *Savasana* and take few breaths. When ready, go back into the pose again and hold it for longer time and take the pose deeper with every exhalation.
9. *Savasana* is considered a relaxing pose after practicing *Matsyasana*.





Benefits

1. *Matsyasana* opens and stretches the neck muscles and shoulders.
2. Helps in opening the chest and corrects round shoulders too.
3. This posture provides relief from respiratory disorders by encouraging deep breathing. Hence, *Matsyasana* increases lung capacity to a great extent.
4. This posture, with the spine curved and bent backwards, provides a great way of strengthening the back muscles with the formation of the arch.
5. There is an increased supply of blood to the cervical and thoracic regions of the back that helps tone the parathyroid, pituitary and pineal glands.
6. The practice of *Matsyasana* brings down the tensions and the stiffness at the neck and the shoulders. It also helps in curing the initial stages of spondylitis with the guidance of an experienced yoga teacher.
7. The repeated practice of *Matsyasana* improves the flexibility of the neck. This flexibility in the neck helps in the practice of various other yoga poses that are of advance level.
8. This posture helps to regulate emotions and stress.

Contraindications

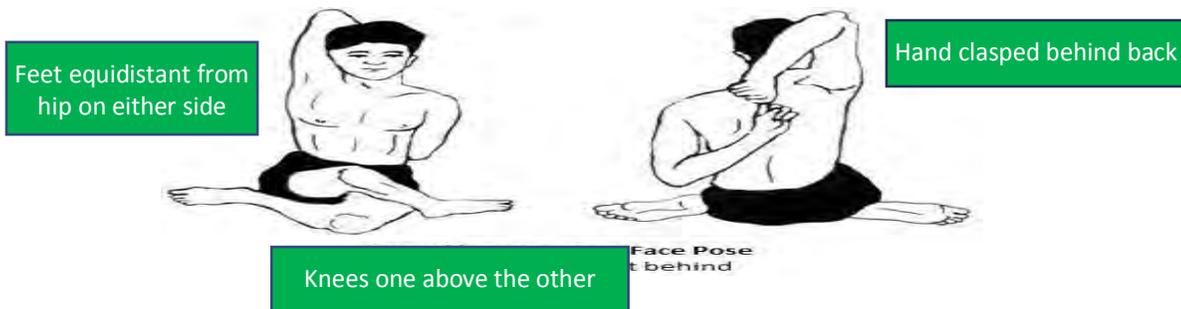
Matsyasana should not be practised by someone suffering from

1. high or low blood pressure
2. neck injuries or injury to any part of the lower or middle back.
3. migraine.
4. spondylitis
5. heart ailments
6. Women who are pregnant should not attempt this yoga pose.
7. If at the time of practice of *Matsyasana*, one feels any kind of tightness around the lower neck and upper back, one should immediately stop doing the *asana* and relax in *Savasana*.





GOMUKHASANA



The name *Gomukhasana* comes from the Sanskrit words *Go*, meaning **Cow** and *Mukha*, meaning **Face** or **Mouth**. The word *Go* also means **light**, so *Gomukh* may refer to the **light in or of the head**, or **lightness of the head**. This yoga *asana* gets its name because the thighs and calves of the person performing it resemble a cow's face, wide at one end and tapering towards the other. This *asana* is a seated one and is considered as an Intermediate Level Posture, requiring a good degree of flexibility. Different body parts involved in performing this *asana* are arms and shoulder, middle back, upper back, biceps and triceps, hamstrings, hips, knees, pelvis and quadriceps. *Baddha Konasana* (Bound angle pose) and *Dhanurasana* are the suggested preparatory *asanas* before practicing this *asana*.

Procedure

1. Sit on the floor legs extended and spine straight.
2. Place the palms on the floor and bring the left leg bent at the knee and place the left foot below the right hip by raising the body a bit. Sit on the left foot taking the ankle and the toes deep inside.
3. Raise the right leg bent at the knee and place the right thigh over the left thigh by bringing the right foot close to the left hip on the floor. Make sure both knees are one above the other or if possible interlocked deeper trying to balance the body well.
4. Bring your left arm and stretch it above your shoulder and head. Bending it, take the left palm and place it on your back, close to the shoulder blade.
5. Now raise the right arm and from below take it behind you bending at the elbow and with the right palm try to reach for the left palm. Once comfortable, clasp the left palm and maintain the position feeling the stretch at the shoulders and the elbows.
6. Gradually, pull the palms closer and bring the chest out raising the upper body upwards. Ensure the neck does not bend forward, but remains in line with the shoulders and chest.
7. Feel the stretch at the thighs, knees, chest, abdomen, shoulders, arms, neck and the elbows.





8. Maintain this position for a few breaths and slowly release. Relax by stretching the legs out in front of you and bring the arms down beside you.
9. After taking a few breaths in the relaxed pose, bring the right leg bent at the knee and place the right foot close to the left hip and cross the left thigh over the right thigh and bring the left foot close to the right hip on the floor.
10. Raise the right arm and bring the right palm from up and behind your head and place it close to the shoulder blade behind you.
11. Stretch the left arm and take it from down and place the left palm close to the shoulder blade behind you and try to clasp the right palm. Interlock the fingers and pull the chest out and the shoulder blades closer expanding the spine upwards.
12. Remain in this posture for a few breaths, then release the arms and stretch the leg out in front of you and relax.
13. Relax the body completely and go back into the *asana* again.

Relaxation *asana* – Paschimotasana

Advance *asanas* – *Gomukhasana* with *Garudasana* (cow pose face with eagle arm), *Bharadvajasan*.

Benefits

1. The stretch at the hamstrings helps in gaining flexibility and this can be beneficial to athletes in the long run with repeated practice.
2. *Gomukhasana* enables greater flexibility of the hip joint.
3. It stretches and tones the muscles of the chest.
4. This *asana* increases blood supply to the legs and arms, making it a useful posture to counteract long periods of sitting in a chair or being hunched over a desk.
5. The flexion of the knee joint can be useful to heal certain kinds of weakness in the knees (provided there is no ligament tear).
6. The shoulders and the chest expand, thus making the upper spine strong and erect.
7. The raising of the entire body upwards to get the arms or fingers interlocked behind works with the expansion of the lower abdominal muscles thus improving the functioning of the abdominal organs and digestion.
8. Stretching the abdominal area also burns the unnecessary fat at the tummy area and tones the entire torso.
9. Breathing through the diaphragm improves the blood circulation at the chest and





helps fight allergies. 10. Biceps and triceps muscles are strengthened and there's increased flexibility of the shoulder and the upper arms. 11. The entire spine is stretched, bringing in a good flow of *prana* to the entire body.

Contraindications

Gomukhasana should not be practised by those suffering from

1. shoulder pain, back ache, hip or knee pain or stiffness in the shoulders. They may have to take it slow and easy.
2. any kind of hip problems or injury at the knee, hamstrings, and quadriceps.
3. sciatica.
4. any kind of neck and shoulder injury.
6. This *asana* must be avoided when pregnant.

PARVATASANA



Parvatasana or the Mountain pose is part of the *Surya Namaskar* series of *asanas*. It appears as the 4th pose and the 9th pose in the *Surya Namaskara*. In Sanskrit *Parvata* means **mountain**. The *asana* looks like a mountain from the sides and hence the name *Parvatasana*. Arms, shoulders, chest and knees are the body parts involved in this *asana*. *Balasana*, and *Tadasana* are preparatory *asanas* before doing this *asana*.

Procedure

The correct steps to do both sitting and standing pose are:

1. Sit straight on yoga mat in the lotus position with both hands resting on knees palms down.
2. Raise your hands to the front and clasp together with palms outwards.
3. Lift your hands over your head straight with palms facing up.
4. Stretch and hold the position for few seconds. Repeat multiple times.





5. Stand straight on your yoga mat with legs together and hands to the sides.
6. Lift your hands up and bring them down. As you do this, bend from the waist.
7. Reach to the floor at an angle.
8. Let your legs be straight and firm on the floor. Make sure you do not bend knees.
9. Keep the shape of exactly 45° relative to floor.
10. Keep this position for few seconds and release.
11. Repeat multiple times.

Benefits

1. If done in the morning, *Parvatasana* keeps you alert.
2. *Parvatasana* stretches the spine. The stretch in this pose reduces extra fat in the back and waist.
3. It helps practitioners below 18 years to gain some height.
4. It tones the abdominal muscles and hence stimulates the inner organs in the abdominal region.
5. It is helpful in ameliorating respiratory disorders including asthma.
6. It helps to reduce back pain.

Contraindications

Parvatasana should not be attempted by those suffering from

1. knee pain
2. dizziness.





I. Tick the correct option

1. What causes an Asthma Attack?
 - (a) Allergy
 - (b) Smoke
 - (c) Exercise
 - (d) All of the above
2. Poor exchange of oxygen and carbon dioxide in an individual is the result of
 - (a) exercise induced Asthma
 - (b) allergy induced Asthma
 - (d) Pulmonary Hypertension
 - (d) Respiratory Failure
3. Which *asana* is base *asana* for curing Asthma?
 - (a) *Sukhasana*
 - (b) *Chakrasana*
 - (c) *Matsyasana*
 - (d) *Parvatasana*

II. Answer the following questions

1. Draw and label the diagram of *Parvatasana* correctly and discuss the technique for the *asana*,
2. Explain the correct breathing pattern while performing *Chakrasana*.
3. Write in detail the benefits of *Gomukhanasana*.

III. Answer the following questions in 150-200 words.

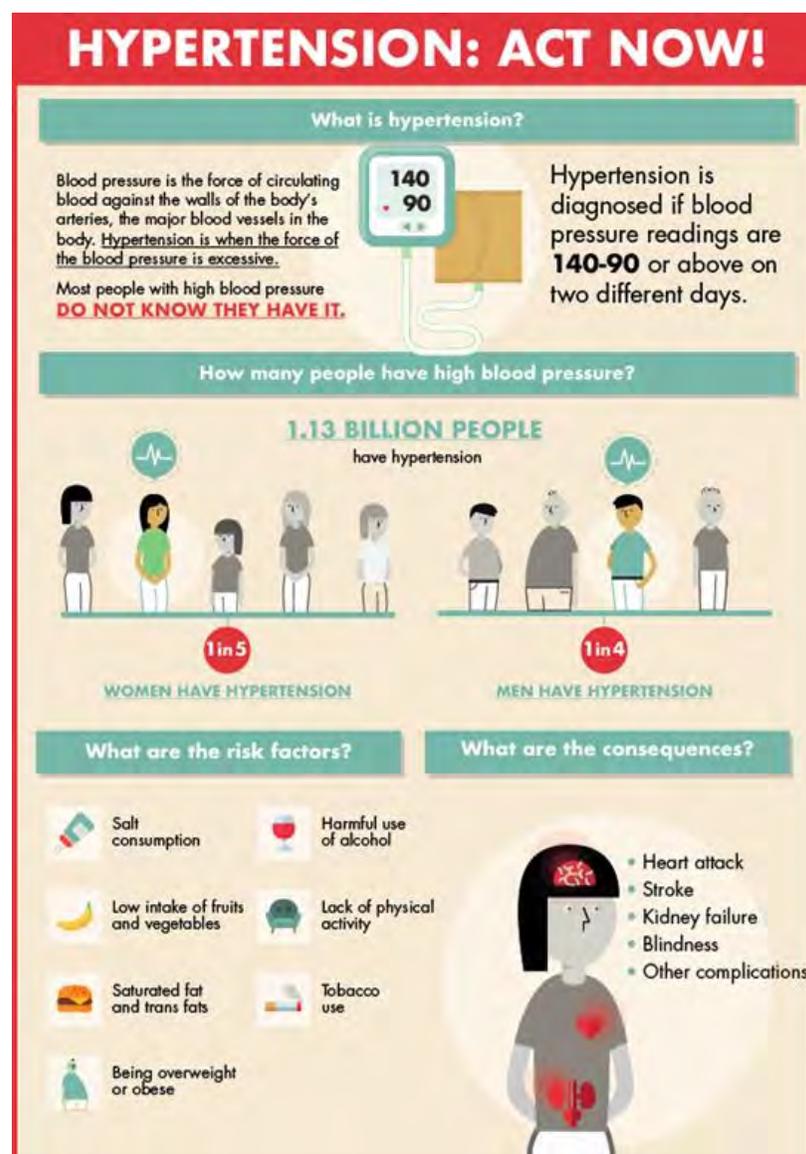
1. Discuss the *asanas* helpful for a person suffering from asthma.
2. Write down the procedure and contraindications of *Matsyasana* in detail.
3. Explain Asthma and its symptoms





3.5.1 Hypertension

Hypertension is the elevation of the blood pressure above normal. The levels of Systolic and Diastolic pressure are both risk factors. BP > 140 mmHg, and Diastolic Bp > 90 mmHg are generally accepted as hypertension.



Picture Source⁷

Classification of hypertension

1. Primary Hypertension is also known as essential hypertension. This is the most prevalent form of hypertension and it has no identifiable cause.
 - Benign Hypertension
 - Malignant Hypertension





2. Secondary Hypertension is high blood pressure due to some underlying disease or even medication.

- Cardiovascular Hypertension
- Endocrine Hypertension
- Renal Hypertension
- Neurogenic Hypertension
- Pregnancy-induced Hypertension

Do you Know?

Blood pressure is the pressure your blood exerts against your blood vessel walls as your heart pumps. Blood pressure comes from two physical forces. The heart creates one force as it pumps blood into the arteries and through the circulatory system. The other force comes from the arteries resisting the blood flow.

Blood pressure is measured in millimeters of mercury (written as mmHg). For example, normal blood pressure in adults should be less than 120/80 mmHg.

Systolic Pressure is the higher, or top, number and represents the pressure at the peak of each heartbeat.

Diastolic Pressure is the lower, or bottom number and represents the pressure when the heart is resting between beats.

Sphygmomanometer is the instrument used to measure blood pressure.

Manifestations of Hypertension:

High blood pressure is itself asymptomatic, that means there is no indication or any clear symptoms. This is the reason why high blood pressure is also referred to as 'the silent killer' since it could cause damage to the cardiovascular system without the [patient being aware of the fact that she/he is suffering from High blood pressure.

High blood pressure could also create problems in certain organs. A prolonged illness may lead to complications such as arteriosclerosis, where the production of plaques narrows the blood vessels. It may lead to

- Renal Failure
- Left Ventricular Failure
- Myocardial Infarction
- Cerebral Haemorrhage





Yogic Management

The role of yoga in the management of Hypertension is well documented now. Aim of treatment of Hypertension should be to lower the blood pressure and to prevent further complications. In general, the practices prescribed for the Hypertension cases are:

Kriyas: *Jalneti, Sutraneti, Surya-*

Namaskara and selected practices of Yogic *SukshmaVyayama* (*Suryanamaskara* may be avoided in severe cases)

Asanas: *Vajrasana, Bhujangasana, Pavanamuktasana, Tadasana, Ardha-Chakrasana, Shavasana,*

Pranayama: *Nadishuddi, Ujjayi and Bhramari.*

Meditation: Breath Awareness.

3.5.2 Asanas to Prevent Hypertension

VAJRASANA

See in Obesity management

PAVANAMUKTASANA

See in Diabetes management

BHUJANGASANA

See in Diabetes management

Extension Activity

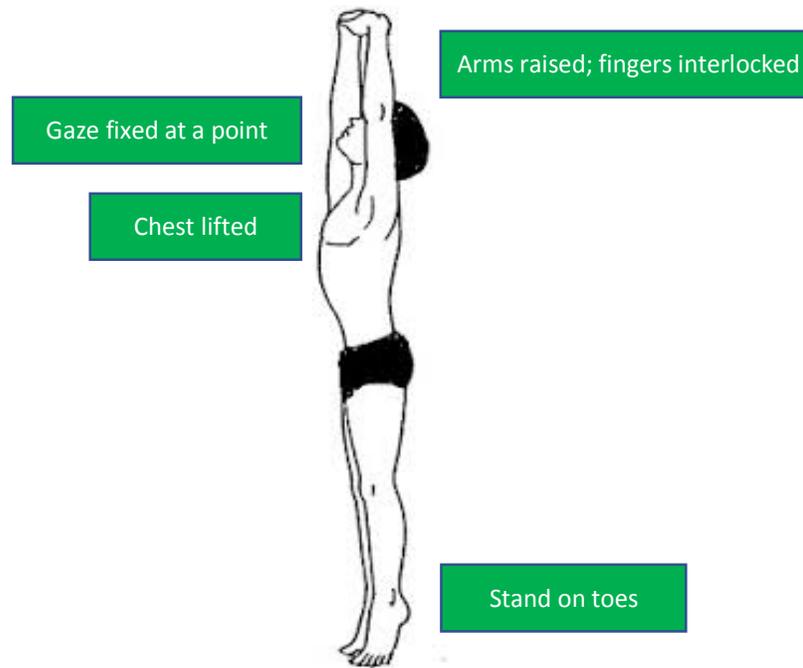
Find out

- Three factors that may increase blood pressure.
- Relationship between having high blood pressure and the circulatory system.
- The reason high blood pressure is called the “silent killer”.
- Five symptoms of high blood pressure?
- Three factors that could cause a decrease in blood pressure.





TADASANA



Tada means **mountain**, *Sama* means **upright** or **straight** and *Sthiti* means **standing still**. *Tadasana* therefore implies an *asana* where one stands firm and erect as a mountain. *Tadasana* (Mountain Pose) is considered as a basic standing pose or the foundation pose for any other yoga pose. *Smashthiti*, Equal standing pose and Prayer pose are other names for *Tadasana*. Mastery over this *asana* with firmness of the feet, toes and the shoulders and chest will benefit in the practice of all other yoga poses. Toes, abdomen, arms and neck are the body parts involved in performing *Tadasana*.

Procedure

1. Stand erect with feet together, heels and big toes touching each other. Expand the spine with chest out and shoulders straight. Keep the stomach tucked in, chest forward, spine stretched up and the neck straight.
2. Inhale and raise the hands and place the palms on the crown of the head with fingers interlocked and exhale completely.
3. Inhale again and raise the interlocked fingers above your head with palms facing upwards bringing the entire body on your toes, and stretch the entire body upwards exhaling completely.
4. As you lift the heels, feel as though you are being drawn upwards, and completely stretch your body.
5. Remain in this posture looking in front and gazing at any one point. Bring the body under control by keeping it relaxed through slow breathing.





6. Do not bear the weight of the body either on the heels or the toes, but distribute it evenly.
7. You could close your eyes and focus on your breath and on keeping your body steady.
8. Stand in this *asana* for as long as comfortable. With practice, the stability of the body improves along with straightening of the spine with proper breathing.
9. Inhale deeply, and when exhaling slowly bring the heels down along with the arms stretched backwards and release the *asana*.
10. Relax and repeat this again, taking the *asana* deeper by holding it longer.

Advanced *asanas* – *Vrikasana* (Tree pose), *Urdhava Hastasana* (Volcano pose) and *Garudasana* (Eagle pose) are advanced *asanas* after master *Tadasana*

Benefits

1. The legs become strong at the ankles and the knees. With long periods of practice in this pose, the toning of the leg muscles will help to practice all other standing *asanas* with ease. Muscles, too, are stretched giving room for expansion and strengthening of the muscles.
2. The hips are raised and this brings a good support to the entire back ensuring the spine is expanded giving room for proper flow of *prana* to the entire body.
3. Toning of the chest and the shoulders helps in improving bad posture and results in strong upper back.
4. Focus should be to keep the spine straight by pulling in the tummy. This eventually helps in toning of the abdominal muscles and lengthens the spine.
5. This *asana* helps to keep the body light which is essential for the practice of most other *asanas*.

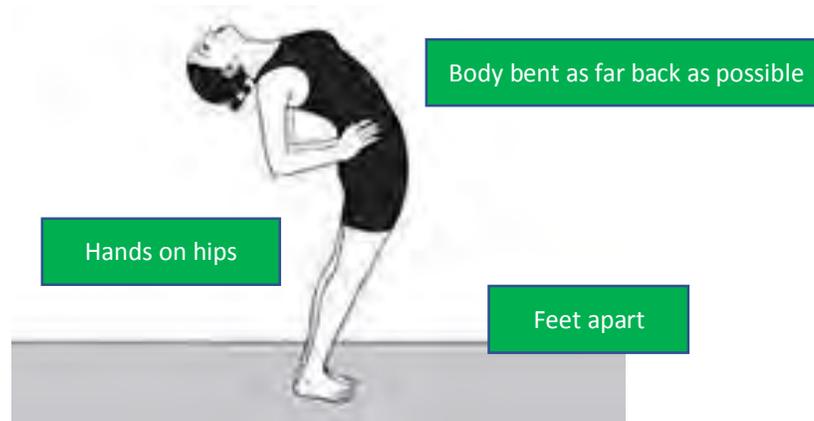
Contraindications

1. This *asana* is not beneficial for anyone whose leg muscles are weak or someone who finds it difficult to stand for long periods.
2. Someone who is suffering severe migraine or giddiness would find this *asana* a challenge.
3. Avoid putting too much strain on the spine by carrying the entire body weight. This can bring more stress to the spine.
4. Initially don't work hard on raising the body and remaining still. Only when the body is ready then move towards a little stretch.





ARDHA- CHAKRASANA



In Sanskrit *ardha* means **half**, *chakra* means **wheel** and *asana* means **posture**. *Ardha Chakrasana* is considered a base *asana* as a number of variations can be derived from this *asana*. *Ardha Chakrasana* helps boost energy in the body and hence can be included in flow yoga sequences. *Ardha Chakrasana* is considered a warm-up yoga *asana* to prepare the body for more intense yoga *asanas*. Arms, shoulders, lower back, upper back, neck, psoas muscles are involved in performing this *asana*. *Ardha Chakrasana* is also known as Raised arm pose, *Hasta Uttanasana*, sky reaching pose.

Procedure

1. Stand straight and bring your hands together in a clasped position.
2. Raise and rotate your hands above the shoulders.
3. Slowly bend the upper part of your body backwards along with the hands, as far as you can go.
4. Remain in this position for few breaths, according to your capacity.
5. To release the *asana*, come back slowly to the standing position with hands by your side.
6. There is a variation of *Ardha Chakrasana*, where the hands are placed behind the hips and then bending the back is attempted

Benefits

1. This is one of the best yoga *asanas* to treat and cure respiratory congestion and problems related with lungs viz. asthma, bronchitis, blockage of nasal passage, clearing alveoli etc. It also helps to increase lungs capacity thereby ensures good health.
2. It is beneficial in relieving neck pain if it is performed with care.
3. This *asana* is extremely beneficial for stiff back muscles and nerves. It is useful in de-stressing and for strengthening, and suppleness of back muscles and nerves.



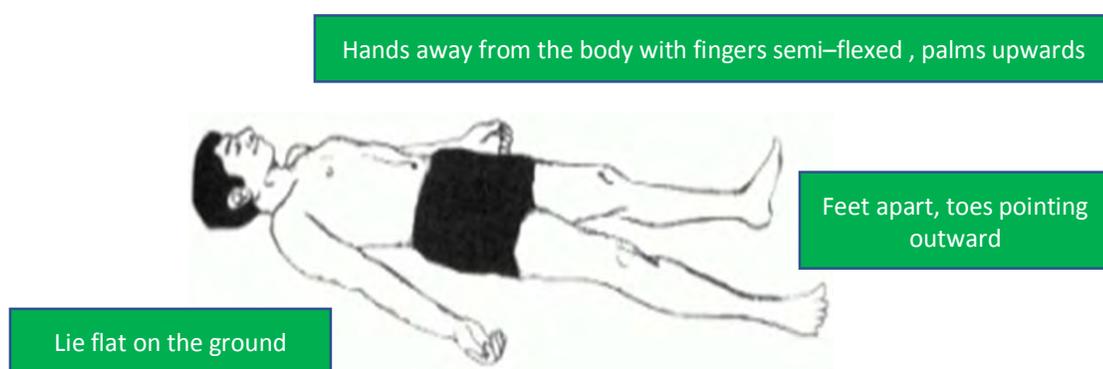


4. It can be used to shed extra fat from the abdomen. But for this, one has to perform it on regular basis and follow the steps as mentioned above.
5. This yoga pose ensures lightness and relieves the practitioners from problem of retention of gas. It also enhances the efficiency of abdominal organs.
6. The yoga pose provides soothing massage to the thyroid gland, thus controls hyperthyroidism and hypothyroidism. It also regulates metabolism and controls weight.
7. It is good for knees, hips and nerves and muscles of the leg.
8. By removing sluggishness, it energizes your body thus enhances the efficiency of various systems.
9. It is good in controlling blood sugar as the yoga pose stirs pancreas to secrete optimum level of insulin in blood.

Contraindications

1. Consult your doctor before practicing *Ardha Chakrasana* during pregnancy.
2. Those suffering from serious spine problems should not practice this *asana*.
3. Ulcer and hernia patient should not practice this *asana*.
4. Those suffering from high blood pressure should avoid this *asana*.

SAVASANA



In Sanskrit *Sava* means **dead body**. The posture is called *Savasana* as the body in this *asana* resembles a dead body. Verse 32 of the first chapter of the *Hatha Yoga Pradipika* states: 'Lying upon one's back on the ground at the full length like a corpse is called *Savasana*. This removes fatigue caused by the other yoga poses and induces calmness of mind'. The objective of this *asana* is to imitate a corpse by keeping the body still. By remaining





motionless for some time and keeping the mind still while you are fully conscious, you learn to relax. This conscious relaxation invigorates and refreshes both body and mind.

Procedure

1. Lie down on the back with the hands comfortably away from the body. Keep the head in a comfortable position.
2. Keep a distance of one to two feet between the feet with toes pointing outward.
3. Place both the hands on the ground, 10 inches away from the body with fingers in a semi-flexed position, with palms facing upwards.
4. Gently close the eyes, breathe normally or practice moderately deep abdominal breathing.
5. Focus on the flow of the breath without moving the body.
6. Try to relax the body by diffusing the tension in each part of the body.

Benefits

1. It helps reduce stress and removes physical and mental fatigue.
2. It relaxes all muscles and nerves of the body
3. It is helpful to overcome psychological disorders.
4. It is very beneficial for managing high blood pressure, cardiac diseases and anxiety disorders.

Contraindications

1. A very distracted mind is going to find it difficult to relax and by pushing the body, it will cause more irritation and bring a headache.
2. Someone with severe acidity may find lying on the back very uncomfortable as the food pipe may cause irritation.

3.6.1 Low Back Pain

Low back pain is the most common cause of job-related disability and a leading contributor to missed work. Fortunately, most occurrences of low back pain go away within a few days. Others take much longer to resolve, or, may even lead to more serious conditions. Chronic back pain is a major cause of social and financial problems as it is associated with impaired quality of life, loss of productivity and huge health care expenses.

Acute short-term low back pain generally lasts from a few days to a few weeks. Most acute back pains are mechanical in nature – the result of trauma to the lower back or a disorder such as arthritis. Pain and strain may be caused by a sports injury, work around the house or





in the garden, or a sudden jerk such as a car accident or other stress on spinal bones and tissues.

Extension Activity

Find out

- What structures make up the back?
- What causes lower back pain?
- What are the risk factors for developing low back pain?
- How is low back pain diagnosed?
- How is back pain treated?
- How can you prevent a back pain?

Share your answer in the form of a poster.

Symptoms

- Symptoms may range from muscle ache to shooting or stabbing pain, limited flexibility and/or range of motion or inability to stand straight.
- Occasionally, pain felt in one part of the body due to disorder or injury, may “radiate” elsewhere in the body.
- Chronic back pain is measured by duration – pain that persists for more than 3 months is considered chronic. It is often progressive and the cause can be difficult to determine.

Yogic Management of Low Back Pain -- Spinal exercise – simple spinal movements facilitate the practice of a further range of Yogic techniques by loosening the joints and muscles.

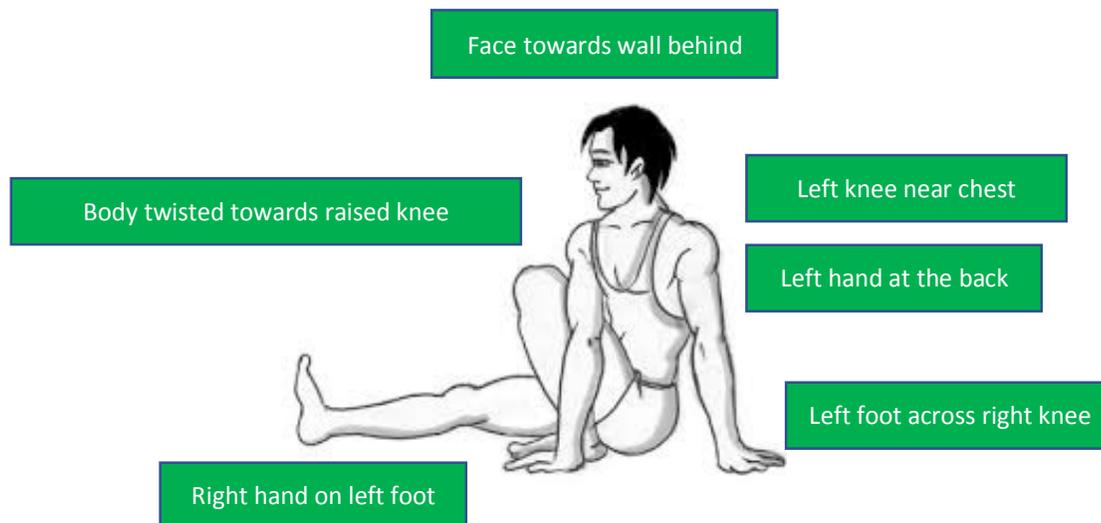
1. **Sukshma Vyayama:** *Griva-sakti-vikasaka* (Strengthening the Neck) *SkandhatathaBahumula-sakti-vikasaka* (Developing the strength of the Shoulder-Blades and Joints), *Purnabhujasakti-vikasaka* (Developing the arms) *Kati- sakti* (strengthening the Back).
2. **Yogasanas:** *Tadasana, Ardhamatsyaendrasana, Bhujangasana, Vakrasana, Shalabhasana*
3. **Pranayama:** *Nandishodhana Pranayama, Suryabhedana Pranayama, Ujjayi, Bhramari*
4. **Special Practices:** *YogaNidra*
5. **Dhyana:** Meditation





3.6.2 Asanas to Prevent Low Back Pain

VAKRASANA



Vakra means **twist** in Sanskrit. Thus the Sanskrit name of *Vakrasana* means Twisted Pose because the spine is twisted in practicing this *asana*. *Vakrasana* comes under the category of seated *asanas*. The lower back, middle back, hips, neck are involved in practicing *Vakrasana*. Easy raise arm pose, side bend pose, *Janu sirsasana* or head to knee pose are suggested as a preparatory pose for *Vakrasana*. This *asana* works on the entire spine if focus is on breathing is right. The upper body is twisted to bring the upper spine parallel to the sides of the yoga mat.

Procedure

1. Seated in *Dandasana*, take a few breaths and expand the spine upwards. Connect the breath with the movement of the spine and relax the entire body.
2. Bring the left knee close to your chest and take a few breaths, then pick up the left foot and place it outside of the right knee.
3. Twist your upper body towards the left while the right elbow is placed at the outside of the left knee and place the hand on the floor close to your right knee. Remember the body is twisted to the same side as the knee is bent and, in this case, because the left knee is bent, the body is twisted to the left.
4. Take a deep breath and, with the support of the right elbow, twist the upper body to the left as much as possible and face the wall behind you.
5. Place the left hand behind you as close as possible to your lower back, this should help you raise your spine up and also to balance your body.





6. With every exhalation raise the spine and twist as much as possible trying to turn your neck and shoulders to bring it parallel to the wall to your left.
7. Release the pose and take a few breaths and relax in *Dandasana*.
8. Continue the stretch with the same position of the left knee, but twist your body now to the right by placing both the palms on to the floor on the right close to your lower back and try to look behind you as much as possible.
9. Repeat the same now with the right knee and start with turning to the right and then release. Continue the pose with the upper body twisted to the Left.

Relaxation Pose – *Hindolasana* (Cardlepose), *Badhakonasana*, *Paschimotasana* are to relax the muscles after practicing *Vakrasana*

Advance Pose – *Ardhamatsyendrasana* and *Ek pada Rajakapotasana* (pigeon pose)

Benefits

1. As the very name suggests, the twist of the spinal cord tones the muscles of the back and thus brings stability to the spine. This pose helps a person who is tall, and has the habit of not standing or sitting with the spine straight to overcome this habit.
2. This *asana* helps straighten the upper back and brings the sagging shoulder in alignment with the spine thus making shoulders look strong.
3. It strengthens the neck muscles as the twisting of the upper body requires flexibility of the neck.
4. This *asana* tones the internal organs like the digestive system, intestines, uterus and kidneys. As the body twists, some pressure is felt at the lower part of the abdomen, thus internally working on the organs. The pressure on the abdominal muscles assists in faster toning and tightening of the muscles.
5. As this *asana* puts neck muscles to work, it activates thyroid gland. This ensures a balanced hormone level in the body.

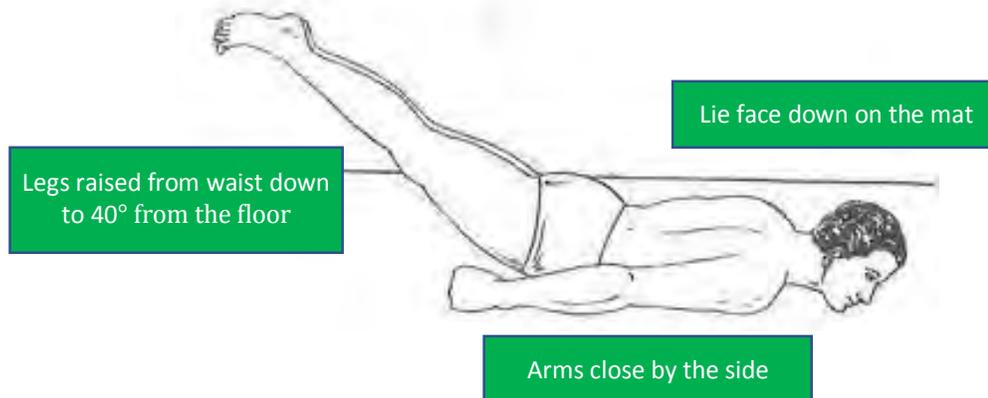
Contraindications

1. It may not be a good idea to practice this yoga pose if there is a back injury. Also, pressure on sciatic nerves can aggravate injury as the pressure is on the nerves while the body is twisted.
2. Pregnant women should avoid this yoga pose as it will bring discomfort to the uterus and hence this pose is not good for them.
3. Turning of the entire neck may make the muscles around the neck sore for someone suffering from weak neck muscles or upper spine.





SALABHASANA



The name comes from the Sanskrit *Salabh* which means **grasshopper** or **locust**. So, in this pose the body looks like a grasshopper. *Salabhasana* is entered from a prone position. This *asana* brings tightness to the back and hips and stimulates the parasympathetic nerves in the lower spinal region. Lower back, upper back, core, hamstrings, chest, neck, and pelvis are involved in performing this *asana*. *Paschimottanasana* and *Bhujangasana* can be done as preparatory *asanas* before practicing *Salabhasana*.

Procedure

1. Begin with lying down face down on tummy in *Makarasana* (Crocodile Pose). Relax the spine with few breaths and connect the breathing with the movement of the spine.
2. With feet close to each other and chin on the floor, place your arms close to your body to the side, palms facing up. You could place these palms below your upper thighs too for giving support.
3. While you take a deep breath, raise both legs from the waist, keeping the legs together and knees straight at about 40 degrees from the floor or as per your comfort. The lower body is raised from the pelvic area and balanced on the upper abdomen, chest and chin. Remain in this position with slow breathing and try and bring your mind to the lower back.
4. With every inhalation raise the legs higher by supporting the upper thighs with your palms and straighten the legs behind you as much as possible.
5. The maximum benefit from this *Asana* is derived by raising the body higher off the floor and balancing only on the chest and chin for greater flexibility of the back and abdomen.
6. With slow exhalation, bring the lower body to the floor and relax the chin and begin to come back to *Makarasana*. Here you relax the entire body for a few breaths until you are ready to take the next round of *Shalabhasana*. **Relaxing Asanas** – *Makarasana*, *Utthanashishosana*, *Adhomukhvirasana* are relaxing pose suggested after practicing *Salabhasana*.





Advance Asanas – *Dhanurasana*, *Ekpada Rajakapotasana* (Pigeon pose), *Naukasana* (Boat pose) are advance level *asanas*.

Benefits

1. The most important benefit is that this posture stimulates the parasympathetic nerves in the lower spinal region and improves blood circulation.
2. Removes the pressure on the sciatic nerve and gives relief from backache and slipped disc if the case is not severe.
3. Removes stiffness around the lower back, legs and neck.
4. Removes excess fat around the hips thus toning the muscles.
5. As a lot of pressure is put at the lower abdomen, women with menstrual disorders can practice this *asana* thus helping in proper functioning of the organs.
6. As the pressure is on the abdominal area, digestion is improved and the internal organs are helped in doing their functions properly thus balancing the body from within.
7. Therapeutic benefits like curing of mild sciatica, healing of mild slipped disc and improving constipation also accrue from this *asana*.

Contraindications

1. Someone with acute back pain or slip disc should avoid this *asana*.
2. Someone with severe sciatica can cause greater injury to themselves as this *asana* tightens the entire body from hips to the feet.
3. Someone with major problems with menstruation or with a prolapsed uterus should avoid this *asana*.
4. Women in their pregnancy should avoid this posture.
5. Someone suffering from Blood Pressure problems, thus should avoid this posture.

TADASANA

See in Hypertension management

ARDHAMATSYAENDRASANA and BHUJANGASANA

See in diabetes Management





I. Tick the correct options

1. At what point is Blood pressure considered high
 - (a) 80 over 120
 - (b) 130 over 80
 - (c) 140 over 90
 - (d) 210 over 120
2. Which *asana* suggested for low back pain is contraindicated for sciatica?
 - (a) *Vakrasana*
 - (b) *Savasana*
 - (c) *Ardhchakrasana*
 - (d) *Salabhasana*

II. Answer the following questions

1. Draw and label the diagram of Salabhasana correctly
2. Explain the correct breathing pattern while performing *Vakrasana*.
3. Write in detail the benefits of *Salabhasana*.

III. Answer the following questions in 150-200 words.

1. Write down the benefits and contraindications of *Savasana* in detail.
2. Explain Hypertension and yogic method of dealing with it.





Art Integration

Music and yoga are both considered as parts of alternative medicine. Individually, the two possess extraordinary healing powers. It stands to reason then, that combining music and yoga together can create limitless possibilities of healing, transformation and peace.

Although yoga can be practiced in silence, its effects can be magnified if it is paired with nice, pleasant music.

Music improves meditation by calming our volatile thoughts and allowing us to find stillness in the mind which is the goal of meditation. It creates a positive mood. In one way or another, all of us have experienced being instantly lifted out of a bad mood just by listening to a favorite song. Scientifically speaking, our brain's electrical signals are strengthened or weakened depending on our mood. Therefore, altering our brain's electrical waves through music can also influence our state of mind and health in general.

Music enhances movement. When practicing *yogasanas*, you may find some *asanas* difficult or challenging. Listening to music transforms yoga into a dance than just mere posture. Transitioning from one pose to the next feels really good and effortless when it is accompanied by beautiful music.

Keeping the above points in mind, compose music for a Yoga session.

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UNIT-IV: PHYSICAL EDUCATION AND SPORTS FOR CHILDREN WITH SPECIAL NEEDS

Chapter Content

Concept of Disability & Disorder

- Types of Disability, its causes & nature (cognitive disability, intellectual disability, physical disability)
- Types of Disorder, its cause & nature (ADHD, SPD, ASD, ODD, OCD)
- Disability Etiquettes
- Advantage of Physical Activities for children with special needs
- Strategies to make Physical Activities assessable for children with special need.

Learning Outcomes

In this chapter you will learn to

- describe the concept of Disability and Disorder.
- outline types of disability and describe its causes and nature.
- outline types of disorder and describe its causes and nature.
- explain various disability etiquettes
- list advantage of physical activities for children with special needs
- explain Strategies to make physical activities accessible for children with special needs

Discussion

Several terms and phrases related to special needs may create some amount of confusion, perhaps misunderstanding. Look at the already know, want to know and ultimately learn (KWL) Chart given below. Complete the first two columns. Fill in the last column after completing your research by reading, or watching relevant videos.

Word	What I Know	What I Want to Know	What I Learned
Differently abled			
Disability			
Hidden disability			
Temporary disability			
Impairment			
Disorder			
Integration			
Adaptation			
Inclusion			





Case Study

The Commonwealth Games in Manchester, England in 2002, marked an extremely important change in the way disabled competitors were treated in athletics tournaments. For the first time, medals won by disabled competitors were counted towards their countries' final totals. Disabled competitors joined the procession of national teams, they lived together in the athletes' village, and their events were staged in the same stadiums at peak times alongside star names.

Read the following transcript of a radio interview with Desmond Green, a former athlete on the changes in the Manchester Commonwealth Games.

Presenter: Do you think these changes are a welcome step forward?

Desmond Green: Much, much more than that. They are a revolution in sport. After yesterday we can't go back, though for certain the traditionalists will complain. No, it's a marvellous turning point. Calling someone a 'disabled athlete' will no longer be considered one of those second best, embarrassing expressions: it will stand for status of a sort that will appeal to the public.

Presenter: Surely, what the public want to see is first past the post, the world's fastest – that sort of thing... **Green:** Ah, that's precisely what traditionalists will say! But it isn't like that. These decisions have turned sport upside down because, from now on, we shall acknowledge what individuals can do. Take Natalie du Toit. Since losing her leg in a road accident, she's trained relentlessly. Now she's in Manchester representing South Africa as a swimmer. What an achievement against the odds! That's the sort of story readers want. They're tired of muscles and speed and running the same old races in the same old ways.

They want real competitors, people who are doing their best under very trying circumstances, just like them. The traditionalists can't handle that. They fear change and want athletics competitions to be the same as always.

Presenter: So you reckon spectators will like this?

Green: Of course. They've seen it in marathon events. You see, they want more than excellence. To see a magnificent performance by someone in a sporting wheelchair is moving and uplifting. You identify strongly with them, which is emotional. You could say that these changes give us a new version of an old sport, something fresh and exciting to talk about. But the real importance is that it inspires the spectators. How many of us who are burdened by unhappiness and depression will see the Games and ask ourselves why we can't overcome our difficulties and go and do something positive ourselves?

Presenter: I suppose you're also saying that these changes in the ways disabled athletes are treated mark a change in our attitudes towards them.

Green: Absolutely. They're taking a real part. No one can patronise them with second-class events that 'someone let us have because we are cripples', tagged on for the sake of





political correctness. No patronising, that's the point. They're there in their own right. You know, 'political correctness' is necessary because it protects people – but it's marvellous when you can throw it out of the window and start again.

Presenter: You feel very strongly about disability, don't you, Desmond?

Green: I do. There are many forms, and you and I could easily find ourselves classified in some way. When we talk about a minority, we forget how many real people there are out there and the important part they play in society. These games will help people to turn disability into normality. I've seen blind people skiing, and we both know about the work done by societies for horse-riding for the disabled. We all want to be accepted as normal, and this will help.

Presenter: Will the Games change disabled people's attitudes too?

Green: Anything that gives them the confidence they deserve is important. They will hear interviews with athletes and they'll say, 'Why can't we do something like that?'

Presenter: I can see why you mistrust traditionalists.

Green: They live in ivory towers, in the past. They talk about the pursuit of excellence and how athletes must be ruthless. They deride the participation of the disabled because they say that athletics is not suitable for them. But no organisation can protect itself from change. If it does, it withers away. These changes are important because they show that athletics is alive and that will gain public support and interest.

Presenter: Some disabled athletes argue that not enough has been done.

Green: There's a long way to go, but what has been done is radical. It'll take some time to digest. Then we can all think what we should add. It's not beyond us to invent other ways of celebrating the excellence of personal achievement.

- Q. Why is the format of the Manchester Commonwealth Games being referred to as revolutionary?
- Q. What does the term 'political correctness' mean? What is being referred to as political correctness?
- Q. Based on your reading of the transcript, and the subsequent changes that have taken place in the sports activities related to athletes with special needs, write a paragraph in about 200 words expressing your views on the issue of the equal participation of able-bodied and disabled athletes.

4.1.1 Disability

Disability is an integral part of human life. Almost everyone of us has faced some kind of temporary or permanent impairment at some point in life that may have led us to experience difficulties in functioning. In other words, in addition to needs in common with other children, some children may have needs that are special needs. From early times,





humanity has faced the moral and political issue of how best to include and support people with disabilities.

Thus, the understanding of the concept of Children With Special Needs (CWSN) is essential. CWSN are children who have some difficulties which may in some way impede their ability to function adequately in the family, community or school. Because of these difficulties they find it challenging to attain their full potential. The difficulties they experience may be physical, cognitive, linguistic, social, emotional or psychological. They may, therefore, require special and extra inputs to overcome their challenges.

The term Disability is a very vast one and encompasses all kinds of physical impairments, activity limitations, and participation restrictions. Around 15% of the global population – over a billion people – lives with some form of disability, of whom 2–4% experience significant difficulties in functioning. This number is expected to double to 2 billion by 2050. Many of these people require assistive technologies such as low-vision devices, wheelchairs or hearing aids.

3rd December is celebrated as World Disability Day.

4.1.2 Concept of Disability

Disability is understood as a condition that produces a long-term impairment that affects activities of daily living, such as eating, walking, and maintaining personal hygiene. Disability may be

- congenital, or present from birth,
- occurring during a person's life time,
- invisible disability (not noticeable easily) and
- temporary disability (recovery is possible).

Do you know

Barriers include communicational, cultural, economic, environmental, institutional, political, social, attitudinal or structural factors which hamper the full and effective participation of persons with disabilities in society. For instance, 'stereotyping' might be an attitudinal barrier, wherein people assume that the quality of life of a person with disability is poor or that they are unhealthy because of their impairments, and so such a person must live a dull life without seeking happiness. Lack of availability of books/ materials in Braille for a visually impaired person can be a communicational barrier. Social barriers are related to the conditions in which people are born, grow, live, learn, work and age – or social determinants of health – that can contribute to decreased functioning among people with disabilities. For instance, persons with disabilities are more likely to be unemployed than others.





Institutional barriers include many laws, policies, strategies or practices that discriminate against people with disabilities. This may not be intentional but there are practices which do not accommodate persons with disabilities denying them equal rights in many circumstances.

These conditions, or impairments, may be cognitive, developmental, intellectual, mental, physical, sensory, or a combination of multiple factors.

The **Convention on the Rights of Persons with Disabilities** and its **Optional Protocol** was adopted on 13 December 2006 at the United Nations Headquarters in New York. The Convention follows decades of work by the United Nations to change attitudes and approaches to persons with disabilities. The Convention is intended as a human rights instrument with an explicit, social development dimension. It adopts a broad categorization of persons with disabilities and reaffirms that **all persons with all types of disabilities must enjoy all human rights and fundamental freedoms**. To give the effect to the United Nations Convention on the Rights of Persons with Disabilities an act names the **Rights of Persons with Disabilities Act 2016** (RPWD Act 2016) was passed by Indian Parliament on 27th December 2016.

4.1.3 Definition of Disability

According to the **Rights of Persons with Disabilities Act, 2016**¹

“**Person with disability**” refers to a person with long term physical, mental, intellectual or sensory impairment which, in interaction with barriers, hinders his full and effective participation in society equally with others.

“**Person with benchmark disability**” is a person with disability or affected by - Blindness, Low-vision, Hearing Impairment (deaf and hard of hearing), Dwarfism or a leprosy cured person-(Disabilities defined in measurable terms) or a person with not less than 40% of the following disabilities as certified by a certifying authority - Locomotor Disability, Intellectual Disability, Mental Illness, Autism Spectrum Disorder, Cerebral Palsy, Muscular Dystrophy, Chronic Neurological conditions, Specific Learning Disabilities, Multiple Sclerosis, Speech and Language disability, Thalassaemia, Hemophilia, Sickle Cell disease, Multiple Disabilities, Acid Attack victim, Parkinson’s disease. (Disabilities not defined in measurable terms in the Act).

According to **World Health Organization** – *Disabilities is an umbrella term, covering impairments, activity limitations, and participation restrictions. An impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations. Thus, disability is a complex phenomenon,*





reflecting an interaction between features of a person's body and features of the society in which he or she lives.

Do you know?

Impairments are problems in body function or alterations in body structure – for example, paralysis or blindness.

Activity limitations are difficulties in executing activities – for example, walking or eating.

Participation restrictions are problems with involvement in any area of life – for example, facing discrimination in employment or transportation

The International Classification of Functioning, Disability, and Health (ICF)² lists 9 broad domains of functioning which can be affected:

- Learning and applying knowledge
- General tasks and demands
- Communication
- Basic physical mobility, Domestic life, and Self-care (for example, activities of daily living)
- Interpersonal interactions and relationships
- Community, social and civic life, including employment
- Other major life areas

The ICF states that a variety of conceptual models have been proposed to understand and explain disability and functioning, which it seeks to integrate. Major conceptual models of disability have been proposed by ICF.

The medical model views disability as a feature of the person, directly caused by disease, trauma or other health condition, which requires medical care provided in the form of individual treatment by professionals. Disability, on this model, calls for medical or other treatment or intervention, to 'correct' the problem with the individual.

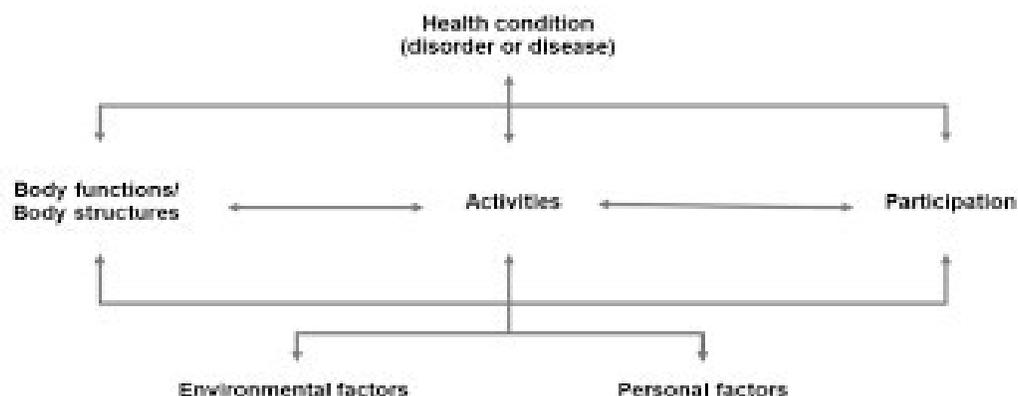
The social model of disability sees disability as a socially created problem and not at all an attribute of an individual. On the social model, disability demands a political response, since the problem is created by an unaccommodating physical environment brought about by attitudes and other features of the social environment.

Biopsychosocial model is one that synthesizes what is true in the medical and social models, without making the mistake each makes in reducing the whole, complex notion of disability to one of its aspects. ICF is based on this model, an integration of medical and social. ICF provides, by this synthesis, a coherent view of different perspectives of health: biological, individual and social.





The following diagram is one representation of the model of disability that is the basis for ICF.



As the diagram indicates, in ICF disability and functioning are viewed as outcomes of interactions between health conditions (diseases, disorders and injuries) and contextual factors. Among contextual factors are external environmental factors (for example, social attitudes, architectural characteristics, legal and social structures, as well as climate, terrain and so forth); and internal personal factors, which include gender, age, coping styles, social background, education, profession, past and current experience, overall behaviour pattern, character and other factors that influence how disability is experienced by the individual. The diagram identifies the three levels of human functioning classified by ICF: functioning at the level of body or body part, the whole person, and the whole person in a social context. Disability therefore involves dysfunction at one or more of these same levels: impairments, activity limitations and participation restrictions.

The formal definitions of these components of ICF are provided below.

Body Functions are physiological functions of body systems (including psychological functions).

Body Structures are anatomical parts of the body such as organs, limbs and their components. **Impairments** are problems in body function or structure such as a significant deviation or loss. **Activity** is the execution of a task or action by an individual.

Participation is involvement in a life situation.

Activity Limitations are difficulties an individual may have in executing activities.

Participation Restrictions are problems an individual may experience in involvement in life situations. For example, a hearing-disabled individual without a sign language interpreter, a wheelchair user in a building without an accessible bathroom or elevator, a visually-challenged person using a computer without screen-reading software.

Environmental Factors make up the physical, social and attitudinal environment in which people live and conduct their lives.





4.1.4 Concept of Disorder

Disorder is a functional abnormality or disturbance. The Oxford English Dictionary defines a disorder as *an illness that disrupts normal physical or mental function*. Going by this definition, disorder could be defined as a set of problems, which result in causing significant difficulty, distress, impairment and/or suffering in a person's daily life, or a dysfunction which negatively affects the structure or function of an organism physiologically and psychologically.

Do you know>

Emotional and Behavioural Disorders (EBD) is a broad category which is used commonly in educational settings, to group a range of more specific perceived difficulties of children and adolescents.

A child exhibiting one or more of the following characteristics to a marked degree for a long duration of time that adversely affects their education:

1. Difficulty to learn that cannot be explained by intellectual, sensory, or health factors.
2. Difficulty to build or maintain satisfactory interpersonal relationships with peers and teachers.
3. Inappropriate types of behaviour or feelings under normal circumstances.
4. A general pervasive mood of unhappiness or depression.
5. A tendency to develop physical symptoms or fears associated with personal or school problems.

A disorder must be "a manifestation of a behavioural, psychological, or biological dysfunction in the person" (American Psychiatric Association, 1987). It is also required that a disorder must be associated with "present distress (a painful symptom) or disability (impairment in one or more important areas of functioning) or with a significantly increased risk of suffering death, pain, disability, or an important loss of freedom."

Looking at disorders in a little more detail, we can say they are physical or mental conditions that disturb the regular or normal functioning and everyday activities of an individual. They can take up a lot of time and complicate the normal functioning of an individual. Due to the nature of disorders being flexible, they may not always be evident in every single situation. Equally what may affect one individual may not be as troublesome to another individual in the same situation. Therefore, a disorder is a very flexible and individual term.

4.1.5 What is the Right Term?

It is a matter of confusion for many as to what is the right term – Disability/Disorder/Children with Special Needs/*Divyangjan*. As per the Disability Act, "Person with Disability" or





Divyangjan are the acceptable terms. Disorders are used frequently in medical terminology whereas Children with Special Needs (CWSN) is more frequent in educational set up.

I. Tick the correct option

1. A Disability present at the time of birth is also known as
 - (a) invisible disability
 - (b) cognitive disability
 - (c) congenital Disability
 - (d) temporary Disability
2. Which one is Congenital disability?
 - (a) Down syndrome
 - (b) Cerebral palsy
 - (c) Polio
 - (d) Both A and B
3. Name the category of disability which can be difficult for others to recognize/acknowledge.
 - (a) Physical Disabilities
 - (b) Hidden Disabilities
 - (c) Cognitive Disabilities
 - (d) Intellectual Disabilities
4. Which is Hidden disability?
 - (a) Dyslexia
 - (b) Autism Spectrum Disorder
 - (c) ADHD
 - (d) Down Syndrome

II. Answer the following questions briefly.

1. Write in detail about Disability.
2. How are the terms Disability and Disorder associated with each other?
3. Define Impairment and Disability.

III. Answer the following question in 150—200 words.

1. Discuss the need of sports for children with special needs.





4.2.1 Types of Disability

Prior to 1995, we were familiar with only four types of disabilities; Orthopaedic Handicap, Visual Handicap, Hearing Handicap and Mental Handicap. In 1995, **Persons with Disability Act** came into force and term handicap was replaced with terms disability and impairment. This act recognized three more disabilities; Low Vision, Leprosy Cured and Mental Illness. In the year 2016, a new Act was enforced -**Right of Persons with Disability Act** (RPwD Act). This act recognizes 21 disabilities.

4.2.2 Physical Disability

A physical disability is the long-term loss or impairment of part of an individual's body function, resulting in a limitation of physical functioning, mobility, dexterity or stamina. Due to the functional loss the individual experiences the inability to perform normal movements of the body, such as walking and mobility, sitting and standing, use of hands and arms, muscle control, etc. These disabilities include

1. **Locomotor Disabilities** – A person's inability to execute distinctive activities associated with movement of self and objects resulting from affliction of musculoskeletal or nervous system or both including.
2. **Leprosy cured person** means a person who has been cured of leprosy but is suffering from:
 - i. loss of sensation in hands or feet as well as loss of sensation and paresis in the eye and eye- lid but with no manifest deformity;
 - ii. manifest deformity and paresis but having sufficient mobility in their hands and feet to enable them to engage in normal economic activity;
 - iii. extreme physical deformity as well as advanced age which prevents him/her from undertaking any gainful occupation, and the expression "leprosy cured" shall be construed accordingly;
3. **Cerebral Palsy** refers to a Group of non-progressive neurological condition affecting body movements and muscle coordination, caused by damage to one or more specific areas of the brain, usually occurring before, during or shortly after birth;
4. **Dwarfism** means a medical or genetic condition resulting in an adult height of 4 feet 10 inches (147 centimetres) or less;





5. **Muscular Dystrophy** means a group of hereditary genetic muscle disease that weakens the muscles that move the human body and persons with multiple dystrophy have incorrect and missing information in their genes, which prevents them from making the proteins they need for healthy muscles. It is characterised by progressive skeletal muscle weakness, defects in muscle proteins, and the death of muscle cells and tissue;
6. **Acid attack victim** refers to a person disfigured due to violent assaults by throwing of acid or similar corrosive substance.
7. **Visual impairment** (blindness) means a condition where a person has any of the following conditions, after best correction
 - i. total absence of sight; or
 - ii. visual acuity less than 3/60 or less than 10/200 (Snellen) in the better eye with best possible correction; or
 - iii. limitation of the field of vision subtending an angle of less than 10 degree.
8. **Visual impairment** (Low-vision) means a condition where a person has any of the following conditions, namely:
 - i. Visual acuity not exceeding 6/18 or less than 20/60 upto 3/60 or upto 10/200 (Snellen) in the better eye with best possible corrections; or
 - ii. limitation of the field of vision subtending an angle of less than 40 degree up to 10 degree.

Hearing Impairment - Hearing impairment is the inability of an individual to hear sounds adequately. This may be due to improper development, damage or disease to any part of the hearing mechanism. Hearing is a prerequisite for the development of normal speech and language. A child learns to speak by hearing the speech of others in the family and in his surroundings. Deafness at birth or in early childhood has disastrous effects on the child's overall development. These effects vary depending upon the age of onset, nature and degree of hearing impairment. Deafness is an invisible impairment. Keen observation is necessary in order to identify a deaf child/individual.
9. **Hearing impairment** (Deaf) means persons having 70 DB hearing loss in speech frequencies in both ears;
10. **Hearing impairment** (Hard of hearing) means person having 60 DB to 70 DB hearing loss in speech frequencies in both ears;
11. **Speech and language disability** means a permanent disability arising out of conditions such as laryngectomy or aphasia affecting one or more components of speech and language due to organic or neurological causes.





4.2.3 Intellectual Disability

An individual with intellectual disability has limitations in two areas.

Intellectual functioning, which refers to a person's ability to learn, reason, make decisions, and solve problems.

Adaptive behaviours, or skills necessary for day-to-day life, such as being able to communicate effectively, interact with others, and take care of oneself.

1. **Intellectual disability**, a condition characterised by significant limitation both in intellectual functioning (reasoning, learning, problem solving) and in adaptive behaviour which covers a range of every day, social and practical skills.
2. **Specific learning disabilities** means a heterogeneous group of conditions wherein there is a deficit in processing language, spoken or written, that may manifest itself as a difficulty to comprehend, speak, read, write, spell, or to do mathematical calculations and includes such conditions as perceptual disabilities, dyslexia, dysgraphia, dyscalculia, dyspraxia and developmental aphasia.
3. **Autism spectrum disorder** means a neuro-developmental condition typically appearing in the first three years of life that significantly affects a person's ability to communicate, understand relationships and relate to others, and is frequently associated with unusual or stereotypical rituals or behaviours.

4.2.4 Mental Behaviour

1. **Mental illness** means a substantial disorder of thinking, mood, perception, orientation or memory that grossly impairs judgment, behaviour, capacity to recognise reality or ability to meet the ordinary demands of life, but does not include retardation which is a condition of arrested or incomplete development of mind of a person, specially characterised by sub normality of intelligence.

4.2.5 Chronic Neurological Conditions

1. **Multiple sclerosis** means an inflammatory, nervous system disease in which the myelin sheaths around the axons of nerve cells of the brain and spinal cord are damaged, leading to demyelination and affecting the ability of nerve cells in the brain and spinal cord to communicate with each other.
2. **Parkinson's disease** means a progressive disease of the nervous system marked by tremor, muscular rigidity, and slow, imprecise movement, chiefly affecting middle-aged and elderly people associated with degeneration of the basal ganglia of the brain and a deficiency of the neurotransmitter dopamine.





4.2.6 Blood Disorders

1. **Haemophilia** means an inheritable disease, usually affecting only male but transmitted by women to their male children, characterised by loss or impairment of the normal clotting ability of blood so that a minor wound may result in fatal bleeding;
2. **Thalassemia** means a group of inherited disorders characterised by reduced or absent amounts of haemoglobin.
3. **Sickle cell disease** means a haemolytic disorder characterised by chronic anaemia, painful events, and various complications due to associated tissue and organ damage; "haemolytic" refers to the destruction of the cell membrane of red blood cells resulting in the release of haemoglobin.

4.2.7 Multiple Disabilities

1. **Multiple Disabilities** (more than one of the above specified disabilities) including deaf blindness which means a condition in which a person may have combination of hearing and visual impairments causing severe communication, developmental, and educational problems.

4.2.8 Nature of Disabilities

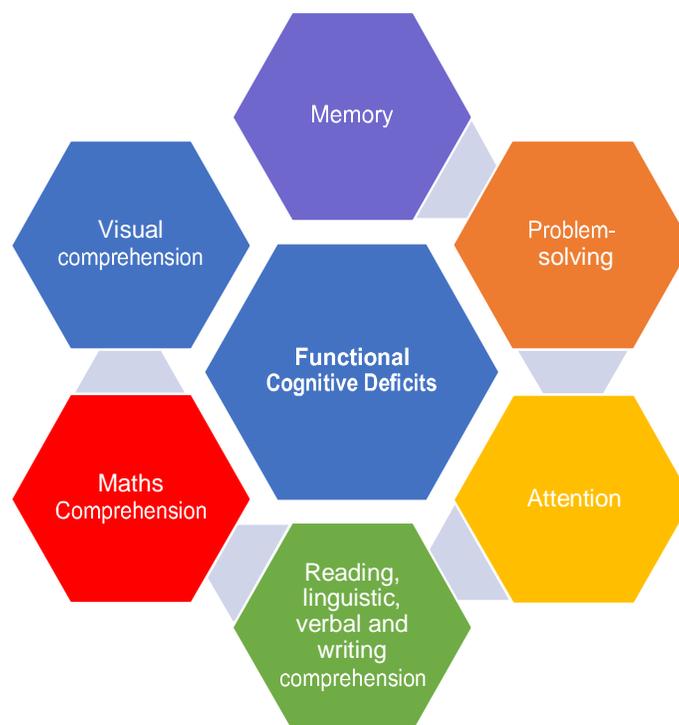
Students with disabilities face various difficulties in their personal, academic and sports related aspects. Broadly these may be described into three major domains. These difficulties may be caused by:

1. Learning Disabilities
2. Intellectual Disabilities
3. Physical Disabilities

4.2.9 Learning Difficulties

A person with cognitive disabilities has trouble remembering, learning new things, concentrating, or making decisions that affect her/his everyday life. Cognitive disability ranges from mild to severe. A person with a mild cognitive disability people may be able to do her/his everyday activities. Severe levels of disability can lead to her/his losing the ability to understand the meaning or importance of something and the ability to talk or write, resulting in the inability to live independently. Some of the main categories of functional cognitive disabilities include the following deficits or difficulties.





Memory - Memory refers to the ability of a user to recall what they have learned over time. A common model for explaining memory involves the concepts of working (i.e., immediate) memory, short-term memory, and long-term memory. Some individuals with cognitive disabilities have difficulties with one, two, or all three of these memory types.

Problem Solving - Some individuals with cognitive disabilities have a difficult time solving problems as they arise. In many instances, their resilience can be low, and the resulting frustration is such that they choose to give up and not persist to solve the problem.

Attention -There are many individuals that have difficulty with focusing their attention to the task at hand. Distractions such as any specific sound, colour, design frequently shift the attention.

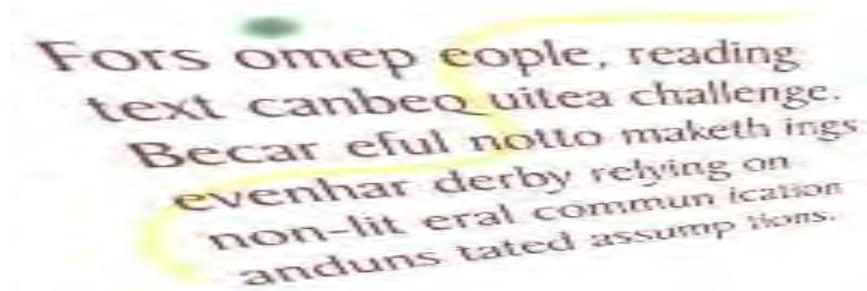
On a positive note, some people with attention deficits are highly creative and very productive in short bursts, with an abundance of energy and enthusiasm. On a less positive note, it can be difficult for people with ADHD to stick to a task for a long period of time.

Reading, Linguistic, Verbal and Writing Comprehension – Difficulties related to reading, speaking, understanding and writing are another challenge. Reading disorder, also known as Dyslexia, is characterized by trouble with reading despite normal intelligence. These difficulties may be mild or severe. Problems may include difficulties in spelling words, reading quickly, writing words, "sounding out" words in the head, pronouncing words when reading aloud and understanding what one reads. In fact, many of the brightest minds of





recent generations such as Albert Einstein, Thomas Edison and Henry Ford have suffered from some sort of language or text comprehension difficulty.

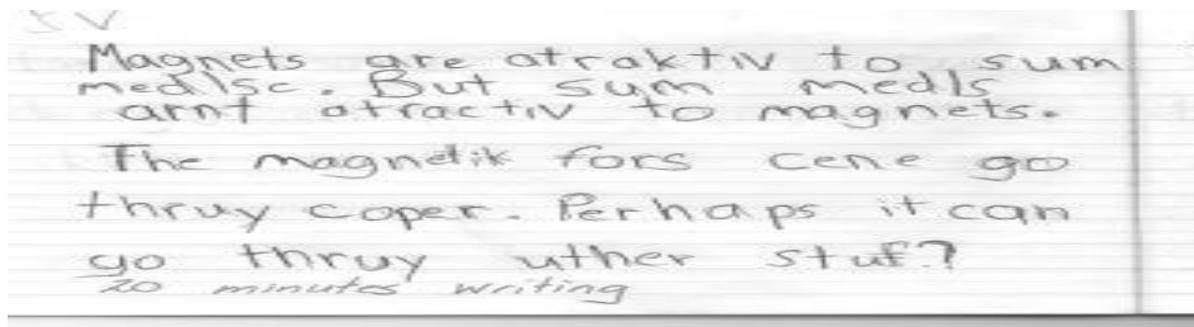


Non-literal text, such as sarcasm, parody, idiom, metaphor, slang, can be a problem for some readers to understand.

The following are the six types of Reading difficulties.

- i. **Phonological** - trouble in breaking speech into individual sounds
- ii. **Surface Dyslexia** - taking longer to process language when they move beyond the decoding stage
- iii. **Visual Dyslexia** - trouble reading and remembering what has been seen on a page because the brain doesn't receive the full picture of what the eyes are seeing.
- iv. **Primary Dyslexia** - refers to dyslexia when it is a result of a genetically inherited condition. The individual has difficulties in processing sounds, letters and numbers, which negatively impact her/his abilities in spelling, reading and math.
- v. **Secondary Dyslexia** – neurological impairment caused due to infections, or poor nutrition in the womb, leading to brain development issues which result in dyslexia.
- vi. **Trauma Dyslexia** - brain injury from trauma or disease can sometimes lead to difficulties with language processing, which result in dyslexia.

Difficulty in Writing, also known as Dysgraphia, is a learning disability that affects a person's handwriting ability and fine motor skills. Problems may include illegible handwriting, inconsistent spacing, poor spatial planning on paper, poor spelling, and difficulty composing writing as well as thinking and writing at the same time.





There are three type of dysgraphia:

- i. **Dyslexic Dysgraphia** – Their written text is unreadable; are there spelling issues. However, the individuals can copy, draw and colour.
- ii. **Motor Dysgraphia**– It is caused by weakness of fine motor skills. An individual with motor dysgraphia can copy, draw, colour within normal range, but has difficulty in all types of written work, manipulating a pencil, tying shoes etc.
- iii. **Spatial Dysgraphia** -A person with spatial dysgraphia has a defect in the understanding of space caused by brain having a difficult with evaluating what the eyes are seeing and how objects are positioned relative to each other. Handwriting is unreadable with unevenly spaced and sized letter.

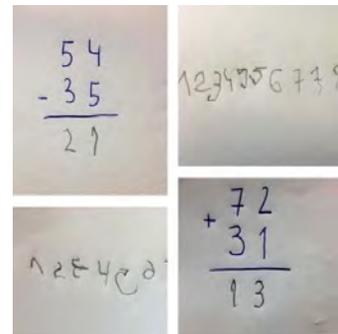
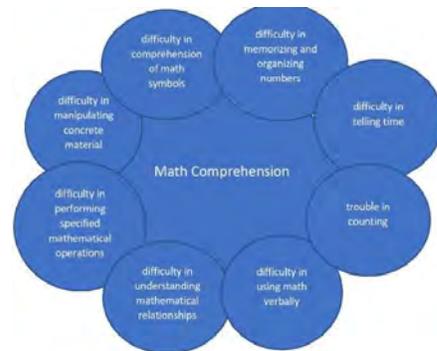
Visual comprehension - In many ways, this is the opposite of the problem experienced by people with reading and verbal processing difficulties. Individuals with visual comprehension difficulties may recognize the fact that there are objects, but may not be able to identify the objects. For example, they may not realize that a photograph of a person is a representation of a person, though they can plainly see the photograph itself (as an object). For these people, a moving, talking person in a video may be easier to identify and process mentally than a static image of a person in a photograph.

Video and multimedia, accompanied with narration, may be the best way to communicate with these individuals. For example, it will be difficult for some person with cognitive disability difficult to comprehend or recognize this sports personality in the given picture or what she is doing.

Math Comprehension – Also known as **Discalculia**, is a difficulty in learning or comprehending arithmetic, such as difficulty in understanding numbers, learning how to manipulate numbers, performing mathematical calculations and learning facts in mathematics. It includes

- difficulty in comprehension of math symbols,
- difficulty in memorizing and organizing numbers,
- difficulty in telling time,
- trouble in counting
- difficulty in using math verbally
- difficulty in understanding mathematical relationships
- difficulty in performing specified mathematical operation
- difficulty in manipulating concrete material.





4.2.10 Intellectual Disabilities

Intellectual disability is a condition of significantly subaverage general intellectual functioning that impacts adaptive behaviours. Different domains of adaptive behaviour may be affected in this condition. These domains determine how well an individual copes with everyday tasks.

- i. **Conceptual** – Language, Reading, Writing, Math, Reasoning, Knowledge, Memory
- ii. **Social** - Empathy, Social judgement, Interpersonal communication skill, Make and retain friendships
- iii. **Practical** - Self-management, Personal care, Job responsibilities, Money management, Recreation, Organizing school and work tasks

On the basis of IQ, children with intellectual disabilities can be classified as mild, moderate, severe and profound. Study the following summary of the common attributes.

CATEGORY	IQ	COMMON ATTRIBUTES
Mild	50-55 to 70-75	Constitutes the largest proportion (about 85%) of persons with intellectual disabilities. They typically develop communication and social skills from ages 0-5 years, have minimal impairment in sensorimotor areas, and often are not distinguishable from children without intellectual disabilities until a later age.
Moderate	35-40 to 50-55	Constitutes about 10% of those with intellectual disabilities. These individuals typically acquire communication skills during early childhood. They benefit from vocational training and, with proper supervision, can attend to personal care. They also benefit from training in social and occupational skills, but struggle to progress beyond a second-grade level in academic tasks. During adolescence, their difficulties in recognizing social norms may interfere with peer relationships.
Severe	20-25 to 35-40	Constitutes 3% to 4% of those with intellectual disabilities. These individuals typically acquire little or no communicative speech during early childhood but during their school-age years may learn to talk and acquire basic self-care skills. They benefit to a limited extent from instruction in basic content such as the alphabet. In adulthood, they may be able to perform simple tasks if closely supervised.
Profound	below 20-25	Constitutes 1% to 2% of those with intellectual disabilities. These individuals exhibit considerable impairments in sensorimotor functioning during early childhood. Optimal development requires highly structured environments with constant individualized support and supervision. Their motor skills, self-care, and communication skills may improve if proper training is provided. They may learn to perform simple tasks under close supervision.

Down Syndrome – Down Syndrome is a condition which is considered as subtype of intellectual disability. Also known as trisomy 21, it is a genetic disorder caused by the





presence of all or part of a third copy of chromosome 21. It is usually associated with physical growth delays, mild to moderate intellectual disability, and characteristic facial features. The average IQ of a young adult with Down syndrome is 50, equivalent to the mental ability of an 8- or 9-year-old child, but this can vary widely. At birth, babies with Down Syndrome usually have certain characteristic signs, including:



Picture Source³

- flat facial features,
- small head and ears
- short neck
- bulging tongue
- eyes that slant upward
- atypically shaped ears
- poor muscle tone

People with Down syndrome usually have some degree of developmental disability, but it's often mild to moderate. Mental and social development delays may mean that the child could have:

- impulsive behaviour
- poor judgment
- short attention span
- slow learning capabilities

Autism Spectrum disorder - Autism spectrum disorder (ASD) is an umbrella term for a group of developmental disorders that are neurological in origin and cause social, communication and behavioural challenges. ASD is mainly characterized by impaired social interaction and





communication and the presence of repetitive behaviours or restricted interests. Children with ASD may also have their sensory sensitivity affected i.e, they may be under or over sensitive to certain senses (For example, loud noises, certain fabrics etc).

Symptoms are typically recognized between one and two years of age. Long-term problems may include difficulties in performing daily tasks, creating and keeping relationships, and maintaining a job.

Symptoms of ASD include

Developmental Delay in Initial Years

- i. failure to show interest, not responding to name
- ii. delayed imaginative play
- iii. regression in variety of domain as communication, social cognitive and self - help skills.

Problems with Social Interaction

- i. largely prefer not to play or interact with others
- ii. display lack of awareness or understanding of other people's thoughts or feelings
- iii. display attention seeking behaviour
- iv. maintain poor eye contact: a child with autism may fail to make eye contact when called by name.
- v. inability to read facial expressions: they often don't know how to recognize emotions from others' facial expressions, or they may not respond with the appropriate facial expressions
- vi. display unusual speech pattern; at least half of children with autism speak in a flat, monotone or they may not recognize the need to control the volume of their voice in different social settings. For example, they may speak loudly in libraries or movie theatres.

Difficulty in Communication

- i. repetitive or rigid language, and restricted interests in conversation. (For example, a child might repeat words or insist on always talking about the same subject.)
- ii. impairments in pragmatic communication skills, such as difficulty initiating a conversation or failure to consider the interests of the listener to sustain a conversation.
- iii. language impairment. (children may develop language skills at an uneven pace acquiring some aspects of communication, while never fully developing others, or may remain completely nonverbal throughout their lives.)





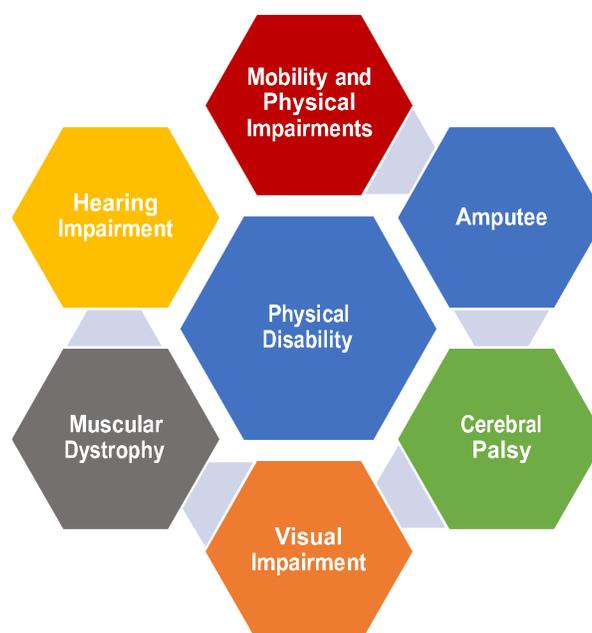
- iv. Behaviour Problems
- v. stereotyped behaviours such as rocking, hand flapping, finger flicking, head banging, or repeating phrases or sounds, especially when the child gets stressed, anxious or upset.
- vi. resistance to change, and preference for routines and rituals that they must follow, like eating certain foods in a specific order, or taking the same path to school every day. The child may have a meltdown if there is any change or disruption to his routine.
- vii. restricted interests and excessive interest in a thing or topic while ignoring everything else. (For example, children might try to learn everything about a single topic, such as the weather or sports, and talk about it constantly.)
- viii. oversensitivity to loud sounds, bright lights, strong smells, or being touched.

Self-injury

- i. self-injurious behaviours (SIB) including head-banging, self-cutting, self-biting, and hair- pulling. These behaviours may even result in serious injury. Higher rates of self-injury are also noted in socially isolated individuals with autism.

4.2.11 Physical Disabilities

There are different types of Physical Disabilities. Paralympics Committee divides athletes in groups by the degree of activity limitation related to the impairment and/or specific to the tasks in the sport.



Mobility and Physical Impairments – Physical impairment may affect upper limbs only and the this is commonly called ‘Upper limb disability’ or lower limbs may be impaired and the





condition is termed as Lower limb disability. Manual Dexterity of the person may also be affected due to physical impairment. This refers to the ability to make coordinated hand and finger movements to grasp and manipulate objects. Manual dexterity includes muscular, skeletal, and neurological functions to produce small, precise movements.

Extension Activity

Design some physical activities for students with physical or intellectual disabilities. Some of these students are sensitive to sound, others have difficulties with coordination. Create some fun games that these students could play. As you go through this process, you may need to research the features of the disability and adapt equipment, or the structure of the activity, to support the students. Reflect on what you have learned in this process. How has your understanding of sport for diverse ranges of ability changed?

Amputation - It is the removal of a limb by trauma, medical illness, or surgery. As a surgical measure, it is used to control pain or a disease process in the affected limb, such as malignancy or gangrene. The amputated person is called an amputee.

Cerebral Palsy- The word *cerebral* means **having to do with the brain**. The word *palsy* means **weakness or problems with body movement**. **Cerebral Palsy (CP)** is caused by damage to the parts of the brain that control movement, balance, and posture. CP is a group of permanent movement disorders that appear in early childhood. Signs and symptoms vary among people and over time. Although, most often, the problems occur during pregnancy, they may also occur during childbirth or shortly after birth. Symptoms include poor coordination, stiff muscles, weak muscles, and tremors. There may be problems in sensation, vision, hearing, swallowing, and speaking. Often, babies with cerebral palsy do not roll over, sit, crawl or walk as early as other children of their age. Other symptoms include seizures and problems with thinking or reasoning, which occur in about one third of people with CP.



Picture Source⁴





Physical problems related to Cerebral Palsy include

- Delays in reaching motor skill milestones, such as rolling over, sitting up alone, or crawling
- Variations in muscle tone, such as being too floppy or too stiff
- Delays in speech development and difficulty speaking
- Spasticity, or stiff muscles and exaggerated reflexes
- Lack of muscle coordination
- Tremors or involuntary movements
- Excessive drooling and problems with swallowing
- Difficulty in walking
- Favouring one side of the body, such as reaching with one hand
- Neurological problems, such as seizures,

Types of Cerebral Palsy – Depending upon the type of muscle tone, cerebral palsy can be classified into four types.

Types of Cerebral Palsy			
Spasticity	Athetosis	Ataxia	Mixed Type

Spasticity refers to muscle stiffness or increased muscle tension. Muscular stiffness may be mild, moderate or severe. In severe spasticity muscles are very tight and hypertonic.

Athetosis means uncontrolled movement. The person shows jerky or slow wriggly movement of the legs, arms, hands or face. The muscle tone keeps fluctuating from stiff to floppy.

Ataxia means unsteady, shaky movements. Low muscle tone (Hypotonia) and poor coordination of movements are the characteristics of ataxic type of cerebral palsy.

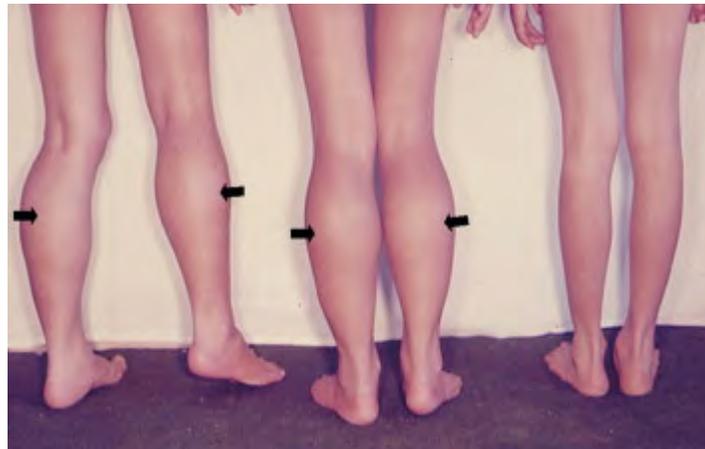
Mixed type of cerebral palsy reflects damage in more than one area of brain. If a child has both spastic and athetoid cerebral palsy, then some of the muscles have stiffness and others have involuntary movement.

Muscular Dystrophy- is a group of muscle diseases that results in increasing weakening and breakdown of skeletal muscles over time. The disorders differ depending upon the muscles that are primarily affected, the degree of weakness, how fast they worsen, and when symptoms begin. Many people eventually become unable to walk. Some types are also associated with problems in other organs. Muscular Dystrophy may even be fatal. Muscular dystrophy is caused by mutations on the X chromosome. Each version of muscular





dystrophy is due to a different set of mutations, but all prevent the body from producing dystrophin. Dystrophin is a protein essential for building and repairing muscles. At present, there is no way to prevent or reverse muscular dystrophy, but different kinds of therapy and drug treatment can improve a person's quality of life and delay the progression of symptoms.



Picture Source⁵

Early symptoms of Muscular Dystrophy include:

- a waddling gait
- pain and stiffness in the muscles
- difficulty with running and jumping
- walking on toes
- difficulty sitting up or standing
- learning disabilities, such as developing speech later than usual
- frequent falls

As time goes on, the following become more likely:

- inability to walk
- a shortening of muscles and tendons, further limiting movement breathing problems can become so severe that assisted breathing is necessary
- curvature of the spine can be affected if muscles are not strong enough to support its structure
- the muscles of the heart can be weakened, leading to cardiac problems
- difficulty swallowing, with a risk of aspiration pneumonia. A feeding tube is sometimes necessary.





Visual Disability - Visual impairment is often defined as a best corrected visual acuity of worse than either 20/40 or 20/60. The term blindness is used for complete or nearly complete vision loss. Visual impairment may cause difficulties with normal daily activities such as driving, reading, socializing, and walking. A significant limitation of visual capability resulting from either disease, trauma or congenital or degenerative condition that cannot be corrected by conventional means such as refractive correction, medication, or surgery.

Hearing Disability - Hearing loss, also known as hearing impairment, is a partial or total inability to hear. A person with hearing impairment has little to no hearing. Hearing loss may occur in one or both ears. In children, hearing problems can affect the ability to learn spoken language and in adults it can create difficulties with social interaction and at work. Hearing loss can be temporary or permanent.

4.2.12 Causes of Disabilities and Disorder

Causes of disabilities can be broadly classified into three categories; pre-natal causes, perinatal causes and post-natal causes.

- **Pre-natal causes** involve events, accidents, illness, infection to mother during pregnancy that affect the baby. Conditions like high blood pressure or diabetes of the mother during pregnancy can cause disability in the child.
- **Perinatal causes** are the conditions occurring during the delivery of the child that affect the new-born. Delayed labour pain, low birth weight or neonatal infections may cause a disability.
- **Post-natal causes** include post birth conditions like, illness, infection, poor environment, accidents, psychological factors etc.

The causes may be further sub-divided as

1. **Biological Causes** – Some disabilities are due to the disorder of genes, infectious disease disturbance in glands functioning, illness. Down syndrome, Muscular dystrophy, polio, Developmental disorder are example of various biological issues.
2. **Psychological Causes** – Mental health problems such as depression, bipolar disorder may lead to a spectrum of mental disorders or conditions that influence our emotions, cognitions, and/or behaviours. As a matter of fact, the causes of mental health problems are very difficult to diagnose. They tend to be some of the most misunderstood disabilities.
3. **Delay in Early Screening and Poor management of Disability** - How a child plays, learns, speaks, moves, and behaves all offer important clues about a child's development. A delay in any of these developmental milestones could be a sign of





developmental challenges. Early intervention services, like those services that help a child learn to speak, walk, or interact with others, can really make a difference and enhance a child's learning and development. Early screening and identification are critically important steps towards giving young children with disabilities a strong start in life.

4. **Lifestyle** – The mother's lifestyle during pregnancy has a vital effect on the child's growth and development. If a mother smokes during pregnancy, it has an adverse effect on foetal growth and development. Intake of alcohol and indulgence in substance abuse during pregnancy are the most common causes of developmental disabilities, including cognitive disability, learning disabilities, ADHD and behavioural challenges. Once the child is diagnosed with a learning disorder, she/he must be kept meaningfully occupied. The child's eating, sleeping, and exercise habits are very important. In addition to healthy physical habits, children may be frustrated by the challenges presented by their learning disability and, so, should be encouraged to have healthy emotional habits too.
5. **Accidents and War** – One can be the victim of an accident at the workplace, road accident, chemical accident, nuclear accident, or get exposed to radiation etc. This may lead to disability. Dangerous working environment and poor safety precautions are the conditions where one may get disabilities in the long run. Exposure to biological warfare, nuclear radiation, and suffering physical or psychological trauma of a bomb explosion are other reasons of wartime disabilities.
6. **Poor Approach to Healthcare** – Many disabilities can be prevented easily if there is proper access to healthcare facilities during difficult labour and birth. Proper immunization also helps in preventing many disabilities. In remote areas people do not get proper health facilities and it sometimes results in disabilities and disorders.
7. **Lack of Education and Awareness** – Lack of awareness about certain precautions during or post pregnancy may lead to disability. Awareness about nutrition and exercise helps to prevent disabilities or disorders. Due to lack of awareness people start believing in many kind of superstitions and get misguided.
8. **Exposure to Chemicals** – Pesticides and insecticides and other harmful chemicals if mixed in edible items and may give rise to disabilities in people and birth defects in babies. These substances may cause disorder in the functioning of the human body system and may lead to disabilities.
9. **Illness** – Illnesses like cancer, diabetes, heart disease cause a number of long term disabilities such as arthritis, musculoskeletal disorder etc are a significant cause of disability.





I. Tick the correct option

1. In which category would you place a person with intellectual disability if he has a IQ level between 50-55?
 - (a) Mild
 - (b) Moderate
 - (c) Severe
 - (d) Profound
2. A genetic disorder is found in an intellectual disability which is known as?
 - (a) Autism
 - (b) Cerebral palsy
 - (c) Down-syndrome
 - (d) None
3. World Disability Day is celebrated on
 - (a) 2nd April
 - (b) 21st June
 - (c) 29th August
 - (d) 3rd December

II. Answer the following questions briefly

1. Write a short note on cognitive disabilities
2. What are the characteristics of cerebral palsy?
3. What are the difficulties faced by person with visual impairment?

III. Answer the following question in 150—200 words

1. What are the causes of intellectual disability?

4.3.1 Types of Disorder

Mental disorders - A mental disorder, also called a mental illness or psychiatric disorder, is a behavioural or mental pattern that causes significant distress or impairment of personal functioning. Such features may be persistent, relapsing and remitting, or occur as a single episode. Many disorders have been described, with signs and symptoms that vary widely between specific disorders. Such disorders may be diagnosed by a mental health





professional. Some commonly occurring disorders include ADHD, ASD, Depression, Dementia, Bipolar, Schizophrenia

Genetic disorders - A genetic disorder is a health problem caused by one or more abnormalities in the genome. It can be caused by a mutation in a single gene (monogenic) or multiple genes (polygenic) or by a chromosomal abnormality. Down Syndrome, Muscular Dystrophy, Alzheimer, Dwarfism are some common genetic disorders.

Sensory Disorders - Sensory processing is the normal neurological function that all people experience when their brain processes sensory information from the environment around them. It is a condition in which the brain has trouble receiving and responding to information that comes in through the senses. When a person has a sensory processing disorder, she/he usually has no difficulties receiving the information itself, but their brain cannot effectively process certain sensory information. The disorders cause inappropriate responses, reactions, or both to sensory information. Some people become oversensitive to sensory input. Others may become under-sensitive to sensory input. For example, children with a sensory processing disorder may find certain places or people overwhelming. Others may lack sensations, causing them to play rough and constantly touch objects.

Emotional and Behavioural Disorders - refer to a disability classification used in educational settings that allows educational institutions to provide special education and related services to students who have displayed poor social and/or academic progress. Emotional and Behavioural Disorders includes such emotional and behavioural disorders wherein children exhibit one or more of these five characteristics:

- An inability to learn that cannot be explained by intellectual, sensory, or health factors.
- An inability to build or maintain satisfactory interpersonal relationships with peers and teachers.
- Inappropriate types of behavior or feelings under normal circumstances.
- A general pervasive mood of unhappiness or depression.
- A tendency to develop physical symptoms or fears associated with personal or school problems.

These students need individualized behaviour supports such as a Behaviour Intervention Plan. For example, Anxiety disorder, ODD, OCD

4.3.2 Attention Deficit Hyperactive Disorder (ADHD)

Attention Deficit Hyperactive Disorder is a neurodevelopmental type. It is characterized by symptoms such as inattentiveness, hyperactivity and impulsiveness or acting without regard to consequences, in a manner which is not age-appropriate. Some individuals with ADHD





also display difficulty regulating emotions or problems with executive function. For a diagnosis, the symptoms should appear before a person is twelve years old, be present for more than six months, and cause problems in at least two settings (such as school, home, or recreational activities). Although it causes impairment, many people with ADHD can have sustained attention for tasks they find interesting or rewarding (known as hyper focus). The symptoms of ADHD usually improve with age, but many adults who were diagnosed with the condition at a young age continue to experience problems such as sleep and anxiety disorders.

Common symptoms of ADHD include

- hyperactivity and impulsiveness
- having a short attention span and being unable to stick to tasks that are tedious or time-consuming
- inability to control emotions or outbursts
- constantly fidgeting and being unable to concentrate on tasks
- excessive talking
- acting without thinking with little or no sense of danger.

4.3.3 Sensory Processing Disorder

Sensory processing disorder is a condition in which the brain has trouble receiving and responding to information that comes in through the senses. The condition used to be called sensory integration dysfunction. Sensory processing problems are usually identified in children, but they can also affect adults.

Symptoms may vary according to the disorder's type and subtype present. SPD can affect one sense or multiple senses

Signs of over-responsivity include

- dislike of textures such as those found in fabrics, foods, grooming products or other materials found in daily living, to which most people would not react,
- serious discomfort, sickness or threat induced by normal sounds, lights, movements, smells, tastes, or even inner sensations such as heartbeat.

Signs of under-responsivity include

- sluggishness and lack of responsiveness
- sensory cravings including fidgeting, impulsiveness, and/or seeking or making loud, disturbing noises
- sensorimotor problems, including slow and uncoordinated movements or poor handwriting.



**Sensory discrimination problems** include

- problem in recognising / interpreting differences or similarities in the qualities of stimuli
- problem in processing sensations from touch, muscles and joints [proprioception] and head movements [vestibular or inner ear sensations].

Common Signs are

- Bumps or pushes others
- Grasps objects too tightly or uses too much force
- Frequently drops things or knocks things over
- Mouths, licks, chews or sucks on non-food items
- Craves movement For example, likes to spin self around
- Afraid of heights / swings / slides
- Has poor balance

Extension Activity

Nicknamed “Water Baby” for being a natural in water, Yash Singh became the first and youngest Indian to win a medal at the Special Olympics World Summer Games 2015 in Los Angeles. He won a Bronze in the 25-metre backstroke swimming event.

Born on November 14, 2001, Yash Singh embarked on his sporting journey as a 9-year-old boy, participating in school-level competitions. At 11 years, he won a Bronze medal at SO Bharat Delhi Aquatics State Championship in 2013 and thoroughly impressed the judges by his speed. It was a turning point in his life. Being a differently abled athlete did not deter his passion for swimming. He trained and practiced with great zeal and enthusiasm, and followed a strict regime of diet and training, putting in more hours than his peers.

Yash’s journey was not an easy path, but he crossed all hurdles to prove to the world that he is no less than his peers and can even be better. Being a visual learner, he takes time in grasping and learning new skills. He always inspires people around him. Being the only differently abled athlete competing in both mainstream and Special Olympics competitions has boosted his confidence and participating at national and international competitions has presented Yash with myriad social and cultural experiences which have enhanced his holistic development.

Sports taught Yash to be independent, never to give up and empowered him to become self-reliant. He could learn and move forward because of the immense support provided by his school, Step by Step School, his coaches and last but not the least his fellow swimmers.

Since 2016, Yash is in Canada. Being on the High School Swim team and Special Olympics and winning at various competitions at different levels gave him confidence and respect





from his fellow team members. He trains regularly at a Swim club and is guided by National and Olympic level coaches including former world record holder Annamay Pierce, Anna Lydall and few other specialists to improve his technique and performance. He has a rigorous training schedule, which includes 1-2 hours of swimming each day, 3-4 days of dryland training, power yoga and playing basketball for overall fitness. He is on a high protein and low carb diet. His regular day begins at 5:30 am with dryland exercises, followed by school, then swimming and ends at around 11 pm.

Yash also played on his school's Cricket and Bowling Team. In 2017, his school cricket team was awarded the Mayor's School Cricket Excellence Award. He also participated in the Track and Field events.

Sports has played an important role in his healthy growth and overall development. He has grown into a well-rounded young man with strong character, self-discipline and high values. He greatly benefitted from the conducive and inclusive environment provided by his school, here and in India. He now wants to explore avenues to learn new skills. His first step in this direction started with being a Volunteer at a Community library and he has not looked back since then. The dedication and sincerity of his work has earned kudos from his colleagues.

Presently, Yash has graduated with majors in Hospitality and Tourism. Apart from representing his country at international competitions, Yash wants to pursue a career in the Hospitality industry and lead a successful and an independent life. He is an inspirational role model for inclusion.

In his words, "Pursuing swimming helps me to achieve my dreams by focussing on my strengths."

Read the profile of one of an Indian athlete to win a Bronze Medal in the Special Olympics World Summer Games 2015 in Los Angeles.. Get into groups and discuss his/her achievements.

What do you think motivated him/her? Are there any messages in his/her story that inspire you?

4.3.4 Oppositional Defiant Disorder

Oppositional Defiant Disorder (ODD) is a behaviour disorder mostly diagnosed in childhood. Children with ODD are uncooperative, defiant, and hostile toward peers, parents, teachers, and other authority figures. They are more troubling to others than they are to themselves. Children with anxiety issues and ADHD are more likely to have ODD.

ODD can vary in severity:

- **Mild.** Symptoms occur only in one setting, such as only at home, school, work or with peers.





- **Moderate.** Some symptoms occur in at least two settings.
- **Severe.** Some symptoms occur in three or more settings.

Symptoms of ODD

Angry and irritable mood.

- often and easily loses temper
- is frequently touchy and easily annoyed by others
- is often angry and resentful

Argumentative and defiant behaviour.

- often argues with adults or people in authority
- often actively defies or refuses to comply with adults' requests or rules
- often deliberately annoys or upsets people
- often blames others for his or her mistakes or misbehaviour

Vindictiveness.

- is often spiteful or vindictive
- has shown spiteful or vindictive behaviour at least twice in the past six months

Children and teenagers with oppositional defiant disorder may have trouble at home with parents and siblings, in school with teachers, and at work with supervisors and other authority figures.

Children with ODD may struggle to make and keep friends and relationships. ODD may lead to problems such as:

- poor school and work performance
- antisocial behaviour
- impulse control problems
- substance use disorder
- suicide

4.3.5 Obsessive Compulsive Disorder

Obsessive Compulsive Disorder (OCD) is an anxiety disorder where people feel the need to check things repeatedly, perform certain routines repeatedly (called "rituals"), or have certain thoughts repeatedly (called "obsessions"). They are unable to control either the thoughts or the activities for more than a short period of time. Common activities include hand washing, counting of objects, and checking to see if a door is locked, putting things in





certain order, checking that they have completed some action, usually checking a certain number of times. Obsessions are repeated, persistent and unwanted thoughts, urges or images that are intrusive and cause distress or anxiety. As a result, the person may try to ignore them or get rid of them by performing a compulsive behaviour or ritual. These obsessions typically intrude when the person is trying to think of or doing other things. OCD usually begins in the teens or young adult years, but it can start in childhood too. Symptoms usually begin gradually and tend to vary in severity throughout life. The types of obsessions and compulsions you experience can also change over time.

Symptoms generally worsen when the person experiences greater stress. OCD, usually considered a lifelong disorder, can have mild to moderate symptoms or be so severe and time-consuming that it becomes disabling.

Obsessions often have themes such as:

- Fear of contamination or dirt
- Doubting and having difficulty tolerating uncertainty
- Needing things orderly and symmetrical
- Aggressive or horrific thoughts about losing control and harming yourself or others
- Unwanted thoughts, including aggression, or sexual or religious subjects As with obsessions, **compulsions** typically have themes, such as:
- Washing and cleaning
- Checking
- Counting
- Orderliness
- Following a strict routine

I. Tick the correct options.

1. What type of disorder is ADHD?
 - (a) Mental Disorder
 - (b) Emotional Disorder
 - (c) Behavioural Disorder
 - (d) Genetic Disorder
2. Putting things in certain order is a sign of
 - (a) OCD





- (b) ODD
 - (c) ASD
 - (d) SPD
3. A disorder that may also be categorised as an intellectual disability is
- (a) Autism
 - (b) Cerebral palsy
 - (c) Down Syndrome
 - (d) ADHD
4. World Autism day is celebrated on
- (a) 2nd April
 - (b) 29th August
 - (c) 21st June
 - (d) 3rd December
- II. Answer the following questions briefly.**
- 1. Write a short note on Attention Deficit Hyperactive Disorder.
 - 2. List the signs and symptoms of Oppositional Defiant Disorder.
 - 3. What do you know about Sensory Processing Disorder?
- III. Answer the following question in 150—200 words**
- 1. What are the characteristics of Autism spectrum disorder?

4.4.1 Disability Etiquette

Disability Etiquette is a set of guidelines dealing specifically with how to approach a person with a disability. Disability etiquette refers to communicating and interacting respectfully and courteously with people who have disabilities.

Positive and Energetic Attitude – One should approach a person with special needs with positive energy and attitude. Approach should be warm and friendly. One should not show sympathy for, or, even in certain cases, fear of the person.





Picture Source⁶

Communication - Communication should be two way – speaking to the person directly, and not to the person accompanying her/him. Establish a rapport with her/him. If necessary, use a communication aid such as a communication book or communication device, if required. Keep your tone low. Communicate with the individual slowly and clearly. Give them time to respond. While writing, or talking to or about a person with a disability, use “people first” language. Refer to her/him as a person with disability and not as “the disabled” or “the handicapped.” Avoid referring to people by their disability. For example, do not say, “She is an epileptic.” Instead, say, “She has epilepsy.” Do not say “wheelchair-bound” or “confined to a wheelchair.” Most wheelchair users perceive their wheelchair as liberating, not confining. Do say, “She uses a wheelchair.” Do not use negative, demeaning, and outdated terms such as “cripple,” “deaf and dumb,” or “retarded.” Be aware that many people with disabilities do not wish to be referred to euphemistically. So, avoid using terms such as “physically challenged,” or “differently abled.” Also, avoid referring to an individual with a disability as someone who is “suffering from Cerebral Palsy or Parkinson’s.”

Social Etiquette – Make surroundings disabled-friendly and comfortable for people with special needs. Do not make assumptions about what they can or cannot do. The impact of a specific disability can vary widely from person to person, so help only if it appears to be needed. Just because someone has a disability, don’t assume she needs help. If the setting is accessible, people with disabilities can usually get around fine. Adults with disabilities want





to be treated as independent people. Offer assistance only if the person appears to need it. A person with a disability will oftentimes communicate when she needs help. And if she does want help, ask how before you act. Acknowledge and respect the individual's ability to make decisions and judgments on their own behalf. Never physically or verbally bully them. Never play with their equipment. Ask them before offering any help. Only ask question about their disability if you know the person. Develop a culture of inclusion in surroundings.

Physical Etiquette - The height difference between a person in a wheelchair and an able-bodied person can create an unspoken feeling of superiority and inferiority. To be safe, sit or stand at eye-level with the person who has a disability when it is appropriate and possible. Finding a table to sit at is a great option because it can eliminate any visible differences, such as a wheelchair.

Sitting in a chair (with or without a table) is also better than kneeling, which may cause the person in a wheelchair to feel like a child. Make eye contact; never avoid someone with a disability. Some people with disabilities depend on their arms for balance. Grabbing them, even if your intention is to assist, could knock them off balance. Avoid patting a person on the head or touching his wheelchair, or cane. People with disabilities consider their equipment part of their personal space.

I. Tick the correct option

1. You have a new classmate who has a disability and has an interpreter as She/He has just joined your school. She/He speaks to you. You will
 - i. communicate with the interpreter
 - ii. stare between the interpreter and your classmate
 - iii. speak directly to your classmate
 - iv. look at neither your classmate nor the interpreter.

II. Answer the following questions briefly

1. What is the role of positive and energetic attitude in dealing with person with Disability?
2. How can you make a person with disability feel comfortable?
3. Disability etiquettes has a big role to give a sense of acceptance to person with disability. Explain how?

III. Answer the following question in 150—200 words

1. Explain what ettiquette should one keep in mind while communicating with a person with special needs?





4.5.1 Advantages of Physical Activities for CWSN

It is no secret that physical activities are an important aspect of a healthy lifestyle and can provide significant benefits for children in all developmental stages. Children with special needs have less opportunities to be less physically active and, therefore, are at higher risk for complications associated with inactivity. The benefits of regular physical activity for children with special needs can range from physical, emotional and social. CWSN demonstrate strength gains, increased flexibility, improved bone health, and better endurance and cardiovascular fitness as a result of regular physical activity. In the case of children with movement disabilities, physical activity is important in maintenance of mobility throughout the aging process. With enhanced physical health, children are better able to fight problems such as obesity and the associated health complications that may follow. Physical activity can also improve general mood and wellness. Regular fitness can be linked to improved self-esteem, social awareness, and self-confidence, which aid in empowering the lives of children with special needs.

1. **Physical benefits** – Scientific studies into disability groups have demonstrated that participation in physical activity and sport leads to improved levels of well-being and physical health. Children with intellectual disabilities may have additional physical disabilities resulting in below age-level performance in typical motor skills. Regular involvement in physical education and sport can help them to develop their gross motor and fine motor skills which may improve their overall performance. When encouraged to participate in a regular fitness routine, many CWSN show improvement in everything from their hand-eye coordination and flexibility, to their muscle strength, endurance, and even cardiovascular efficiency. These are all simply the natural benefits of exercise. This development of better motor skills and enhanced physical health helps individuals to fight back against problems such as obesity, and the health complications that follow.
2. **Mode of Recreation and Fun** -- CWSN frequently miss out on social activities, recreation and fun. Participation in extracurricular and sports activities can help them overcome this obstacle, providing them with the ability to engage in social interactions, make friends and initiate social skills.
3. **Improved Emotional Health** -- Including physical activity in a healthy lifestyle is proven to decrease rates of depression. CWSN often tend to have more emotional problems like depression. Participating in regular exercise can be a life-changing benefit by improving mental health and wellbeing. Physical activity can also improve general mood and wellness, which aid in empowering the lives of children with special needs.





4. **Channelizing the Surplus Energy** – Children with disabilities like ADHD display hyperactivity that, if appropriately directed, can bear positive results regarding cognitive benefits and constructive behaviour.
5. **Psychological benefits** –Regular participation in sports and physical activities is not just beneficial for the body, it is beneficial for the mind, too. Physical activity improves general mood and wellness in CWSN by improving their self-esteem, social awareness, and self- confidence, all of which are factors essential for empowering their lives. On the one hand the physical outlet provided by sports and physical activity reduces anxiety, stress and depression, and on the other, interaction and involvement with other students gives children a sense of accomplishment and confidence. For CWSN, developing a sense of self-esteem is particularly important, as they may often feel isolated and removed from the group.
6. **Healthy lifestyle** – CWSN are about twice as likely as other children to be overweight or obese often due to the related greater likelihood of being sedentary. As a result of their disability, their levels of participation in sports and physical activity is much lower than their peers. It is imperative that these children, as much or more, than other students must learn what about the steps to leading a healthy lifestyle, within the context of the abilities and limitations of their respective conditions.
7. **Behavioural Benefits** – The energetic nature of physical education leads to cognitive improvements in CWSN, allowing them to develop skills that they may not develop in a traditional classroom setting. Sports and Games are a structured activity with a set of rules and organisation. They help the child learn to practice self-regulation and enhance their decision- making skills. In addition, CWSN can learn to focus on specific goals, and work on their verbal communication by interacting with peers on the sports field. Sports and Physical education teach children a range of skills that including teamwork, problem solving abilities, increased attention span, and focus on task-based behaviour. Eventually, these skills can transfer into other classroom settings too, so that CWSN have a greater ability to learn and engage with their peers outside of physical education.
8. **Increased Independence** – Participation in Physical Education and Sports is a mode to transit towards greater independence due to improved daily life skills. For a person with a disability, an increase in physical activity can lead to more independence and freedom. Increased physical strength and energy that come from regular exercise allows persons with disability to do more daily tasks without assistance.





4.6.1 Strategies to Make Physical Activities Accessible for CWSN

Participation in physical activity is beneficial for all children, including those with disabilities. In fact, participation of children with disabilities in sports and recreational activities promotes inclusion, minimizes deconditioning, optimizes physical functioning, and enhances overall well-being. Despite these benefits, children with disabilities are more restricted in their participation, have lower levels of fitness, and have higher levels of obesity than their peers without disabilities. Well-informed decisions regarding each child's participation must consider certain well-devised strategies.

Communication – Advance information about activity, space, resource person or any change in activity should be communicated clearly. A variety of different instructional strategies such as verbal, visual and peer teaching should be used for performing various types of physical activities so that children get opportunity to participate in physical activity. The teacher could use visuals or social story about the activity. Give positive, corrective or specific feedback. As per the ability of the child, specific instruction must be provided in simple words and sentences. The tone should be low and one instruction should be given at a time. If necessary, a communication board or communication book could be used.



Space – For CWSN, space should be approachable for people having physical disability. The area for the physical activity should be limited. Space for activities should be disturbance free (noise, heat, cold, texture of floor, audience etc.) It is always better to start with indoor space. Boundaries should be demarked clearly as starting point, finishing point, sitting area. In case of children who have autism, they must be provided specific area because they may need some time to relax. Once behaviours, discipline, understanding of instructions are clear then one can transit towards outdoor space also. It does not mean that one is not allowed to go to outdoor sports.



Equipment -- A lack of appropriate equipment, coupled with a lack of professionals trained to support physical activity among children and youth with different ability levels, discourages participation. There are a growing number of disabled people who are interested in recreation and sport activities. In recent years several modified devices are on offer for adapted sports. There are many examples of simple and sophisticated equipment,





including computerized devices like wheelchairs for recreation and sport activities. There are sport competitions involving four groups of disabled sportspersons, namely 1) the deaf, 2) people with physical disability, 3) people with intellectual (mental) disability, 4) people supported by specially designed high level engineering equipment. All of them can use many kinds of equipment and facilities.

Targets





Table 7.4 Equipment Characteristics

Weight	Lighter	↔	Heavier
Size	Smaller	↔	Larger
Shape	Regular	↔	Irregular
Height	Lower	↔	Higher
Speed	Slower	↔	Faster
Distance	Closer	↔	Farther
Sound	Soft	↔	Noisy
Color	Pale	↔	Bright
Trajectory	Medium level	↔	High or low level
Direction	Forward	↔	Backward and sideways (right and left)
Surface contact	Increased	↔	Decreased
Surface or texture	Level or smooth	↔	Rough or uneven
Length	Shorter	↔	Longer
Resiliency	Less	↔	More

Graded Activities– During initial stage activities should be simple and the activity should be based on a single action. There should be a gradual move from non-locomotor to locomotor to manipulated activities. For these activities, the level of assistance should be physical, verbal and independent. CWSN need help children in learning a fundamental motor skill. It will need to be practised with the students so they are able to see visualize it through the teacher’s body action or one can use

videos. As they watch the video, words or phrases that highlight the important part on which the demonstration is focusing must be used. They could also be asked to demonstrate the skill to ensure the instructions have been understood before commencing practise and they must start practice immediately after viewing a demonstration. The activity must be practised with progressive count, or even performed dramatically with rhymes or songs with voice modulation so they enjoy the activities.

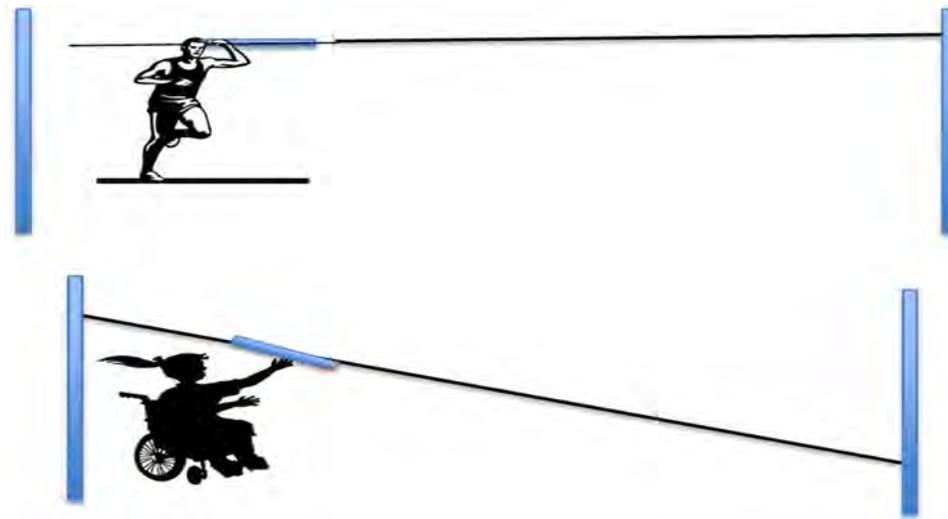
Do you know?

Locomotor skills include running, jumping, hopping, galloping, rolling, leaping and dodging, horizontal jump, slide.

Manipulative skills are throwing, catching, kicking, striking and trapping, dribble, overhand throw, and underhand roll

Stability skills are balance, twisting, turning and bending





Social strategies - Allow the child to choose a sport she/he enjoys. It's easier for children to be motivated when they enjoy the activity. At first, encourage the child with special needs to watch others. Let the child see people having fun as they play. Then, start with individual training, transfer to small group with supervision and reminder. Be a mediator to interact with other members of group. Keep individual check on each person participation and motivate them with reminder whenever they get distraction. End the lesson with positive feedback and each person greet with other before the session and after the sessions.

Psychological strategies – Because of previous exclusion or limited access, children with disabilities need a lot of motivation to participate in physical activity. It's all about the cycle of conditioning: active kids who stay active grow stronger and more physically literate as they age. The cycle of deconditioning works the same way: for children who don't participate, the less they do, the less they're able to do. In fact, "Psychological barriers are the most influential.

Changing attitudes is the key to increasing participation..." These barriers include attitudes, opinions and perceptions preventing participation in sport.

- Personal attitudes of persons with disability
- Attitudes of non-disabled people

All individuals benefit from regular physical activity and children with special needs especially gain from these physical, mental and social benefits of being active. Once children see improvements in muscle strength, coordination, and flexibility and experience better balance, motor skills and body awareness, they will have positive changes towards sports. It has been found that children with a disability choose to play sport for a number of reasons including





- to improve and learn new skills,
- to have fun,
- stay fit
- be physically challenged

While children often choose easier tasks to obtain rewards, doing this decreases the child's enjoyment of and intrinsic motivation for the activity. So, the selection of a challenging activity may be a strong influence in children's participation in sport. However, it may be possible that if the challenge becomes too great, the intrinsic motivation to participate may decrease. Because the level of challenge frequently increases more quickly for the disabled it is likely that this is a strong factor in participation. Therefore, it is better to let the child initially participate with her/his own disability group. Coaches are also often afraid to 'push' individuals with a disability too far and doing 'harm' to the individuals. In contrast to intrinsic motivation, extrinsic motivation involves motivators from the environment (e.g. friends, parents and coaches).

Certainly amongst children it can be expected that a huge part of their reasoning for participation in sport is to make friends. Children with strong peer relationships are more self-motivated in sport and, in addition, enjoy themselves more. It has also been found that a greater competence in sport coincided with stronger peer relationships. A PE teacher in UK revealed that her pupils "actively encourage and support the pupils with disabilities" in sport and that those pupils "grow in confidence as a result of their involvement". Disability in sport is, evidently, becoming more accepted than it ever has been.

I. Answer the following questions briefly.

1. How will you communicate with a classmate suffering from cognitive disability?
2. In what ways does participation in sports and games benefit a person with disability?

II. Answer the following question in 150-200 words.

1. How will you motivate a classmate with disability to take part in games and sports?

Art Inclusion

Working in groups, design a booklet for your school library on Disability Etiquette.

1. Think of the etiquettes you feel need to be included.
2. Draw Graphics to accompany the etiquettes.
3. Laminate the pages and get your book spiral-bound.





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CHAPTER-V: CHILDREN AND WOMEN IN SPORTS

Contents

- Motor development and factors affecting it.
- Exercise guidelines at different stages of growth and development.
- Common postural deformities-knock knees, flat foot, round shoulders, Lordosis, Kyphosis, Scoliosis and bow legs and their respective corrective measures.
- Sports participation of women in India.
- Special consideration (menarche and menstrual dysfunction)
- Female athlete triad (osteoporosis, amenorrhea, eating disorders)

Learning outcomes

At the end of the chapter, you will be able to:

- understand the concept of motor development and factors affecting it.
- discuss exercise guidelines for different stages of growth and development.
- classify common postural deformities and identify corrective measures.
- recognize the role and importance of sports participation of women in India.
- identify special consideration relate to menarche and menstrual dysfunction.
- express female athlete triad according to eating disorders.

Discussion

Given below is a list of some common postural deformities children may suffer from. What do you know about them? Complete the first two columns of the KWL Chart given below. Fill in the last column after completing your research by reading more about them.

Word	What I Know	What I Want to Know	What I Learned
Knock knees			
Flat foot			
Round shoulders			
Lordosis			
Kyphosis			
Scoliosis			
Bow legs			





5.1.1 Motor Development

Before we start discussion on the term Motor Development, let us start with the basic understanding about it. The word *Motor*, here, refers to **movement of human body**, whereas the word *Development* refers to **growth and changes that occur as life progresses**. Such changes may be result of age or experience. Thus, we can say that motor development refers to the development of a child’s bones, muscles and ability to move around and manipulate her or his environment.

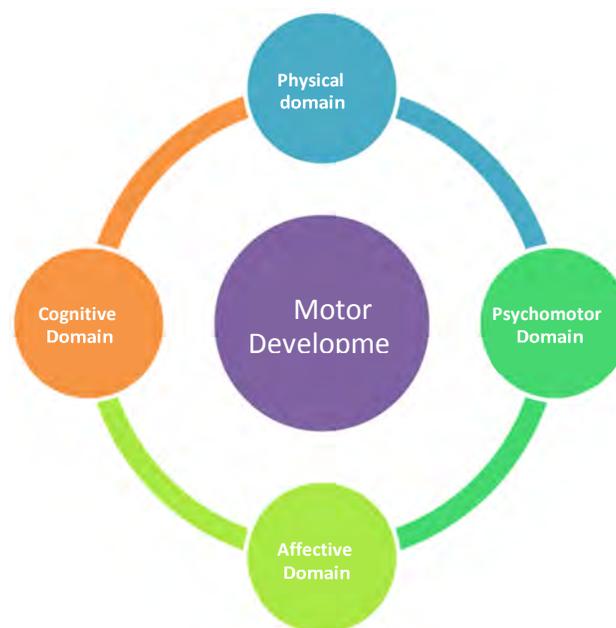
Motor Development refers to “the changes in motor behaviour over the lifespan and the processes which underlie these changes” Clark, J. E.& Whittall, J. (1989). What is motor development? The lessons of history. *Quest*, 41, 183-202.

Human motor development is “the study of the changes in human motor behaviour over the lifespan, the processes that underlie these changes, and the factors that affect them.” Payne, V. G., & Isaacs, L. D. (2012). *Human Motor Development: A Lifespan Approach*. McGraw Hill.

“Motor development is the continuous change in motor behaviour throughout the life cycle, brought about by interaction among the requirements of the movement task, the biology of the individual, and the conditions of the environment.” David L. Gallahue, J. C. (2012). *Understanding Motor Development: Infants, Children, Adolescents, Adults*. McGraw-Hill Education.

5.1.2 Domains of Motor Development

There are four domains of motor development





Cognitive domain: It is concerned with intellectual development of a child. We can take the example of class 4 boy who is sitting in the class room. We can examine his cognitive aspects by asking history question for remembering, maths question for analytical abilities, science question for application etc.

Affective domain: It is primarily concerned with emotional and social aspect of a child. We can understand this domain by asking questions like how the child feels while interacting with her/his classmates, teachers etc.

Psychomotor domain: It is concerned with body movements and factors that affect movements. We can examine the child’s psychomotor domain by examining her/his handwriting, movements of running, throwing, catching, jumping etc.

Physical domain: It is concerned with body changes take place during the life span. We can examine physical domain by testing fitness, height, weight, fat etc.

An example which can demonstrate all four domains of motor development is a man crossing the road. He must have knowledge of road safety rules, be fit enough to cross the road, have movements that are well-coordinated and a positive attitude towards observing the rules of the road.

Motor development should be organized and systematic. To learn to throw a ball, the process will be to first hold the ball, then release the ball, next drop the ball, bounce the ball, roll the ball, and finally throw the ball with both hands, with one hand and later overarm or underarm throw etc.

Motor development can be assessed by the product or process. In running a race, time is a product and running is a process, in shotput distance is a product and putting the shot is the process.

We can classify Motor Movements under the following heads.

Muscular Aspect	Environmental Aspect	Functional Aspect	Temporal Aspect
<ul style="list-style-type: none"> Gross Motor Skill Fine Motor Skill 	<ul style="list-style-type: none"> Open Motor Skill Closed Motor Skill 	<ul style="list-style-type: none"> Stability Skill Locomotor Skill Manipulative Skill 	<ul style="list-style-type: none"> Discrete Motor Skill Serial Motor Skill Continuous Motor Skill

5.1.3 Gross and Fine Motor Skills

On the basis of muscular development, Motor development can be divided into two major areas: gross motor skills and fine motor skills.





Gross motor skills include activities that involve moving major areas of the body. Activities like running, jumping, climbing, throwing, standing, and sitting are examples of gross motor skills.

Fine motor skills require more precision and involve hand and eye coordination. These skills, which seem simple to adults, require concentration for children to develop them. A snooker shot is an example of fine motor skill.

Extension Activity

Working in pairs, list the following activities into Gross and Fine Motor Skills.

- Climbing up, down, over, under and through things
- Completing shape puzzles
- Cutting shapes with scissors
- Dumping and filling a bucket
- Jumping
- Making shapes with play dough
- Running
- Stacking blocks
- Stringing beads
- Throwing and catching

5.1.4 Open and Closed Motor Skills

Sports skills can be classified according to how much they are affected by the sporting environment. Environmental stimuli include

Other people – for example, a netballer reacting to their own and the other team's players

Terrain/surface – for example, a cross-country runner running on muddy and dry ground

Weather – for example, a golfer playing on a windy day

Situation – for example, the venue and crowd

Performers need to have a good perception of these stimuli to adapt their skills to best suit the environment. These skills may be divided into **Open** and **Closed** Skills.

Open skills: An open motor skill is a skill performed in an unstable environment, where the start point is determined by the environment. Team-based sports such as Netball, Football, and Hockey involve open skills where the environment is continually changing, and so movements have to be continually adapted.

Closed skills: A closed motor skill is a skill which is performed in a stationary environment, where the performer chooses when to start the skill. These skills take place in a stable, non-





team based, predictable environment, and the performer knows what to do and when. For example, a free throw in Basketball and serving in Squash or Tennis.

5.1.5 Stability, Locomotor and Manipulative Skills

Fundamental movement skills provide a foundation for many physical activities including play, games, outdoor recreation and sports. Having these skills is an essential part of enjoyable participation and a lifelong interest in an active lifestyle. Fundamental movement skills include stability, locomotive, and manipulative or object control and skills.

Stability skills involve the body balancing either in one place (static) or while in motion (dynamic). Stability skills in this resource include landing, balance (static and dynamic) and rotation.

Locomotor Skills involve the body moving in any direction from one point to another. Locomotor skills include walking, running, dodging, jumping, hopping and skipping.

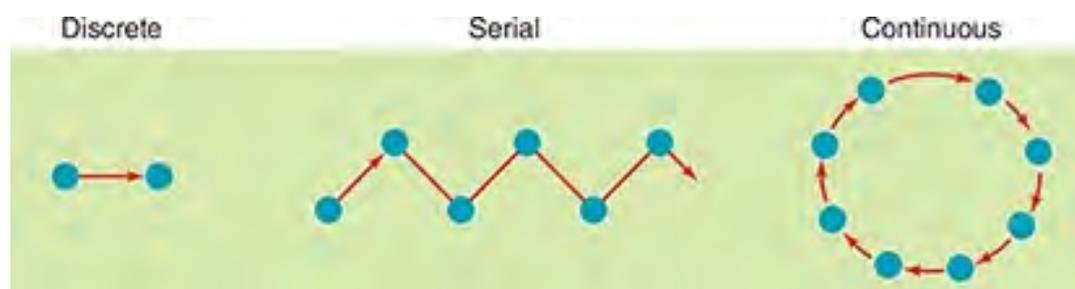
Manipulative skills involve handling and controlling objects with the hand, the foot or an implement (stick, bat or racquet). Manipulative skills in this resource include throwing and catching, striking with the hands, feet and an implement (e.g. kicking, volleying, batting and dribbling).

5.1.6 Discrete, Serial and Continuous Motor Skills

The **Temporal Aspect** refers to the organisation of the motor skill in time,

Discrete skills are brief, well-defined actions that have a clear beginning and end. They are single, specific skills, which make up the actions involved in a variety of sports such as hitting and throwing. For example, a penalty flick in Hockey.

Serial Skills are a group of discrete skills strung together to make a new and complex movement. For example, the sequence of skills for the triple jump.



Continuous skills have no obvious beginning or end. The end of one cycle of movements is the beginning of the next, and the skill is repeated like a cycle. These skills could be stopped at any moment during the performance of the skill. For example, Swimming, Running, Cycling.





Extension Activity

The physical abilities of a one-year-old are much different than the abilities of a five-year-old. Complete the table listing the abilities of both.

	One-year-old	Five-year-old
Movement		
Playing		

5.1.7 Factors that Affect Motor Development



Human beings are different from others in terms of personality, appearance, motor movements etc. As a result, the rate and level of motor development also varies. Therefore, to understand the stages of Motor development it is essential we discuss factors that affect it. The primary factors affecting Motor development are individual ability, environment and the given task.

Do you know

Developmental milestones are behaviours or physical skills seen in infants and children as they grow and develop. Rolling over, crawling, walking, and talking are all considered





milestones. The milestones are different for each age range. There is a normal range in which a child may reach each **milestone**.

Delayed milestones, also called **developmental delays**, describes the condition where a child does not reach one of these stages at the expected age.

Let us study factors affecting Motor development in detail.

1. **Lifestyle of mother:** An individual's growth and development journey starts in the mother's womb as a zygote. For the next nine months of foetal period the zygote develops extremities, teeth, nose, eyes, ears, central nerve system etc. During this period the baby is totally dependent on the mother. As a result, the mother lifestyle affects the baby. An unhealthy lifestyle like imbibing certain medicines, drugs, smoking, alcohol and other unhealthy food leads to growth deficiency, CNS dysfunctions, other anomalies and complications. Maternal nutrition should be balanced and must include all nutrients like protein, calcium, iron-rich foods, vitamins, and extra calories as per requirement of the body.
2. **Genetic factors:** Abnormal development can be caused by gene-based disorders or chromosomal disorders. Deformities like heart defects, respiratory distress syndrome, Musculo-skeletal deformities etc. and Down Syndrome, which includes short stature, late or no speech development, slow development of fine motor skills etc. may happen due to genetic factors.
3. **Learning:** Learning is one of the important factors that affect growth and development. Learning requires readiness to seek or acquire new information or skills. A child must be physiologically ready to develop strength, endurance and flexibility that will help to control the body, and psychologically ready to acquire skills. In other words, the child must be physically and mentally ready to seek information. Motivation and timely reinforcement promote learning. Individual differences including race, gender, culture and socioeconomic status may affect growth and development process.
4. **Psychological Factors:** Self-esteem plays an important role in growth and development of the individual. An individual with high self-esteem in the physical arena is not likely to give up physical activity. It motivates her/him to join and sustain the particular activity. Other factors including self-confidence, self-worth, self-image, emotions, also play a vital role in growth and development.
5. **Early Stages:** Parents and teachers should work on a programme where stimulation and deprivation are given systematically. While the more stimulation and opportunities a child is provided in order to develop both gross and fine motor skills, the faster her/his capacity increases. For instance, if a child is encouraged to play outside on park equipment or other areas where she/he can climb, run, and play,





her/his gross motor skills will develop quickly. Additionally, fine motor skills develop when children are encouraged to play with their hands, hold and touch smaller items, feed themselves, and draw or colour. Timely immunization also helps to prevent disease from child and would not hinder learning process. However, we must keep in mind the child's readiness to learn. Now-a-days parents provide stimulation too early like focus on swimming, reading, writing etc in early stages. This may have an adverse effect on the child's growth and development.

6. **Personal Factors:** Physical characteristics, intelligence, aptitude, height, weight, age, muscle fibres, length of fibres, bone structure, gender, diseases are factors that affect motor development. Taking a balanced diet or proper proportion of nutrition in food is required to promote motor development. Malnutrition leads to disease, low immunity, and adversely affects the child's health and motor development. Starvation, overeating, eating disorders negatively affect motor development leading to obesity, diabetes, heart disease etc. Good fitness level leads to good health, better reflexes and readiness of muscles to do complex movements. To keep body fit, children should be exposed to outdoor activities also. These activities should be planned in such way that there is focus on muscular aspect of movement for gross and fine motor skills development.

I. Tick the correct options

1. An activity that is NOT an example of gross motor skills is
 - (a) **drawing**
 - (b) standing
 - (c) throwing a ball
 - (d) jumping
2. An activity that is NOT an example of fine motor skills is
 - (a) using cutlery
 - (b) **riding a bike**
 - (c) building a toy tower
 - (d) cutting shapes using scissors

II. Answer the following questions briefly

1. Define Motor Development.
2. Briefly describe the domains of motor development.
3. Describe any one factor that affects motor development.
4. List down the major factors affecting motor development.

III. Answer the following questions in 150-200 words

1. Explain factors affecting motor development.





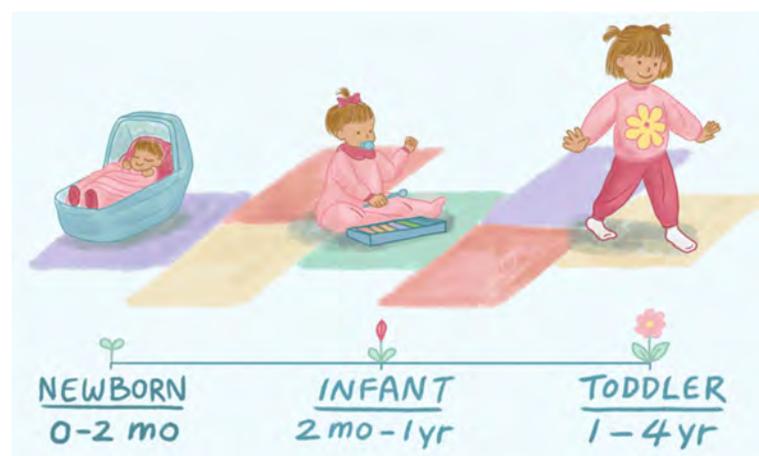
5.2.1 Physical Activity Guidelines at Different Stages of Growth and Development

World Health Organisation (WHO) has identified lack of physical activity, or physical inactivity, as the fourth leading risk factor for global mortality (6% of deaths globally). Regular participation in physical activities and sports provides ample opportunities to maintain physical, mental and social health. Participation in sports and physical activity results in benefits like an increase in self-confidence and self-esteem, a better control over emotions, reduction in levels of stress, anxiety and depression, maintenance of healthy weight social interaction and achieving high performance in academics. Regular physical activities help in not just physical, but also social, emotional and mental growth and development of infants, children, adolescents and adults. Physical activities should be encouraged among children to ensure strong muscles and bones. Children and young people should not be allowed to sit for long hours watching TV, playing computer games and travelling by car.

WHO has developed certain guidelines – **Global Recommendations on Physical Activity for Health** – with the overall aim of providing national and regional level policy makers with guidance on the frequency, duration, intensity, type and total amount of physical activity needed for the prevention of Non-Communicable Diseases or Lifestyle Diseases.

5.2.2 Children Under 5 Years of Age

“Achieving health for all means doing what is best for health right from the beginning of people’s lives,” says WHO Director-General Dr Tedros Adhanom Ghebreyesus. “Early childhood is a period of rapid development and a time when family lifestyle patterns can be adapted to boost health gains.” Children under five must spend less time sitting watching screens, or restrained in prams and seats, get better quality sleep and have more time for active play if they are to grow up healthy.



Picture Source¹





The following guidelines are recommended for healthy children aged Under 5 years, irrespective of gender, race, ethnicity, cultural background, and the socio-economic status of the family.

These are also relevant for children with different abilities. Children with a medical condition or disability should consult with health professionals before undertaking these activities. The goals of these guidelines are to recommend time spent on physical activities, and on sleep and sedentary activities to get health benefits. The age group further divided in to three group namely Less than 1 year, 1 to 2 years, 3 to 4 years.

Age	Sedentary Behaviour	Physical Activity	Sleep
Less than 1 year	Not be restrained for more than 1 hour at a time. Encourage reading and storytelling when sedentary. Screen time is not recommended.	Physically active several times a day through interactive floor-based play including 30 minutes of tummy time.	14–17hours (0–3 months of age) or 12– 16h (4–11 months of age) of good quality sleep, including naps.
1-2 years	Not restrained for more than 1 hour at a time or sit for extended periods of time. No screen time for 1-year-olds. For 2 years, sedentary screen time should be no more than 1 hour. Encourage reading and storytelling.	At least 180 minutes in a variety of types of physical activities including moderate-to-vigorous-intensity physical activity, spread throughout the day.	11-14 hours of good quality sleep, including naps, with regular sleep and wake-up times.
3-4 years	Not restrained for more than 1 hour at a time or sit for extended periods of time. Sedentary screen time should be no more than 1 hour; less is better. Encourage reading and storytelling.	At least 180 minutes in a variety of types of physical activities at any intensity, of which at least 60 minutes is moderate-to vigorous intensity physical activity, spread throughout the day.	10–13h of good quality sleep, which may include a nap, with regular sleep and wake-up times.





Infants (Less than 1 year)

Infants should be provided enough space and open environment to promote movement and minimize restrictive or sedentary behaviour so that they may explore their surroundings. Babies should be encouraged to be active throughout the day, every day. Before your baby begins to crawl, encourage her/him to be physically active by reaching and grasping, pulling and pushing, moving her/his head, body and limbs during daily routines, and during supervised floor play. This includes giving the baby 30 minutes in prone position (tummy time). Playing equipment should not be too small that can be swallowed or having sharp edges or prepared with toxic material. Activities like crawling and rolling should be performed on mat or sheet size of at least 7 feet by 4 feet. Once babies can move around, encourage them to be as active as possible in a safe, supervised and nurturing play environment. During sedentary timing child must be engaged in reading and storytelling for encouragement. For 0-3 months ages 14-17 hours and for 4-11 months of age baby should have good quality sleep that includes naps.

Toddlers (1-2 years of age)

During this period, the child should not be involved in any sedentary activity which is more than one-hour long including being restrained in prams/strollers, high chairs, or strapped on a caregiver's back, or sitting for extended periods of time. Once they learn to sit and stand toddlers should be encouraged to undertake fundamental physical activity like walking, running, jumping, catching, throwing, leaping etc. In this group sedentary screen time like involvement with computer games, watching TV or video is not recommended. Engagement in reading and storytelling should not be more than one hour. It is recommended toddlers get 11-14 hours of good quality sleep, including naps, with regular sleep and wake-up times.

Children 3–4 years

Children should spend at least 180 minutes in a variety of types of physical activities at any intensity, of which at least one hour is spent in moderate to vigorous intensity physical activity. This should be spread throughout the day, indoors or outside. In the 180 minutes of physical activity, we can include light activity such as standing up, moving around, rolling and playing, as well as more energetic activities like skipping, hopping, running and jumping. Active play, such as using a climbing frame, riding a bike, playing in water, chasing games and ball games, is the best way for this age group to get moving. Sedentary time should not be more than one hour, and during this period engagement in reading and storytelling should be encouraged. Quality sleep between 10-13 hours is recommended which includes a nap, with regular sleep and wake-up times.





All these recommendations are divided into three components Physical activity, sedentary behaviour and sleep. Lesser sedentary time and more moderate to vigorous intensity physical activity with sufficient sleep can provide additional health benefits.

5.2.3 Children and Youth 5-17 Years

These recommendations are relevant to healthy children and youth between 5 to 17 of age irrespective of gender, race, ethnicity or socio-economic status.

Children and youth with a specific medical condition or disability may follow these recommendations under advice of a medical official or with the help of the school special education teacher. Activities should be done in a progressive manner, for example starting the session with simple exercises to complex, gradually increasing the frequency, duration and intensity of the activities. There are various stages of growth in this age group, wherein at every stage the type of activities changes. The chief aim of activities during this age group is to improve cardiorespiratory and muscular fitness, bone health, cardiovascular and metabolic health biomarkers and to reduce symptoms of anxiety and depression.



Picture Source ²

Intensity	Moderate to Vigorous.
Volume/ Duration	At least one hour in a day; more than 60 minutes will provide additional health benefits.
Frequency	One session of 1 hour or two sessions of 30 minutes each.
Types of Activities	Aerobic, basic exercises for strengthening of muscles, Fundamental activities (Jumping, running, throwing, turning twisting etc.)





Benefits	Regular exercise helps to develop Musculo-skeletal system (Bones, muscles and joints), cardiovascular system (heart and lungs), neuromuscular system (coordination, movement control, motor learning) and maintain health body composition. Physical activities also help to develop psychological (control over emotions, anxiety, depression, and manage stress) and sociological aspects (interaction, integration, leadership), result in healthy behaviour (avoidance of tobacco, alcohol, drugs) and promote academic performance.
Activities	Play, Games, Sports, recreation, physical education, unplanned to planned exercises with or within family, school and Community.

5.2.4 Adults 18-64 Years

These recommendations are relevant to healthy adults aged between 18 to 64 irrespective of gender, race, ethnicity or social-economic status. Adults youth with disabilities may follow these recommendations with adjustment as per capacity or limitations. Adult having any medical condition should follow the advice of medical official. Activities should be done in progressive manner for example to start session with simple exercises to complex, gradually increase frequency, duration, intensity of the activities.



Intensity	Moderate to Vigorous.
Types of Activities	Muscular strengthening (strength) and Aerobic physical activities
Aerobic activities	150 to 300 minutes per week with moderate intensity or 75 to 150 minutes per week with vigorous intensity; One aerobic activity bout should be at least 10 minutes





Muscle strengthening activities	Activities involving major muscles involved activity, two or more days in a week
Benefits	Regular physical activity helps to lower the risk of all causes of mortality, (For example, Heart diseases, blood pressure, stroke, Type 2 diabetes, metabolic syndrome, colon and breast cancers and depression) hip or vertebral fractures, and to develop higher level of cardiorespiratory muscular fitness and maintain healthy weight with healthy body composition, bone health. It lowers the risk of Non-Communicable Diseases and depression.
Activities	Physical activities (walking jogging, swimming, weight training, dancing etc.), occupational work, household work (car wash, gardening, etc.) Games, Sports, recreation, transportation (walking, cycling), planned exercises with or within family and community.

5.2.5 Older Adults 65 Years and Above

These recommendations are relevant to healthy older adults aged between 65 and above irrespective of gender, race, ethnicity or social-economic status. These recommendations are also relevant for individuals suffering from chronic NCD conditions Adults, youth with disabilities may follow these recommendations with adjustment as per capacity or limitations. Individuals with specific health conditions, such as cardiovascular disease and diabetes, may need to take extra precautions and seek medical advice before trying to achieve the recommended levels of physical activity for older adults. Activities should be done in progressive manner for example to start session with simple exercises to complex, gradually increasing frequency, duration and intensity of the activities as per their ability and as conditions allow.



Picture Source ³





Intensity	Moderate to Vigorous.
Types of Activities	Muscular strengthening (strength) and Aerobic physical activities and Balance-enhancing exercises.
Aerobic activities	150 to 300 minutes per week with moderate intensity or 75 to 150 minutes per week with vigorous intensity; One aerobic activity bout should be at least 10 minutes.
Muscle strengthening activities	Activities involving major muscles involved activity, two or more days in a week
Balance-enhancing Activities	Older adults, with poor mobility, should perform physical activity to enhance balance and prevent falls on 3 or more days per week.
Benefits	Regular physical activity helps to lower the risk of all causes of mortality, (For example, Heart diseases, blood pressure, stroke, Type 2 diabetes, metabolic syndrome, colon and breast cancers and depression) hip or vertebral fractures, and to develop higher level of cardiorespiratory muscular fitness and maintain healthy weight with healthy body composition, bone health. It lowers the risk of Non-Communicable Diseases, depression and cognitive decline.
Activities	Physical activities (walking jogging, swimming, weight training, dancing etc.), occupational work, household work (car wash, gardening, etc.) Games, Sports, recreation, transportation (walking, cycling), planned exercises with or within family and community.

Do you Know?

Type of physical activity: includes aerobic, strength, flexibility, balance.

Duration: is the length of time in which an activity or exercise is performed. Duration is generally expressed in minutes.

Frequency: is the number of times an exercise or activity is performed. Frequency is generally expressed in sessions, episodes, or bouts per week.

Intensity: refers to the rate at which the activity is being performed or the magnitude of the effort required to perform an activity or exercise.

Volume: Aerobic exercise exposures can be characterized by an interaction between bout intensity, frequency, duration, and longevity of the programme. The product of these characteristics can be thought of as volume.





Moderate-intensity physical activity: On an absolute scale, moderate intensity refers to activity that is performed at 3.0–5.9 times the intensity of rest. On a scale relative to an individual's personal capacity, moderate-intensity physical activity is usually a 5 or 6 on a scale of 0–10.

Vigorous-intensity physical activity: On an absolute scale, vigorous intensity refers to activity that is performed at 6.0 or more times the intensity of rest for adults and typically 7.0 or more times for children and youth. On a scale relative to an individual's personal capacity, vigorous intensity physical activity is usually a 7 or 8 on a scale of 0–10.

Aerobic activity: also called endurance activity, improves cardiorespiratory fitness. Examples of aerobic activity include: brisk walking, running, bicycling, jumping rope, and swimming.

Sedentary behaviour: is characterized by a very low energy expenditure, such as sitting, reclining or lying down

Sleep behaviour: Duration and timing of sleep. For children under 5 years of age includes both at night and daytime naps. Toddler Child aged 1 to under 3 years (12.0–35.9 months).

Tummy time: Time an infant spends lying on her/his stomach (in prone position) while awake with unrestricted movement of limbs.

Nap: Period of sleep, usually during the daytime in addition to usual night time sleep.

Reference: www.who.int

I. Tick the correct options

1. Minimum duration of activity should be _____ per week at vigorous intensity in adults above 65 years of age.
 - (a) 75 minutes
 - (b) 150 minutes
 - (c) 300 minutes
 - (d) 450 minutes
2. Rate at which the activity is being performed is known as ____
 - (a) Volume
 - (b) **Intensity**
 - (c) Type of Activity
 - (d) Frequency

II. Answer the following questions briefly

1. Write down Physical activities exercise guideline for under 5 of age.





2. Briefly tell about physical activities exercises guideline for above 65 of age.

III. Answer the following questions in 150-200 words

1. Describe Physical activities exercise guideline for all groups.

5.3.1 Posture

Posture is defined as the attitude assumed by the body either with support during the course of muscular activity, or as a result of the coordinated action performed by a group of muscles working to maintain the stability. Posture is classified into two categories.

1. **Dynamic posture** is how one holds oneself when moving, For example, walking, running, or bending over to pick up something. It is usually required to form an efficient basis for movement. Muscles and non-contractile structures have to work to adapt to changing circumstances.
2. **Static posture** is how one holds oneself when stationary or not moving, For example, sitting, standing, or sleeping. Body segments are aligned and maintained in fixed positions. This is usually achieved by co-ordination and interaction of various muscle groups which are working statically to counteract gravity and other forces.

Extension Activity

Working in groups

- Distinguish between poor posture and proper posture.
- Describe proper posture while sitting, studying, writing, standing, walking.
- Discuss the significance of having a good posture.

Design a poster to be put up on the school Notice Board urging students to maintain good posture. Highlight the ill effects of poor posture.

It is important to make sure to maintain a good posture. This is possible where all body parts are aligned in such a way that least stress put on joints and muscles and, thus, it helps to prevent fatigue. A good posture helps to give good productivity in work, and leads to a physically and mentally stress-free condition. Postural deformity may be caused by heredity, disease, injury, poor habits, improper clothing, unhygienic living conditions, improper diet, improper exercises, lack of exercise, obesity, socio-economic status, etc.





5.3.2 Common Postural Deformities

There are a number of postural deformities, some of which are given below along with corrective measures. Corrective exercises should be done under advice and supervision of a physician or a physiotherapist.

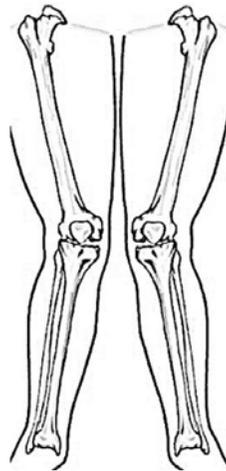


5.3.3 Knock Knees

Knock Knees, also known as ***Genu valgum***, is a knee misalignment that turns the knees inward. As a result, both knees touch or knock against each other in a normal standing posture but there is a gap of 3-4 inches between the ankles. It is generally first noticed in early childhood, but in most cases, it usually corrects itself naturally by the time children are 7-8 years old. However, in some cases it continues till adolescence. In some cases Genu valgum can also develop due to an injury or infection in the knee or leg, rickets, severe lack of vitamin D and calcium, obesity, or arthritis in the knee.

It negatively effects walking and running and impedes other legs movement which hinder performance. In case Genu valgum persists beyond childhood, it may have other symptoms besides misaligned knees. They include stiff joints, knee pain and walking with a limp. Stressed ligaments and muscles can also cause pain in the hips, ankles, or feet. If only one knee is out of line, the stance may be unbalanced.





Do you know?

The man who discovered genes was an Austrian Gregor Mendel. Mendel was a scientist, Augustinian friar and abbot of St. Thomas' Abbey in Brno, Margraviate of Moravia. Though farmers had known for millennia that crossbreeding of animals and plants could favor certain desirable traits, Mendel's pea plant experiments conducted between 1856 and 1863 established many of the rules of heredity, now referred to as the laws of Mendelian inheritance.



Corrective Measures

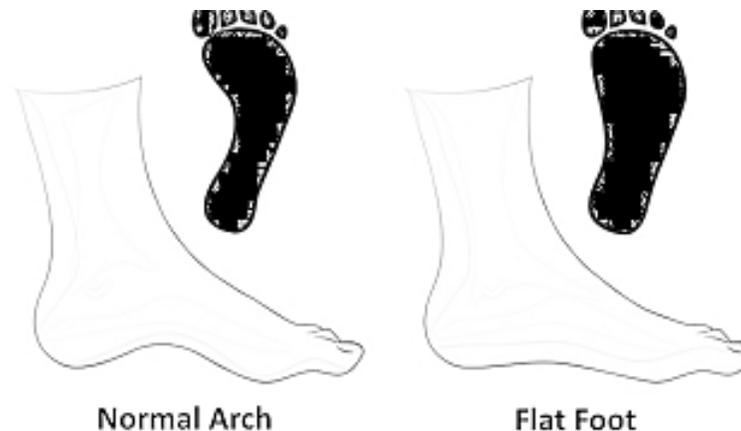
Treatment for Genu valgum largely depends on the cause and severity of the problem. Exercises like horse riding and keeping the pillow between the knees and standing erect for some time are the best. For most people with Genu valgum, Yoga and exercise can help realign and stabilize the knees. Performing *padmasana* and *gomukhasana* regularly can help strengthen muscles of the legs and realign the knees. Strengthening exercises can be simple, such as leg raises while seated or lying down. Using of walking callipers is also a big help at pre-puberty stage.

Excessive body weight can be a contributing factor to Genu valgum as extra weight puts additional strain on the legs and knees, and this can cause knock-knees to worsen. A person who is overweight should lose weight through a combination of diet and exercise.

5.3.4 Flat Foot

Flat foot is also known as *pes planus* or *fallen arches*. It is a condition that may be diagnosed by looking at the arch of the foot or by taking the water print test. As the name flat foot suggests, people suffering from this deformity have either no arch in their feet, or one that is very low, allowing the entire soles of the feet to touch the floor in standing position.





This problem may be genetic or environmental. At times a foot or ankle injury due to obesity, injury, wearing improper shoes (tight shoes, high heels etc.), carrying heavy weight for long time, arthritis or rheumatoid arthritis. It may be caused by a baby being forced to walk in an early stage, or it may be age related. Another condition that might cause flat feet is tarsal coalition.

This condition causes the bones of the foot to fuse together unusually, resulting in stiff and flat feet. Tightness in calf muscles may lead to temporary flat feet.

Arches provide a spring to the step and help to distribute body weight across the feet and legs. The structure of the arches determines how a person walks. Arches need to be both sturdy and flexible to adapt to stress and a variety of surfaces. When people have flat feet, it affects their posture while standing, their walking, running, and other related performances. Flatfeet can sometimes contribute to problems in the ankles and knees. Majority of babies are born with flat feet but as they grow or get involved in physical activities the arch in the foot develops.

Corrective Measures

Exercises like walking, standing or jumping on toes and heels in all four directions, skipping rope, strengthens the muscles of foot which help to develop the arch in the foot. Activities like picking up marbles with toes, writing numbers in the sand with the toes will also help in developing the arch. Yoga *asanas* like *Adhomukhsavasana* performed in *Surya Namaskar*, *Vajrasana* and other therapeutic massages are also helpful in developing the arch.

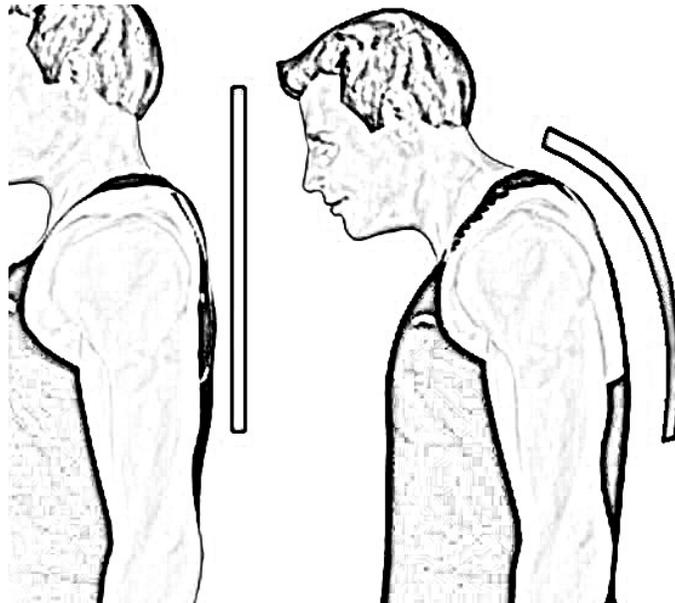
5.3.5 Round Shoulders

Round shoulders is a postural deformity in which shoulders are bent forward from the ideal alignment, thereby giving a narrow curve to upper back. It leads to postural deviations such as hyperkyphosis, or hunch back and anterior head carriage, or forward head posture. Over time, these postural conditions can progress and lead to other conditions such as chronic neck pain, thoracic outlet syndrome and lack of shoulder mobility.





It may occur at any age due to poor posture habits, heredity, muscle imbalance, tight fitting clothes, injury, disease etc. Poor posture habits include using smartphone, tablet, computer, driving, carrying heavy weights and sitting for long periods.



Corrective Measures

Most important measure to correct rounded shoulders is strengthening and stretching of muscles and trying to correct the imbalance of muscles by doing chest stretches, T stretch, wall stretch, Handclasp stretch and planks, pull ups, reverse shoulder stretch, etc. Developing the habit of keeping the spine straight is also helpful in correcting rounded shoulders. Yoga *asanas* like *Chakrasana*, *Dhanurasana*, can be useful in correcting rounded shoulders.

5.3.6 Kyphosis

Kyphosis is also known as Hunch Back or round upper back. The word **Kyphosis** comes from the Greek term *kyph* and means **bent or bowed**. It is a condition of the spine where the curvature of the upper back gets exaggerated or increases. It is an exaggerated, forward rounding of the back. Kyphosis can occur due to heredity, aging, disease (arthritis, osteoporosis), malnutrition, pulling of heavy weight over a period, unstable furniture, poor postural habit, weakness in muscles etc. It can occur at any age but is most common in older women. Age-related kyphosis is often due to weakness in the spinal bones that causes them to compress or crack. Kyphosis can appear in infants or teens due to malformation of the spine or wedging of the spinal bones over time.





While mild Kyphosis causes few problems, severe Kyphosis can cause pain and be disfiguring. This posture creates instability while walking, running etc. that may lead to fall or injury.

Corrective Measures

Exercises which help to strengthen back muscles, provide stability and make muscles more flexible should be performed. Physical therapy, swimming, exercise/ gym ball exercises, exercises with bands, and Yoga *asanas* like *Dhanurasana*, *Chakrasana* and *Bhujangasana* should be performed to get optimum benefits. Using a flat bed with a thin pillow while sleeping.

5.3.7 Lordosis

The term **Lordosis** comes from the Greek *lordos* which means ***bent backward***. The spine curves a little in the neck, upper back, and lower back. These curves, which create the spine's S shape, are called the kyphotic (upper back) and lordotic (neck and lower back). Lordosis is a spinal deformity in which the angle of arc of the lower back is reduced. This leads to an increase and exaggeration of normal concavity of the lumbar region of the spine. It is also known as sway back. Chronic Lordosis may lead to pain and discomfort and become more serious if left untreated.





Lordosis is often caused by obesity, improper development of muscles, muscular or skeletal disease or accident, poor posture while standing, sitting and walking, malnutrition, etc. There are few cases where the cause was unknown. It is generally found in children because of weakening or tightening of muscles of the hip area, but they easily recover as they grow and muscles get strengthened.

Corrective Measures

Most people with Lordosis don't require medical treatment unless it's a severe case. In severe cases of Lordosis in children and teens may require use of braces, or even surgery. Largely, weight loss, to help posture and daily physical therapy, to strengthen muscles and range of motion prove quite helpful. Exercises to develop strength in the pelvic region like sit-ups, sitting against the wall and pushing the trunk backward and lying on the back and raising upper extremities and legs together will give significant benefits. Yoga *asanas* including *Dhanurasana* and *Halasana* will be helpful. Use of braces, weight reduction, maintaining a good posture and taking a balanced diet are helpful in reducing the problem.

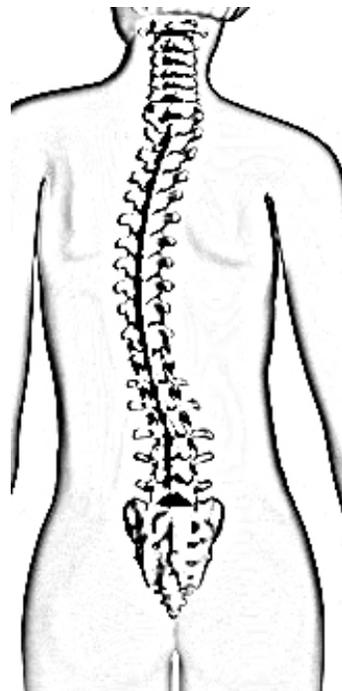
5.3.8 Scoliosis

The word **Scoliosis** comes from the Greek *skolios* which means **bent**. Scoliosis is a position in which the spine is tilted to either side of the body. It is a position of exaggerated lateral





curvature or sideways curvature of the. In this disorder, the spine bends, twists or rotates in a way that it makes a C or an S shape. Scoliosis is found more commonly in girls than in boys and, though it can occur at any age, but it is more common during the growth spurt just before puberty. Most cases of scoliosis are mild, but some spinal deformities continue to get more severe as children grow. Severe scoliosis can be disabling. An especially severe spinal curve can reduce the amount of space within the chest, making it difficult for the lungs to function properly.



Scoliosis can be caused by conditions such as cerebral palsy and muscular dystrophy, or diseases like Arthritis, Paralysis, Rickets. It may result from lifting heavy weights, living in an unhealthy environment, and standing and sitting in a wrong posture. However, the cause of most scoliosis is unknown.

Corrective Measures

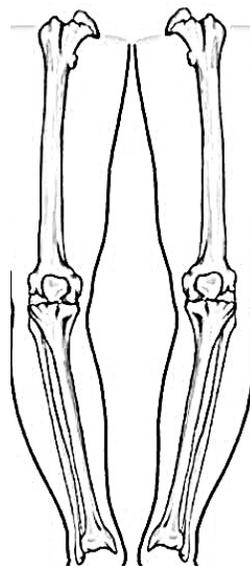
In cases of mild Scoliosis, no treatment is necessary. Some children may need to wear a brace to stop the curve from worsening. Others may need surgery to keep the problem from worsening and to straighten the spine. Exercises like hanging on the horizontal bars and swinging should be done on opposite side of the C-shaped curve. Aerobic activities with slow pace and breaststroke in swimming are helpful and also give good results. In yoga *Trikonasana* and *Adhomukhasana* should be performed to straighten the spine.





5.3.9 Bow Legs

Bow Legs, also known as Genu varum, is a position of knees in which legs look like a bow, when the legs curve outward at the knees while the feet and ankles touch. Infants and toddlers often have bow legs. It may be caused due to lack of Vitamin D, Phosphorus and Calcium and can be easily cured at an early stage. The condition doesn't cause pain or discomfort and is rarely serious. It does not affect running, standing, crawling etc. Bow legs is a condition that usually goes away without treatment, often by the time a child is 3–4 years old and does not affect a child's ability to crawl, walk, or run. However, parents might worry about the appearance of their child's legs, or an awkward walking pattern.



Sometimes, kids with bow legs may walk with the toes pointed inward, called pigeon-toes, or they may trip a lot and appear clumsy. Although in most cases the problem generally gets resolved on its own as the child grows, sometimes, it may lead to arthritis in the knees and hips. At times Bowlegs can be a sign of an underlying disease, such as Blount's disease, rickets, or arthritis.

Corrective Measures

Use of braces and modified shoes can be along with sufficient intake of balanced diet can prove to be of help. Walking on the inner edge of the feet may also help.

I. Tick the correct options

1. Deformity of the legs is known as
 - (a) Scoliosis
 - (b) Lordosis
 - (c) **Knock knees**





- (d) Kyphosis
- 2. Lordosis is a problem of the
 - (a) Lower Back
 - (b) Middle Back
 - (c) Upper Back
 - (d) Shoulders
- 3. Scoliosis is a postural deformity related to
 - (a) Muscles
 - (b) Shoulders
 - (c) Legs
 - (d) Spine
- 4. Kyphosis is a deformity found in
 - (a) Shoulders
 - (b) Lumber region
 - (c) Hips
 - (d) Thoracic region

II. Answer the following questions briefly

- 1. What is meant by Round Shoulders? Mention a few exercises to correct it.
- 2. What is the Lordosis? Write in brief.
- 3. Write in brief the causes and symptoms of Knock Knees.
- 4. Explain corrective measures for Flatfoot.

III. Answer the following questions in 150-200 words

- 1. Explain any five postural deformities with their corrective measures.
- 2. Describe corrective measures of some common spinal postural deformities.

5.4.1 Participation of Women in Sports in India

Women's sports, both amateur and professional, have existed throughout the world for centuries in all varieties of sports. There is a rich record of sports participation of women in India. In the days of Mahabharata, Shakuntala, Madhuri, Kunti all choose physical activities as recreation. As time passed, India women were deprived of participation in sports for a number of reasons, despite having potential and talent. They were put on the back seat, and were not allowed to participate in sports. However, female participation and popularity in





sports increased dramatically in the last quarter of the 20th century, reflecting changes that emphasize gender parity. Although the level of participation and performance can still be improved, women's participation in sports is generally accepted and promoted today.

Although women have shown a dramatic rise in sports participation, there is still a large disparity in participation rates between women and men remains. These disparities continue to hinder equality in sports. Many institutions and programmes still remain conservative and do not contribute to gender equity in sports. Some research in physical domain lists constraints like heavy limbs, pear-shaped body structure and postural deformities like flat foot knock knees etc., and physiological constraints including low level of RBCs, smaller heart and lungs, high fat percentage, menstrual disorders etc as reasons for women's non-participation in sports. There are certain psychological constraints like low self-confidence and self-esteem, higher levels of stress and anxiety and social causes like lack of support or positive reinforcement from family and a male-dominated social structure that affect women's participation in Sports. Religious and economic factors also play a negative role that affects women's participation in sports.



However, these constraints are now being reduced or eliminated as more women athletes are participating in sports. Regular physical activities and sports help to manage weight, tone the muscles, lower blood pressure, improve blood flow, increase high density lipoprotein and lower low density lipoprotein levels. Increased physical activity lowers the risk of heart and lungs disease and increases heart and lung capacity. Sports is an important





tool for social empowerment and helps to develop skills like communication, teamwork, leadership, respect, social interaction, sportsmanship etc. and can significantly contribute to develop society and community. Sports participation not only provide health benefits but give overall development. Sport does not discriminate on the basis of colour, cast, creed, sex, race etc.

This trend of lower participation of women in sports exists not just in India, but is a global phenomenon. Participation of women at all levels from regional to international is limited. It affects all domains like participation in sports activities, administration of associations and federations, and participation in national and international level committees. Women who play sports continue to face many obstacles, such as lower pay, less media coverage, and different injuries compared to their male counterparts. Many female athletes have engaged in peaceful protests, such as playing strikes, social media campaigns, and even lawsuits to address these inequalities.

Do you know?

Some Indian women sportspersons who won medals in international events in 2019.

- 1. Dutee Chand** - First Indian to win a 100m gold in a global event at the 30th Summer University Games in Napoli, Italy.
- 2. Hima Das - Won 5 gold medals in 20 days**
 - July 2, Poznan: 200m gold (23.65 seconds)
 - July 7, Kunto: 200m gold (23.97 seconds)
 - July 13, Kladno: 200m gold (23.43 seconds)
 - July 17, Tabor: 200m gold (23.25 seconds)
 - July 20, Prague: 400m gold (52.09 seconds)
- 3. PV Sindhu - First Indian to win World Championships**
 - 2013 - Bronze
 - 2014 - Bronze
 - 2017 - Silver
 - 2018 - Silver
 - 2019 – Gold
- 4. Manasi Joshi - Won BWF Para-Badminton World Championship**

Para-badminton player Manasi Joshi created history by securing gold at the BWF Para-Badminton World Championships, just a day before Sindhu.
- 5. PU Chitra - Clinched gold in women's 1500m race**

Won the Gold at the Asian Athletics Championship 2019 in Doha.





The International Olympic Committee (IOC) encourages participation not only in playing sports but in National Olympic Committees and International Federations and conducting regional seminars for female administrators, coaches, technical officials and journalists. In a recent announcement by IOC, 49% women will take part in next Olympic games. The constitution of India also provides gender equality and ensures to eliminate any type of hindrance. Sports is a medium to get gender equity and empowerment.

5.4.2 Constraints for Women's Participation in Sports in India

Physical Constraints - Physical constraints refer to the morphological feature adaptations to particular sports. Basically, it refers to the qualities of the sports person such as the physical fitness parameters. If there is failure in any of these required parameters it results in the reduction of sports performance. To mention a few: heavy musculature of limbs, pelvic or abdomen, improper posture/ postural deformity or flat foot.

Physiological Constraints -Physiological constraints refer to the organ functions ultimately impacting the system coordination. If there is any dysfunction of the organs it results in reduction of sports performance. Some women have lower levels of RBCs, lower percentage of Haemoglobin, smaller or weaker heart and its circulation, smaller or weaker lungs and breathing mechanism, dysfunction of organs of endocrine system, greater body fat percentage, dominance of neither aerobic power nor anaerobic power, Menstrual disorders.

Psychological Constraints - Psychological constraints comprise the behavioural process such as higher level of anxiety or aggression, lack of self- confidence, achievement motivation or interest, lower self-esteem or hesitation to participate during menstrual periods. These factors result in the reduction of wilful participation in sports.

Social Constraints - Social constraints refer to the behaviour of society in general and sports field in particular. During training and competition, the relationship with coaches, arena persons, training-mates, co-participants, opponents and officials during competition affects not just performance, but also participation. If there is any undue harassment or misbehaviour during this period, it results in reduction in sports performance or ultimately exit from sports participation. Lack of parental support and encouragement, and male dominant social structure also has a very negative impact on participation.

Religious Constraints - Religious constraints prevail in those societies who are fundamentalist and have rigid religious beliefs. They fear as society may ostracise them for going beyond the boundaries of their religion. This might also be the cause of limited participation in sports by women in India.





Economic Constraints - Economic constraints are considered the most important factor that hinders the women participation in sports. Insufficient funds, lack of sponsors also results in women exiting the sports arena. Economic constraints are magnified by the triangular or pyramidal factors. Non-availability of expert trainers, lack of sufficient infrastructural facilities and non-availability of sports equipment compounds the problem. Infrastructural facilities include availability of area for training, indoor stadiums or constructive sporting environment to undergo training. Lack of qualified coaches results not just in poor performance but also becomes a cause of sports injuries.

Because of the above discussed constraints and barriers women face problems is sports participation. Campaign for all women's participation in sports should be encouraged in schools, colleges and in universities. Awareness programmes for women's participation in sports should be conducted on a regular basis and they should be encouraged to participate in competitive sports. Families should also be encouraged to support their girls to participate in sports. Media coverage and sponsorship can enhance sports participation of women in India. Sports equipment must be developed focusing on physiological aspects of women. Appointment of women coaches, providing opportunities for competitions, eliminating cultural and social negativity and proper facilities can ensure larger participation. And in those states where religion is becoming a constraint should come up with some alternatives so that their women can also participate in sports and live a better and healthy life.

Now times are changing and society is accepting, and even encouraging, women's participation in sports on National and International levels. In recent years, it has been raining gold on Indian women athletes in the International arena proving women are no less of a powerhouse when it comes to winning medals and championships for the country. Barriers which prevented women from participating in sports are getting broken. Women are coming out and participating in sports and physical activities in large numbers. Karnam Malleswari was the first women who won a medal in Olympic Games in Sydney in 2000. In 2012, London Olympics, five times world champion Mary Kom won a medal in boxing and Saina Nehwal in Badminton. In 2016 Rio Olympics Sakshi Malik won medal in wrestling and P.V. Sindhu won the first ever women's silver medal in badminton. P.T Usha and Anju Bobby George were athletes who earned a name in Athletics at international level. Our Indian women cricket team, wrestling, badminton, boxing, giving country name new heights.





Extension Activity

In recent years Indian women athletes have done India proud in International Sports events. Identify the following and match the pictures to their names. Mention their games in the blank.

Make a PPT about any one of them.

	SANIA MIRZA	
	P.T USHA	
	SAINA NEHWAL	
	P.V. SINDHU	
	MARY KOM	

I. Tick the correct options

- Karnam Malleswari won a bronze medal in Olympic Games at
 - Rio De Janeiro
 - London
 - Sydney
 - Athens
- Sakshi Malik won a medal in
 - Badminton
 - Weightlifting
 - Wrestling
 - Boxing



**II. Answer the following questions briefly**

1. Write a short note on benefits of participation in sports.
2. How has women's participation in sports changed over the last two decades?

III. Answer the following questions in 150-200 words

1. Explain the various constraints faced by women in sports. How have they overcome them?

5.5.1 Menarche

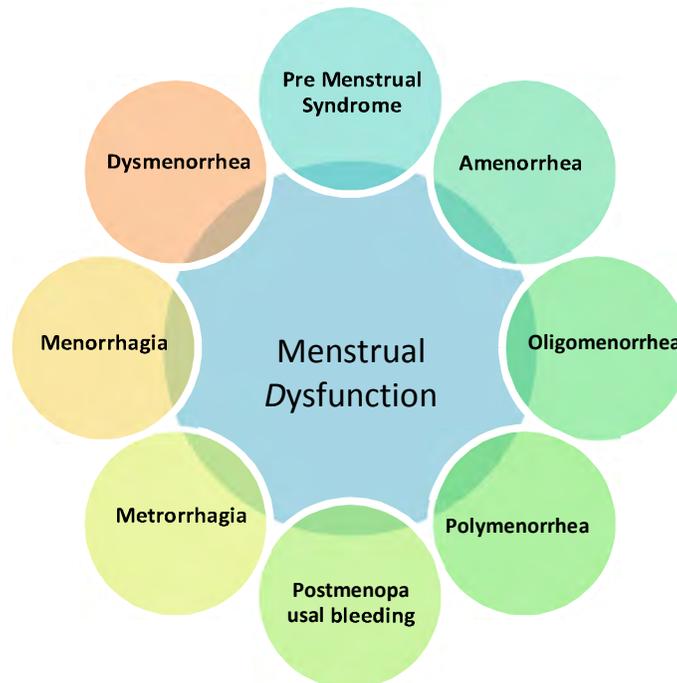
The period of adolescence is marked by certain universal physical and biological changes in the body which lead to the attainment of sexual maturity. The time when sexual maturity is reached is called puberty. Menarche (first menstruation) is usually considered the point of sexual maturity for girls. It is the process in which female reproduction system matures and the body prepares itself for potential pregnancy. It is associated with the development of secondary sexual characteristics. Menarche is one of the most significant milestones in a woman's life. The average age for a girl to get her first period ranges from 8 to 15 years old. Although the precise determinants of menarcheal age remain to be understood, genetic influences, socio-economic conditions, general health and well-being, nutritional status, certain types of exercise, seasonality, and family size possibly play a role. Over the past century the age at menarche has fallen due to reasons still unknown.

Menstruation (also termed as period or bleeding) is the process in a woman of discharging (through the vagina) blood and other materials from the lining of the uterus at about a monthly interval from puberty until menopause, except during pregnancy. This discharging process lasts about 3-5 days. Women usually have periods until about ages 45 to 55 and have menopause usually around age of 50. Menopause means that a woman is no longer ovulating and can no longer get pregnant. Like menstruation, age of menopause can vary from woman to woman and these changes may occur over several years.





5.5.2 Menstrual Dysfunction



Menstrual dysfunction is an abnormal condition in a woman's menstrual cycle. Normal range of the menstruation cycle is 21 to 35 days. If it happens earlier than 21 days or after more than 35 days, then it's a problem. Other menstrual problems include missing three or more periods, menstrual flow heavier or lighter in comparison with usual, cycle happening longer than seven days, any pain, cramping or vomiting during period, bleeding after menopause etc.

Causes of abnormal menstrual cycles or menstrual order are: overweight, stress, dietary disorder, disease, sudden change in exercise schedule, travel, other medical complications etc.

There are different types of menstrual disorders which are given below:

1. **Pre-menstrual Syndrome:** Pre-menstrual Syndrome includes unpleasant or uncomfortable symptoms during the cycle. These may include depression, anxiety, irritation, headache, fainting, vertigo, infection etc. and may last from a few hours to few days. Symptoms Such symptoms may be reduced through moderate exercise, taking a balanced diet, having a good sleep and rest.
2. **Amenorrhea:** Amenorrhea is known as missed periods or absence of a normal monthly period or menstrual cycle. There are two types of amenorrhea.
 - (a) **Primary amenorrhea:** Menstruation cycle does not begin at puberty.





- (b) **Secondary amenorrhea:** It happens when menstruation for three months or more. This is the most common type of amenorrhea.
3. **Dysmenorrhea:** When menstruation happens with severe pain or frequent menstrual cramps, the condition is called Dysmenorrhea. Symptoms associated with dysmenorrhea may be cramping in lower abdomen, low back pain, pain in legs, nausea, fatigue, weakness etc.
 4. **Menorrhagia:** Menorrhagia is characterized by heavy and long term or continuous menstrual bleeding.
 5. **Polymenorrhea:** Polymenorrhea is a term used to describe a menstrual cycle that is shorter than 21 days.
 6. **Oligomenorrhea:** Oligomenorrhea is infrequent menstruation. More strictly, it is menstrual periods occurring at intervals of greater than 35 days.
 7. **Metrorrhagia:** Metrorrhagia refers to missed, delayed or erratic periods or abnormal bleeding patterns.
 8. **Postmenopausal bleeding:** Postmenopausal bleeding is bleeding that occurs after one year of menopause or after a woman has stopped having menstrual cycles due to menopause.

The female hormones oestrogen and progesterone are important for overall body health. These hormones also regulate a woman's periods. Intense exercise and extreme thinness can reduce the levels of these hormones to prevent or stop monthly menstrual cycles.

Extension Activity

Visit a nearby stadium and talk to women athletes. Collect a data of 5 such athletes in their teens. Are they facing any problem related to their health, diet etc? Discuss about it in the class.

I. Tick the correct options

1. Frequent menstruation is known as:
 - (a) Metrorrhagia
 - (b) Oligomenorrhea
 - (c) **Polymenorrhea**
 - (d) Menorrhagia
2. If the menstruation cycle does not begin at puberty, the condition is called
 - (a) **Primary amenorrhea**
 - (b) Secondary amenorrhea





(c) Oligomenorrhea

(d) Dysmenorrhea

II. Answer the following questions briefly

1. What is menstrual dysfunction? Write in brief.
2. Explain the term Menarche.
3. Write short note on Amenorrhea.

III. Answer the following questions in 150-200 words

1. Explain menstrual dysfunction.

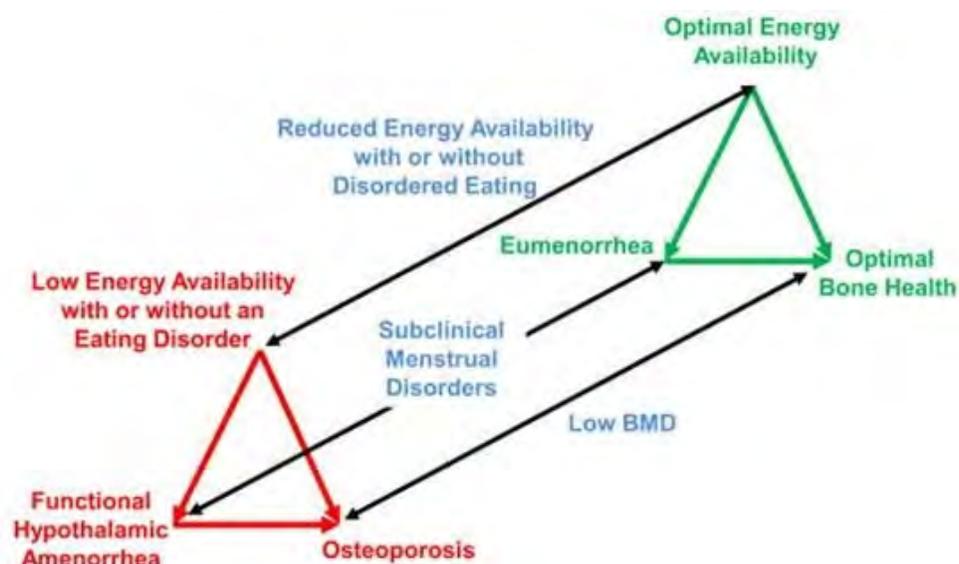
5.6.1 Female Athlete Triad

Participation in sports and physical activities provides a lot of physical and social benefits like developing leadership qualities, competition, team work etc. Regular participation in such activities is associated with a longer and better quality of life, reduced risks of a variety of diseases and many psychological and emotional benefits. Evidence suggests a positive relationship between physical activity and a host of factors affecting girls' physical health, including diabetes, blood pressure and the ability to use fat for energy, thus preventing obesity. Physical activity could reduce the risk of chronic diseases in later life. Conditions, such as cancer, diabetes and coronary heart disease, have their origins in childhood, and can be aided, in part, by regular physical activity in the early years. Also, regular activity beginning in childhood helps to improve bone health, thus preventing osteoporosis, which predominantly affects females.

However, participation in sports is not without certain health risks. Sports like Judo, boxing, wrestling, taekwondo etc. exert a lot of pressure on athletes to maintain their shape and weight. Participation in sports like distance running, cycling, cross country etc. athletes have to take a balanced diet since these demand high levels of energy and a good quantity of dietary intake. Such pressures put the athlete's health at risk and leads to **Female Athlete Triad**. The term 'triad' was first described by American college of sports medicine in 1992, and the three components to describe the triad were

- (a) disordered eating,
- (b) amenorrhoea and
- (c) osteoporosis





Picture Source ⁴

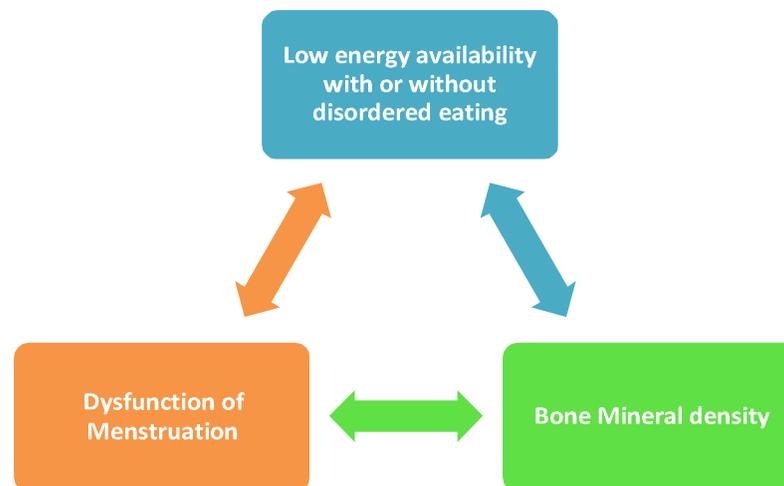
The illustration above depicts the female athlete triad spectrum. The black lines represent the spectrums of each of the 3 components and the red and green triangles show both of the extremes. The top green triangle represents a healthy athlete who has a good balance between energy intake and expenditure. Because of this, they have a normal menstruation cycle and a bone mineral density that is above average for the athlete's age. The bottom left, red triangle represents an athlete who does not have an appropriate balance between energy intake and expenditure, which may be the result of restrictive dieting and/or clinical eating disorders.

The terms to describe Female Athlete Triad have now been revised. The new terms to indicate problems are

- (a) low energy availability with or without eating disorder,
- (b) dysfunction of menstruation and
- (c) low bone density.

This change was relevant because all these three revised components can be easily resolved by proper energy intake and expenditure and same may be used as effective strategy. Thus, if an individual takes optimum calories as required by body, including energy required for physical activity and energy required for body functions, the result is promotion of healthy bones and normal menstrual function. All three components are very much interlinked.





5.6.2 Low Energy Availability with or Without Disordered Eating

Disbalance of energy may occurs due to disordered eating and eating disorderly. The problem of female athlete triad originated from not balancing energy intake and energy expenditure. Consequently, an athlete must have knowledge of how to balance the energy intake.

Eating disorder is known as gross disturbance in eating behaviour. Disordered eating has wide range of harmful and often ineffective eating behaviours in the process of weight reduction.

These includes calorie restriction to clinical disorders of *Anorexia nervosa* and *bulimia nervosa*. Sportspersons participating in activities in which leanness or specific weight is required for performance are at higher risk of developing eating disorders. Coaches, team physicians, parents, and other supporting staff should know the symptom so that the problem can be treated on time, other-wise it leads to long term physiological, psychological effects or, in extreme cases, fatal results.

Anorexia nervosa is an eating disorder where an individual tries to reduce body weight abnormally, having an intense fear of gaining weight or misconception over his/her weight. Individuals with anorexia place a high value on controlling their weight and shape, using extreme efforts that tend to significantly interfere with their lives. To prevent weight gain or to continue losing weight, people with anorexia usually severely restrict the amount of food they eat. They may control calorie-intake by vomiting after eating or by misusing laxatives, diet aids, or diuretics. They may also try to lose weight by exercising excessively. No matter how much weight is lost, the person continues to fear weight gain. Symptoms may include menstrual dysfunction, constipation, diarrhoea, bloating, unexpected weight loss, muscle weakness, stress fracture, bone weakness, overuse injuries, anxiety etc.





Bulimia nervosa is an eating disorder in which an individual eats large amount of food with loss of control over eating and then adopts unhealthy ways to cut down calories like vomiting, take laxatives, weight loss supplements, diuretics, excessive exercises etc. Symptom of bulimia are dehydration, dental problems, oedema, electrolyte abnormalities, extreme weight fluctuation, menstrual irregularity, weakness, cramps, depression etc.

5.6.3 Menstrual Dysfunction

Menstrual irregularities is one of the components of Female Athlete Triad and it is a marker of quality health in female athletes. Menstrual dysfunction is common in sportswomen and is often ignored. It is important that young female athletes should be informed enough to understand the problem and must know the management of the menstruation disorder. If the problem is managed in time, then it may positively affect athletic performance. Ignored or untreated menstrual irregularities may have a prolonged effect on bone mineralization and the treatment may last months and years. Generally female sportspersons suffering from menstrual irregularities, self- select different sports in comparison with normal menstruating peers because in delayed puberty females develop strong bones and taller height than others. However, such dysfunction may affect sports performance in the long run and lead to complications. Recent research says weight training has lots of benefits including strengthening of the bones and may not affect adolescent menstrual irregularities. Studies show that more than 15% females participating in Olympics may be suffering from amenorrhea. Sometimes the skeletal health of a female athlete suffering from amenorrhea is much lower than that of a sedentary woman.

5.6.4 Low Bone Mineral Density

Low bone mineral density, previously termed osteoporosis, may be defined as a disease marked by increased bone fragility, disturbance in bone structure including low bone mineral density (BMD) that may result in fractures, pain, deformity, disability etc. Low BMD is generally caused by improper diet and amenorrhoea. Due to low level of oestrogen and progesterone in female athletes, their bones become weaker and lose minerals. Effects of low bone mineral density include increased occurrence of injury, stress fractures, and risk of early osteoporosis after menopause. Deposition of bone increases during childhood and adolescence and peaks during the 20s and 30s. A large genetic component to BMD also exists, with heritability of BMD suggested to be 50–85%. Knowledge of family history or other medical condition linked with BMD will help keep female athletes safe from risk of injury and fractures. Intensity, volume, frequency, type of activity should be determined by knowledge of genetic characteristics.



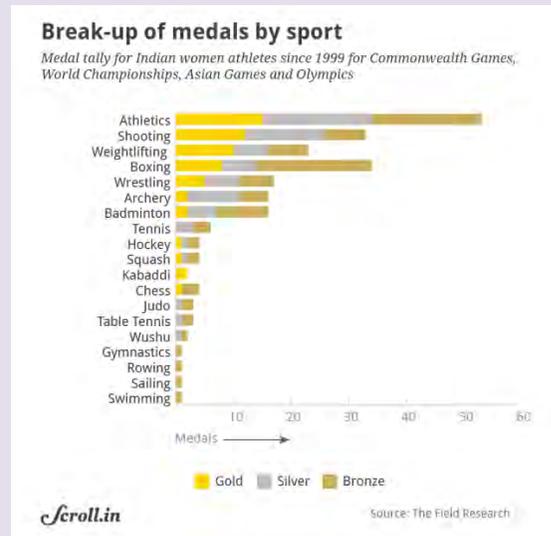
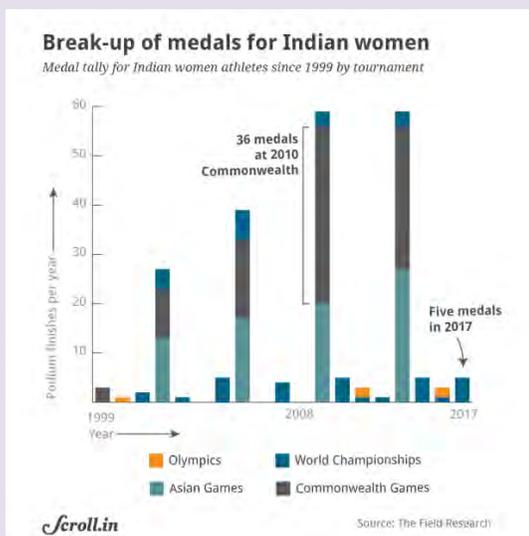


The female athlete triad is a result of energy imbalance; thus, adjusting the energy expenditure and energy availability is the main intervention. For this the main treatment is restoration of regular menstrual cycle for reestablishment of energy balance and enhancement of bone mineral density. The strongest predictor of recovery to normal menstrual function in young athletes is weight gain. Family-based therapy and cognitive behavioural therapy, also have been known to be effective interventions for disordered eating. A sports nutritionist can help the athlete and her family determine the quantity and quality of food consumption and dietary supplements required to meet her bodily functions, replace energy output due to athletic training, and enhance bone health. Additionally, weight gain may be necessary to increase BMD.

Case Study

In 2000 Sydney Games weightlifter Karnam Malleswari won the bronze medal and created a historic moment for India, becoming the first Indian woman to win a medal at the Olympics. She was followed by Saina Nehwal and Mary Kom in the London Olympics 2012 years.

the Olympics. The last eight years have seen a slow, but steady rise for Indian women athletes at world events. Study the charts given below and answer the following questions?



Picture Source ⁵

- Q. Which year marks a turning point in women’s winning medals at International Sports Competitions?
- Q. Which are the fields that they have excelled in?
- Q. In which International competition have they won the greatest number of medals?
- Q. What are the reasons for the consistently good performance of Indian women in International sports?





I. Tick the correct options.

1. Weakening of bones due to loss of bone density and improper bone formation is
 - (a) Amenorrhea
 - (b) Anorexia Nervosa
 - (c) Osteoporosis
 - (d) Lordosis
2. What is the cause of Osteoporosis in women?
 - (a) High blood pressure
 - (b) Menarche
 - (c) Excessive exercise
 - (d) Lack of calcium and vitamin D
3. Female athlete triad is a syndrome characterized by
 - (a) Osteoporosis
 - (b) Amenorrhea
 - (c) Eating disorder
 - (d) All of the above
4. In which type of Anorexia does an individual lose weight by taking laxatives or diuretics
 - (a) Bulimia Nervosa
 - (b) Purging type
 - (c) Restricting type
 - (d) Anorexia Nervosa

II. Answer the following questions briefly.

1. Explain eating disorder.
2. Write a short note on Bone Mineral density.

III. Answer the following questions in 150-200 words

1. What is Female Athlete Triad? Explain.





Art Integration

There's no easier way to make someone smile, or let them know you admire them than giving them a heartfelt compliment. It's amazing how much saying these kind words can lift someone up and really turn a person's day around. There are many ways to deliver a compliment. However, nothing can be as beautiful as saying it in a song.

Write and dedicate a song to the Female Sports person you admire most.

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UNIT-VI: TEST AND MEASUREMENT IN SPORTS

Contents

- Motor Fitness Test – 50 M Standing Start, 600 M Run/ Walk, sit and Reach, Partial Curl Up, Push Ups (Boys), Modified Push Ups (Girls), Standing Broad Jump, Agility – 4x 10 M Shuttle Run.
- General Motor Fitness – Barrow three item general motor ability (Standing Broad Jump, Zig Zag Run, Medicine Ball Put – For Boys: 03 Kg and For Girls: 01 Kg).
- Measurement of Cardio-Vascular Fitness – Harvard Step Test/Rockport Test - Computation of Fitness Index: Duration of the Exercise in Seconds x 100 5.5 x Pulse count of 1-1.5 Min after Exercise.
- Rikli and Jones - Senior Citizen Fitness Test 1. Chair Stand Test for lower body strength 2. Arm Curl Test for upper body strength 3. Chair Sit and Reach Test for lower body flexibility 4. Back Scratch Test for upper body flexibility 5. Eight Foot Up and Go Test for agility 6. Six Minute Walk Test for Aerobic Endurance.

Learning Outcomes:

After completing this chapter, you will be able to:

- perform 50 M Standing Start, 600 M Run/ Walk, sit and Reach, Partial Curl Up, Push Ups (Boys), Modified Push Ups (Girls), Standing Broad Jump, Agility – 4x 10 M Shuttle Run
- demonstrate Barrow three item general motor ability test
- compute physical fitness Index through Harvard Step Test/Rockport Test
- describe the procedure of Rikli and Jones - Senior Citizen Fitness Test

Discussion

Discuss with your group

- What are the areas that a physical fitness test evaluates?
- How many of you can test your own fitness?
- What are the criteria that you will employ to test your own fitness?
- What is the aim of testing for physical fitness?
- Have you heard of motor fitness? What is it? How is it tested?
- Have you heard about broad jump?





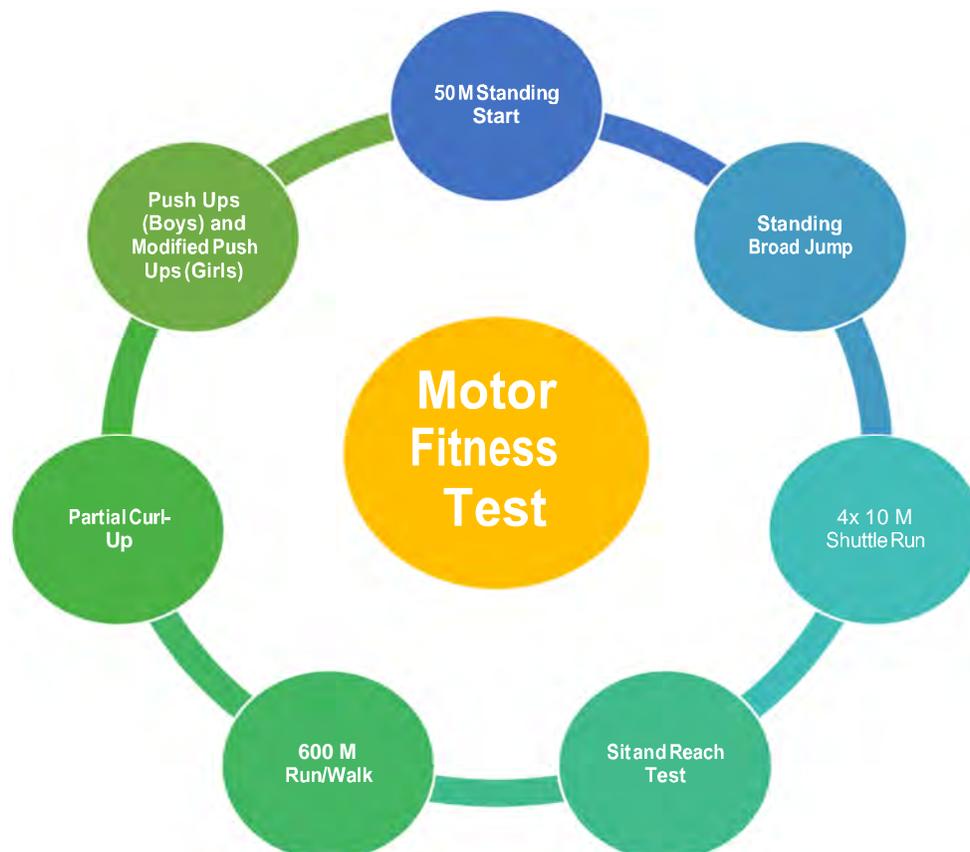
Do you Know

Test protocol is the correct procedure for carrying out a test. If a test is done incorrectly, it might affect the results.

Valid A test is valid if it measures what it sets out to measure e.g., a test for upper body strength should not measure leg strength.

Motor fitness refers to the neuromuscular components of fitness, which enable a person to perform successfully at a particular motor skill, game, or activity. Specific motor fitness components include agility, balance, coordination, power, reaction time, and speed. Motor fitness is sometimes referred to as skill-related fitness.

6.1.1 Motor Fitness Test



Testing motor fitness consists of measuring of all components of motor fitness (agility, coordination, balance, speed, reaction time). Motor fitness test provides to the student a score regarding the level of fitness, effectiveness of any training programme, and present status, thereby motivating her/him to do better etc.

Following tests are employed to test motor fitness:





6.1.2 50 M Standing Start: Boys and Girls

Purpose: To determine running speed and acceleration of a student.

Objective: To cover the set distance as fast as possible.

Equipment: Flat and clean field with markings; stopwatch.

Procedure: There will be distance of 50 meters between two straight lines – starting line and finishing line.

At least two officials are required to successfully complete the process, one who stands behind the standing line to give commands “On your mark” and “Go” along with a downward sweep of her/his arm thereby giving visual signal to the other official who stands perpendicular to the finishing line to clock the timing.

The student will take a standing start and run as fast as possible to give her/his best time.

Scoring: The total time taken to complete the distance between the command “Go” and when the student crosses the finish line to nearest tenth of a second.



6.1.3 600 M Run / Walk

Purpose: To determine the endurance of a student.

Objective: To cover the set distance as fast as possible.

Equipment: Flat and clean field with markings; stopwatch.

Procedure: Student should be informed about the distance before the start of the run/walk.

One official will give command “On your mark” and “Go” with visual signal to the other official. The student will run or walk and cover the distance in the shortest possible time.

The test may be done in a group, but the number of officials must be the same as the number of participants.

Scoring: The total time taken to complete the distance between the command “Go” and when the student crosses the finish line to nearest tenth of a second.

6.1.4 Sit and Reach Test

Purpose: To determine trunk flexibility of a student.

Objective: To stretch trunk as far forward as possible.





Equipment: Sit and Reach Box; mat

Procedure: Student should sit without shoes, with the soles of her/his feet touching the sit and reach box.

Both knees should be locked and pressed flat to the floor (tester may assist the subject by holding the knees down).

Student to place both arms forward, palm downwards without stretching.

As instructions are given by the official to start the test, the student should stretch forward slowly, reaching as far as possible with both hands without a jerk and should hold the maximum stretch position for 2 seconds. Hands should remain at same level.

Scoring: The score is recorded to the nearest centimetre that is the distance between the initial position and final position.



6.1.5 Partial Curl-Up

Purpose: To determine abdominal strength and endurance of a student.

Objective: To perform as many as curl-ups as possible in the given time.

Equipment: Gym Mat with two parallel lines 6 inches apart; stopwatch.

Procedure: Student should lie in supine position on the mat with knee flexed at an angle of 90 degrees.

Feet should be placed apart and hands should be placed straight and parallel to the body.





The student will pull upper body, curling up at least 6 inches above the surface of the mat or 6 inches towards the parallel strip.

Movement should not be jerky and the upper body must come down slowly.

The complete cycle of rising up and going back down will be counted as one curl-up.

Scoring: Maximum number of partial curl-ups completed without rest in 30 seconds will be recorded.

6.1.6 Push Ups (Boys) and Modified Push Ups (Girls)

Purpose: To determine upper-body endurance of a student.

Objective: To perform as many as push-ups as possible in the given time.

Equipment: Gym Mat.

Procedure: Male students will take face down position in which hands should be placed slightly apart from shoulder. Knees, back and neck must be rigid and straight. In this position, the student's palms and toes will touch the ground.



The position will remain the same for Female students, except their knees should touch the ground.

Student will lower the body by flexing elbows till 90° flexion at elbow joint and come back to initial position. In both positions, back must be straight. Remember, in the starting position stomach should not touch the ground.



Scoring: The maximum number of push ups recorded without rest will be counted as the score.

6.1.7 Standing Broad Jump

Purpose: To determine explosive leg strength of a student.

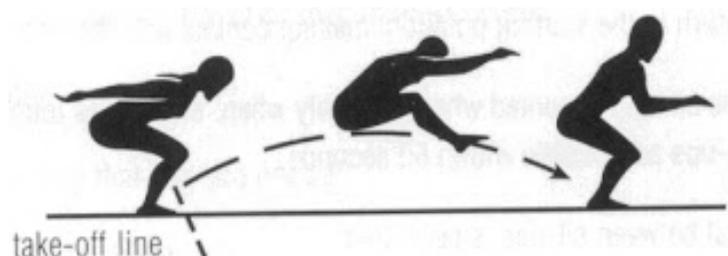
Objective: To perform horizontal jump as far as possible.

Equipment: Flat and clean field with markings; measuring tape.





Procedure: Student will stand behind the take off line, keeping both feet slightly apart and parallel apart to each.



Picture source¹

The student will then lean forward, swinging arms back and bending both knees to gain momentum.

The jump will be performed by extending knees and swinging arms forward to provide forward drive.

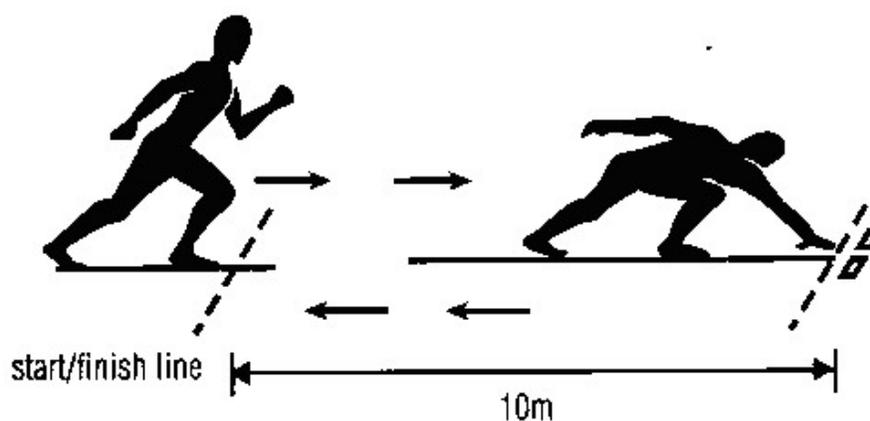
The student jumps forward as far as possible, landing on both feet without falling backwards.

Distance will be measured from the back of the heel to the take-off line.

Scoring: The longest distance jumped – the best of three attempts will be considered as score which will be measured in feet and inches.

6.1.8 Shuttle Run (4x10 M)

Purpose: To determine the agility and speed of a student.



Picture source²

Objective: To run back four times between two parallel lines as fast as possible.

Equipment: 2x2x4 inches wooden blocks; stopwatch; non-slip surface with markings of two parallel lines having distance of 10 meters.





Procedure: Two wooden block each will be placed behind one of the parallel line opposite the starting line.

On the command “ready” and “Go” the student will run as fast as possible to reach the other line and pick up a block and return back to starting line.

She/He will place first block behind the line and continuously run to get another one.

Scoring: Record the best time out of two attempts. Score will be measured in seconds.

Extension Activity

Your school is holding trials for the following games. Which of the tests will you conduct for the candidates and why?

Game	Motor Fitness Test	Reason
Kho-kho		
Kabbadi		
Basketball		
Football		
Badminton		

I. Tick the correct options.

Q1. Partial curl up is to test .

- (a) agility and speed
- (b) leg strength and endurance
- (c) **abdominal strength and endurance**
- (d) upper body strength and endurance

Q2. Sit and reach test measures

- (a) endurance
- (b) **flexibility**
- (c) strength
- (d) speed

II. Answer the following questions briefly.

Q1. Write down the process to determine the upper body endurance.

Q2. Explain the process of 600meter run/walk.

III. Answer the following questions in 150-200 words.

Q1. What is general motor fitness? How can it be measured?





Do you Know?

General Instructions before Exercise/Testing

Clothes- Students should wear comfortable, loose fitting sportswear during the test.

Food- Students should take food at least three hours before testing. Plenty of fluids should be taken 24 hours before testing. Alcohol and caffeine should be avoided 24 hours before testing.

Rest- Students should take proper rest and sleep on the night of testing. Any strenuous exercise should be avoided on the day of tests.

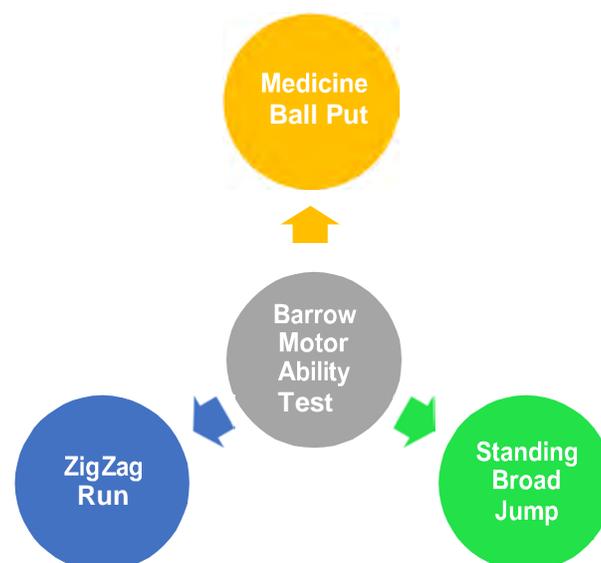
Warming up and cooling down- Students should do proper warm up and cooling down exercises before and after the testing respectively.

Equipment- Equipment should be calibrated, organized, sterilized and tested before the test. **Administration-** Temperature should not be too hot, cold, or humid. All stationary item should be ready before the test. Students should be informed about the procedure of the test and consent should be taken well in advance.

6.2.1 Barrow Motor Ability Test

Barrow motor ability test was developed by Harold M. Barrow in 1953. The purpose of the study was to measure general motor fitness. The test has three items:

- (a) Standing Broad Jump,
- (b) Zig Zag run and
- (c) Medicine Ball Put (for boys: 03 kg and for girls: 01 kg).





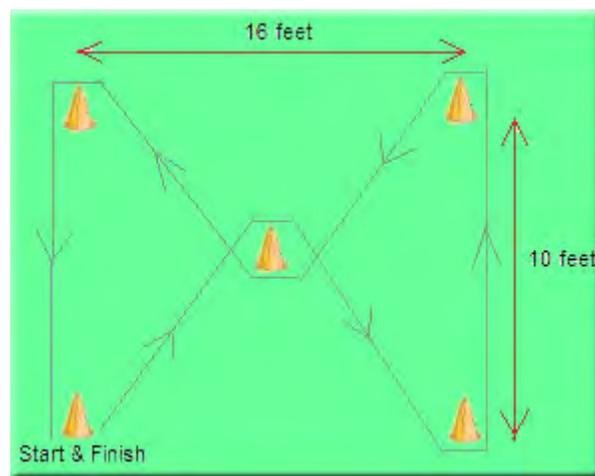
All three items can be administered through circuit method. There is no sequence to be followed.

6.2.2 Item I: Standing Broad Jump

You have already read about this test in 6.1.7

6.2.3 Item II: Zig Zag Run

Purpose: To determine agility and speed of the student.



Picture Source³

Objective: To complete a zig zag path as fast as possible.

Equipment: Stopwatch; cones; and a flat and clean field with markings.

Procedure: On the command “Go” student will run as fast as possible and complete zig zag pathway as illustrated in picture.

Scoring: Record the best time out of two attempts. The score will be measured in seconds.

6.2.4 Item III: Medicine Ball Put

Purpose: To determine strength, power, agility, coordination, speed and balance.

Objective: To throw the medicine ball as far as possible.

Equipment: Medicine ball for boys- 3kgs and girls – 1kgs; measuring tape; flat and clean field with markings.

Procedure: Student will hold the ball as per guidelines and will throw the medicine ball as far as possible using one hand.





Scoring: Student will get three attempts and best will noted as score to the nearest foot.

Norms of three item Barrow motor ability test for 17 to 20 years

Extension Activity

Try the following Muscular Strength and Muscular Endurance activities with your partner. Note your findings.

Intensity is how hard you found the task. (10 is extremely hard, 1 is I could do it very easily)

Effort is how hard you tried during the activity (10 is my hardest, 1 is without effort.)

Exercise	Number completed 30 secs	Number completed 45 secs	Intensity 1-10	Effort 1-10
Press ups				
Sit ups				
Squats				
Plank				
Tricep dip				





SBJ (inches)	ZigZag Run (sec.)	Medicine Ball Put (feet)	T-Score
Upto 68	29.5 and more	upto 22	20
69-72	29.4-28.7	23-25	25
73-76	28.6-27.9	26-28	30
77-80	27.8-27.2	29-31	35
81-84	27.1-26.4	32-34	40
85-88	26.3-25.6	35-38	45
89-92	25.5-24.8	39-41	50
93-96	24.7-24.0	42-44	55
97-100	23.9-23.2	45-47	60
101-104	23.1-22.5	48-51	65
105-108	22.4-21.7	52-54	70
109-112	21.6-20.9	55-57	75
113 and above	20.8 or less	58 and above	80

Norms Reference: Dr. D. K. Kansal (2008), Textbook of Applied Measurement, Evaluation and Sports Selection, Sports and Spiritual Science Publication, Delhi, ISBN No.8190228234

Do you know?

What is Vo_2 Max?

The maximum rate of oxygen used by heart, lungs and muscles during the exercise. It also known to measure aerobic capacity of an individual.





I. Tick the correct options.

Q1. Which is **not** an item of Barrow motor ability test?

- (a) Medicine Ball Put
- (b) Zig Zag Run
- (c) Standing Broad Jump
- (b) **Push-ups**

Q2. What is the weight of Medicine ball for boys in medicine ball put?

- (a) 1 kg
- (b) 2 kg
- (c) **3 kg**
- (d) 4kg

II. Answer the following questions briefly.

Q1. Explain an item of motor ability test for testing agility.

III. Answer the following questions in 150-200 words.

Q1. Explain the Barrow motor ability test.

6.3.1 Harvard Step Test

Harvard step test was developed by Brouha in 1943 for the purpose of measuring physical fitness for work and the ability to recover from work. The test was originally designed for young men of college age. In the original validation of the step test Brouha tested 2200 male students at Harvard.





Purpose: To determine aerobic fitness.

Objective: To perform step test continuously without break for 5 minutes or until exhausted.

Equipment: Bench or wooden block 20 inches in height; stopwatch; metronome.

Procedure: Student will start test at the command “Go” and will step up and down, on and off the wooden block or bench at the rate of 30 steps per minutes for 5 minutes.

If the student is unable to maintain the pace, then she/he is considered to be exhausted and the test is brought to an end.

After completion of the test student sits down and tester takes the hearts beats between 1 to 1½ minutes.

Scoring: Fitness Index score will be determined by applying following equation:

$$\frac{\text{Duration of the Exercise in Seconds} \times 100}{5.5 \times \text{Pulse count of 1 – 1.5 min after Exercise}} = \text{Fitness Index score}$$

Norms for Harvard Step Test

Upto 49	Poor
50-80	Average
81 or Above	Good

Norms Reference: Dr. D. K. Kansal (2008), Textbook of Applied Measurement, Evaluation and Sports Selection, Sports and Spiritual Science Publication, Delhi, ISBN No.8190228234

6.3.2 Rockport 1-Mile (1.6 KM) Walk Test

Rockport Test is a sub-maximal field test to estimate VO2 max. This test may be useful for those who are unable to run due to sedentary lifestyle and/or older individuals and/ or those of low fitness level and /or injury.

Purpose: To estimate VO2 max.

Objective: To complete one mile walk as fast as possible.

Equipment: Flat and clean field with markings; stopwatch.

Procedure: Student will stand behind the starting line and on command “ready” and “Go” he/she will walk as fast as possible to complete one mile.

Heartrate will be recorded immediately after completion of the walk through heart rate monitor or 15 second count of radial artery whichever is feasible. Exercise heart rate should be below 120 bpm.





To estimate VO2 max timing of 1 mile walking, gender, age, weight, heart rate taken immediate after the walk are required.

Scoring: Unit of VO2 max is ml · kg⁻¹ · min⁻¹

$$VO2max = 132.853 - (.0769) \times wt - (.3877) \times age + (6.315) \times gv - (3.2469) \times 1 \text{ mile walk time} - (.1565) \times \text{heart rate}$$

Wt = weight in pounds, age= age in years, gv= gender values (0 for female and 1 for males), timing of one mile walk in minutes (to hundred of a minute) and heart rate.

Extension Activity

Every student will prepare their own profile of fitness testing as per below format.

	Week 1	Week 2	Week 3	Week 4
Standing Broad Jump				
50M standing start				
600 M Run/ walk				
Sit and reach Test				
4x10 M shuttle Run				
Push-ups				
Partial Curl Up				
Zig Zag Run				
Medicine Ball Put				
Fitness Index (Harvard step test)				
VO2 max through Rockport Test				





I. Tick the correct options.

Q1. The test duration for the Harvard fitness test is .

- (a) 3 minutes
- (b) 4 minutes
- (c) **5 minutes**
- (d) 6 minutes

Q2. To determine VO₂ max which of the following is **not** required?

- (a) Weight
- (b) Gender
- (c) Age
- (d) **Name**

II. Answer the following questions briefly.

Q1. What do you mean by aerobic fitness?

Q2. Write the procedure of Rockport 1 mile walk test.

III. Answer the following questions in 150-200 words.

Q1. Briefly describe the tests used for assessing cardio-vascular fitness?

6.4.1 Rikli and Jones Senior Citizen Fitness Test

The senior citizen's fitness test (SFT) was developed by Rikli and Jones for older people aged between 60 to 94 years. The purpose of the test was to evaluate functional ability and monitor the physical fitness status of older people and to identify problems and work on the weakness. This test should not be practiced by those who have any medical conditions like chest pain, dizziness, high blood pressure, heart problems etc. This test is economical and easy to administer. The test includes the following items:

1. Chair Stand Test for lower body strength
2. Arm Curl Test for upper body strength
3. Chair Sit and Reach Test for lower body flexibility
4. Back Scratch Test for upper body flexibility
5. Eight Foot Up and Go Test for agility
6. Six Minute Walk Test for aerobic endurance

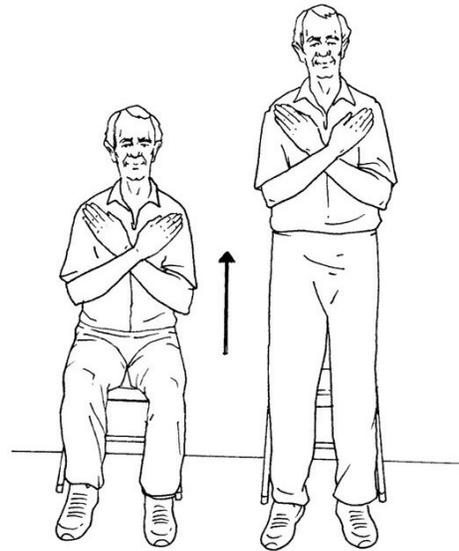
Source of all Pictures⁴





6.4.2 30 Second Chair Stand Test

Purpose: To determine lower body strength. **Objective:** To complete maximum stands in 30 seconds.



Equipment: Straight back chair without arms; stopwatch.

Procedure: The chair should be placed against the wall or somewhere where it gets stabilized.

Initially, the individual will sit on the chair, back straight, arms crossed and feet firmly on the floor shoulder width apart.

On the command “Go” the individual will stand up completely, then return back to the initial position. This will be counted as one stand. The individual should be motivated to do maximum stands in 30 seconds.

Scoring: Maximum number of complete stands will be counted as score. If the individual is in half way of the stand and time is over, then it will be counted as a full stand.

6.4.3 Arm Curl Test

Purpose: To determine upper body strength.

Objective: To complete maximum arm curls in 30 seconds.

Equipment: Straight back chair without arms; Dumbbell for men- 8 pounds(3.6kgs) and women- 5 pounds(2.3kgs); stopwatch.

Procedure: The chair should be placed against the wall or somewhere where it gets stabilized.





The individual sits on the chair with back straight, feet on floor, holding dumbbell with dominant hand using handshake grip.

On the command “Go” the individual flexes the elbow or curls the arm with full range of motion then returns back to its initial position.

In the down position dumbbell will return to handshake grip.

The individual can perform as many arm curls as possible in 30 seconds.

Scoring: Maximum number of correct arm curls in 30 second will be counted.



6.4.4 Chair Sit and Reach Test

Purpose: To determine lower body flexibility.



Objective: To stretch the lower body as far as possible. **Equipment:** Straight back chair without arms; 18 inches ruler.

Procedure: The chair should be placed against the wall or somewhere where the chair gets stabilized.

Participant sits on the chair with one foot flat on the floor and the other leg extended forward with the knee straight, heel on the floor, and ankle bent at 90°.





The participant, then, tries to touch the toe of that foot by bending at the hip and sliding her/his hands towards the toes.

To clock score participant must hold that position for 2 seconds.

Scoring: Measurement will be taken between extended long finger and tip of the toe and minimum to .5 inches will be recorded as score. If fingers cross the toe then + will be indicated before the score and if the participant is unable to touch the toe, then – sign will be indicated.

6.4.5 Back Stretch

Purpose: To determine upper body flexibility



Objective: To touch or overlap the finger of the both hands behind the back.

Equipment: 18 inches ruler

Procedure: In standing position participant will place one hand over the shoulder and one hand middle of the back and try to touch or overlap each other.

Scoring: Measurement will be taken by measuring the distance between the tips of the middle fingers. If the fingertips touch then the score is zero. If they do not touch, measure the distance between the finger tips (a negative score), if they overlap, measure by how much (a positive score).

6.4.6 8 Foot Up and Go

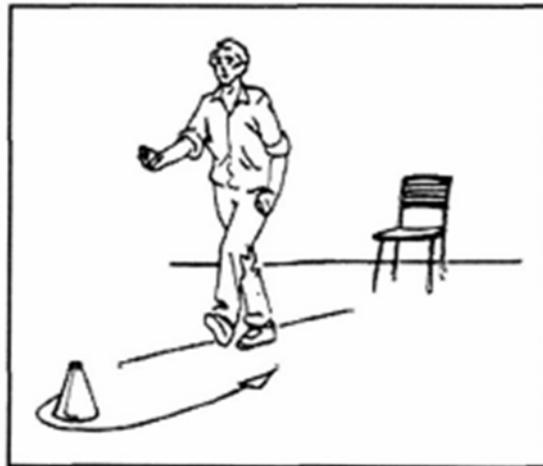
Purpose: To determine physical mobility (power, speed, agility and balance).

Objective: To stand and walk 16 feet and sit back as fast as possible (without running).

Equipment: Straight back chair without arms; cone; stopwatch,

Procedure: A chair should be placed against the wall or somewhere where the chair get stabilized.





The participant sits on the chair with both feet on the floor.

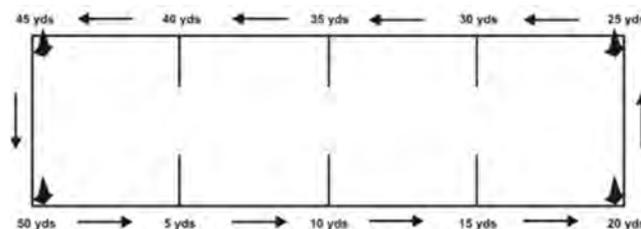
At the command “Go” he/she walks as fast as possible (not running) and returns back after walking to and around the cone which is placed 8 ft away from the chair.

There should be enough space around the cone from where participant can take an easy turn.

Scoring: Two attempts will be made and the best score will be taken for record. Fastest time taken between command “Go” and return to the chair will be recorded.

6.4.7 6 Minute Walk Test

Purpose: To determine aerobic endurance



Objective: To walk maximum distance in 6 minutes.

Equipment: Walking area of 20 yards each between parallel lines connected with 5 yards lines making rectangles; stopwatch; cone.

Procedure: Participant will start walking after the command “Go” and continuously walk on the track for 6 minutes.

He /she has to cover maximum distance in 6 minutes but without running.

Scoring: Maximum distance covered in 6 minutes will be recorded as score





6.4.8 2 Minutes Step Test

Purpose: To determine aerobic endurance.



Objective: To count maximum number of steps in 2 minutes. **This test is performed as an alternative to the 6- minute walk test** for people who use orthopaedic devices when walking, as well as in the case of people who have difficulty balancing.

Equipment: tape for marking the wall; stopwatch; wall. **Procedure:** The participant stands up straight next to the wall while a mark is placed on the wall at the level corresponding to midway between the patella (knee cap) and iliac crest (top of the hip bone).

The participant then marches in place for two minutes, lifting the knees to the height of the mark on the wall. Resting is allowed, and holding onto the wall or a stable chair is allowed.

Stop after two minutes of stepping.

Scoring: The total number of times the right knee reaches the tape level in two minutes is recorded.





Normal Range of Score for Men

	60-64	65-69	70-74	75-79	80-84	85-89	90-94
Chair stand (no. of stands)	14 - 19	12 - 18	12 - 17	11 - 17	10 - 15	8 - 14	7 - 12
Arm Cuel (no. of reps)	16 - 22	15 - 21	14 - 21	13 - 19	13 - 19	11 - 17	10 - 14
6-Min Walk (no. of yds)	610 - 735	560 - 700	545 - 680	470 - 640	445 - 605	380 - 570	305 - 500
2-Min Step (no. of steps)	87 - 115	86 - 116	80 - 110	73 - 109	71 - 103	59 - 91	52 - 86
Chair Sit-&-Reach (inches +/-)	-2.5 - +4.0	-3.0 - +3.0	-3.5 - +2.5	-4.0 - +2.0	-5.5 - +1.5	-5.5 - +0.5	-6.5 - -0.5
Back Scratch (inches +/-)	-6.5 - +0.0	-7.5 - -1.0	-8.0 - -1.0	-9.0 - -2.0	-9.5 - -2.0	-10.0 - -3.0	-10.5 - -4.0
8-Ft Up-&-Go (seconds)	5.6 - 3.8	5.7 - 4.3	6.0 - 4.2	7.2 - 4.6	7.6 - 5.2	8.9 - 5.3	10.0 - 6.2

Reference: The Journal for Active Aging, March April 2003 Page No. 28

Normal Range of Score for Women

	60-64	65-69	70-74	75-79	80-84	85-89	90-94
Chair stand (no. of stands)	12 - 17	11 - 16	10 - 15	10 - 15	9 - 14	8 - 13	4 - 11
Arm Cuel (no. of reps)	13 - 19	12 - 18	12 - 17	11 - 17	10 - 16	10 - 15	8 - 13
6-Min Walk (no. of yds)	545 - 660	500 - 635	480 - 615	430 - 585	385 - 540	340 - 510	275 - 440
Chair Sit-&-Reach (inches +/-)	-0.5 - +5.0	-0.5 - +4.5	-1.0 - +4.0	-1.5 - +3.5	-2.0 - +3.0	-2.5 - +2.5	-4.5 - +1.0
Back Scratch (inches +/-)	-3.0 - +1.5	-3.5 - +1.5	-4.0 - +1.0	-5.0 - +0.5	-5.5 - +0.0	-7.0 - -1.0	-8.0 - -1.0
8-Ft Up-&-Go (seconds)	6.0 - 4.4	6.4 - 4.8	7.1 - 4.9	7.4 - 5.2	8.7 - 5.7	9.6 - 6.2	11.5 - 7.3

Reference: The Journal for Active Aging, March April 2003 Page No. 28



**Do you Know**

We can improve fitness through following activities: Muscular Strength: Jumps, throws, weight training

Muscular Endurance: Pull ups, Push-ups, Sit-ups, weight training Cardiovascular Endurance: Long distance running, swimming, cycling Flexibility: Yoga Asana

Speed: 10m, 30m, 50m, 100m sprint etc.

Coordination: ball throw and catching, kicking and stopping ball Agility: Cone, ball, balloon and ladder drills

Case Study

Shyam, Vinay and Ram are engaged in regular fitness activity. Ram runs for an hour every day, Shyam goes to the Gym for a workout every day and Vinay, who is a national level football player, does two hours of vigorous physical fitness every day. They often discuss various aspects of their daily physical routine. Today their discussion turned into an argument, with each claiming that he was fitter than the others. They meet their physical education teacher and he suggests all three undergo a fitness test to determine their physical abilities. All agree and the teacher administers a few tests. Their results are given below:

Test	Shyam Score gym	Vinay Score foot	Ram run
50 M Standing Start	7.1 seconds	6.4 seconds	6.9 seconds
600 M Run/ Walk	2.14 minutes	1.40 minute	1.41 minute
Sit and Reach	40'	42'	39'
Partial Curl Up	29	27	18
Push Ups	22	19	13
4x 10 M Shuttle Run	7.0	7.3	8.2
Standing Broad Jump	7'2"	7'8"	7'4"
Zig Zag Run	29.2	21.6	24.1
Medicine Ball Put	56 feet	55 feet	32 feet
Harvard Step Test Index	56	89	82





- Q. Which of the following friends had an 'average' score in Harvard step test?
- (a) Ram
 - (b) Shyam
 - (c) Vinay
- Q. Who has better agility, upper extremity strength and Physical Efficiency Index scores among the three friends?
- (a) Shyam
 - (b) Vinay
 - (c) Ram
- Q. 4x10 m shuttle run was conducted for assessment of which of the following ability of all three friends.
- (a) Agility
 - (b) Speed
 - (c) Endurance
 - (d) Flexibility
- Q. Suggest an alternative test other than mentioned that of mentioned in the case study, for assessment of the strength, speed and agility. Give your reasons for choosing the Test.

I. Tick the correct options.

- Q1. Which is **not** an item of Rikli and Jones Test?
- (a) 8 Foot Up and Go
 - (b) **Sit and Reach test**
 - (c) 6 Minute Walk Test
 - (d) Arms Curl Test
- Q2. What is the weight of dumbbell for men in arm curl of Rikli and Jones Test?
- (a) 5 pounds
 - (b) 6 pounds
 - (c) **8 pounds**
 - (d) 10 pounds





II. Answer the questions briefly.

Q1. Explain any two test that form part of the Rikli and Jones Test.

Q2. Write down the purpose of all the tests that form a part of Rikli and Jones Test.

III. Answer the questions in 150-200 words.

Q1. Discuss any three tests for testing the endurance and agility of senior citizens.

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² Standing Broad Jump. (n.d.). Retrieved 11 25, 2020, from Education-Health-Science: <http://education-health-science.blogspot.com/p/standing-broad-jump.html>

³ *Zig-Zag Test*. (n.d.). Retrieved 11 25, 2020, from BrianMac Sports Coach : <https://www.brianmac.co.uk/zigzag.htm>

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UNIT-VII: PHYSIOLOGY AND INJURIES IN SPORTS

Contents

Physiological factor determining component of Physical Fitness

- Effect of exercise on Cardio Respiratory System
- Effect of exercise on Muscular System
- Physiological changes due to ageing
- Sports injuries: Classification (Soft Tissue Injuries:(Abrasion, Contusion, Laceration, Incision,

Sprain & Strain) Bone & Joint Injuries: (Dislocation, Fractures: Stress Fracture, Green Stick, Communated, Transverse Oblique & Impacted) Causes, Prevention& treatment

- First Aid – Aims & Objectives

Learning outcomes

At the end of the chapter, you will be able to:

- recognize the physiological factors determining the components of physical fitness
- comprehend the effects of exercise on cardio respiratory system
- know the effects of exercise on cardio respiratory system
- figure out the physiological changes due to ageing
- identify and classify sports injuries
- recognize and demonstrate the aims and objectives of First Aid

Discussion

In groups, discuss

- The injuries you have suffered on the Games field.
- The Sport/Game you were playing when the injury occurred.
- The cause of the injury.
- The treatment.
- Could the injury have been prevented?

Share your information with the class.





7.1.1 Physiological Factors Determining the Component of Physical Fitness

Exercise physiology is a study of the body's response to exercise. In the human body we majorly study skeletal, muscular, nervous, endocrine, cardiovascular, metabolic, respiratory, digestive, urinary and reproductive systems which are somehow affected by exercises. During exercise, all systems of our body work jointly but responses of these systems are independent. Metabolic system produces energy and also takes care of intake and output of energy. Cardiovascular system controls circulation, transports oxygen and energy to muscles and waste products from muscles. Respiratory system takes in air, diffuses oxygen to lungs and muscle tissue and removes carbon dioxide from body. Neuromuscular skeletal system allows body movements through muscle contraction. Neuroendocrine and Immune system help to maintain homeostasis of the body. To develop fitness, each component has different exercise, intensity and volume, so the responses of systems are different. Here we will study on three major physiological factors that determine the various components of fitness.

7.1.2 Skeletal Muscles Factor

Skeletal muscles are made up of muscles fibres which are divided into two categories Slow twitch fibres or Type I fibres and Fast twitch fibres or Type II fibres. Mostly muscles contain a mix of both fast and slow twitch fibres and proportion of these fibres is dependent on genetics, hormones and habits of exercises. Composition of fibres in muscles plays a dominant role in development of strength, endurance, and speed performance. Skeletal muscles have four properties contractility, excitability, extensibility and elasticity and four contractile characteristics namely maximal force production, speed contraction, maximal power output and efficiency of contraction. These characteristics existing in muscles determine different components of fitness.

Type I fibres or slow twitch fibres or slow oxidative fibres contain large numbers of oxidative enzymes, have more capillaries, higher concentration of myoglobin and mitochondrial enzyme than fast twitch fibres which promote aerobic activity and resistance against fatigue. Due to higher concentration of capillaries the colour of fibres becomes red and has greater supply of blood. Such types of fibres contract at low rate and keep contracting for longer duration without fatigue; thus, producing large amounts of energy slowly. Slow twitch fibres help in long distance running, swimming, cycling etc.

Type II fibres or Fast twitch fibres or Fast glycolytic fibres contain a good volume of glycolytic enzymes which promote anaerobic activity but due to less number of mitochondria they have limited aerobic capacity and low fatigue resistance. Fast twitch fibres do not require blood supply to produce energy so their colour is lighter as compared to slow twitch fibre. Such fibres have fast contraction rate, tire rapidly and consume lots of





energy, and are able to produce small amount of energy quickly. It helps in anaerobic activities like jumps, throws, sprint etc.

Muscles fibres play a dominant role in sports performance. Regular training can change the proportion of slow and fast twitch fibres.

Sprinters generally have a higher percentage of Type II fibres and a lower percentage of Type I fibres, while endurance athletes have a higher percentage of Type I fibres and a lower percentage of Type II fibres. There are variations of types of fibres among athletes participating in the same sports also. The amount of force generated through muscle contraction depends on the number and types of motor units, length of muscles, nature of neural stimulation of the motor units and contractile history of muscle.

Do you Know?		
Sports	Slow Twitch Fibre	Fast Twitch Fibre
Long Distance Runners	70 to 80 %	20 to 30 %
Sprinters	25 to 30 %	70 to 75 %
Non-Athletes	48 to 52 %	48 to 52 %

7.1.3 Energy Production Factor

Cellular respiration is a process in which ATP is formed through food. Main source of energy in food is in form of carbohydrates, proteins and fats. Each has different complex chemical process to form ATP energy. During exercise, the load on metabolic system increases manifold because of increase in demand of energy by different systems. In this process, carbohydrates give instant energy as compared to fats and proteins, but fats give a larger amount of energy as compared to carbohydrates and proteins. Higher intensity aerobic activity requires carbohydrates in the form of glucose and glycogen as fuel.

Do you know?

Metabolism: is a process of overall energy transformations occurring in the body.

Anabolism: is a process of energy used to build tissues through proteins.

Catabolism: is a process of breakdown of food and stores to produce energy for work.

Carbohydrates work as a fuel for short duration exercise, fats are utilized for long duration exercises and proteins contribute a small but important proportion of nourishment. Basically, three energy system works in our body ATP-CP system, anaerobic system and aerobic system. ATP- CP system provides energy if the activity is less than 10 second. Such activities are dynamic in nature and of very short duration and very intensive. They include jumps, throws, sprints, weightlifting, powerlifting etc. Anaerobic system provides energy for





less than two minutes, in activities like 200m, 400m races. Aerobic system provides energy for long duration activities like marathon, football, hockey etc. Aerobic and anaerobic systems work simultaneously, but which system is predominant depends upon type, duration, intensity of exercise, long and short-term nutritional status, proportions of types of muscle fibres etc.

7.1.4 Cardiorespiratory Factor

Cardiorespiratory system is combination of respiratory and cardiovascular systems which jointly work to transport oxygen to the cells and support metabolism by delivering nutrients, which provide energy to neuromuscular system and neuroendocrine system. During exercise, the demand for energy increases and to meet the demand, oxygen is required in appropriate volume, to achieve the same. Demand of energy depends on intensity, duration and type of activity. To match the same, the respiratory system parameters: pulmonary ventilation, external respiration and internal respiration work together. The cardiovascular response to exercise is directly proportional to the demands of the skeletal muscles for Oxygen. Maximal oxygen consumption (VO₂ Max), Blood pressure, blood volume, oxygen diffusion and extraction, muscle and arterial blood flow etc. simultaneously increase as per activity.

7.1.5 Physical Fitness Components determined by the Physiological Factors

Now we will understand how above-mentioned physiological factors determine fitness. We have taken four components of physical fitness namely strength, endurance, speed and flexibility.

The factors can be briefly understood as:

Strength – Strength component has varied sub-types like maximum strength, Explosive strength, Strength, Endurance etc. Each has different types of exercise, intensity and duration so physiological factors vary. In games like weightlifting, jumps, sprint or power, agility and strength dominating sports where force production is high, fatigue is quick, and fast twitch fibre percentage must be high in muscles. ATP-CP system or anaerobic system works to produce energy for strength training. Stroke volume (the volume of blood pumped out of the left ventricle of the heart during each systolic cardiac contraction) is a vital parameter as far as cardiovascular system is concerned.





Picture Source¹

Do you know?

Nameirakpam Kunjarani Devi (born 1 March 1968) is the most decorated Indian sportswoman in weightlifting. She is a recipient of Arjuna Award, Padma Shri and Rajiv Gandhi Khel Ratna.

Endurance: Endurance also varies from brisk walk to running to marathon. While in each activity intensity and duration varies, but one thing is common in all these activities: that is long duration and low fatigue activity. Activities like cycling, swimming or long duration activities come under endurance component. Slow twitch fibre percentage must be higher in comparison with fast twitch fibres to give better performance in endurance. Aerobic system provides energy in endurance training. Maximal oxygen consumption (V_{O_2}), ventilation capacity plays dominating role in endurance training.

Speed: In speed training percentage of fast twitch fibres is very high in muscles, These activities include 100m race, roller skating, or any movements that require work to be done in minimum possible time. A vital physiological factor to give best speed performance is motor neuron stimulation. The brain sends a message to the muscles to act fast. To meet the demand of energy, the ATP CP system works.





Do you know?

In 100 m sprint event:

The current men's world record is 9.58 seconds, set by Jamaica's Usain Bolt in 2009, while the women's world record of 10.49 seconds set by American Florence Griffith-Joyner in 1988 remains unbroken.

Flexibility: Activities of stretching or yoga require a good deal of flexibility. Physiological factors like elasticity and extendibility of muscles, type of joint, homothermal temperature are key determinants of flexibility. Muscles, tendons and ligaments are key components that affect flexibility. Muscles groups like agonists, antagonists, neutralizers and stabilizers should understand for training purpose.

Do you know?

Aerobic Exercise is any type of cardiovascular conditioning. It can include activities like brisk walking, swimming, running, or cycling. You probably know it as “cardio.” By definition, aerobic exercise means “with oxygen.” Your breathing and heart rate will increase during aerobic activities.

Anaerobic Exercise is any activity that breaks down glucose for energy without using





oxygen. Generally, these activities are of short length with high intensity. The idea is that a lot of energy is released within a small period of time, and your oxygen demand surpasses the oxygen supply.

ATP The Full form of ATP is Adenosine Triphosphate. ATP is a complex organic chemical that provides energy to drive many processes in living cells, eg., nerve impulse propagation, muscle contraction, and chemical synthesis

ATP-PCr Known also as immediate energy system, phosphagen system, and alactic anaerobic system, the ATP – PCr system is the main energy provider for a high intensity exercise of short duration up to 10 seconds, for example lifting a weight, swinging a golf club, doing a push – up, and throwing a hammer

Myoglobin a red iron-containing protein pigment in muscles that is similar to haemoglobin

Mitochondrion any of various round or long cellular organelles of most eukaryotes that are found outside the nucleus, produce energy for the cell through cellular respiration, and are rich in fats, proteins, and enzymes

Extension Activity

Think of an activity/exercise you would suggest for improving

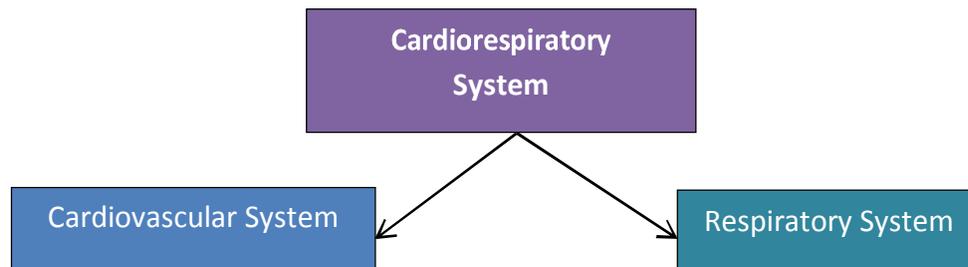
Muscular strength	_____
Power	_____
Speed	_____
Muscular endurance	_____
Agility	_____
Flexibility	_____





7.2.1 Effect of Exercise on Cardiorespiratory System

Cardiorespiratory system consists two parts. They are



Cardiovascular system - It consists of three parts: the heart, blood vessels and blood. Its major function is to deliver oxygen and nutrients, remove CO₂ and other metabolic waste products, to transport hormones and other molecules, to support thermoregulation and control of body fluid balance and lastly to regulate immune function.

Respiratory system - The important parts of the respiratory system are the nose, nasal cavity, pharynx, larynx, trachea, bronchi, and lungs. Air can also enter the respiratory system through the oral cavity. Its major functions include, transporting air to the lungs, exchanging gases (O₂ and CO₂) between the air and blood and regulating blood pH.

I. Tick the correct answers.

Q1. _____ system provide energy during 5000m race.

- (a) ATP CP system
- (b) Anaerobic System
- (c) **Aerobic System**
- (d) Endurance System

Q2. Slow twist fibres are of _____ colour.

- (a) **Red**
- (b) White
- (c) Black
- (d) Blue

Q3. Vo₂ max is related to _____

- (a) Muscular system
- (b) **Respiratory system**





- (c) Cardiovascular system
- (d) Energy production system

Q4. Which is NOT a property of muscles?

- (a) Contractility
- (b) Excitability
- (c) Extensibility
- (d) **Durability**

II. Answer the following questions briefly.

- Q1. Point out physiological factor for strength.
- Q2. Briefly describe the energy production system in our body.
- Q3. Explain different properties of muscles.
- Q4. Write a few points on cardiorespiratory factors determining fitness.

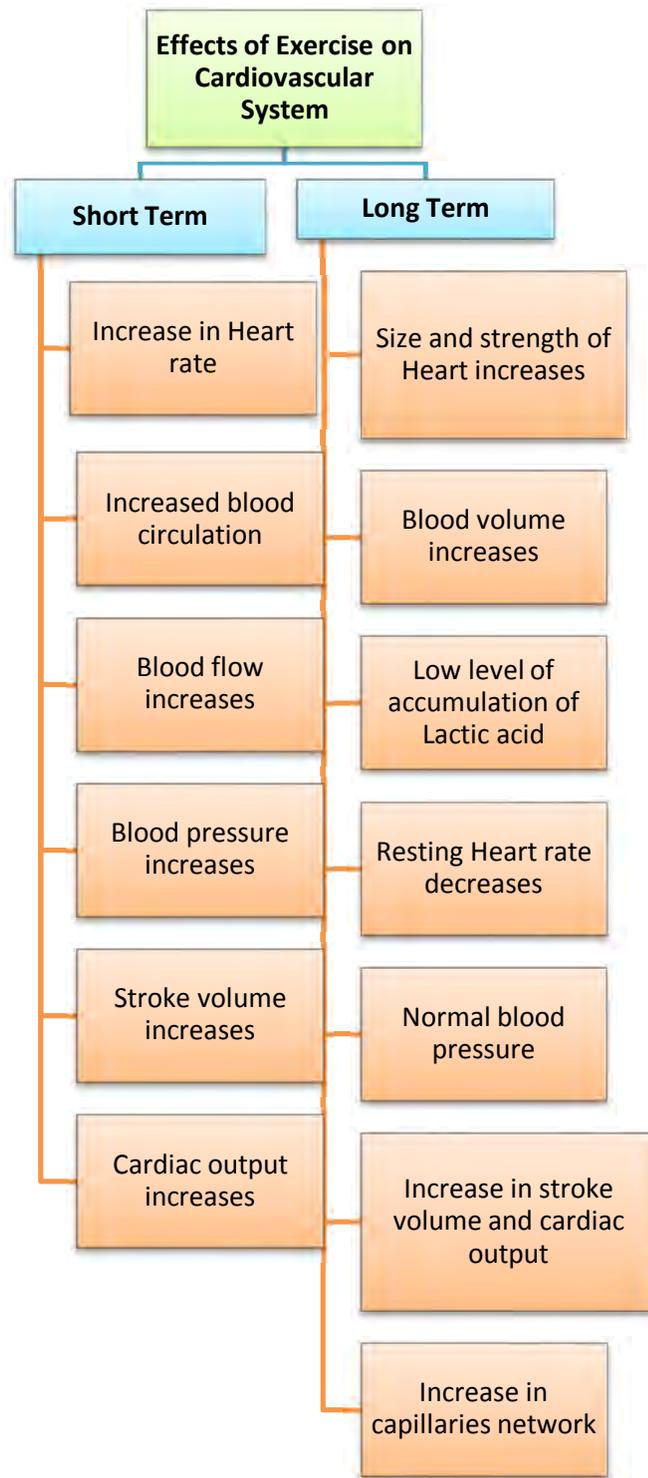
III. Answer the following questions in 150-200 words.

- 1 Explain Physiological factors determining fitness.





7.2.2 Effect of Exercise on Cardiovascular



Short Term Effects of Exercise on Cardiovascular System

1. **Increased Heart Rate:** Exercise makes the body work harder and therefore muscles require more oxygen to continue to work effectively. This sudden increase in demand





of oxygen is met by an increase in blood circulation which is achieved by the heart. In this process, the heart rate increases.

- 2. Increased Blood Circulation:** As the heart rate increases, blood circulation increases in the body to deliver the oxygen to muscles. As a result, the movement or flow of blood increases to tissues or organs.
- 3. Increased Blood Pressure:** Endurance exercise leads to increase in systolic blood pressure which is in direct proportion to the increase in exercise intensity. The increased systolic blood pressure is because of the increased cardiac output that accompanies increasing rates of work. With most types of training there is minimal change in diastolic blood pressure.
- 4. Increased Stroke Volume:** The volume of blood pumped during one beat (contraction) is called stroke volume. During exercise, stroke volume increases as more oxygen is required which is accomplished by delivering blood to muscles. After an endurance training program capacity of heart to pump blood in one contraction increased by 20 to 50 percent.
- 5. Increased Cardiac Output:** Cardiac output is the amount of blood pumped out by each ventricle of the heart in 1 minute. It is the product of the heart rate (HR) and the stroke volume (SV). Resting cardiac output is approximately 5.0 L/min but differs according to the size of the person. Maximal cardiac output varies between less than 20 L/min in sedentary individuals to 40 or more L/min in elite endurance athletes. Increase in heart rate and stroke volume results in increase in cardiac output.

Long Term Effects of Exercise on Cardiovascular System

- 1. Increased Size and Strength of Heart:** Continuous aerobic exercises help to increase the strength and the size of heart which helps in better performance. It is also referred as cardiac hypertrophy.
- 2. Low Level of Accumulation of Lactic Acid:** Anaerobic respiration is the process of converting glucose into energy without oxygen. During the conversion from glucose to energy, lactic acid, a waste product, is created. Lactic acid makes muscles tired and painful. Regular exercises prepares muscles to adjust to working with lower levels of oxygen and the circulatory system develops itself to transport oxygen to different parts of the body, thereby resulting in low levels of lactic acid.

Extension Activity

Discuss in your group

The heart is an important part of the cardiovascular system. What can you do to keep your heart healthy?





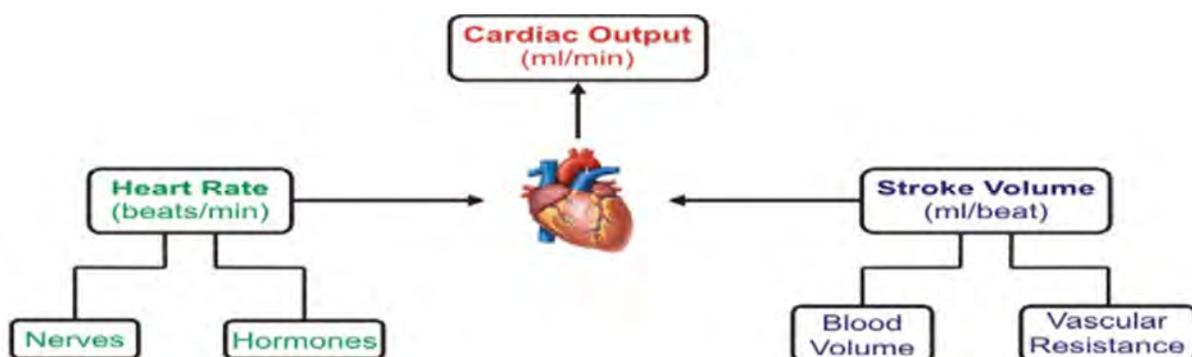
What should you avoid doing?

What can happen if the cardiovascular system becomes unhealthy?

Your heart is a muscle about the size of your fist. Compare it to other muscles. Can you control it like you do the muscles in your arms or legs?

Can you exercise it like you do other muscles?

- 3. Decrease in Resting Heart Rate:** Due to improved efficiency of the heart, it is required to pump less blood to meet the needs of the body. As a result, the heart rate at rest decreases. It is also called as Bradi Cardia.
- 4. Normal Blood Pressure:** In response to endurance training, there can be substantial reduction in both systolic and diastolic blood pressure. Regular exercise helps keep the blood pressure normal.
- 5. Increase in Stroke Volume and Cardiac Output:** Since the size and strength of the heart increases, heart pumps blood more efficiently with increase in stroke volume and cardiac output.
- 6. Increase in Capillaries Network:** To achieve the demand for oxygen, capillaries network increases. Due to the demands placed on different parts of the body during exercise, the capillary density at muscle sites improves. Increased capillary density allows for greater oxygen being transported to the muscles, improving their ability to perform intense exercise. Moreover, exercise helps in preventing the decline in capillary function that happens with age.



Picture Source²



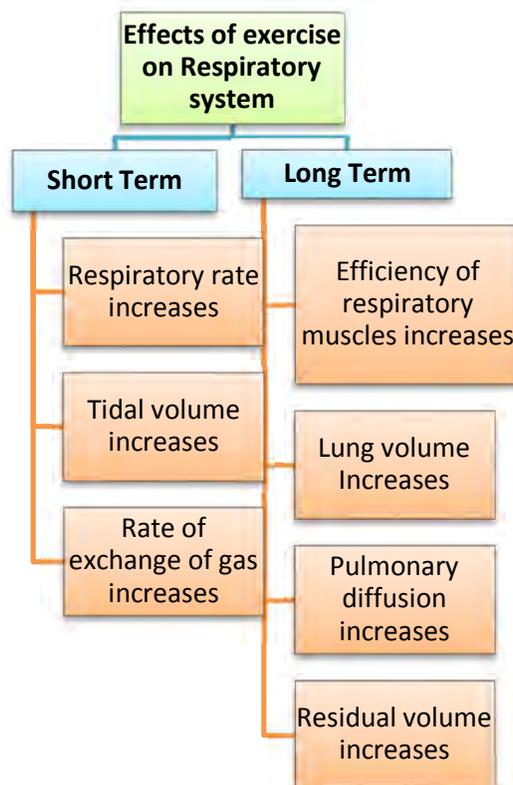


Picture Source³

Do you know?

Most veins carry deoxygenated blood from the tissues back to the heart; exceptions are the pulmonary and umbilical veins, both of which carry oxygenated blood to the heart.

7.2.3 Effect of Exercise on Respiratory System





Extension Activity

Working in groups, create a working model of lungs.

Research respiratory diseases and how they affect the function of the respiratory system.

Can you alter your model to show what happens to the lungs with these diseases?

Can you demonstrate on their models what has been done to help people with respiratory problems?

Short Term Effects of Exercise in Respiratory System

1. **Respiratory Rate Increases:** Our body requires more oxygen during exercise, and to meet this increased demand, the respiratory rate (breathing rate) increases. The normal respiration rate for an adult at rest is 12 to 20 breaths per minute. per minute, but during exercises it increases to 40 breaths per minutes.
2. **Tidal Volume Increases:** The amount of air inhaled and exhaled in one breath is known as tidal volume. Tidal volume increases as a result of exercise to take in more oxygen and remove carbon dioxide from our body.
3. **Rate of Exchange of Gas Increases:** Regular exercise increases the rate of exchange of gas in lungs.

Long Term Effects of Exercise in Respiratory System

1. **Increased Efficiency of Respiratory Muscles:** Due to regular exercise efficiency of respiratory muscles increases, inhalation and exhalation become fluent. This helps to meet the demand of oxygen.
2. **Increased Lung volume:** Continuous exercises done for long duration help to increase the capacity and volume of lungs. Vital capacity increases almost 100 % as compared to that of a normal individual.
3. **Increased Pulmonary Diffusion:** Pulmonary Diffusion refers to the capacity of the lungs to allow oxygen and carbon dioxide to pass in and out of the blood. Regular sub-maximal exercise training develops the scope of increasing the exchange of gases to oxygen in this process the size of the alveoli also increases.
4. **Increased Residual Volume:** Residual volume is the volume of air that remains in the lungs after forceful expiration. Regular exercise increases residual volume that helps to exchange the gases in normal limits.





Do you know?

Universal donors are those with an O negative blood type. Why? O negative blood can be used in transfusions for any blood type. Types O negative and O positive are in high demand. Only 7% of the populations are O negative. However, the need for O negative blood is the highest because it is used most often during emergencies. The need for O+ is high because it is the most frequently occurring blood type (37% of the population).

I. Tick the correct options

1. It is a condition typically defined wherein an individual has a resting heart rate of under 60 beats per minute (BPM) in adults.
 - (a) Bradycardia
 - (b) Hypertrophy
 - (c) Alveoli
 - (d) Perfusion
2. It is the amount of blood pumped out by each side of the heart (actually each ventricle) in 1 minute.
 - (a) Blood pressure
 - (b) Cardiac output
 - (c) Blood volume
 - (d) Anaemia
3. The resting Cardiac output is approximately.
 - (a) 10.0 lt.
 - (b) 1.0 lt.
 - (c) 5.0 lt.
 - (d) 15.0 lt.
4. The volume of blood pumped during one beat (contraction) is called,
 - (a) Blood flow
 - (b) Stroke volume
 - (c) Veins and arteries
 - (d) Capillaries
5. Process of converting glucose into energy without oxygen:
 - (a) Anaerobic respiration
 - (b) Aerobic respiration
 - (c) Vital capacity
 - (d) Stroke Volume





7. Cardiac hypertrophy is
 - (a) plateauing of heart rate due to maximal exercise intensity
 - (b) enlargement of heart due to chronic endurance training
 - (c) lowering of heart rate due to physical training
 - (d) increase in ventricular volume because of exercise
8. What is the normal respiratory rate for an adult?
 - (a) 10 to 12 breath per minute
 - (b) 40 to 60 breath per minute
 - (c) 12 to 20 breath per minute
 - (d) 30 to 40 breath per minute
9. The amount of breath per minute increases during exercise to:
 - (a) 20 breath per minute
 - (b) 40 breath per minute
 - (c) 30 breath per minute
 - (d) 10 breath per minute

II. Answer the following questions briefly.

1. What is Stroke Volume?
2. What is residual volume?
3. What are the effects of exercise on the heart?
4. Write briefly about the effect of training on
 - (a) Blood flow
 - (b) Blood volume
5. How does cardiac output respond to training?
6. What is pulmonary diffusion? How does it respond to training?

III. Answer the following questions in 150-200 words.

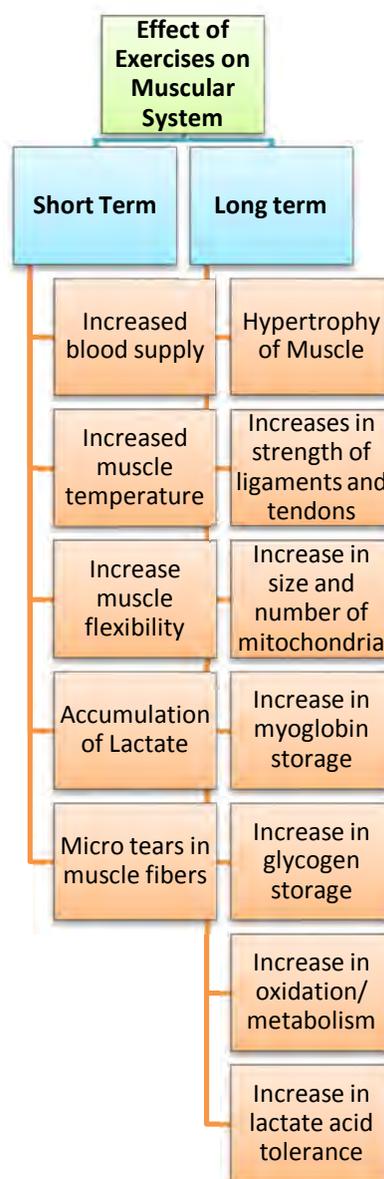
1. Write briefly about the effect of training on
 - (a) Lung Volume
 - (b) Heart rate
2. What is blood pressure? Briefly explain its response to exercise.
3. Define and explain the effect of exercise on:
 - (a) Total Volume
 - (b) Stroke volume





7.3.1 Effect of Exercise on Muscular System

Exercise involves a series of sustained muscle contractions, of either long or short duration, depending on the nature of the physical activity. Effects of exercise on muscles can be considered short-term or immediate, both during and shortly after exercise; as well as long-term, lasting effects.



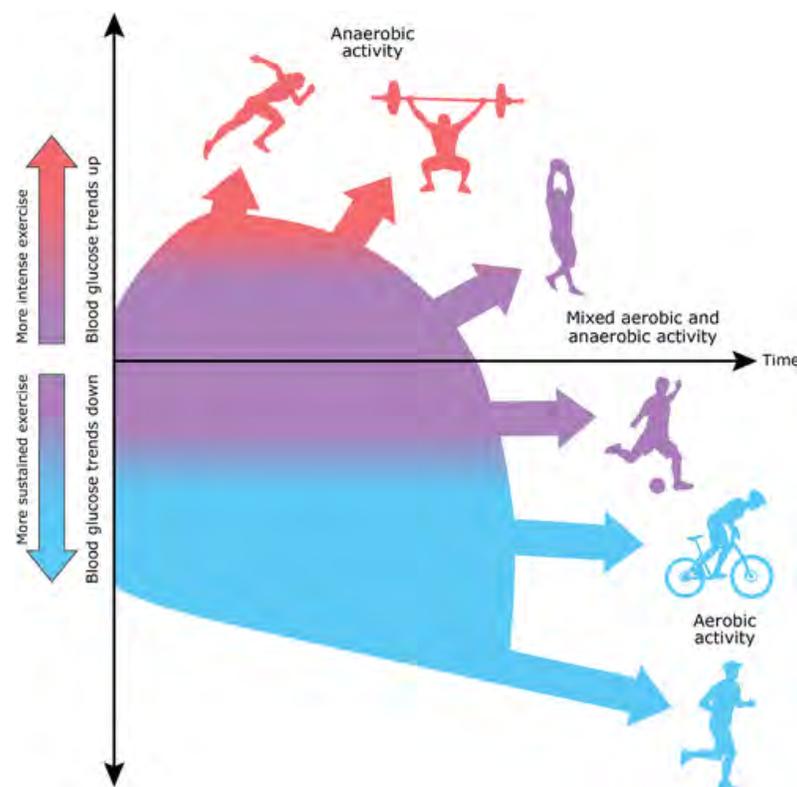
Short Term Effect of Exercises on Muscular system

1. **Increased blood supply:** During exercise, in order to match demand of fuel to muscle, the supply or concentration of blood increases in the whole body or, in the particular muscle group where activity is largely impacted.





- 2. Increased muscle temperature:** During exercises muscles demand energy, which comes from contracting muscles. During the process, a lot of heat energy is generated which increases the temperature of muscles, and/ or the body.
- 3. Increased muscle flexibility:** Due to increase in blood flow and rise in temperature, elasticity of muscles increases. Stretching and mobility exercises also play a dominant role in increasing muscular flexibility.
- 4. Accumulation of Lactate:** Muscles requires oxygen. If blood supply does not provide appropriate volume of oxygen to muscles, it leads to accumulation of lactate acid in muscles which result in pain, and soreness in muscles.
- 5. Micro-tears in Muscle Fibres:** During exercises muscle tissue is placed under stress which results in micro-tears in muscle fibres. The body responds by repairing the muscle fibres and making them larger. When a muscle gets bigger, the process is called hypertrophy.



Picture Source⁴

Long term effects of Exercise on Muscular system

- 1. Hypertrophy of Muscle:** Scientific and systematic exercise leads to increase in thickness of muscle fibres that results in increase in muscle size also known as muscle hypertrophy.





2. **Increases in Strength of Ligaments and Tendons:** regular exercise helps to strengthen bones, ligaments and tendons. This helps prevent injury and promotes performance.
3. **Increase in Size and Number of Mitochondria:** Aerobic exercises leads to increase in size and numbers of mitochondria and which take in more oxygen and produce more ATP and energy.
4. **Increase in Myoglobin Storage:** Long term effect of aerobic exercise is to increase the storage of myoglobin which transports oxygen to mitochondria. Large amount of myoglobin means large amount of oxygen and large amount of energy.
5. **Increase in Glycogen Storage:** Glycogen is generally stored in muscles and liver. Regular exercise helps the body to increase the storage of glycogen which may give continuous energy for 90 to 120 minutes.
6. **Increase in Oxidation/ Metabolism:** Endurance exercise training increases the capacity skeletal muscle fat oxidation by increasing mitochondrial density. Long term exercises demand a lot of energy, and to meet this demand, metabolism increases due to oxidation of fat. This leads to increase in provision of energy.
7. **Increase in Lactate Acid Tolerance:** Regular exercises help to tolerate pain and sourness in muscles due to accumulation of lactate acid.

I. **Tick the correct answers:**

1. Which is not a long term effects of exercise on muscular system?
 - a. Hypertrophy of muscle
 - b. Increase metabolism
 - c. Increase Myoglobin
 - d. Increase blood supply
2. Which is not a Short term effects of exercise on muscular system?
 - a. Accumulation of Lactate
 - b. Micro-tears in muscle fibers
 - c. Increase muscle temperature
 - d. Increase in lactate acid tolerance
3. Physical activity helps to increase _____.
 - a. Size of muscle
 - b. Size of bone
 - c. Size of brain
 - d. Size of liver
4. Increase in glycogen stored in muscle is an effect of _____.
 - a. Aerobic Training
 - b. Anaerobic Training





- c. Cross Training
- d. Above all

II. Answer the following questions briefly:

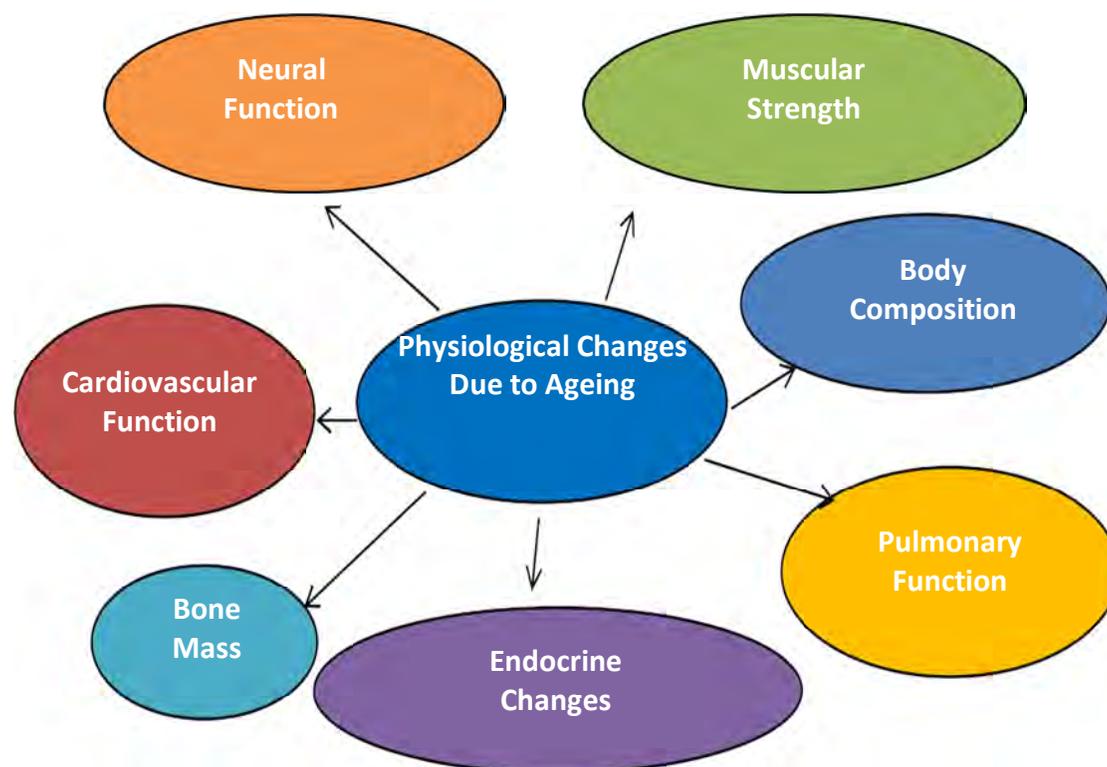
1. Explain long term effects of exercise on muscular system
2. Explain Short term effects of exercise on muscular system

III. Answer the following questions in 150-200 words:

1. Describe the various effects of exercises on muscular system

7.4 Physiological Changes Due to Ageing

Ageing, an inevitable and extremely complex, multifactorial process, is characterized by the progressive degeneration of organ systems and tissues. It is largely determined by genetics, and influenced by a wide range of environmental factors, such as diet, exercise, exposure to microorganisms and pollutants.



Muscular Strength - It is defined as the maximal force that a muscle or muscle group can generate. Men and women usually attain their highest strength levels between ages 20 and 40, the time when muscle cross-sectional area is largest. Concentric strength of most muscle groups declines, slowly at first and then more rapidly after middle age. Decline in eccentric strength begins at a later age and progresses more slowly than those in concentric strength.





Strength loss begins at a later age for women than for men. A 40% to 50% reduction in muscle mass from muscle fibre atrophy and actual loss of motor units between ages 25 and 80 is the primary cause of reduced strength, even among healthy, physically active men and women.

Neural Function - A nearly 40% decline in the number of spinal cord axons and a 10% decline in nerve conduction velocity reflects the cumulative effects of ageing on central nervous system functioning. These changes are likely to contribute to the age-related reduction in neuromuscular performance assessed by simple and complex reaction and movement times. Ageing most adversely affects the time required to detect a stimulus and process the information to produce the response.

Endocrine Changes with Ageing - The endocrine system consists of a host organ (gland), minute quantities of chemical messengers (hormones), and a target or receptor organ. Approximately 40% of individuals aged between 65 and 75 years and 50% of those older than age 80 have impaired glucose tolerance leading to type 2 diabetes. Thyroid dysfunction, primarily from lowered pituitary gland release of the thyroid-stimulating hormone thyrotropin (and reduced output of thyroxine), is common among the elderly. This directly affects metabolic function, including decreased glucose metabolism and protein synthesis. Mean pulse amplitude, duration, and fraction of secreted growth hormone (GH) gradually decrease with ageing, a condition termed somatopause.

Pulmonary Function - Mechanical constraints on the pulmonary system progress with age to cause deterioration in static and dynamic lung function measures. Also, pulmonary ventilation and gas exchange kinetics during the transition from rest to submaximal exercise slow substantially.

Cardiovascular Function - Cardiovascular function and aerobic capacity do not escape age-related effects. Because of a lower maximum heart rate, maximum cardiac output typically decreases with age in trained and untrained men and women. Reduced peripheral blood flow capacity accompanies age-related decreases in muscle mass. Sedentary living produces losses in functional capacity at least as great as the effects of ageing.

Body Composition - In physical fitness, body composition is used to describe the percentages of fat, bone, water and muscle in human bodies. After age 60, total body mass decreases despite increasing body fat.

Bone Mass- Bone Mass is a measure of the amount of minerals (mostly calcium and phosphorous) contained in a certain volume of bone. Osteoporosis poses a major problem with ageing, particularly among postmenopausal women. In this condition it produces loss of bone mass as the ageing skeleton demineralizes and becomes porous. Bone mass can decrease by 30% to 50% in persons older than age 60.





Do you know?

Oldest woman lived on earth was Jeanne Calmenta from France (born on 21 February 1875, died on 4 August 1997, lived for 122 years, 164 days).

Oldest man lived on earth was Jiroemon Kimura from Japan (born on 19 April 1897, died on 12 June 2013, lived for 116 years, 54 days).

I. Tick the correct answers:

1. Men and women usually attain their highest strength levels between the ages of
 - (a) 1 and 2
 - (b) 5 and 7
 - (c) 7 and 11
 - (d) 20 and 40
2. It is a measure of the amount of minerals (mostly calcium and phosphorous) contained in a certain volume of bone,
 - (a) Body composition
 - (b) Bone Mass
 - (c) Pulmonary function
 - (d) Neuron
3. The chemical substances synthesized by specific host glands, secreted into the blood, and carried throughout the body are called
 - (a) hormones
 - (b) sugar
 - (c) electrolytes
 - (d) capillaries
4. It is a disease in which bone weakening increases the risk of a broken bone,
 - (a) Measles
 - (b) Osteoporosis
 - (c) Atherosclerosis
 - (d) Beriberi
5. Decrease in size of a body part, cell, organ, or other tissue is called
 - (a) Myopia
 - (b) Atrophy





- (c) Cardiac arrest
- (d) Cardiac cycle

II. Answer the following questions in 150-200 words:

1. Describe the changes in endocrine system due to ageing.

7.5 Sports Injuries

Sports participation and exercise engagement have always witness an interruption among athletes towards active participation or lead to painful experience due to some or the other form of injuries. The injuries may be due to incorrect movement, hitting or colliding with equipment or aggressive sporting actions like diving and sliding, overtraining or lack of conditioning. All these injuries caused due to different reasons may not be of the same type, which means it may need different remedies and specific understanding towards each injury to avoid and prevent such injuries. The injury in sports and exercise refers to the physical damage caused to tissue, bone or any other organ of the body while in action and further leading to withdrawal from participation or experience pain while performing movement actions.

Definitions

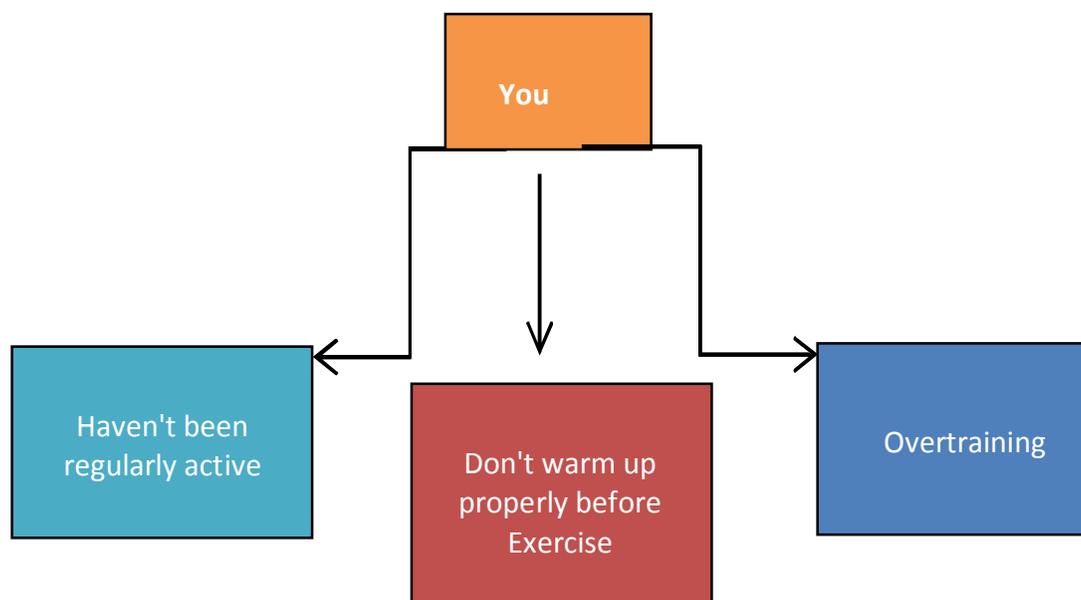
An athletic injury is defined as “some physical damage or insult to the body that occurs during athletic practice or competition causing a resultant loss of capacity or impairing performance.” Morris (1984)⁵

a sports injury may be defined as damage to the tissues of the body that occurs as a result of sport or exercise. IOC manual of sports injuries (2012)⁶

Sports injury may be define as any stress or overstretch put on soft tissues or bone on/off the field resulting pain and hinder performance. Cut, tear, overstretching of tissues, breakage of bone or dislocation of joints are common injuries in sports, lets try to understand these classifications:

The injuries that occur during sport, athletic activities or during certain exercises. The risk for sports injuries occur if





7.5.1 Classification of Sports Injuries

Sports Injuries can be classified according to the cause of the injury:

1. **Direct Injuries:** They are sustained from an external force causing injury at a point of contact.
2. **Indirect Injuries:** It usually involves the athlete damaging the soft tissues such as ligaments tendons or muscles of the body through internal or external force.
3. **Soft Tissue Injuries:** Any injuries to skin muscles or ligaments are soft tissue injuries.
4. **Hard Tissue Injuries:** Injuries that occur in bones and cartilages.
5. **Overuse Injuries:** They are sustained from continuous or repetitive stress, incorrect technique or equipment or too much training.

Extension Activity

Working in groups discuss

Have you ever had a sports injury? How did you get it?

Are there any ways for fellow athletes to avoid similar injuries?

Why is it important to take time to heal after a sports injury?

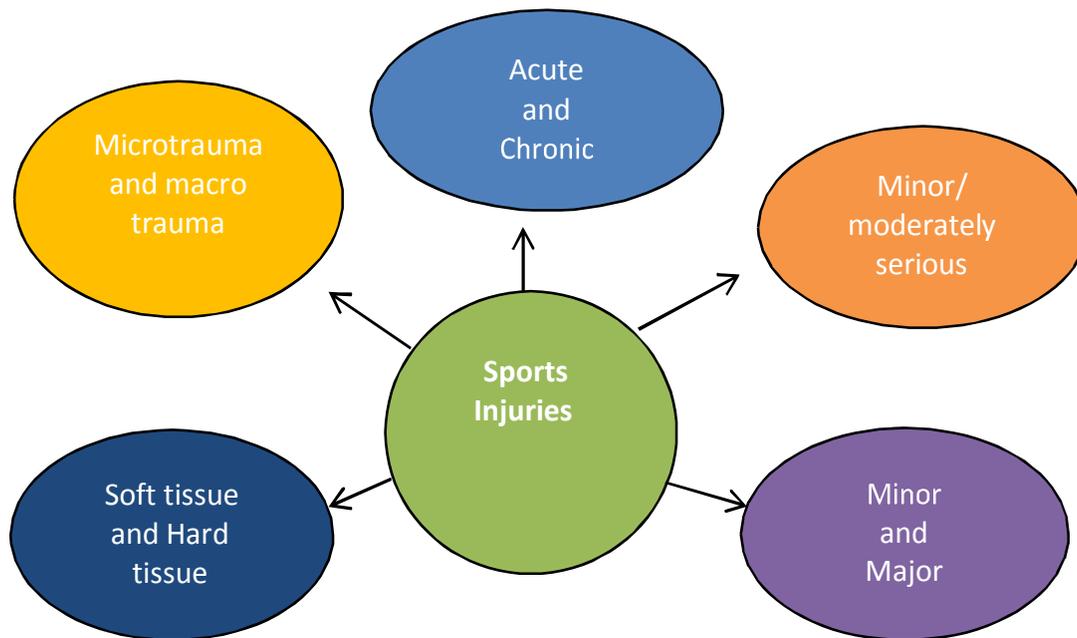
Why is it not a good idea to ignore any pain that you feel while playing a sport?

Why should you warm up before playing a sport? What can happen if you don't warm up?





7.5.2 Types of Sports Injuries



Injuries	Types
Skin injuries	<p>Abrasion – injury caused by falling on rough or firm surface.</p> <p>Laceration – tears in the skin.</p> <p>Incision – cut by a sharp edge of an object.</p> <p>Puncture wound – pierced by a sharp and pointed object.</p> <p>Avulsion – tearing away of a part of the skin.</p>
Soft tissue injuries (eg., muscles, ligaments)	<p>Contusion – bruise caused by a direct blow to some part of the body. eg., knee of a player knocks against the thigh of another person.</p> <p>Sprain – injury of ligament of joints, caused by the violent overstretching of ligament in a joint or the movement of the joint in abnormal directions. It is characterised by pain, tenderness, swelling at the joint.</p> <p>Strain – injury of muscle or tendon, three types– mild, moderate, severe.</p>

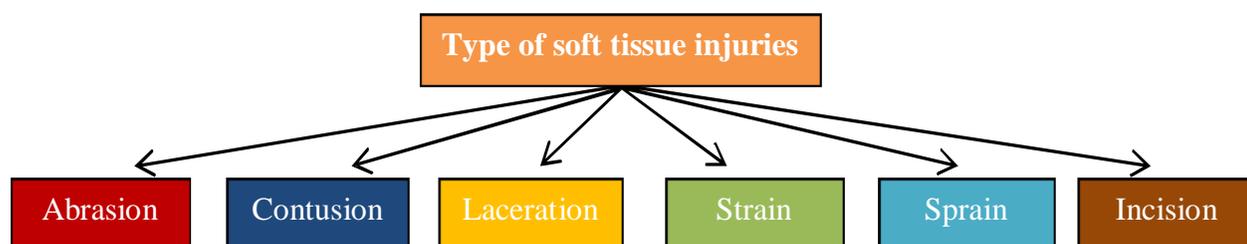




Joint injuries	Joint injuries are very common in sports they are known as joint dislocation. “Dislocation is the displacement of contiguous surfaces of two or more bones which are in a joint.” It is caused by an external force which forces the joint to move beyond the limits of a joint. If the joint is forced to move in an abnormal direction, this dislocation can be a complete or a partial displacement of the bones.
Bone injuries	Fractures (Fracture is a break in the continuity of the bone. The fractures can be open/compound fracture or a closed/simple fracture. Severity of the fracture varies from a mild crack in the bone to the severe shattering of the bone into many pieces.

7.5.4 Soft Tissue Injuries

A soft tissue injury is the damage of muscles, ligaments and tendons throughout the body.



Abrasion:

Abrasion injuries most commonly occur due to moving contact with a rough surface, causing a grinding or rubbing away of the upper superficial layers of the epidermis.

Cause - Abrasion injuries commonly occur when exposed skin comes into contact with a rough surface, causing a grinding or rubbing away of the upper layers of epidermis.





Treatment - Clean the surface of the affected part. Stop bleeding at the earliest by compression bandages. Anti-tetanus injection should be provided.

Contusion:

It is the type of hematoma, which refers to any collection of blood outside of a vessel.

Cause - When a part of the body is struck by enough force to crush underlying muscle fibers and connective tissue without breaking the skin, a contusion may occur. It can be due to a blow from a collision with a player or a piece of equipment or because of a heavy fall.

Prevention - All the safety gear to be worn upon while playing (Helmet, anal guards,) should be worn.



Treatment - Non-steroidal anti-inflammatory drugs such as Ibuprofen, or other medications for pain relief as prescribed by the doctor.

Laceration:

The irregular tear-like wounds caused by some blunt trauma.

Cause – Mostly, laceration is the result of the skin hitting an adjacent object, or an object hitting the skin with force.

Prevention - Proper personal equipment, including eye protection can be helpful in preventing the same.

Treatment - Clean the surface of the effected part. Stop bleeding at the earliest by compression bandages.





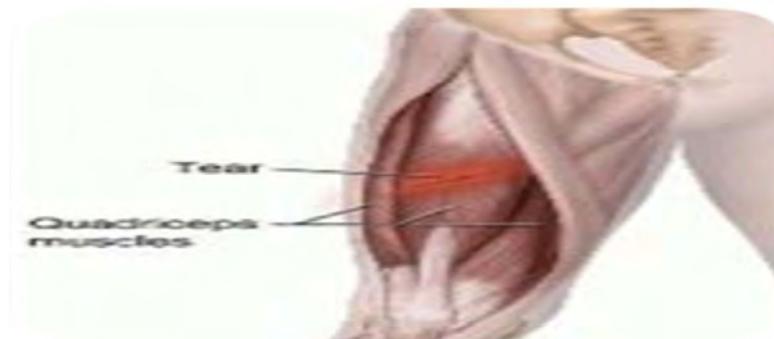
Strain:

A strain is an injury to either a muscle or a tendon generally caused by overuse, force, or stretching. Depending on the severity of the injury, a strain may be a simple overstretch of the muscle or tendon, or it can result in a partial or complete tear. A strain could be an acute or chronic soft tissue injury that is a twist, pull or tear of a muscle or the tendon.

Cause - Strains occur suddenly (acute strain) or develop slowly over time (chronic strain). Causes include lifting of heavy objects, running, jumping, throwing etc.

Prevention - Regular stretching and strengthening exercise for any kind of sport can be the preventive measure for strain.

Treatment - It can be managed by applying ice packs and maintaining the strained muscle in a stretched position. (RICE: rest, ice, compression and elevation).



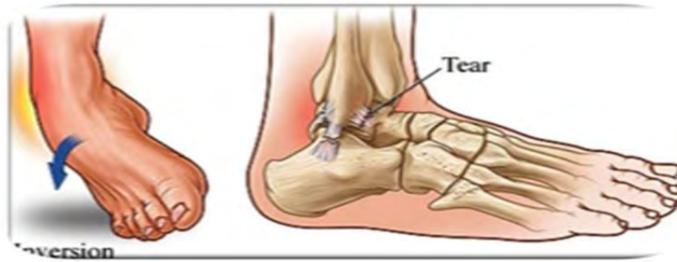
Sprain:

Sprain is the stretching or tearing of ligaments, the fibrous tissue that connects bones in the joints. A sprain occurs when you overextend or tear a ligament while severely stressing a joint. The most common location for a sprain is in your ankle.

Cause - A sprain occurs when one overextends or tears a ligament while severely straining a joint.

Prevention - Regular stretching and strengthening exercises for any kind of sport can be the preventive measure for such kind of sports injury.





Treatment – RICE (rest, ice, compression and elevation).

Incision:

An incision is a cut made into the tissues of the body to expose the underlying tissue, bone or organ.

Cause - Can be caused by a clean, sharp-edged object – such as a knife, razor or glass splinter.

Prevention - The area should be free from the sharp edges.

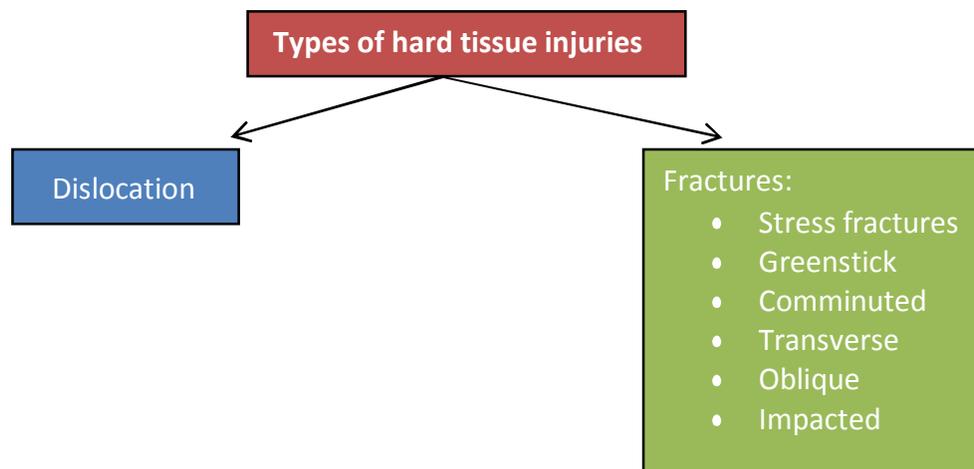
Treatment - Gently wash the affected area with soap and water to remove the dirt. Dry the incision with a clean, fresh towel before applying the dressing.



7.5.5 Hard Tissue Injuries

An injury to the skeletal system of the body is termed as the hard tissue injury. They are the injuries where the bone fractures means the bone either cracks or breaks.





DISLOCATION

Dislocations are joint injuries that force the ends of your bones out of position. The cause is often a fall or a blow, sometimes from playing a contact sport. A joint dislocation, also called luxation, occurs when there is an abnormal separation in the joint, where two or more bones meet. A partial dislocation is referred to as a subluxation. Dislocation can be caused by a trauma (accident or fall) or the weakening of muscles and tendons. A dislocated joint can be treated through medication, manipulation, rest or surgery.

Causes - Trauma that forces a joint out of place causes a dislocation. Accidents, falls, and contact sports such as football are common causes of this injury. Dislocations also occur during regular activities when the muscles and tendons surrounding the joint are weak. These injuries happen more often in older people who have weaker muscles and balance issues.

Symptoms - Symptoms of a dislocation vary depending on the severity and location of the injury. The symptoms of a dislocated joint include:

- Pain
- Swelling
- Bruising
- Instability of the joint
- Loss of ability to move the joint
- Visibly deformed joint (bone looks out of place)

Treatment - Treatment can vary based on the severity of the injury, and the joint that is dislocated. Applying ice and keeping the joint elevated can help reduce pain while you wait to see a doctor. Treatment includes:





- Medication: Your doctor may recommend medication to reduce pain from a dislocation
- Manipulation: A doctor returns the bones to their proper places.
- Rest: Once the joint is back in place, you may need to protect it and keep it immobile. Using a sling or splint can help the area heal fully.
- Rehabilitation: Physical therapy exercises strengthen the muscles and ligaments around the joint to help support it.
- Surgery: Your doctor may recommend surgery if:
 - Manipulation does not work to put the bones back in place.
 - The dislocation damaged blood vessels or nerves.
 - The dislocation damaged bones, tore muscles or ligaments that need repair.



FRACTURES

A fracture is a break in a bone. Fractures are caused by a direct impact, such as a fall or a severe tackle. Stress fractures develop over time and are caused by overuse.

Stress fracture:

Stress fractures may occur because of overuse injuries and the failure to have adequate equipment to protect the body.

Causes - Stress fractures often result from increasing the amount or intensity of an activity too quickly.

Prevention - Low impact activities added to exercise regimen to avoid repetitively stressing a particular part of the body.





Treatment - Rest, cold therapy ice packs, cold compresses, apply ice to the injured area, anti-inflammatory medications such as Ibuprofen, aspirin etc and a recovery time of 6 to 8 weeks is required for healing.



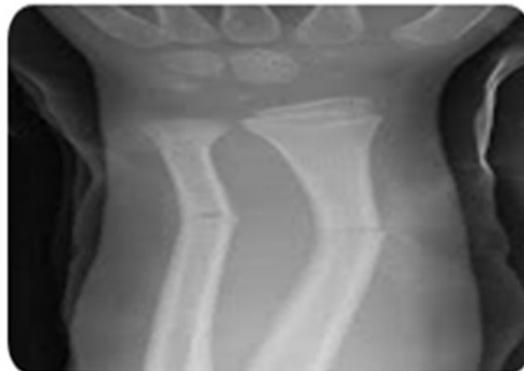
Greenstick:

A fracture in a young, soft bone, in which the bone bends.

Causes - These fractures most commonly occur with a fall.

Prevention - Promotion of regular exercise, ensuring the child's safety by providing proper safety equipment and adequate calcium in the child's diet can also help to prevent this kind of fracture.

Treatment - Removable splints result in better outcomes than casting in children with – lorus fractures of the distal radius.



Comminuted:

A fracture in which a bone is broken, splinted or crushed into number of pieces.

Causes - Direct and indirect trauma or violence can be causes for commutated fracture.

Prevention - Maintaining strong bones by eating food that is rich in calcium and regular exercise can help in the prevention of this type of fracture.





Treatment - An X-ray is important for diagnosing of the condition. An open reduction when the bone fragments are jammed-together using surgical nails, wire plates etc. is required for commutated fracture.



Transverse:

Transverse fracture is when there is a straight break right across a bone.

Causes - When a large amount of force is transmitted directly ie., perpendicularly to the bone.

Prevention - Physical activity and weight bearing exercises will make the bones stronger and denser. Bones can also be strengthened by eating foods rich in calcium and taking regular exercise.

Treatment - Can be treated at home along with rest and medicine. A back brace (called TSL) or abdominal binder may be prescribed to reduce the pain by limiting motion at the fracture site.



Oblique:

Oblique fracture is one in which the bone breaks diagonally. **Causes** - This fracture is usually caused by an injury to the bone as the result of a fall, accident or other trauma.





Prevention - Bones can be strengthened by eating food rich in calcium and exercising regularly to help prevent this type of fracture.

Treatment - It depends upon the severity of the crack or break. Anti-inflammatory medication, reduction (Resetting the bone) can also help to some extent.



Extension activity

Write down the examples of dislocation and fracture on the various body parts and its treatment.

Impacted:

This type of fracture occurs when the broken ends of the bones are jammed together by the force of the injury.

Causes - It is caused mainly when someone falls from height with a great impact.

Prevention – Increased physical activity, weight bearing exercises and maintaining good intake of calcium in food can help in preventing this type of fracture.

Treatment - In an impacted fracture the bones get broken into fragments. Therefore, a sling or a splint may be required to keep the broken bones in place, so that movement of the sharp ends of the broken bone is prevented. This is essential to prevent further damage to the bone.



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I. Tick the correct answers:

1. A sprain is an injury to:
 - (a) Muscle
 - (b) Tendon
 - (c) Ligament
 - (d) Bone
2. A bone fracture is an example of injury to
 - (a) Skin
 - (b) Soft tissue
 - (c) Hard tissue
 - (d) Eyes
3. A soft tissue injury damages,
 - (a) Ligaments and tendons
 - (b) Bone
 - (c) Cartilage and muscles
 - (d) Carpals
4. A fracture in which the bone breaks diagonally,
 - (a) Greenstick
 - (b) Impacted
 - (c) Oblique
 - (d) Transverse

II. Answer the following questions briefly:

1. What is comminated fracture? Write its cause, prevention and treatment.
2. What is a sprain? Write its cause, prevention and treatment.

III. Answer the following questions in 150–200 words:

1. Name the more common types of fractures and describe them.
2. What is a soft tissue injury? Name four types of soft tissue injury and describe it.





7.6.1 First Aid

The term was officially adopted in England for the first time in 1879 by St. John's Ambulance Association. It refers to the treatment which is given to the casualty suffering from either a minor or serious illness or injury, to preserve life, prevent the condition from worsening, or to promote recovery. It includes initial intervention in a serious condition prior to professional medical help becomes available, such as performing cardiopulmonary resuscitation (CPR) while waiting for an ambulance, as well as the complete treatment of minor conditions, such as applying a plaster to a cut. A First aid is generally performed by someone with basic medical training.

Do you Know?

The Red Cross and Red Crescent are still the largest providers of First Aid worldwide.

Extension Activity

Do you know how to apply a bandage?

- Do you know what treatments are given for bruises and cuts?
- Find out, discuss in your class and demonstrate.

First aid is the process of carrying out the essential emergency treatment. It is immediate and temporary care given to the victim of accident, injury or sudden illness.

The person who gives treatment to the person suffering from a disease or an accident, to improve his condition is called an 'aides' and the medical treatment given as aid is called – the 'first aid'.

The initial assistance given to a victim of an injury or illness, comprises of relatively simple techniques that can be performed with rudimentary equipment.

First Aid can be carried out by any person until professional medical assistance arrives.

Do you Know?

The basic objectives of First Aid are:

- to give immediate care.
- to protect the casualty from further harm.
- to relieve pain.
- to promote recovery.

The recovery is promoted as the heart rate goes down, which in turn prevents blood loss from the victim's body.



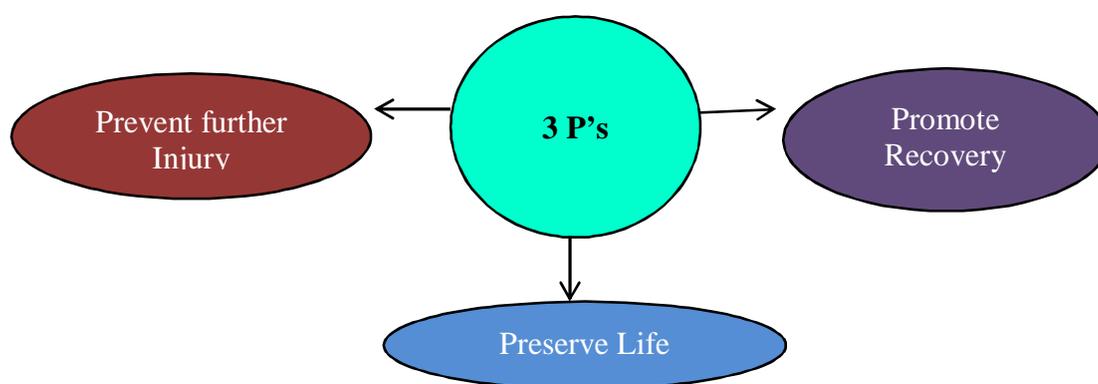


- Its purpose is to preserve life, assist recovery and prevent aggravation of the condition, until the services of a doctor can be obtained or during transport to hospital or casualty's home.
- It is something which means what other people can do for the casualty when he/she is unable to move, the help provided to the casualty is known as First Aid.
- First Aid helps ensure that the right methods of administering medical assistance are provided.
- First Aid is the immediate temporary care given to the victim of an accident or sudden illness.
- Its basic purpose is to provide immediate medical aid by a competent and qualified medical personnel till the casualty reaches Hospital.

Aims and Objectives

1. To prepare properly for any emergent situation to avoid errors and act quickly and calmly.
2. To assess and care life-threatening conditions first
3. To minimize further injury, infection and complications
4. To make the victims comfortable as possible which enable him to save energy.
5. To transport the victim to a medical facility as per necessity.

The key guiding aims and objectives of first aid is given below:





7.6.2 P.R.I.C.E.

The traditional protocol of dealing with sports injury, R.I.C.E., has now been modified to P.R.I.C.E. This refers to the addition of the word “Protection” to Rest, Ice, Compression and Elevation. Protecting the injured area from further damage is crucial to the healing process.

Protection

Protect the affected area from further injury by limiting or avoiding weight-bearing through the use of crutches, a cane, or hiking poles. Partially immobilizing the injured area by using a sling, splint, or brace may also be a means of protection.

Rest

- Stop using injured part or discontinue activity. It could cause further injury, delay healing, increase pain and stimulate bleeding.
- Use crutches to avoid bearing weight on injuries of the leg, knee, ankle and foot.
- Use splint for injuries of the arm, elbow, wrist and hand.

Ice

- Ice application contracts blood vessels.
- Helps stop internal bleeding from injured capillaries and blood vessels.
- Hastens healing time by reducing swelling around injury.
- Keep damp or dry cloth between skin and ice pack.
- Do not apply ice for longer than 15 to 20 minutes at a time.
- Apply every hour for 10 to 20 minutes.
- Apply ice as long as pain or inflammation persists.

Compression

- Hastens healing time by reducing swelling around injury.
- Decreases seeping of fluid into injured area from adjacent tissues.
- Use elasticised bandage, compression sleeve, or cloth.
- Wrap injured part firmly.
- Do not impair blood supply.
- Too tight bandage may cause more swelling.
- Wrap over ice.
- Loosen the bandage if it gets too tight.





Elevation

- Elevate injured part above the level of heart.
- Decreases swelling and pain.
- Use objects and pillows.

Case Study

In sports, injuries are inevitable. Even when athletes are in peak physical form, a single careless step, awkward landing, or violent collision can bend joints and limbs in ways they aren't meant to move. When those serious injuries happen to athletes, it makes the return tougher. Read about these two athletes who suffered injuries and made amazing comebacks.

Saina Nehwal

Saina Nehwal suffered a career-threatening knee injury ahead of the Rio Olympics and had to undergo a surgery in August 2016, but she fought back to recover and play on the International circuit again. She was ranked number one in 2015 when she injured her knee badly during a match. It was a career-threatening injury because badminton players left the game at the age of 26. So, it was very difficult to make comeback but she fought back and recovered from injury and won Malaysia masters and other international tournaments. "I never knew what surgery was but after I went through it I realised how tough returning from it can be. You lose movements, touch and again to get back to your full fitness is extremely tough." In an interview shortly after, she said, "I never knew what surgery was but after I went through it I realised how tough returning from it can be. You lose movements, touch and again to get back to your full fitness is extremely tough. It takes more time than usual, you can't straightaway recover and win. It is not only physical but mental too. Even now there is always this tension and fear that I might pick up an injury again." She added, "My injured knee is far from what it was earlier, but I've understood how to get the most from it."

Ramandeep Singh

Indian hockey team striker Ramandeep Singh said the hunger to wear India colours again kept me motivated and strong while he was battling injury. Ramandeep made a comeback to the national squad after recovering from a career-threatening injury that kept him in the sidelines for nearly a year. He sustained a full thickness condral fracture-injury in the centre of his right knee during India's match against Pakistan at the FIH Men's Champions Trophy in June 2018. "I think what really kept me strong through this entire period was my hunger to wear the India jersey again. I just did not want to give up on this desire and kept working on gaining full match fitness," said Ramadeep. On his selection in the Indian Team he says. "Now that I have been selected, it reinstates my belief and confidence. I am really excited to





play for India again. I have literally counted days for this moment and I will do my best for the team which stood by me during my struggle over the past year.”

- Q. What injuries did the two athletes sustain?
- (a) Injured back
 - (b) Injury to the knee
 - (c) Injured leg
 - (d) Injury to the arm
- Q. What quality did these two athletes display that helped them recover?
- (a) Fear
 - (b) Bravery
 - (c) Determination
 - (d) Patriotism
- Q. What fears did Saina Nehwal have when she started playing again after her injury?
- (a) She may not reach the same level again
 - (b) Her knee may not be what it was earlier
 - (c) It was her age to retire from the game
 - (d) She may injure herself again
- Q. Explain the psychological factors which may have helped Saina Nehwal and Ramandeep Singh to make a comeback.

Art Integration

Knee joints and ligaments are the most affected by a sports injury. The most common tears occur in Anterior Cruciate Ligament (ACL), Posterior Cruciate Ligament (PCL), Medial Collateral Ligament (MCL) and Meniscus. 65-75% cases of twist and bend accidents result in ACL tears, which is the most common. Meniscus usually accompanies an ACL tear with pain in and around the knee.

Make a 3D model of the knee showing any ONE of the injuries that may occur on the field.

I. Tick the correct answers.

1. First Aid is the
- (a) completing secondary survey
 - (b) first help given to the casualty
 - (c) accessing a victim's vital sign
 - (d) electrolyte imbalance





2. Dressing and band ages are used to
 - (a) increase the victim's pain.
 - (b) increases internal bleeding.
 - (c) help control bleeding and prevent infection.
 - (d) Stitch up a deep wound
3. What is the best way to stop external blood loss?
 - (a) apply direct pressure over the wound
 - (b) take the patient to hospital
 - (c) wash the wound with water.
 - (d) apply cream on wound
4. A burn should be immersed or placed under cold water for at least?
 - (a) 5 min
 - (b) 10 min
 - (c) 15 min
 - (d) 20 min
5. The key guiding aims and objectives of first aid are,
 - (a) present, promote injury, preserve water
 - (b) present further injury, promote recovery, preserve life
 - (c) preserve recovery, preserve minerals, preserve environment
 - (d) pull ups, push-ups, power lifting
6. What is R.I.C.E. treatment?
 - (a) Rest, Ice, Crutches, Elevation
 - (b) Rest, Ice, Compression, Elevation
 - (c) Rest, Ibuprofen, Crutches, Exercise
 - (d) Recovery, Ice, Compression, Exercise

II. Answer the following questions briefly.

1. Define muscular strength and Speed.
2. Name the physiological factors determining the component of physical fitness.
3. Write down the aims and objectives of first aid.





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UNIT-8: BIOMECHANICS AND SPORTS

Content

- Meaning and Importance of Biomechanics in Sports
- Types of Movements (Flexion, Extension, Abduction and Adduction)
- Newton's Laws of Motion and Its application in Sports
- Friction and Sports

Learning Outcomes

At the end of this unit students will be able to:

- recognize the concept of sports biomechanics
- know the importance of biomechanics in sports
- classify the various types of movements (such as flexion, extension, abduction and adduction) as well as know the forces involved in it
- define Newton's laws of Motion and identify their applicability in sports
- define friction and its usage in sports

Discussion

Look at the pictures of the various techniques of high jump carefully. and then read the paragraph given below.



Now, discuss in your group

- What are the techniques used in high jump?
- Why do different players adopt a specific technique?
- What do you know about the Fosbury flop? Why is it so called?
- What is the best high jump technique?
- Which biomechanical principle is applied in high jump?

Study of biomechanics provides you with some insights to answer these and other questions you may have about human movement.





8.1.1 Meaning of Biomechanics

It was realized after 1950 that the mechanical principles involving on the human body is entirely different from other things. So, during the early 1970s the international community adopted the terms Biomechanics to describe the application of mechanical principles in the study of living organisms.

Biomechanics is the combination of two words- **bio** and **mechanics**. *Bio* means, **something pertaining to living beings or life**, whereas *Mechanics* is the **branch of physics which studies movement or motion of an object or body with the help of mechanical principles**. Thus, when the study of mechanics is limited to living structures and their function, especially the human body, it is called biomechanics.

Within “mechanics” there are two sub-fields of study. One is **statics** which is the study of systems that are in a state of constant motion either at rest (with no motion) or moving with a constant velocity; and the second one is **dynamics**, which is the study of systems in motion in which acceleration is present, which may involve **kinematics** and **kinetics**.

Kinematics is the study of the motion of bodies with respect to time, displacement, velocity, and speed of movement either in a straight line or in a rotary direction. Whereas, **Kinetics** is the study of the forces associated with motion, including forces causing motion and forces resulting from motion.

8.1.2 Meaning of Sports Biomechanics

Sports biomechanics is a quantitative based study and analysis of professional athletes/sportspersons and sports activities in general. In simple terms, it may be described as the physics of sports. In this subfield of biomechanics, the laws of mechanics are applied to sporting events through mathematical modelling, computer simulation and measurement in order to gain a greater understanding of athletic or sporting performance.

Mechanics is a branch of physics that is concerned with the description of motion/movement and how forces create motion/movement. Biomechanics in sport incorporates detailed analysis of sport movements in order to minimise the risk of injury and improve sports performance. Sport as well as exercise biomechanics encompasses the area of science concerned with the analysis of the mechanics of human movement. It refers to the description, detailed analysis and assessment of human movement during sport activities.

In other words, sport biomechanics is the science of explaining how and why the human body moves in the way that it does. In sport and exercise that definition is often extended to also consider the interaction between the performer and her/his equipment and environment.





Do you know?

- A mathematical model is a description of a system using mathematical concepts and language. The process of developing a mathematical model is termed mathematical modelling. Mathematical models are used in the natural sciences (such as physics, biology, earth science, chemistry) and engineering disciplines (such as computer science, electrical engineering), as well as in the social sciences (such as economics, psychology, sociology, political science).
- Computer simulation is the reproduction of the behaviour of a system using a computer to simulate the outcomes of a mathematical model associated with said system. Since they allow to check the reliability of chosen mathematical models, computer simulations have become a useful tool for the mathematical modelling of many natural systems in physics (computational physics), astrophysics, climatology, chemistry, biology and manufacturing, as well as human systems in economics, psychology, social science, health care and engineering. Simulation of a system is represented as the running of the system's model. It can be used to explore and gain new insights into new technology and to estimate the performance of systems too complex for analytical solutions.

8.1.3 Definitions of Sports Biomechanics

“The area of study between wherein knowledge and methods of mechanics are applied to the structure and function of the living human system.”¹

“The area of study where the knowledge and methods of mechanics are applied to the structure and function of the living human system.”²

“Biomechanics is the science concerned with the internal and external forces acting on a human body and the effects produced by these forces”.³

8.1.4 Importance of Biomechanics in Sports

Sports biomechanics is limited to the study those individuals who are involved in exercise or sports or any physical activity. Sports biomechanics can be defined as the study of forces and their effect on individuals while he/she is exercising or taking part in any sporting activity. The following are some of the areas where biomechanics is applied, to either support the performance of athletes or solve issues in sport or exercise.

- Performance Enhancement,
- Technique Improvement,
- Equipment Improvement,





- Training Improvement, and
- Injury prevention and rehabilitation.

Performance Enhancement: The ultimate goal of sports biomechanics is improvement of sports performance or improvement in the benefits of exercising. Understanding biomechanics and applying the mechanical principles helps improve an individual's technique and enhance performance by utilising the equipment he/she uses more effectively and by modifying the specific training method. By studying how the human body moves, we can remove stress and pressure on the bones, joints, muscles and ligaments. This results in improved athletic performance.

Helps in Improvement of Technique: A sportsperson's performance can be improved by improving her/his technique. The application of biomechanical principles can be applied to improve technique in two ways. First, the coaches may use their knowledge of biomechanics to rectify the errors made by the sportsperson in order to improve the execution of a skill. Second, the sportsperson may discover a new and more effective technique for executing a sports skill.

Do you Know

Researchers have recently also developed a new swimming suit which helped swimmers at the Sydney Olympics in 2000 better several world records because it has a favourable influence on the draft force and buoyancy of water that is acting against swimmers. This swimming suit had such an influence on sport performance in swimming, in fact, that its use was later banned.

Improvement of Equipment: How else can biomechanics contribute to performance improvement? What about improved designs for the equipment used in various sports? Shoes and apparel (sports cloth) constitute the equipment used in almost every sport. The equipment worn may have an effect on the performance, either directly or through injury prevention. Besides shoes and apparel, many sports require the use of some sort of tools.

Think of sports in which an implement is used in your institution. How have changes in sports implements changed performances in these sports? What about bicycling, swimming, tennis, golf, hockey, high jump, javelin throw, soccer, basketball, etc. Lighter and better-designed implements have not only contributed to improved performances by elite athletes in these sports, they have contributed to improved performances by recreational participants as well.

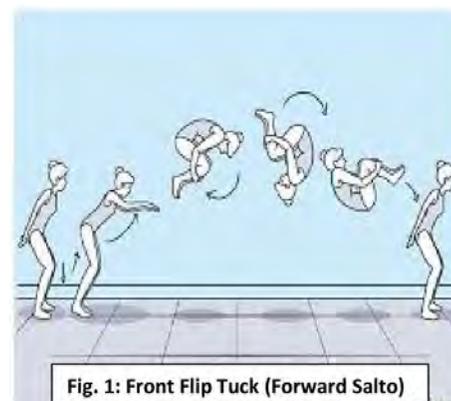


Fig. 1: Front Flip Tuck (Forward Salto)





Improvement in Training: Biomechanics helps improve a sportsperson's performance by offering customised modifications in training to suit an individual's capacity and skills. This can occur in several ways. An analysis of the deficiencies of an athlete's technique can assist the coach in identifying the type of training the athlete requires to improve performance. The athlete's performance, for example, may be limited by the strength or endurance of certain muscle groups, by speed of movement, or by one specific aspect of his/her technique. For example, if a gymnast has difficulty in turning a somersault, the coach could recommend she/he (a) jumps higher, (b) flings arms with more energy before taking off, or (c) curls up more tightly in order to execute the somersault correctly. All these recommendations are based on the principles of biomechanics. Sport events that saw substantial changes in technique in the past include javelin, high jump, and cross-country skiing.

Injury Prevention and Rehabilitation: Injuries are fairly common on the sports field. However, a good knowledge of biomechanics helps in preventing injury in various ways. For example, analysis of the runner's style of running, her/his arm swing, foot strike, even trunk leaning will determine the cause of injury. In fact, just as biomechanics is useful in identifying what forces may have caused an injury, it also helps determine how to prevent the injury from reoccurring. It also helps in the process of rehabilitation of injuries, and helping determine the exercises that may help in the process of rehabilitation of injury. Biomechanics is used to provide the basis for changes in techniques, equipment and training to prevent injuries.

Facilitates in Understanding of Human Body: Biomechanics helps in understanding the complete human body. Knowledge of biomechanics provides the teachers and learners with a better understanding of the human body and various internal and external forces that affect movement. Teachers and Coaches come to know about the various systems such as nervous system, muscular system, skeletal system etc., and their mutual interactions. This knowledge in turn enables them to be better teachers/instructors of many physical activities and skills encompassed within physical education.

I. Tick the correct options.

1. The term 'biomechanics' to describe the application of mechanical principles in the study of living organism was adopted in
 - (a) **early 1970s**
 - (b) late 1970s
 - (c) 1970
 - (d) early 1980s
2. The field where the study of forces is in focus is known as
 - (a) dynamics





- (b) kinematics
 - (c) statics
 - (d) **kinetics**
3. Sports biomechanics can be described as-
- (a) mechanics of sports
 - (b) kinesiology
 - (c) **physics of sports**
 - (d) sports dynamics

II. Answer the following questions briefly.

1. Define biomechanics.
2. What do you understand by the concept of sports biomechanics? Write in your own words.

III. Answer the following questions in 150-200 words.

1. List the importance of sports biomechanics.
2. Differentiate between biomechanics and sports biomechanics.

Extension Activity

Discuss with your group

- What is biomechanics and sports biomechanics?
- How can study of sports biomechanics help a coach to train their trainee in a better scientific manner?

Design a poster to show the importance of sports biomechanics for an athlete.

8.2.1 Movement

Body movement is something that gets polished as we grow in age. In our childhood, we tend to start with basic movements such as rolling, crawling and eventually walking. But have you ever actually decoded, how this happens? What are all body parts involved? In this section, you will learn the exact meaning of movement and its various versions experienced in human beings.

Movement is one of the things that differentiates a living thing from a non-living thing. Movement refers to a change in the position of an object. In the human body, it takes place when the living organism moves a body part or a combination of parts to bring about a change in the position. We use the term locomotion to describe the movement which results in the change of position of the whole organism. It is important to understand the





difference between the two – movement and locomotion – in relation to living things. Movement is the displacement of a body or its parts from their original position to a new position. Locomotion is when the movement of a part of the body leads to change in the position and location of the organism. Both of these are brought about by the joint efforts of the skeletal and muscular systems. Movement is seen in both vertebrates and invertebrates.

There are a variety of movements which happen in the human body, eg., the movement of eyelids, heart muscles, jaw and teeth. In addition, movement could also refer to movement of arms and legs, as well as head and neck. Interestingly, movement of some organs occur because of the collaboration of muscles and bones. In these cases, it happens along a point at which two or more bones form a joint.

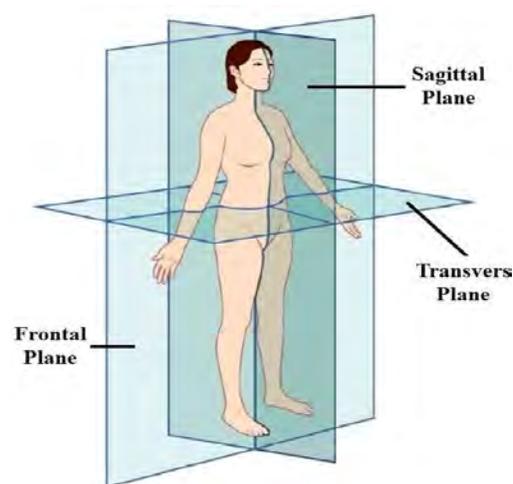
Human movements are described in three dimensions based on a series of planes and axis.

Plane

A plane is an imaginary surface through movement takes place. There are three planes of motion that pass through the human body.

- Sagittal plane
- Frontal plane
- Transverse (horizontal) plane

Sagittal Plane: The sagittal plane is an imaginary vertical surface which divides the body into right and left parts or sections. Flexion and extension types of movement occur in this plane, eg., kicking a football, chest pass in netball/basketball, walking, jumping, squatting.



Frontal Plane: The frontal plane is also an imaginary vertical surface which divides the body into front (anterior) and back (posterior) parts or sections. Frontal plane is also known as Coronal plane. Abduction and adduction movements occur in this plane, eg., jumping jack exercises, raising and lowering arms and legs sideways, cartwheel.





Transverse Plane: The transverse plane is an imaginary horizontal surface which divides the body into upper (superior) and lower (inferior) parts or sections. Rotation types of movement occur in this plane, eg., hip rotation in a golf swing, twisting in a discus throw, pivoting in netball/basketball, spinning in skating.

Axis

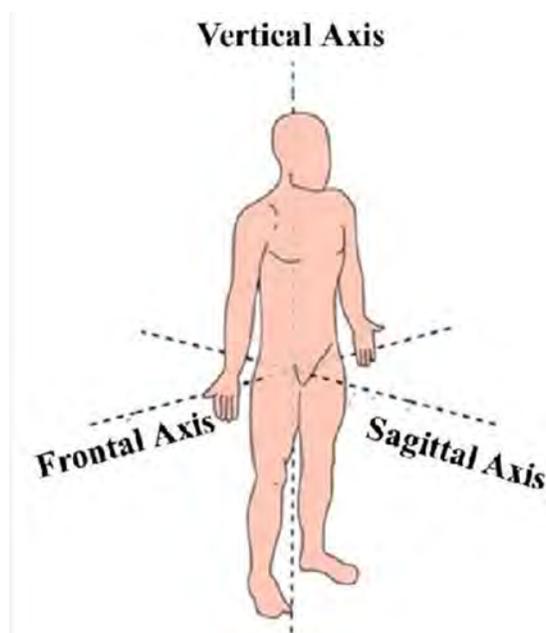
An axis is an imaginary straight line around which an object/parts of human body rotates. Movement at a joint takes place in a plane about an axis. There are three axes of rotation.

- Sagittal axis
- Frontal axis
- Vertical axis

Sagittal Axis: The sagittal axis also known as anteroposterior axis or dorsoventral axis. It is an imaginary line which passes horizontally from back (posterior) to front (anterior) through the centre of the body. It is formed by the intersection of the sagittal and transverse planes. eg., when a person performs a cartwheel they are rotating about the sagittal axis.

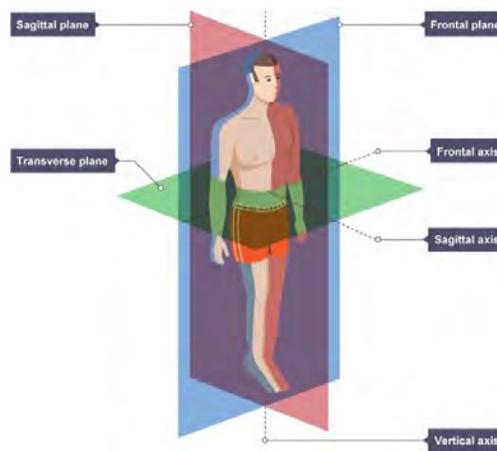
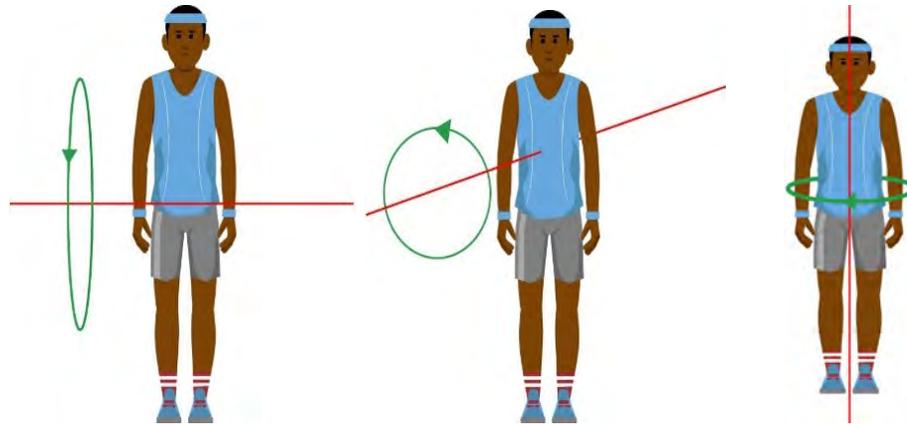
Frontal Axis: It is also known as Horizontal axis or Left-right axis. The frontal axis is an imaginary line which passes horizontally from left to right through the centre of the body. It is formed by the intersection of the frontal and transverse planes. eg., when a person performs a somersault they rotate around this axis.

Vertical Axis: The vertical axis is also known as Longitudinal axis or Craniocaudal axis. This axis is an imaginary line which passes vertically from bottom (inferior) to top (superior) through the centre of the body. It is formed by the intersection of the sagittal and frontal planes. eg., when a skater performs a spin they are rotating around the vertical axis.



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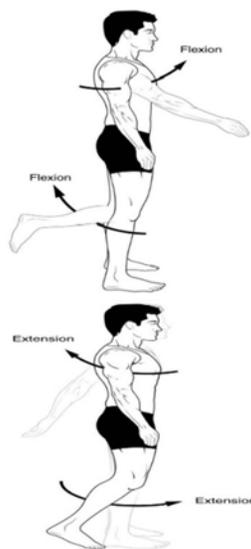




8.2.2 Types of Movement

Flexion and Extension

Flexion and extension are the movements which occur in the sagittal plane. They refer to increasing and decreasing the angle between two body parts.





8.2.3 Flexion

Flexion refers to a movement that decreases the angle between two body parts. Flexion at the elbow is decreasing the angle between the ulna and the humerus. When the knee flexes, the ankle moves closer to the buttock, and the angle between the femur and tibia decreases.

8.2.4 Extension

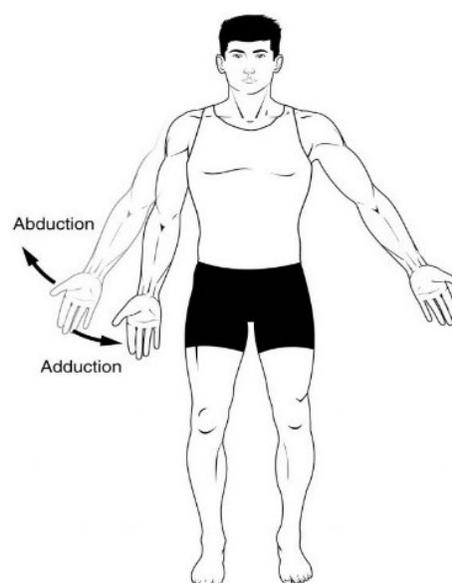
Extension refers to a movement that increases the angle between two body parts. Extension at the elbow increases the angle between the ulna and the humerus. Extension of the knee straightens the lower limb.

Abduction and Adduction

8.2.5 Abduction

Abduction and adduction are two terms that are used to describe movements towards or away from the midline of the body.

Abduction is a movement away from the midline - just as abducting someone is to take them away. For example, abduction of the shoulder raises the arms out to the sides of the body.



8.2.6 Adduction

Adduction is a movement towards the midline. Adduction of the hip squeezes the legs together.





Do you know?

All body movements occur in different planes and around different axes. A **plane** is an imaginary flat surface running through the body. An **axis** is an imaginary line at right angles to the plane, about which the body rotates or spins.

Extension Activity

Perform front-roll, back-roll, and cartwheel. Write on which plane and axis these movements took place.

Name of the Activity	Plane	Axis
Front-roll		
Back-roll		
Cartwheel		

I. Tick the correct options.

- The term flexion refers to
 - bending**
 - turning
 - twisting
 - straightening
- Extension is
 - bending
 - turning
 - twisting
 - straightening**
- Moving away from the reference axis is known as
 - flexion
 - extension
 - abduction**
 - adduction
- Bringing closer to the reference axis is called
 - flexion
 - extension





- (c) abduction
 - (d) **adduction**
5. The plane which divides the body into a left and a right is called
- (a) coronal plane
 - (b) **sagittal plane**
 - (c) vertical plane
 - (d) transvers plane

II. Answer the following questions briefly.

1. What is plane of movement?
2. Which plane and axis is involved while we kick a football.
3. Differentiate between flexion and extension.

III. Answer the following questions in 150-200 words.

1. Differentiate between abduction and adduction.
2. How does knowledge of movement and its type contribute for graceful movement?

8.3.1 Newton's Laws of Motion

Sir Isaac Newton (1642-1727) was one of the greatest scientists and mathematicians that ever lived.



Newton came up with three general rules about the movement of objects, which are now known as Newton's Three Laws of Motion.

8.3.2 Newton's First Law of Motion: Law of Inertia

The Newton's First Law of motion is known as Law of Inertia. *Inertia* is a Latin word used for idleness or laziness. The Law of Inertia can be interpreted as everything in the universe is lazy, thus requiring a force to get it on the move (which then occurs in a straight line). Once moving, more force is needed to slow it, stop it, or to speed it up or to change direction.

So, you can say that the Law of Inertia states a body likes to preserve in its state of being at rest or of moving forward in a straight line except insofar as it is compelled to change its state by applied force. In simple words you can say '**an object will stay at rest or continue at a constant velocity unless acted upon by an external unbalanced force**'. For example, the golf ball remains at rest until it is struck by a golf club.

This is often paraphrased as "zero net force implies zero acceleration", but this is an oversimplification. The key point here is that if there is no net force acting on an object then the





object will maintain a constant velocity. If that velocity is zero, the object remains at rest. If an external force is applied, the velocity will change because of the force.

In brief, the Law of Inertia essentially makes two important points: (a) An object that is not moving will not move until a net force acts upon it; and (b) An object that is in motion will not change its velocity (acceleration) until a net force acts upon it. In football, for example, at the time of kick-off, the ball shall roll forward unless kicked by the player, or, in golf the ball is not moved unless hit. Similarly, the moving football shall not change its velocity unless a player or another object acts upon it.

Inertia is the body's resistance to change in movement. It is proportional to mass, thus the mass of an object is the measure of its inertia. Therefore, mass is the quantity of resistance to change. It should not be confused with weight. The weight of a person (or an object) is the measure of force with which the earth pulls on the body's mass. This downward gravitational force is the body's weight directed towards the earth's centre. Understandably so, a body's mass and weight are directly proportional. The more mass a body has, the greater the earth's attraction on it, the more it will weigh. Weight is a force; whereas, mass is not. It has no direction. Mass is the resistance to change (i.e., inertia).

Principles related to the Law of Inertia

Combining Translator and Rotary Motion: The combined motions, if performed correctly with proper timing and sequence, will produce maximum final velocity of 'an object' in the desired direction of release (eg., discuss toss, bike riding, car, wheelchair etc.).

- **Continuity of Motion:** The accomplishment of the first motion represents the overcoming of a certain amount of inertia and, therefore, any hesitation prior to the next motion will result in loss of some or all of the advantage gained by the previous motion (eg., backward roll, pole vaulting). Interruption of motion costs energy.
- **Effects of Momentum:** More momentum can be produced with a longer implement in that the end will move faster than a shorter implement (eg., don't choke up on a tennis racket or baseball bat).
- **Transfer of Momentum:** Momentum develop in a body segment may be transferred to the total body, but only while the body is in contact with the supporting surface (eg., earth, diving board).

8.3.3 Newton's Second Law of Motion: Law of Acceleration or Law of Resultant Force

The second law states that, the rate of change of momentum of a body is proportional to the resultant force acting on the body and is in the same direction. This explains how the





velocity of an object changes when it is acted upon by an external force. The law defines a force to be equal to change in momentum (mass times velocity) per change in time.

Acceleration is produced when a force acts on a mass. The greater the mass (of the object being accelerated), the greater the amount of force needed (to accelerate the object). In simple words you can say the acceleration of an object is directly proportional to the force exerted upon it, takes place in the direction of applied force, and is inversely proportional to the mass of the body.

When a body is acted upon by a force, its resulting acceleration is proportional to the force and inversely proportional to the mass. Hence, with a constant mass, the greater the force, the greater the acceleration. And, with a constant force applied, the greater the mass, the less the acceleration. Another way of saying the same thing is: "The velocity of a moving object will remain constant unless a force acts on it."

What does this Second Law mean?

Everyone knows that heavier objects require more force to move the same distance as lighter objects.

However, the Second Law gives us an exact relationship between force, mass, and acceleration.

Do you know?

A Newton (N) is the international unit of measure for force. One newton is equal to 1 kilogram meter per second squared.

$$1 \text{ N} = 1 \text{ kg } \frac{\text{m}}{\text{s}^2}$$

It can be expressed as a mathematical equation:

$$F = MA$$

or

$$\text{FORCE} = \text{MASS times ACCELERATION}$$

Important Principles Related with the Law of Acceleration

Acceleration is propositional to the force causing it: A sprinter can increase acceleration by increasing the force that he/she applies backward and downward against the surface on which he/she is running and, if he/she should double the force, then acceleration would double and, similarly, if he/she should keep the force constant and reduce mass, he/she would increase acceleration.

Maximum acceleration and efficiency of motion: To achieve maximum acceleration, all available forces should be applied sequentially with proper timing and as directly as possible in the intended line of motion.





Effects of body's radius on angular velocity: The rate of rotation is increased as the radius of rotation is decreased (For example, tuck head and bend knees; a shorter person will have higher rate of rotation).

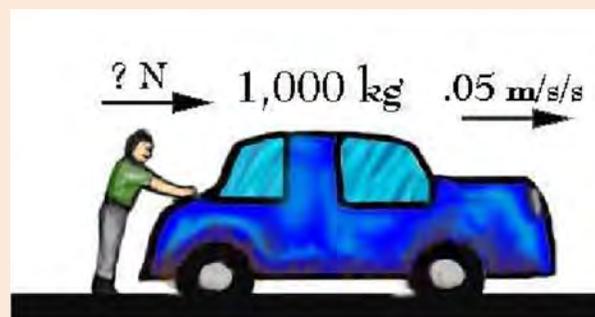
Conservation of momentum in swinging movements: To build or to conserve momentum in any swinging movement, the radius of rotation should be shortened on the upswing and lengthened on the downswing.

Movements while unsupported: When the body is unsupported, movements may occur to aid in controlling balance, but the flight path (trajectory angle) will be unaffected by the movements.

Twisting movements: These are based on the transfer of momentum from part to whole, when in contact with a surface (have to initiate the twist in some way at take-off).

Extension Activity

Anmol's car, which weighs 1,000 kg, is out of fuel. Anmol is trying to push the car to a fuel station, and he makes the car go 0.05 m/s/s. Using Newton's Second Law, compute how much force Anmol is applying to the car.



8.3.4 Newton's Third Law of Motion: Law of Reaction or Law of Reciprocal Action Force

Commonly paraphrased as; "For every force (action) there is an equal, but opposite, force (action)", the Third law of motion states: All forces occur in pairs, and these two forces are equal in magnitude and opposite in direction.

A more direct and detailed description of the law may be that the mutual actions of two bodies upon each other are always equal, and directed to contrary parts. Whatever draws or presses another object is as much drawn or pressed by that other. If you press a stone with your finger, the finger is also pressed by the stone. If a horse draws a stone tied to a rope, the horse will be equally drawn back towards the stone: for the distended rope, by the same endeavour to relax or unbend itself, will draw the horse as much towards the stone, as it does the stone towards the horse, and will obstruct the progress of the one as much as it





advances that of the other. If a body impinges upon another body, and by its force changes the motion of the other, that body also (because of the equality of the mutual presser) will undergo an equal change, in its own motion, towards the contrary part. The changes made by these actions are equal, not in the velocities but in the motions of the bodies; that is to say, if the bodies are not hindered by any other impediments. For, as the motions are equally changed, the changes of the velocities made toward contrary parts are reciprocally proportional to the bodies.

What is meant here is that all forces are interactions - that there is no such thing as a unidirectional force. If body A exerts a force on body B, simultaneously, body B exerts the same force on body A.

That means for every action there is an equal and opposite reaction. Whenever one body exerts a force on another body, the second body always exerts a force on the first body which is equal in magnitude, opposite in direction and has the same line of action.

Principles Related to the Law of Counter Force

Surface variation and the amount of counterforce: The counterforce is equal to the applied force when a stable surface is used. The less stable the surface, the less will be the counterforce. Examples include: (a) decreased friction on ice (fast skating); (b) increased friction running in the sand; and (c) quality of a trampoline bed (ie., new vs. old, as in sagging). **Direction of the counterforce:** The direction of the counterforce is directly opposite that of the applied force. The counterforce is most effective when it is perpendicular to the supporting surface. If not perpendicular, the force is separated into two components, vertical and horizontal. Hence, it is important to consider the trajectory angle.

Counterforce in striking activities: The amount of force a striking implement imparts to an object depends upon the combined momentum of the implement and the object at the moment of impact (ie., how is the force dissipated). Also, it depends on the mass of the object and the implement. Examples include baseball bat hitting a baseball or a tennis racket hitting a tennis ball.

Temporarily stored counterforce: If a surface or implement used in a performance has elasticity, then an applied force produces bend or compression that represents stored force, and the stored force increases the propulsive force over what it would be if elasticity were not present. Examples include pole vaulting (eg., fiberglass poles bend more and store more energy than aluminium poles) and diving boards (the aluminium board vs. the wooden board). **Surface contact while applying forces to external objects:** In throwing, pushing, pulling, and striking activities, one or both feet should be kept in firm contact with the supporting surface until the force providing motion is complete, otherwise the maximum force is decreased.





8.3.5 Application of Newton's Law of Motion in Sports

Newton's Laws of Motion form the basis for principles used in sport movements. Methods of training that depart from these laws would not make sense mechanically. Tips for efficient sport performances are built around these laws and principles.

First, it helps to know that there are two basic types of motion. These come into play in combination when applying mechanical principles to sport skills:

1. **Linear motion** occurs when an object or person travels in a straight line, as when sledding across a level surface.
2. **Angular motion** occurs when an object or person turns about a centre point, axis, or fulcrum and does not travel from place to place. It is common in diving and gymnastic skills when athletes rotate, twist, or spin.

I. Tick the correct options

1. According to Newton's Second Law of Motion, the greater the movement of an object, the
 - (a) longer distance will it travel
 - (b) stronger will it resist the external forces
 - (c) speedier it will cover the given distance
 - (d) **more stable will it remain in its motion.**
2. Newton's First Law of Motion is known as the
 - (a) Law of Reaction
 - (b) **Law of Inertia**
 - (c) Law of Effect
 - (d) Law of Momentum
3. Newton's Second Law of Motion is also known as
 - (a) Law of Reaction
 - (b) Law of Inertia
 - (c) **Resultant Force**
 - (d) Law of Effect
4. Acceleration due to an external force acting on a moving object is technically defined as change in that object's
 - (a) location
 - (b) direction





- (c) **velocity**
- (d) movement

II. Answer the following questions briefly.

1. List Newton's Laws of Motion.
2. Elucidate Newton's Law of Inertia.
3. What is linear motion?

III. Answer the following questions in 150-200 words.

1. With the help of suitable examples, discuss the application of Newton's Laws of Motion in sports.
2. How can Newton's second law and third law of motion be applied in sports?

8.4.1 Friction

Friction may be defined as

1. Force acting over the area of contact between two surfaces in the direction opposite that of motion or motion tendency. ⁴
2. Force that resists the sliding or rolling of one solid object over another. ⁵

Friction is a force that acts parallel to the two surfaces. or in other words, it is a force that resists the movement. Friction works in opposite direction of the moving object resulting in slowing down that moving object. Friction is dependent upon properties of the two surfaces. Rough surface produces more friction and smooth surface produces less friction. Friction also produces heat. For example, if you rub your hands against each other you can feel the heat that is generated. Friction helps to prevent falling while walking and running. If you wear shoes that are new or those that have a good grip you will experience more stability, than shoes that are old and have a poor grip. Similarly, if the surface is wet or slippery, you will find it difficult to stabilize your body.

8.4.2 Friction in Sports

In sports, friction in human movement varies widely depending on different sports because each sport has its own movements and surface of the playing field. For example, in Athletics (running), the surface is a track and the movement is linear or curvy linear. Here, the sports person has to wear shoes with spikes. However, in other events in Athletics like discus throw and shot put, the surface is hard and movement is rotatory so the shoes are relatively flat. In football, where surface is grassy and the players need greater stability to control the ball and make quick movements, they wear studs or football boots to increase friction. In hockey, badminton, tennis grip taps are used by the player to increase friction. In shot put,





javelin throw, gymnastics magnesium powder is used to increase friction. Thus to adjust friction, the two surfaces should be compatible with each other, to provide desired movement in sports.

8.4.3 Types of Friction

In the field of sports, we will study following types of friction.

1. **Static friction:** Static friction is friction that exists before an object starts to slide. For example, When you hit a cricket ball with a bat, or a tennis ball with racket, or in rock climbing where hand and feet are static.
2. **Kinetic or Sliding friction:** Kinetic friction is friction that is created when the object starts to slide. For example, when an ice skater is skating, or friction produced while rubbing hands.
3. **Rolling friction:** Rolling friction is friction when an object rolls on the surface. For example, a ball bearing, any ball rolling on the ground.
4. **Fluid Friction (Air and Water resistance):** Fluid friction is friction when the movement of an object or a person is hindered or meets resistance from water or air. For example, swimming, diving, sky diving, discuss and javelin floating in air, high jump etc

Do you know?

Recently one more friction type has been recognised which is known as Limiting Friction. Limiting friction is the force that comes into play when one body is just on the verge of moving over the surface of another body.

8.4.4 Co-Efficient of Friction

Friction is determined by the coefficient of friction. It is a ratio of force of friction between bodies or force required to start movement and the force pressing the two bodies together. It is symbolized by μ . Range of COF is ranging near to 0 from 1 but sometimes it can be greater than 1 due to a stronger frictional force. When force is applied to an object, the resistive force of friction acts in the opposite direction, parallel to the surfaces. The standard friction equation for determining the resistive force of friction when trying to slide two solid objects together is written as $F_r = \mu N$, where F_r is the resistive force of friction and N is the perpendicular force pushing the two objects together (both in units of force, pounds or newtons), and μ is the coefficient of friction for the two surfaces. The coefficient of friction varies for each situation, and is related to the two specific surfaces that are in contact with each other.





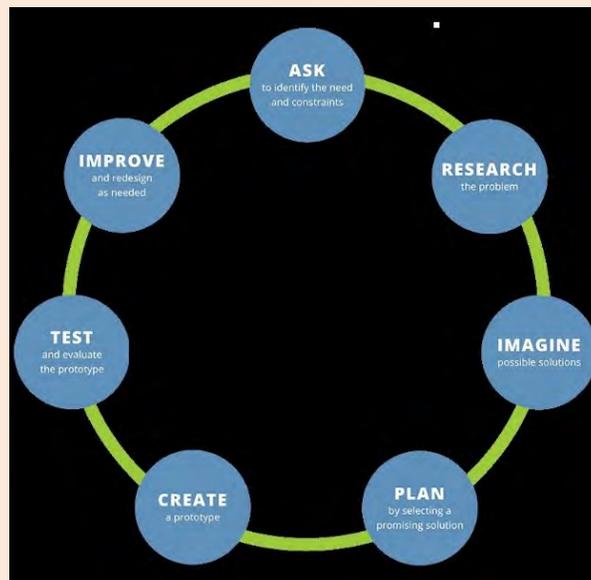
Extension Activity

Draw images of five sports where you find usage of Friction most prominent.

Art Integration

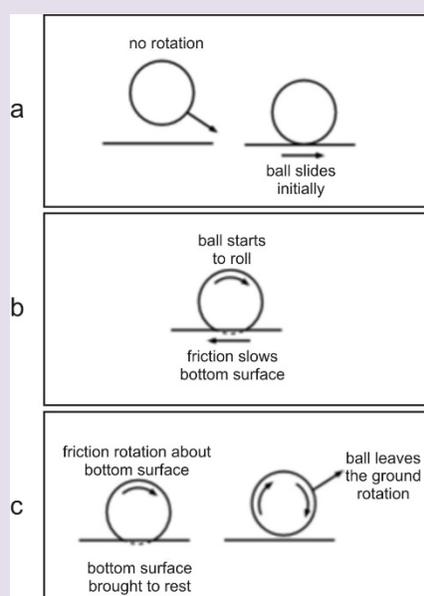
Keeping in mind the biomechanics of sports, design sports apparel – dress, footwear etc. – for your favourite sport. You must justify the changes in design by listing the benefits of your apparel.

You could follow the steps given below.



Case Study

Study the picture given below.





Based on your study above, and your own knowledge, answer the following questions.

- Q1. Which of the following Laws of Motion to initiate the rotation of the ball is depicted in illustration (a)?
- (a) Law of Acceleration
 - (b) Law of Inertia
 - (c) Law of action and reaction
- Q2. In illustration (b), which force is acting upon the ball to slow it down?
- (a) Gravity
 - (b) Buoyancy
 - (c) Friction
- Q3. Which force will determine the quality of bounce?
- (a) Law of Acceleration
 - (b) Law of Inertia
 - (c) Law of action and reaction
- Q4. In what ways will the Laws of Motion help you if you are a Football player, Batsman, Bowler and Badminton Player

I. Tick the correct option.

1. The Friction force acts in a/an _____ direction to the direction of motion of an object.
- (a) **opposite**
 - (b) same
 - (c) downwards
 - (d) diagonal
2. Among the following sports, in which friction plays the least important role?
- (a) Car Race
 - (b) Football
 - (c) Hockey
 - (d) **Ice Skating**
3. Friction is a -
- (a) Magnetic Force
 - (b) Non-contact Force
 - (c) **Contact Force**
 - (d) Couple Force





4. The measurement of the amount of friction a surface will generate is called the ___ of friction.
- (a) Calibration
 - (b) **Coefficient**
 - (c) Smoothness
 - (d) Description

II. Answer the following questions briefly.

1. Define Friction.
2. What is Air Resistance?
3. What is Limiting Friction?

III. Answer the following questions in 150-200 words.

1. Discuss various types of friction.
2. Is friction advantageous or disadvantageous in games and sports?
3. Suggest the methods of reducing friction.

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UNIT-IX: PSYCHOLOGY AND SPORTS

Contents

- Personality; its definition and types – Trait and Types (Sheldon and Jung Classification) and Big Five Theory
- Motivation, its type and techniques
- Exercise Adherence; Reasons to Exercise, Benefits of Exercise
- Strategies for Enhancing Adherence to Exercise
- Meaning, Concept and Types of Aggressions in Sports

Learning Outcomes

At the end of the unit, students will be able to:

- classify different types of personality and its relationship with sport performance.
- recognise concept of motivation and identify various types of motivation.
- illustrate various strategies of motivation used in sports.
- various reasons to exercise and its associated benefits.
- identify strategies for promoting exercise adherence.
- differentiate types of aggression in sports

Discussion

Read an excerpt from a leading newspaper regarding news for requirement of sports psychology in Indian Sports.

BCCI for hiring psychologists to arrest stress

TNN | Mar 11 NEW DELHI: The Indian Cricket Board has discussed plans to ask its state units to hire good sports psychologists who can help young players handle pressure better and ensure lesser drop-outs from the game. With India losing several talented Under-14 and Under-16 level players every year due to family and academics pressures, BCCI also wants to make the hiring of psychologists compulsory at state academies for age group players.

According to a board official, "India is losing a lot of talent at the age-group levels, The stake-holders of the game are all concerned and they want a system in place to tackle this problem. It is common these days to see talented players leaving the game after one or two bad seasons. As you go higher, the talent pool is reduced. "This shouldn't happen," thus the idea of hiring psychologist was discussed. adding that the cricket drop outs should stop at all levels.

<https://timesofindia.indiatimes.com/sports/cricket/news/bcci-for-hiring-psychologists-to-arrest-stress/articleshowprint/57587522.cms> 1/1



**Discuss in your group**

- What causes a person to persist or to give up?
- What is the person thinking and feeling while engaged in the activity?
- What can be the reasons for drop-out of talented athletes from sports?
- How can a Sports Psychologist help young players handle pressure better?
- Can different motivation techniques help athletes towards continued sports participation?

Present your ideas to the class

9.1.1 Personality: Concept and Definitions

Reading the news clipping, did you wonder why a psychologist would be required to prevent athletes from dropping out, even though they have achieved success? Are we able to identify athletes who have the talent or skill to continue with sports participation but still lack the determination to continue in sports? If we were asked to analyse reasons why some sportspeople succeed despite all odds, surely, we will come up with adjectives like determined, persistent, courageous, dynamic, robust, etc. Is there something more which can be added to describe these athletes – eg., consistent or possessing a stable pattern of behaviour? Sports psychologists have tried to answer these by relating them with various theories of personality. Understanding personality has been an area of interest which is as old as our civilization. Even before the present day scientific and systematic research to explain personality developed, philosophers across the globe tried to analyse characteristics which were unique to an individual and why people differed in various ways. However, the concept of personality is still evolving and covers such a large range of phenomenon, that it is very difficult to include all the aspects of personality in one definition.

The word **personality** is derived from the Latin word *persona*, the mask used by actors in the Roman theatre for changing their appearance for performing in-front of their audience according to the given role. The actor performed as per the script or story wearing a particular mask. The audience also expected them to act in a particular manner on seeing the mask. However, it didn't mean that the actors possessed the desired qualities of the character in themselves. Therefore, the concept of personality came to refer to an individual's characteristic way of responding to other individuals and situations. When we observe people around us, we are able to describe their actions and responses to different situations based on the combination of their individual thoughts, characteristics, behaviour, attitude, ideas and habits. We may represent them as shy, happy, courageous, aggressive etc. These characteristics are a representation of different components of personalities. Therefore, we can view personality as the relatively stable and unique characteristics of an individual across different situations and varied period of time.





Thus, Personality is a body of habits, traits, attitudes and ideas of an individual which are organized externally into roles and statuses. They relate internally to motivation, goals and various aspects of selfhood. In fact, personality is a composite total of all that a person is. It is the totality of one's behaviour towards one's own self as well as others and includes everything about the person, his/her physical, emotional, social, mental and spiritual make-up.

In sports also, it is important to understand athletes and their unique and relatively stable characteristics in different situations and conditions. It is essential to know how a particular athlete responds to the situational demands of the training as well as competitions. No two athletes behave in a similar manner; they may behave differently in a common situation. Some athletes may not like to take a command from a coach but may respond positively towards acceptable alternatives like cooperative learning from coaches. Sports psychologist may also be interested to learn which type of people opt for a particular type of sports or exercise program. To understand this, let us overview personality from various approaches and theories propounded by eminent psychologists from across the world. These theories represent various contrasting views and perspectives on the origin and nature of human uniqueness. Each theory may have vast differences but offers wide range of insight that can add towards effective understanding of personality of an individual.

Personality, thus, can be defined as the characteristic set of behaviours, cognitions and emotional patterns that evolve from biological and environmental factors. It is the integration of those systems and habits that represent an individual's characteristic adjustment to his environment. According to Robert A Baron, "Personality is an individual's unique and relatively stable pattern of behaviour, thoughts and feelings." Matt Jarvis (2006) in his book presented a general definition of personality offered by Pewin (1993) "Personality represents those structural and dynamic properties of an individual or individuals as they reflect themselves in characteristic responses to situations". It is the integration of those systems and habits that represent an individual's characteristic adjustment to his environment."

Carl Jung (1933)¹: Personality as an attitude refers to a predisposition to behave in a certain manner.

William Herbert Sheldon (1942)²: offered a topology of personality based on three major morphologies or body types (Endomorph, Ectomorph, Mesomorph), each associated with a different temperament of an individual.

Cattell (1950)³: Personality is "that which permits a prediction of what a person will do in a given situation."

Guildford (1959)⁴: Personality is an 'individual's unique pattern of traits.'

Allport (1961)⁵: Personality is the dynamic organization within the individual of those



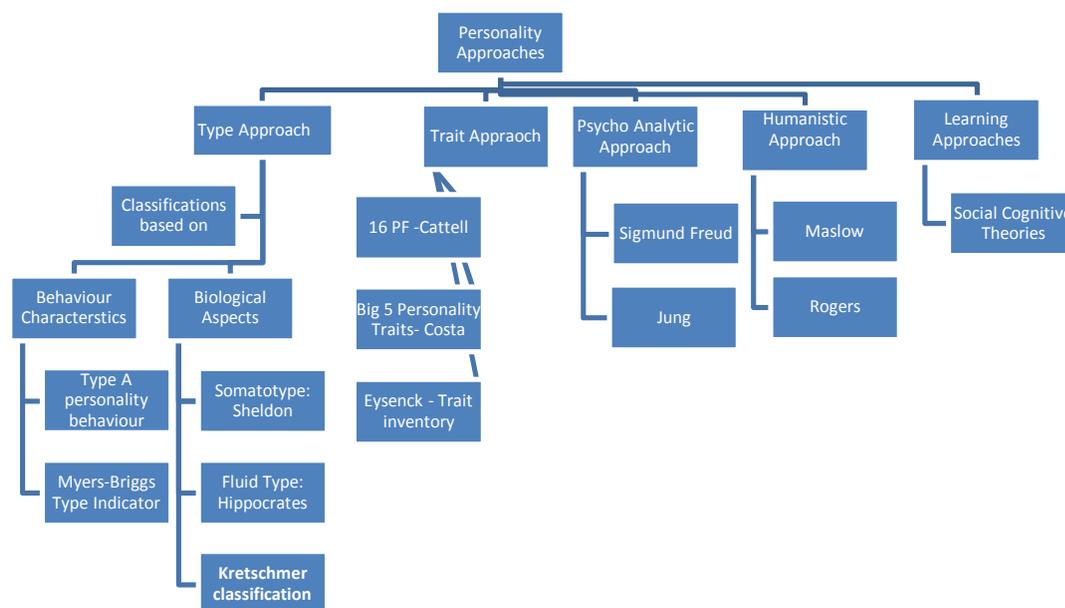


psychological systems that determine his unique adjustment to his environment.

Eysenck (1953)⁶: Personality is defined as more or less stable and enduring organization or a person’s character, temperament, intellect and physique which determine his unique adjustment to the environment.

Robert A Baron (2008)⁷: Personality is defined as individual’s unique and relatively stable pattern of behaviour, thoughts and feelings.

9.1.2 Personality Types



Some of the Personality Types and Traits mentioned here could be used for research as Extension Activities or as Project Work

Over the years, with the progress of research and development of literature in the field of personality by various psychologists, it is essential to understand the various approaches for getting a better perspective and understanding of personality.

Personality type refers to the psychological classification of different types of people. Personality types are distinguished from **personality traits**, which come in different degrees. There are many theories regarding personality types, and each theory contains several and sometimes many sub theories. For example, according to type theories, there are two types of people, introverts and extroverts. According to trait theories, introversion and extroversion are part of a continuous dimension with many people in the middle. The major theories include dispositional (trait) perspective, psychodynamic, humanistic, biological, behaviourist, evolutionary, and social learning perspective. However, many researchers and psychologists do not clearly subscribe to any one particular perspective, but instead take an





heterogeneous approach. There is also a substantial emphasis on the applied field of personality testing. In psychological education and training, the study of the nature of personality and its psychological development is usually reviewed as a prerequisite.

Since no one particular theory or approach covers the complete aspects of personality, the approach for explaining 'personality' includes mainly, the 'Type' approach which consists of classification or comprehending of personality type based on a set of behaviour characteristics with similarities as done by Myers and Briggs type indicator, Friedman and Rosenman Type A personality behaviour etc., as well as on the basis of body type classification by Kretschmar, or somatotype by William Sheldon, and the fluid type classification as explained by Hypocrites.

In the Indian context also, the famous Ayurveda book **Charak Samhita** classifies individuals into three types known as *vat*, *pitta*, *kapha* on the basis of three humoral elements are referred as *tridosha*. Each of these elements are associated with the basic nature of an individual referred to as *prakriti*. The Indian literature also refers to personality typology based on *trigunas* meaning three qualities:

- (a) *Sattva Guna*;
- (b) *Rajas Guna*;
- (c) *Tamas Guna*.

The *Sattva Guna* consists of qualities related to "spirituality". When *Sattva Guna* is dominant, a person has an inherent desire to be good and caring. Cleanliness, truthfulness, discipline, constructive thought and self-control are the motive force of sattvic action. *Rajas Guna* gives rise to passion and desire. Such a person veers towards greed, activity, undertaking of works, restlessness, gratifications, dissatisfactions, and envy. A person who is *Tamasic* possesses characteristics associated with laziness, inactivity, destructive behaviour, arrogance, anger etc.

Trait approach, on the other hand, focusses on specific psychological attributes based on the concept of individuals differing in 'unique' and 'stable' characteristics. Trait refers to a characteristic that is unchanging and predictable. For example, shyness is a trait that is usually stable in an individual's personality. Some traits are innate – the infant possesses a basis for developing the trait at birth, while others are acquired through learning, such as the tendencies toward tidiness or untidiness. Some researchers like Eysenck, Cattell as well as Allport and others support inherent traits as "cardinal" and proposed a theory of personality based on biological factors, arguing that individuals inherit a type of nervous system that affects their ability to learn and adapt to the environment. Sigmund Freud and Neo-Freudians like Jung, who described the structure of personality in three part-id, ego, super ego, put forward the psycho-dynamic theory of personality that assumes there is an interaction between nature (innate instincts) and nurture (parental influences). The





Humanistic approach of Maslow and Carl Rogers focuses more on human experiences and innate capacities for self-directed changes. They are mainly concerned with an individual's innate drive toward self-actualization—a state of fulfilment in which a person is achieving at his or her highest level of capability. The learning approach to personality through social cognitive theory offered by Bandura and various others like Skinner emphasizes the role of learning and human experiences on consistency and uniqueness in behaviour over time and across situations. They also focus on behaviour as a response to change in environment and conditions, and not merely dependent on personality traits.

In modern sports, interaction perspective regarding personality is an extremely popular and widely adopted approach towards understanding of behaviour. It defines behaviour as function of personality and situational factors acting together. According to the interaction theory behaviour in any situation is a function of both personality and external factors. While personality and situation cannot influence the behaviour independently, but their interaction influences a particular behaviour. For example, a player with high hostility trait may not indulge in aggressive behaviour if he or his team is winning with a large margin, or an athlete with composed traits may reflect neurotic tendencies of anxiety if faced with the challenge of scoring the winning run of the last ball of a knockout round match. Similar forcing influence of situation on behaviour can be observed in various sports environment, where the athletes' behaviour is not influenced by their core traits; instead it is determined by the rewards and threats associated with the particular situation.

9.1.3 Trait Theory

Trait, in psychology, refers to the ways in which we generally describe the characteristics of an individual as part of his personality. The descriptive terms such as extrovert, introvert, sincere, honest, loyal, truthful, impulsive, quiet, conservative, hesitant, dominant, apprehensive are examples of personality traits. Trait approach is one of the most vital areas of study in psychology that helps identify a person's personality.

Trait has two main assumptions:-

- (a) every individual has certain unique characteristics or traits which are stable and consistent under various conditions,
- (b) every individual is different due to Her/He unique characteristics or traits.

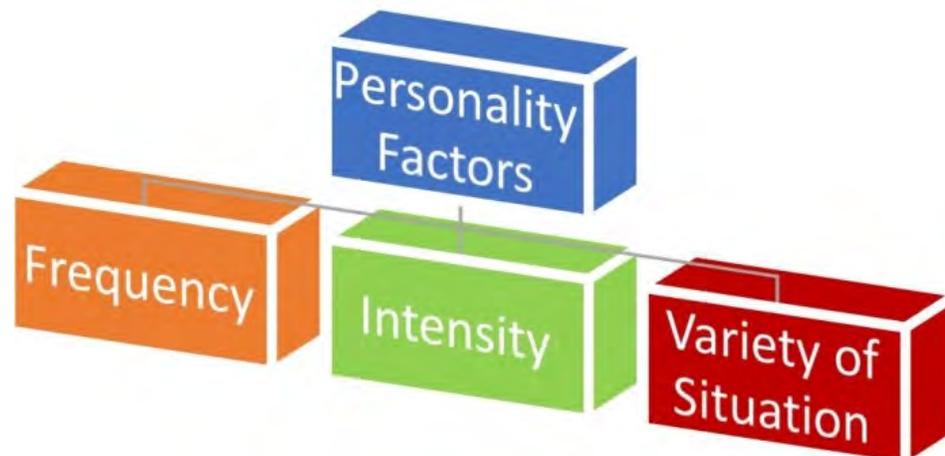
Therefore, trait can be defined as a stable and unique characteristic that causes a person to respond to a given situation in a certain way. Trait theories indicate that the personality of an individual consists of traits which are always constant regardless of the situations. An individual as a whole does not have just a single trait, but a variety of traits form the





personality of an individual. These personality traits are unique and differ from one individual to another.

Assessment of trait can be based on three factors.



- (a) Frequency;
- (b) Intensity and
- (c) Variety of situation.

Frequency refers to repetition of similar behaviour consistently over a period of time, **intensity** refers to reflecting the behaviour at an extreme level, and **variety of situation** refers to repetition of similar behaviour over different situations.

It means, we can describe individual's personality based on trait approach according to the reflection of similar characteristics under variety of conditions to be reflected in their behaviour at an extreme level. For example, if an athlete is sociable, in most situations the athlete will be effectively cooperative and will reflect strong team work inside as well as outside the sporting arena. Thus, trait approach attempts to identify primary characteristics of people. A trait is considered as a relatively enduring attribute or quality on which one individual differs from another. They include a range of possible behaviours that are activated according to the demands of the situation.

Supporting such a theory was Gordon Allport (1936), an initial modern trait theorist who worked towards explaining personality traits. He proposed that individuals possess a number of traits, which are dynamic in nature. They determine behaviour in such a manner that an individual approaches different situation with similar plans. The traits integrate stimuli and responses which otherwise look dissimilar. According to him, personality of an individual can be studied through a distinction between the common traits and the personal disposition. It can be classified into three categories.





1. **Cardinal Traits** – which dominate behaviour of a person; may be developed later in life but rare;
2. **Central Traits** – consisting of characteristics found among everyone and acts as basic building blocks that shape most of our behaviours and lay foundation of an individual's personality;
3. **Secondary Traits**- characteristics or traits which are plentiful but need stimuli, therefore reflected only in certain circumstances.

9.1.4 Sheldon Personality Type

In the 1940s William Herbert Sheldon classified people according to body types. He claimed that a body type could be linked with the personality of the person. According to Sheldon's theory, a fat person with a large bone structure tends to have an outgoing and more relaxed personality while a more muscular body-typed person is more active and aggressive. A slim or scrawny person with thin muscles is usually characterized as being quiet or fragile. He split up these body/personality types into three categories called **somatotypes**.

- (a) **Endomorph** who are rounded and soft, were said to have tendency towards a 'viscerotonic' personality, (ie., Relaxed, comfortable, Social, peaceful, loving);
- (b) **Mesomorph** who are square and muscular, were said to have a tendency towards a 'somatonic' personality (ie., Active, dynamic, assertive); and
- (c) **Ectomorph** who are thin and fine-boned, were said to have a tendency towards a 'cerebrotonic' personality (ie., Introvert, thoughtful, sensitive, inhibited).

Extension Activity

Assess your own personality

Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

1 = Disagree strongly

2 = Disagree moderately

3 = Disagree a little

4 = Neither agree nor disagree

5 = Agree a little

6 = Agree moderately

7 = Agree strongly





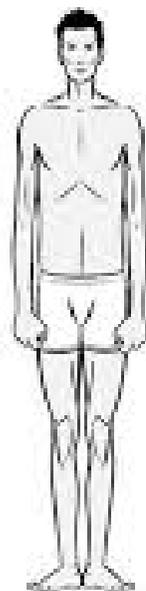
When I participate in Sports, I feel

1. Enthusiastic and Energetic	1	2	3	4	5	6	7
2. Critical, quarrelsome, suspicious of my teammates	1	2	3	4	5	6	7
3. Dependable, disciplined and well-organised	1	2	3	4	5	6	7
4. Anxious about my performance	1	2	3	4	5	6	7
5. Open to new ideas and suggestions.	1	2	3	4	5	6	7
6. Cautious while engaging with others	1	2	3	4	5	6	7
7. Cooperative with my team mates	1	2	3	4	5	6	7
8. Disorganized, careless about my equipment	1	2	3	4	5	6	7
9. Calm and collected about the outcome	1	2	3	4	5	6	7
10. Rigid and unwilling to try out new ideas	1	2	3	4	5	6	7

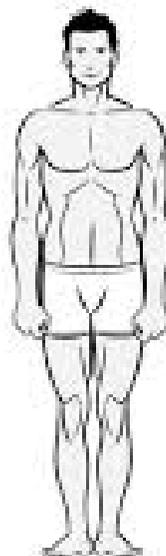
Answer the following:

1. If you were to change one aspect of your personality, what would you like to change and why? If not, why not?
2. Which aspect of your personality would you never want to change? Discuss with a friend.

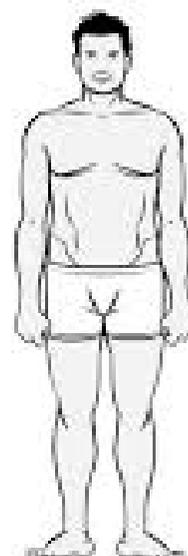
For answers to Personality assessment, see last page of the Unit.



Ectomorphe



Mesomorphe



Endomorphe





Body Type	Physiological Characteristics	Psychological Characteristics
ENDOMORPH	Pear-shaped Round, fat and thick Wide hips and narrow shoulders High fat percentage Under-developed muscles	Relaxed Tolerant Comfortable Sociable Humorous Fun-loving Even-tempered
ECTOMORPH	Thin Under weight Narrow chest and abdomen Narrow shoulders and hip Less fat percentage	Creative Artistic Thoughtful
MESOMORPH	Muscular, wedge-shaped body Broad shoulders Narrow hips Less fat percentage	Active Combative Dominant Courageous

Endomorph

An endomorphic somatotype, also known as *viscerotonic* type, is characterised by the social temperament type. The psychological characteristic traits of this somatotype include being relaxed, peaceful, comfortable, affectionate, loving, tolerant, and sociable. They are fun-loving, good-humoured, even-tempered people and they love food. The endomorph is physical 'round', with wide hips and narrow shoulders that give them a pear-shaped appearance because of extra fat on their body.

Ectomorph

An ectomorph somatotype is also known as the *cerebrotonic* type. This personality type is characterised as an intelligent temperament. The psychological characteristic traits of this somatotype include intelligence, and emotional restraint. These people are introverts. Physically, they are always skinny, thin with narrow shoulders and hips with little fat on their body. Their personality tends to be self-conscious, socially anxious, quiet, reserved but artistic and thoughtful. They always keep to themselves and are afraid to branch out.

Mesomorph

The mesomorph, known as the *somatotonic* type, is characterised by predominance of body over social and intellectual temperament. Physically they are well built with a muscular body, with broad shoulders and a narrow waist. These individuals have very little fat on their body. Psychologically, the mesomorphs are active, combative, dominant, adventurous and courageous. They are not afraid to break out and do new things with new people. They are assertive and prefer vigorous activity and display a keen interest in physical activities.





Heath Carter Model of Somatotype applicable in sports

In each of the three categories (Endomorph, Mesomorph, Ectomorph), athletes can be classified on a scale from 1 to 7. The three numbers together give a somatotype number, with first score representing Endomorph score first, then Mesomorph and finally Ectomorph. For example, 1-7-1 reflects dominant endomorph body type or 4-4-4 reflects a balanced body type between the three, many researchers have tried to identify the body types of athletes and relate with suitable sports.

9.1.5 Jung's Classification of Personality Types

Carl Gustav Jung, a Swiss psychiatrist and a disciple of Sigmund Freud, was once a great admirer of Freud’s view on psychoanalysis and worked with him for five years. However, he started developing contradictory views on some of the major assumptions or findings of Sigmund Freud and later followed a separate professional path. Therefore, many times, Carl Jung is referred to as a Neo-Freudian also.

Characteristics of Introverts & Extroverts	
Introvert	Extrovert
Interested in their own self	Highly socialized
Reserved	Broad-minded
Self-aware and introspective	Expressive and enjoy centre of attention
Take pleasure in reading, writing	Meet unknown people easily
Tend to shy away from public	Bold, outgoing and optimistic person
Think before acting	Action oriented

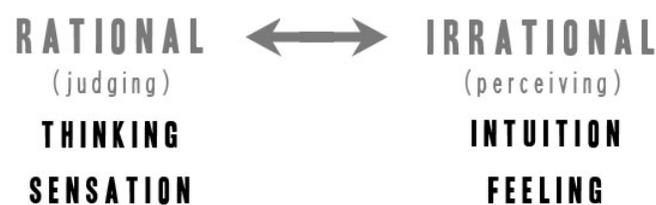




Later he published a book *Psychology Typen* (Psychology Types) in 1921 and presented his own theory of personality by classifying personality based on two important aspects.

First is personality attitude (introvert and extrovert) and second is personality functions (Sensing, Intuitive, Thinking, Feeling). He can be credited for being the first to introduce the concept of introversion and extroversion to the world of psychology. It was not a designed to label type of people, instead the purpose was to demonstrate the complexity of human typology and its consequences. Let us understand Jung's topology based on personality attitude and personality functions:

1. Personality Attitude: which is distinguished as Extrovert or Introvert.
2. Personality Functions: which can be classified as four distinct function namely; Feeling, Intuiting; Judging or Sensing. The four functions are divided into what Jung called rational (or judging) and irrational (or perceiving) functions. Thinking and sensations are rational, according to Jung, while intuition and feeling are irrational.



Introvert: In Jung's theory, introverts are people who are predominantly interested in their own mental self. They are typically seen as more reserved or reflective and prefer to be withdrawn from external reality. They opt to live in their own inner world of feelings and thoughts and often take pleasure in solitary activities such as reading, writing, or meditating. They prefer to create their own virtual and imagery world, due to which they tend to shy away from in public interactions and social connects and are less vocal with people around them, due to this, they like to be reserved and within themselves. They are more analytical before speaking.

Extrovert: In Jung's theory people with an extrovert personality are the total opposite of those with an introvert personality. They prefer the outer world of things, hence are found to be more broad-minded, are highly socialized, hence can meet unknown people easily. They are very bold, outgoing and optimistic person.





The Eight Preferences				
<i>Where you prefer to focus your attention</i>	E	EXTRAVERSION People who prefer extraversion tend to focus their attention on the outer world of people and things	I	INTROVERSION People who prefer introversion tend to focus their attention on the inner world of ideas and impressions.
<i>The way you prefer to take in information.</i>	S	SENSING People who prefer sensing tend to take in information through the five senses and	N	INTUITION People who prefer intuition tend to take in information from pattern and the big picture and focus on future possibilities.
<i>The way you prefer to make decisions</i>	T	THINKING People who prefer thinking tend to make decision based primarily on logic and on objective analysis of cause and effect.	F	FEELING People who prefer feeling tend to make decision based primarily on values and on subjective evaluation of person-centered concern.
<i>How you prefer to deal with the outer world</i>	J	JUDGING People who prefer Judging tend to like a planning and organized approach to life and prefer to have things settled.	P	PERCEIVING People who prefer perceiving tend to like a flexible and spontaneous approach to life and prefer to keep their options open

Extroverts tend to enjoy human interactions and to be enthusiastic, talkative, assertive, and gregarious. They take pleasure in activities that involve large social gatherings, such as parties, community activities, public demonstrations, and business or political groups. They also tend to work well in groups.

Personality Functions: Whether a person is an introvert or extrovert, she/he has a preferred pattern to deal with the situations. There can be four basic way or function used by people:





1. **Feeling:** Feeling is a preference for making decisions based on values and effects on people rather than logic. People use their emotional aspects to understand the situation and deal according to it.
2. **Thinking:** The capacity to decide objectively based on the evidence and applicable principles is defined as thinking. People evaluate the information received with logic and rationale for dealing with outer world.
3. **Sensing:** Sensing refers to a preference for perceiving the world through facts, evidence, data and details. People use their senses to seek information. They are good at looking and listening to understand the world around them.
4. **Intuitive:** Intuition refers to a preference for perceiving the world through concepts, theories and abstractions. People use their perception and intuitions to understand the situation, people around them, sometime its referred as sixth sense of an individual.

According to Jung, the two attitudes of extraversion and introversion cannot be demonstrated in isolation. It need to be associated with one of the four functions. When the two attitudes (Extrovert and Introvert) combine with four functions (Sensing, Intuition, Thinking, Feeling), they form eight mental functions-in-attitude or personality types. Let us briefly view each of the eight combinations of personality types.

Extroverted Thinking	Extroverted thinking involves segmenting; organizing for efficiency; systematizing; applying logic; structuring; checking for consequences; monitoring for standards or specifications being met; setting boundaries, guidelines, and parameters; deciding if something is working or not. Sorting out different colours and styles; thinking about the consequences. Extroverts who are thinkers are able to see the world through complex and solid ideas but these complex ideas are often handed down or moved on by others. These people often work in fields related to Math and Science.
Introverted Thinking	Introverted thinking involves analysing; categorizing; evaluating according to principles and whether something fits the framework or model; figuring out the principles on which something works; checking for inconsistencies; clarifying definitions to get more precision; analysing options for using principles. Introverts who think see how the world works in a subjective and creative way. This analysis is based on internal knowledge. These people often work in science fields as well.





Extroverted Feeling	<p>Extroverted feeling refers to connecting; considering others and the group-organizing to meet their needs and honor their values and feelings; maintaining societal, organizational, or group values; adjusting to and accommodating others; deciding if something is appropriate or acceptable to others.</p> <p>These people base their judgements on factual, known information. They form their assessments on social values and beliefs. These people often work in business fields and politics.</p>
Introverted Feeling	<p>Introverted feeling means valuing; considering importance and worth; reviewing for incongruity; evaluating something based on the truths on which it is based; clarifying values to achieve accord; deciding if something is of significance and worth standing up for.</p> <p>They base their feelings on emotions, feelings and beliefs. These people often work in the art field.</p>
Extroverted Sensing	<p>Extroverted Sensing refers to experiencing the immediate context; taking action in the physical world; noticing changes and opportunities for action; accumulating experiences; scanning for visible reactions and relevant data.</p> <p>These individuals look at the world and interpret reality. They see what is going and go with it. They are not influenced by other opinions. These people often work as taste-testers or proof-readers.</p>
Introverted Sensing	<p>Introverted Sensing involves reviewing past experiences; "what is" evoking "what was"; seeking detailed information and links to what is known; recalling stored impressions; accumulating data; recognizing the way things have always been.</p> <p>Introverts at times look for a hidden message or meaning to something. They do not just look at something and see it being there without a reason. These meanings are based on internal reflection. These people often work in the art field as well.</p>
Extroverted Intuitive	<p>Extroverted Intuition refers to interpreting situations and relationships; picking up meanings and interconnections; being drawn to change "what is" for "what could possibly be"; noticing what is not said and threads of meaning emerging across multiple contexts.</p> <p>These people base their meanings of things on facts rather than feelings. They are usually inventors.</p>





Introverted Intuitive	<p>Introverted Intuition leads people to foreseeing implications and likely effects without external data; realizing "what will be"; conceptualizing new ways of seeing things; envisioning transformations; getting an image of profound meaning or far-reaching symbols.</p> <p>Introverted Intuitives usually base their decisions on their inner desires. They find warmth through subjective ideas. These people usually work as artists or religious figures.</p>
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Ambivert

While explaining personality through the term Introvert and Extrovert, there is reference of a third term called Ambivert which is a relatively new term. Jung did not use the word to explain that there is no such thing as a pure introvert or extrovert. This concept was supported by many other later psychologists. Ambiverts reflect a blend of traits from the introvert as well as the extrovert along with having some specific strengths. Thus, an ambivert can be defined as someone who falls in the middle of the introvert/extrovert continuum. An ambivert is moderately comfortable with groups and social interaction, but also relishes time alone, away from a crowd. In simpler words, an ambivert is a person whose behaviour changes according to the situation she/he is in.



9.1.6 Big Five Theory of Personality

Another important trait approach which can provide essential insights into the key elements of personality is of the Big Five Factor personality model offered by Paul Costa and Robert McCrae. The five personality traits also known as the Five Factor Model of Personality and sometimes referred as OCEAN. The five domains or traits represented by the acronym OCEAN, are Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism.





Let us try to understand the attributes of each of the five personality factors on a continuum leading from high reflected characteristics at one end to low reflected characteristics at the other .

Openness to Experience (Imaginative vs Narrow Interest):

Openness refers to dimension of personality which ranges from being imaginative, humorous, intellectual, creative, curious, having broad interests, open to ideas at one end to being closed to experience, suspicious and rigid at the other. In sports, athletes or Individuals scoring high on Openness are characterized by reflection of demonstrating new ideas and skill execution initiatives along with wide variety in ideas.

EXTRAVERSION (Enthusiastic vs Reserved)

Extraversion refers to dimension of personality which ranges from having enthusiasm, energy, positive emotions, talkativeness, assertiveness at one end to being reserved, sober and cautious at the other. An individual who scored high on extraversion is characterized by high sociability, is outgoing and has a tendency to seek stimulation in the company of others. Those who score low on extraversion prefer solitude or smaller groups, prefer activities alone, and avoid large social situations. Not surprisingly people who score high on both extraversion and openness are more likely to participate in adventure and risky sports due to their curious and excitement seeking nature.

CONSCIENTIOUSNESS (Organized vs Easy-going)

Conscientiousness refers to well-organised, careful, responsible, hardworking and dependable individuals at one end to being relaxed and easy going, spontaneous, disorganized and careless. Numerous studies have found to have a positive correlation between conscientiousness and cognition, individuals high on conscientiousness have been





found to perform better in academics as well as in the sports arena wherever planning, organising skills and decision-making abilities are essential to the task.

AGREEABLENESS (Friendly vs Un-Cooperative)

Agreeableness refers to compassionate behaviour of an individual. Dimensions of agreeableness range from being good-natured, cooperative, trusting at one end to being suspicious, irritable and uncooperative at the other. It is also a measure of a person's helpful and friendly behaviour nature and reflects whether that person is generally friendly and nurturing or not. People who score low on agreeableness tend to be antagonistic towards others and are described as rude and unkind.

NEUROTICISM (Composed vs Nervous)

Neuroticism focusses on the emotional stability on an individual. This trait refers to dimensions of personality which range from being poised, calm and composed at one end to nervous, anxious and excitable at the other. Individuals reflecting high neuroticism are characterized by the tendency to experience unpleasant emotions, and are often found to demonstrate impulsive and hostile behaviour. In contrast, people who score low in neuroticism tend to be calm and even-tempered. Athletes' sports performances are highly influenced by neurotic characteristics and modern findings supports exercise and physical activity as an alternate therapy to manage neurotic behaviours.

BIG 5 Traits	Behaviour for High Score	Behaviour for low score
OPENNESS	Curious, Imaginative, Intellectual, Creative, Open to trying new things, Focused	Dislikes change, Does not enjoy new things, Resists new ideas
	on tackling new challenges, Thinks about abstract concepts	Not very imaginative, Dislikes abstract or theoretical concepts
CONSCIENTIOUSNESS	Well-Organised, careful, responsible, self-disciplined	Disorganised, careless, relaxed, easy going
EXTRAVERSION	Active, optimistic, sociable, interactive, affectionate	Sober; reserved, cautious,
AGGREEABLENESS	Good Natured, friendly, helpful, trusting, cooperative	Irritable, suspicious, rude, uncooperative
NEUROTICISM	Insecure, nervous, anxious, excitable	Calm, composed, poised, Hardy, Secure





I. Tick the correct answers

1. Endomorph body type according to Sheldon is
 - (a) a round body
 - (b) a pear-shaped body
 - (c) a wedge-shaped body
 - (d) a lean and thin body
2. Which body type can be characterized by a round body and jovial personality?
 - (a) endomorph
 - (b) ectomorph
 - (c) mesomorph
 - (d) graphomorph
3. A person who is bold and outgoing is an
 - (a) Introvert
 - (b) Extrovert
 - (c) Ambivert
 - (d) Somatotype

II. Answer the following questions briefly.

1. Define Personality?
2. What does OCEAN represent according to Big Five Theory of Personality?
3. Comment upon Allport's Theory of Personality.

III. Answer the following questions in 150-200 words.

1. Differentiate between Introvert and Extrovert personality?
2. What are the types of personality traits according to the Big Five Theory? Explain with their importance in physical education and sports.

9.2.1 Motivation

Let us re-visit our initial discussion once again. Why did some athlete keep playing without worrying about pain, discomfort of training, injury or even academic pressure? On the other hand, why did many talented athletes stop participating after initial failures?

Let us consider the two important questions.

1. What motivates a player to behave in a certain way?



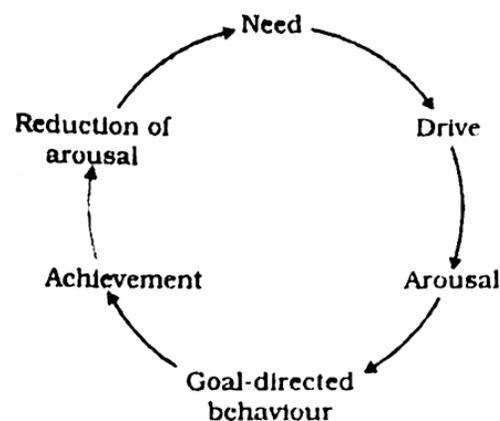


2. How to motivate an athlete to perform better?

To answer the questions above, let us start from understanding of the concept 'motivation'. The term 'Motivation' is derived from Latin word *Movere* meaning 'to move'. The basic reason for any human activity is nothing else but motivation. Motivation is the driving force that spurs a person to action. It can be explained as a process to initiate, guide and maintain behaviour over time as defined by Robert Baron (2008). Motivation can also be defined simply as the direction and intensity of effort. Truly, motivation is a process of inspiring, guiding the organism to move in a particular direction.

From the above definitions, we can understand motivation is influenced by two factors: Objective and Direction. The first factor 'objective' explains the 'why' of an action or behaviour, whereas the second factor 'Direction' explain 'what' of an action or behaviour. The 'why' or objective for a behaviour helps to find the reason for initiating a behaviour. The motives or drives to arouse and initiate an action or behaviour may be different for different individuals. The direction is about 'what' an individual wants to do, 'what' they plan to achieve. If either objective or direction is lacking for an action or behaviour, ultimately the quality of action or achievement suffers. It means, to achieve the desired goal you need to have a purpose or desire which activates you towards initiating a task in a particular direction and seeking behaviours to be persistent with enough fuel and energy till the goal is achieved. This leads us to find which are the various motivating forces which energize us towards selection of meaningful tasks with tangible goals that make an individual persist at a task till new skills are developed or performance mastery has been achieved as perceived with reasonable expectations. Hence, we can safely conclude that motivation is one of the determinants of behaviour. Instincts, drives, needs, goals, and incentives come under the broad cluster of motivation.

What then is 'motivation'? Psychologists now use the concept of need to describe the motivational properties of behaviour. A need is lack or deficit of some necessity. The condition of need leads to drive. A drive is a state of tension or arousal produced by a need. It energises random activity.





When one of the random activities leads to a goal, it reduces the drive, and the organism stops being active. The organism returns to a balanced state. Study the diagram given below.

What is it, then, that arouses the organism to action? How does one get this drive? The answer can be found in the two terms 'Intrinsic' and 'Extrinsic' motivation. **Intrinsic motivation** involves doing something because it's personally rewarding to you. It emerges from within and is directly linked with the natural instincts based on feelings of joy and satisfaction. **Extrinsic motivation**, on the other hand, involves doing something because you want to earn a reward or avoid punishment. Thus, extrinsic motives involve outside forces. Let us find out more about the type of motivation and see how motivation is an important aspect in sports and exercise psychology.

Do you know?

A motivation A state of lacking any motivation to engage in an activity, characterized by a lack of perceived competence and/or a failure to value the activity or its outcomes.

Intrinsic Motivation When you pursue an activity for the pure enjoyment of it, you are doing so because you are intrinsically motivated.

Extrinsic Motivation refers to behaviour that is driven by external rewards such as money, fame, grades, and praise.

9.2.2 Intrinsic and Extrinsic Motivation

Intrinsic Motivation: The word *intrinsic* is derived from the French word '*intrinsicque*' which means inward. Intrinsic is also referred as internal motivation which drives an individual from within to naturally pursue actions that provide fun, pleasure, fulfilment or challenge. If an individual's behaviour reflects a desire to pursue an action for enjoyment, or the individual continues the activity in a consistent manner because it provides a feeling of satisfaction, these can be identified as intrinsic motivation factors towards the directed behaviour. Intrinsic motivation includes satisfaction of needs felt by the individual which comes from inside or within and is directly linked to the individual's instincts or urges. Intrinsically motivated individuals are fully self-determined and characterized by naturally getting interested in the activity to seek enjoyment, novelty and challenge in performing the action or activity. Thus, in intrinsically motivated behaviours, the reward is the activity itself. Just as we have biological needs that we're driven to pursue in order to live and be healthy, we also have psychological needs that must be satisfied in order to develop and thrive. These include the need for competence, autonomy, and relatedness. Along with satisfying these underlying psychological needs, intrinsic motivation also involves seeking out and engaging in activities that we find challenging, interesting, and internally rewarding without the prospect of any external reward. Participation in sports as a natural urge is an example





of internal motivation if participation is directly associated with natural impulse of the athlete to play and participate in actions that create joy and happiness. People taking to exercise and exploring their capabilities through suitable and enjoyable tasks and activities is an example of motivation emerging from within and is referred to as *intrinsic motivation*.

Extrinsic Motivation: The word *extrinsic* is derived from the Latin word '*extrinsecus*' which means *outward*. Just as its meaning suggests, extrinsic motivation is that in which the source of satisfaction does not come from within and the behaviour is not due to natural urges or impulses. Instead, the behaviour or action is influenced by external forces or drives. The reasons for action are not part of an individual's character, but are due to urges from outside such as prize, money, praise, or even punishment. An individual participates or engages in activities because those tasks are linked with various external rewards such as trophies or promotions and they are obliged to continue with the task even if it is not in their natural character, because the driving force is not interest but rewards. Since external factors guide the behaviours and actions, therefore extrinsic motivation it is also considered as controlling form of motivation. Participation in sports to win a medal or prize instead of an innate urge is an example of extrinsic motivation. In sports, extrinsic motivation is reflected when athletes train or learn new skills not because of natural impulse but for various external rewards associated with medals, trophies, certificates and recognitions.

Extension Activity

Talk to a friend who is an athlete and try to find what motivated him to participate in sports. Read the below mentioned responses and identify the statements which most closely suit your friend's reason to participate:

1. Doesn't know why he plays and that he doesn't see any particular benefit associated with it.
2. To learn new skill of the sports.
3. To gain skill mastery and perfection.
4. Find joy and happiness in participation.
5. Perform to obtain a reward or trophy in the championship.
6. To make the coach happy for getting the best athlete ward in school.
7. Participate to avoid pressure from the family.

The response of your friend reflects the following about his motivation.

If YES to:

Item 1: Reflects Amotivation

Item 2, 3, 4: he/ she is Intrinsically motivation

Item 5,6,7: he/ she is Extrinsically motivation





Difference between Intrinsic and Extrinsic Motivation

	Intrinsic Motivation	Extrinsic Motivation
Definition	Driving force to pursue an action for fun, joy or any other inner satisfaction	Driving force to pursue an action due to reward, trophy, money, promotions or praise
Factors	Internal factors like joy, enjoyment	External factors like reward, promotion, praise
Method	Goal Setting strategies, Family and Community support	Associating success with future benefits, awards, promotions and avenues.
Benefits	Long term benefit of maintaining a behaviour	Helpful to initiate or create a drive towards a desired behaviour when internal factors are missing.

9.2.3 Motivation Techniques

Motivation is the process in which the learner’s internal energies or needs are directed towards various goal objects in his environment. In other words, it is the driving force which increases the desire to perform better. Every individual has certain basic motives or needs that she/he tries to satisfy. As long as one is satisfied with one’s present behaviour and knowledge and finds it adequate to satisfy all her/his needs, she/he will not try to change his behaviour or acquire new knowledge. To learn something new, firstly there must be a goal that attracts us and secondly there must be some obstacle that keeps us away from attaining that goal. The reason is simple, because if there is no obstacle in our way, our present behaviour and the knowledge that we have already acquired would lead us directly to our goals, and in such a situation there would be no need to learn. We modify our behaviour only when there is a need to do so. This enables us to reach the goals that our unsatisfied motives create. Motivation can be generated through various sources like family, friends, relatives, teachers etc. Various motivational techniques can be used to help individuals utilize the available sources available around them with maximum effectiveness. In sports, motivation of athletes is of utmost importance and an essential aspect towards success of any athlete. Let us try to understand some of the techniques used in sports to motivate athletes by helping them to maintain their inner urges to continue training as well by utilizing external factors to supplement their drive to prolong with the desired athlete behaviours essential for sports performance.





The motivational techniques are based on the following mentioned approaches. Understanding of each approach will help in developing unique strategies to motivate athletes towards desired behaviours.



- 1. Cognitive Approach:** The active processing and interpretation of information influences the persistent and purposive drive for action by an individual. It is based on the notion that desired motivation can be achieved by an individual through active processing and interpretation of information. *Expectancy theory* and *Goal Setting theory* is widely used as a cognitive approach for motivation. Expectancy theory explains that people are motivated for the task where the probability of success is higher in comparison to failure. Whereas the goal-setting concept maintains that a stronger drive for actions and behaviour is fuelled by quality of information on time set for task attainment along with task difficulty level and specificity of the task.
 - (a) Time Bound:** The task should be time bound
 - (b) Set Complexity level of task:** Task should be neither too difficult nor too easy
 - (c) Make task Specific:** Task instructions should be precise about what is to be done
 - (d) Define Purpose of task:** Outcome of the task should be clear and defined.
- 2. Pedagogical Approach:** Teaching coaching pedagogies used in sports training for planned outcome is largely responsible in guiding and maintaining the desired behaviour of athletes. Adequate communication and maintenance of positive relationship during training is an essential component influencing the motivation of athletes towards a consistent action or behaviour. Making training enjoyable, engaging athletes in decision making and providing valuable feedback to athletes are essential components to motivation. Let us discuss few techniques of motivation using a pedagogical approach.
 - (a) Guided Discovery Method:** Athletes are highly motivated if allowed to find solutions to the problems by themselves rather than if they are just made to do things as per instruction. Lack of independence in decision making and non-





promotion of cohesive training environment for athletes are major reasons affecting motivation. Cooperative learning with opportunities for athletes to engage in decision making is an effective strategy towards motivation.

- (b) **Valuable Feedback System:** To persuade athletes to push harder for a longer period of time, they must be provided with a strong support system. Assisting athletes with feedback which can provide them with specific direction to move in is an effective means towards effective motivation.
 - (c) **Fun-based Training:** Training should be challenging and task-oriented for optimal performance. However, for providing athletes with enough drive and energy to sustain them, training methods should involve fun and enjoyment for athletes. Adding creativity and innovation to training and the teaching-learning system helps in adding motivation for athletes to persist with continuous demands of training load.
 - (d) **Individualized Training Program (ITP/IEP):** All athletes are unique and respond differently to the vast variety of training demands. Each athlete is a unique individual and should have a training programme designed for their abilities and capabilities and which is within attainable limits of the athletes. Individualized training programmes or individualized education programmes are very essential in sports to help athletes to set their own targets, challenges and difficulty levels which will not only help them to avoid burnout, but also keep them motivated.
3. **Social Support Strategy:** Participation in sports and taking up exercise is greatly influenced by an understanding of the social networking and perception of people around them. Conducive exercise environment, creating drive among people to initiate and maintain sporting behaviour is deeply affected by the societal pressure or support provided to the individual. Positive social support from peer group, family members, and friends helps in developing healthy habits and enough drive to maintain the act of exercising. Initiating group activities and engagement of family and peers in sports participation helps in increased participation in sports and exercise.
4. **Facilitation Approach:**
- (a) **Incentives and Rewards:** Drive towards an action to maintain it for a long term may sometimes need external support. Awards and rewards work effectively as a motivation force for athletes to pursue sports with consistency and continuity.
 - (b) **Valance of Reward:** Many time prizes and awards are used extrinsic sources of motivation to maintain a desired action or behaviour. But, at times, even these may prove to be ineffective. It is essential to understand that external factors like prize money or medals do motivate athletes, but the most important aspect is to





understand the need and expectation of the individual athlete, this is known as 'valence' of the reward or valuing the award. To be motivated, athletes must be awarded by considering what is desired or expected by an individual so that he or she can value that reward. An athlete may like to be rewarded by being made the captain of the team and may value it more than being rewarded with a pay hike.

- (c) **Performance appraisals:** Motivation or the driving force for any desired behaviour to last over a long period of time may need support of being recognised and praised for the current and past endeavours. It creates the drive for future action and pursuit of excellence with confidence among athletes. It encourages them to plan their directions and actions. Regular appraisal of performance should be provided to athletes and appropriate rewards given.
- (d) **Quality Support and Facilitation:** Motivation for an action is influenced by the amount of facilitation made available for athletes, but the impact is larger only if the quality of support is of a high standard. Factors influencing or impacting the desired behaviour of athletes need to be studied, diagnosed and appropriate support needs to be provided to ensure maintenance of behaviour of highest standards.

9.2.4 Motivation and Sports

Motivation is an integral aspect of sports and exercise. The participation of an individual in sports activities or involvement in regular exercise for fitness, health or any other reason revolves around the forces that direct her/him towards that particular task. Therefore, it can be said that motivation is central to sports and exercise studies and is an important area of study in sports psychology. It is of great interest to athletes, coaches and parents. All athletes, coaches, and parents want the best performance in sports and work towards keeping their motivation level at the best by supporting them with all required resources and essentials. Individuals get initiated towards exercise or athletes join sports clubs or academies and continue till achievement of pre-determined objectives due to both internal and external motivation. If an athlete participates in sports for fun and enjoyment, or an individual continues with her/his exercise and fitness regime as it provides a feeling of satisfaction or challenge, these can be identified as intrinsic motivations factors. On the other hand, when an athlete participates in sports due to various incentives like cash, prize, trophies, a job, promotion or even less tangible rewards such as praise and status, these can be identified as extrinsic factors of motivation. Even if the motive for taking exercise or participating in sports is to avoid punishment, it is a form of extrinsic motivation, as it is an external force which influences the participation behaviour of an individual.





Extension Activity

Find out more about these athletes and what spurred them to such heights.



Dhanraj pillay, Hockey: Former Indian captain and a legend in Indian hockey. Khe Ratna and padamshir awardee.



Marry kom, Boxing: Bronze medallist, London Olympics 2012,



Deepa Malik, Parathlete: Arjuna Award Winner. 1st women to win a medal in paralympic Games.



Leander paes, Tennis: bronze medal 1996 Olympics, most doubles win in Davis Cup.

A large number of studies and discussions about conversion of intrinsic motivation into extrinsic or vice-versa and benefits or issues associated with it, and with sports participation and exercise behaviours have shown overlapping or change in motivational factors. The motivation reasons may reflect a shift from the initial intrinsic motivation to extrinsic motivation later or from extrinsic motivation to intrinsic motivation over a period of time due to change in conditions, situation or other personal factors. People many times start with participation in exercise, physical activities and sports as it gives them pleasure, fun, excitement, or they may also go for long distance running, tracking or skiing as these may be challenging for them. While this initial intrinsic motivation as a factor may remain unchanged over a long period of time for some individuals, for others the reasons to pursue the same activity or task may change with a change in situation or need. Later, the same





individual's motivation to participate in sports may be guided by a desire to win awards or professional contracts. When extrinsic motives like awards and rewards replace intrinsic factors as primary reasons for engaging in an activity, it becomes difficult for an individual to decide by herself/himself about when and where to participate in an activity. Her/His behaviours, actions and decisions are determined by external motives and, she/he thus experiences a loss of control. For example, children may start playing cricket for fun and excitement, and may be motivated to practice and compete regularly at sports training centres but may start feeling the burden of meeting the expectation of coaches and parents to succeed, creating a blur between the internal and external motives. This creates a burden on the participants to respond to the expectations to succeed. This conflict between the motives to exercise or participate in sports usually leads to burnout and later to dropping out from sports altogether.

Do you know?

Imagine being told that you will never walk again! That was what doctors told Kieran after they removed a cancerous tumor from his thigh at the age of 10. The operation went badly, so badly in fact, that he woke up screaming in pain from massive nerve damage. Up to then, he had been crazy about gymnastics and was determined to become an Olympic champion. But how could he do that when he could not even walk now and was confined to a wheelchair?

Kieran was going to show them and he started on the long road to recovery. He was 15 months in a wheelchair but he persevered and was back in the gym. But within a few months he slipped from the high bar and sustained a terrible head injury. He was so badly injured that frequent blackouts happened when he literally blinked. He missed a whole year at school but the gym was beckoning again. This time though, he had to overcome the challenges of that awful injury. He had to retrain his brain and get back his co-ordination. He returned to school using a walking stick and was cruelly taunted by his classmates.

It then took him three years to get back to where he had been before the awful accident. But he suffered several fractures. Then another blow came when his knee snapped just after he had been selected for the European Championships. Behan has said that was when he was about to give up.

But he never gave up and succeeded in becoming the Challenge World Cup floor champion in 2011, and his greatest moment of glory was when he qualified for the London 2012 Olympics. He had become an Olympic athlete after being through terrible pain, trauma and setbacks. A glorious example of the Olympic spirit.

Motivation as a guiding force to initiate, guide and maintain a behaviour desired for sports participation and performance is well understood but still motivation remains as a challenging task in sports.





Researchers around the world have discussed the methods to maintain or increase motivation of athletes, but little has been done to understand the reasons about why we participate in an exercise or indulge in s activities. Summarizing the conclusions of different research, four motives towards sports and exercise behaviour can be identified.

1. Physical wellbeing;
2. Psychological wellbeing;
3. Performance achievement;
4. Status and Power (assertive achievements).

All the motives mentioned above are intrinsic in nature and point towards the reason for sports participation and exercise as being largely intrinsic in nature. People participate in sports and exercise for various intrinsic motives but external motives can be added wherever or whenever intrinsic motive is reduced.

I. Tick the correct answers.

1. Motivation that drives individuals to naturally pursue actions that provide fun, joy, pleasure or challenge is called
 - (a) Extrinsic Motivation
 - (b) Amotivation
 - (c) Intrinsic Motivation
 - (d) Cognitive Motivation
2. Motivation through reward or praise is known as
 - (a) Intrinsic Motivation
 - (b) Extrinsic Motivation
 - (c) Pedagogical Motivation
 - (d) Facilitation Motivation
3. Which of the following is NOT a feature of Intrinsic Motivation?
 - (a) goals
 - (b) feedback
 - (c) needs
 - (d) attitudes

II. Answer the following questions briefly.

1. Define Motivation.





2. Differentiate between Intrinsic and Extrinsic Motivation.
 3. Write a short note on any two techniques of motivation.
- III. Answer the following questions in 150-200 words.**
1. How can a coach strategize in motivating an athlete to keep performing?
 2. How does motivating a sports person affect games and sports and how do games and sports influence a player's motivation?

9.3.1 Exercise Adherence

"If exercise could be packed into a pill, it would be the single most widely prescribed and beneficial medicine in the nation" – Dr Rober Butler, Former Director, National Institute of Ageing.

What is it that is a common prescription for prevention and treatment of all types of physical ailments, diseases, mental and social disorders faced by humans? There could be no better 'Magic Pill' other than 'exercise'. Let us then try and understand why it is difficult to interest a large percentage of the population in taking this magic pill. And what is it that makes it difficult for people, who start taking this Magic Pill, continue with it for a lifetime. People are less active nowadays, partly because technology has made our lives easier. We drive cars or take public transport. Machines wash our clothes. We entertain ourselves in front of a TV or computer screen. Fewer people are doing manual work, and most of us have jobs that involve little physical effort. We move around less and burn off less energy than people used to. Inactivity has been described as a "silent killer". Evidence is emerging that sedentary behaviour, such as sitting or lying down for long periods, is bad for health.





Not only should you try to raise your activity levels, but you should also reduce the amount of time you and your family spend sitting down. "Previous generations were active more naturally through work and manual labour, but today we have to find ways of integrating activity into our daily lives," says a health expert.

As we get used to a sedentary life, we tend to exercise less. Even if we take up exercise plans or join a Gym, we do not stick to it, but give up after a few months.

Let us examine the importance of exercise and the concept of 'exercise adherence'.

Concept of Exercise Adherence

Purposeful exercise and regular participation in physical activity are among the most important components of lifestyle, especially for older persons. Incorporating regular physical activity in the lifestyle is considered an important behaviour that may yield benefits especially for maintaining physical and psychological well-being. While research has shown older persons who actively participate in a long-term exercise program appear to have a good quality of life, regrettably, majority of the old people around the world lead a sedentary lifestyle with very little knowledge regarding the importance of physical activity. One of the major issues related to participation in an exercise programme is the adherence to such a programme.

The word *adherence* is described by the Oxford Dictionary as ***the fact of behaving according to a particular rule, etc., or of following a particular set of beliefs, or a fixed way of doing something***. Thus, in the simplest term *exercise adherence* refers to ***the extent to which the individual maintains an active involvement in physical exercise and acts in accordance with the advised interval, exercise dose, and exercise dosing regimen despite opportunities and pressures to withdraw***. Exercise adherence, therefore, refers not just initiation but also maintenance of physical activity and exercise behaviour according to individualized need and requirement. It is associated to the 'stickability' factor which is related with quality of any athlete or participants to continue with sports, exercise or any other physical activity without losing the motivation to pursue it further. So, exercise adherence can also be referred as ***a self-regulated, voluntary behaviour directed towards maintaining an exercise routine for a prolonged period of time after initial phase of adoption***. It is important as well as interesting to understand the reasons why people adhere to exercise and the forces that push athletes towards initiating sports participation.

9.3.2 Reason to Exercise

Reason to exercise or exercise determinants point towards the importance of motives of an individual towards initiating and adopting exercise as a part of her/his lifestyle. We find many people around us with different behaviours towards exercise and physical activity and each behaviour can be associated with its own reason for adherence or non-adherence. We





may find many people who have not initiated exercise or even thought of exercise and physical activity in near future, or those who think of starting exercise in the near future but are not able to initiate the programme, and still others who started or initiated an exercise programme but were not able to continue or adhere to it for long and dropped out. Why people find a reason to exercise, participate in fitness and engage in recreation sports can be understood by the following aspects:

1. **Overcoming Social Physique Anxiety:** People in the society are influenced by how other perceive them in-term of their looks, fitness or body shape, weight and size. This leads to adoption of various means and methods to make them lean and fitter. Exercise combined with proper diet can help people attain their goal to be lean and fit thus helping overcoming social physique anxiety with the means of exercise, fitness and recreation sports program engagement.
2. **Reduced risk of disease:** Lifestyle factors does play an important role toward rise of various contemporary health issues. Hypertension, obesity are major health concerns in the modern day due to increase in facilities and urbanization leading to limited physical engagements, lack of physical activity and promotion of sedentary lifestyle. To overcome the sedentary lifestyle, adoption of exercise and fitness are considered to be essential and important.
3. **Recreation :** With change in lifestyle and devotion of more hours on table chair task, engagement in serious academics, focus on professional pathways, individuals are facing with the challenge of finding time and activity for recreation, fun and enjoyment. Recreation sports, fitness and exercise provide fun, enjoyment, recreation along with the physical benefits, thus recreation being considered as an essential reason to exercise.
4. **Mental Relaxation:** There are various means and methods adopted for stress reduction and mental relaxation by people of all segments, demography, age groups. Exercise is one of the most effective ways to cope with stress and depression more economically and with tremendous benefits to the society. Therefore, people participation in exercise for mental relaxation as a reason is relevant.
5. **Socialization:** Often people look for opportunities to engage with community and socialize with friends, peer groups, colleagues etc from their busy life. The engagement with society members are essential to overcome social isolation, tackle loneliness which can affect their mental health and prevent camaraderie spirit among peoples of the society. Especially in the modern lifestyle and with urbanization leading to less time available for social connect, the most effective way to connect socially is through participation in team sports, group exercises program and various other fitness programs. Thus socialization qualifies as a reason for people to engage and experience exercise and sports programs.





9.3.3 Benefits of Exercise

1. **Health Benefits:** There has been evidence of humans working hard and putting in physical effort for their survival and better life since early times. Even today people across the world desire to lead a healthy life and consider health as the most essential aspect of life. With the change in living conditions and transformation in contemporary lifestyle, engaging in physical activity, exercise and sports has a prominence as a chosen activity or preferred behaviour among people to keep themselves healthy. Modern lifestyle has given rise to health issues associated with weight management and cardiovascular diseases, for which engaging in physical activity and exercise is essential. Exercise is the miracle cure we've always had, but for too long we've neglected to take our recommended dose. Our health is now suffering as a consequence. Whatever the age, there's strong scientific evidence that being physically active can help you lead a healthier and happier life. People who exercise regularly have a lower risk of developing many long-term (chronic) conditions, such as heart disease, type 2 diabetes, stroke, and some cancers. Research shows that physical activity can also boost self-esteem, mood, sleep quality and energy, as well as reducing your risk of stress, depression, dementia and Alzheimer's disease.

(a) Reduces risk of Cardiovascular Disease: Exercise and a regular cardio-fitness regime has a significant role in preventing various cardiovascular diseases like hypertension and coronary heart disease. Exercise strengthens the heart and improves circulation. The increased blood flow raises oxygen levels in the body. This helps lower risk of heart diseases such as high cholesterol, coronary artery disease, and heart attack. Regular exercise can also lower blood pressure and triglyceride levels. Exercise can lower blood sugar levels and help insulin work better. This can cut down risk for metabolic syndrome and type 2 diabetes. And if someone already is suffering from one of those diseases, exercise can help her/him to manage it.

(b) Weight Management: Living in a society where physical appearance is important, individuals take to exercise from a desire to keep themselves in shape. Though they may experiment with other methods for losing weight like dieting and calorie control etc., but these methods alone not found to be effective for weight reduction unless regular exercise is not combined with diet control. Along with diet, exercise plays an important role in controlling weight and preventing obesity. To maintain body weight, the caloric intake must equal the energy one burns. To lose weight, one must use more calories than one takes in. Thus, regular physical activity and an active lifestyle are significant methods for effective weight management.





- (c) **Strengthens Bones and Muscles.** Regular exercise helps build strong bones. Later in life, it can also slow the loss of bone density that comes with age. Doing muscle- strengthening activities can help you increase or maintain your muscle mass and strength.
- (d) **Reduces risk of some Cancers.** Exercise reduces risk of cancers like cancers of the colon, breast, uterus, and lungs.
- (e) **Reduces risk of Falls.** For older adults, research shows that doing balance and muscle- strengthening activities in addition to moderate-intensity aerobic activity can help reduce your risk of falling.
2. **Provides Stress Relief:** Modern lifestyle with its work pressure and competitive lifestyle leads to a lot of stress. The physical effects of prolonged stress are numerous, including a greater susceptibility to illness, a lack of energy, problems with sleep, headaches, poor judgment, weight gain, depression, anxiety, and a host of other ills. In fact, chronic stress can be the culprit behind heart disease, type 2 diabetes and an upset stomach. Physical activity, recreational sports and exercise are effective coping strategies for relief from stress and disorders from everyday life. Yoga and aerobic exercise are a good way of combating stress.
3. **Increases Happiness:** It has been evident to find people engaged in physical activity for various extrinsic goals like weight loss, improving physical appearance etc. but there are people who prefer to exercise and engage in physical activities like recreation sports or adventure sports due to their innate nature to experience joy, happiness and satisfaction. During exercise, the body increases the production of endorphins which are known to help produce positive feelings and can improve the mood and make the individual feel relaxed and happy.
4. **Promotes Self-Efficacy:** Self-efficacy is the belief that one is capable of achieving a specific goal. Regular exercise and participation in sports is largely associated with an individual's belief in her/his abilities to complete physical tasks, achieve determined goals and produce challenging outcomes. People with high self-efficacy tend to initiate exercise and physical activity with a positive approach and respond positively to regular engagement in sports and exercise demands. They also demonstrate a greater degree of exercise adherence than others.
5. **Promotes Social Cohesion:** Human beings are social animals who prefer to engage in group activities because it given them opportunity to socialize and interact with other people. As a result, many people engage in exercise behaviour and sports participation. Sports and group exercise programmes also prevent boredom and social isolation by helping participants feel connected with the society and community around them as team mates, opponents or even as spectators. Group cohesion





developed among participants of exercise group and sporting members acts as one of the important reasons for exercise.

6. **Enhances Value Orientation:** Knowledge and understanding about a healthy lifestyle and importance of regular physical activity creates a value orientation among individuals to initiate exercise and later continue with exercise behaviour. Value orientations represent philosophical beliefs. Values inculcated by physical activity and exercise include discipline, enhanced learning process, self-actualization, social responsibility and ecological integration.
7. **Cognitive Benefits:** Regular aerobic activities lead to a positive improvement in attention control and information processing speed. Exercise can improve brain function and protect memory and thinking skills. Exercise increases heart rate, promoting the flow of blood and oxygen to the brain. It can also stimulate the production of hormones that can enhance the growth of brain cells. Exercise has been shown to cause the hippocampus, a part of the brain that's vital for memory and learning, to grow in size. This serves to increase mental function.
 - (a) **Attention Control:** Regular physical activity and exercise help improve attention and concentration among people of all ages. Physical exercise at a moderate level also revealed positive effects and benefits among the participants.
 - (b) **Improves Memory:** Physical activities have been known to enhance intelligence especially among children. Even among the elderly, even a small amount of physical activity delays memory loss. Exercise has been shown to reduce changes in the brain that can cause Alzheimer's disease.
8. **Mental Health Benefits:** A session of jogging or any physical activity has the possibility of mood enhancement and increasing the feel-good factor. Issues associated with depressions, anxiety etc. can be resolved with regular physical activity and exercise.
 - (a) **Exercise as therapy for emotional disorder:** Physical activity is an effective intervention for various mental disorders like depression and anxiety. Exercise therapy has been able to produce improved mood, enhanced self-esteem and thereby, increase productivity.
 - (b) **Fitness as moderator of life stress:** Regular physical activity helps in creating a positive attitude towards work by developing higher ability to cope with stress and tension.
 - (c) **Runners High:** Participating in regular physical activity promotes a high sense of mental alertness, mood upliftment, a feeling of liberation, suppressed discomfort and heightened well-being.





9. **Psychological Well-being:** Participation in regular physical activity, sports and exercise brings positive changes in the mental and physical well-being of an individual. Exercise leads to changes in blood flow to brain, increase in oxygen consumption, reduction in muscular tension, improved metabolism, creating a feeling of wellbeing. Participation in physical activity and exercise promotes positive social interactions, improved self-esteem, feeling of competency, along with an opportunity for fun and joy. All these collectively develop a sense of enhanced well-being among individuals engaged with physical activity.
10. **Personality Enhancement:** Participation in physical activity and exercise has revealed significant influence on personality. Regular participation and long-term engagement in physical activities especially at young age (before maturity) reflects greater extraversion and stability among participants, which are very important characteristics or traits of personality.
11. **Develops Leadership Qualities:** Engagement in an exercise programme and participation in sports provides opportunity for individuals to experience adversities and opportunities to learn from compensating various deficiencies like lack of space, inadequate logistics, adverse conditions and still persist with prolonged activities, so developing qualities of leadership. Sports and exercise opportunities teach individuals to be equally effective in variety of situations and conditions with ability to create variations in similar conditions too, developing another important aspect of a leader.
12. **Special Population:**
 - (a) **Clinical Population:** People with intellectual disabilities of all age groups and have found to derive significant benefits from regular participation in physical activity. Psychomotor activities help them in enhancement their skills in activities related to daily living too.
 - (b) **Elderly Population:** Ageing is a process which is observed to be delayed among the people who are regular participants of physical activity even of an acute nature. Even low intensity bouts of exercise prove to be helpful in slowing down of the ageing process among the elderly.

9.4.1 Strategies for Enhancing Adherence to Exercise

Psychologists and therapists around the world have widely professed the benefits of exercise. Although most people do understand the importance of physical activity and regular exercise, yet a large percentage of them have either not initiated exercise behaviour, or, if a few opted for exercise, they couldn't continue it and dropped out. Therefore, its essential to discuss the strategies for enhancing adherence to exercise.





- 1. Goal setting:** A moderate bout of acute exercise (20-30 min) is considered to be beneficial for improving positive psychological effects of exercise. Exercise performed above lactate threshold (LT) is perceived as unpleasant and the participant may like to discontinue it due to overexertion and discomfort. Therefore, along with setting of SMART – Specific, Measurable, Attainable, Realistic, Time based – goals. It is also essential to make the goals flexible or reversible to prevent drop-outs and help participants engage in prolonged participation with added fun and satisfaction. Studies show that documenting the necessary steps required to achieve your specific goal helps in exercise adherence.
- 2. Adding variety to exercise:** Lack of new variety of exercise may lead to boredom and dropping out. Boredom can be tackled with the addition of a variety of exercises and moves that address the same body issues, without loss of therapeutic benefits. Adding variety to the exercise program through adoption of new strategies, changing methods, using new equipment, re-inventing logistics and adding new members can induce fresh energy to the exercising activity, thus enhance adherence to exercise. Even changing the duration, intensity, frequency along with change in venue and mode of exercising also go a long way in maintaining interest and promoting long-term adherence to exercise behaviour.
- 3. Social support enhancement:** Increasing social support refers to engagement of friends or other members who can contribute towards positive participation in physical activity, exercise and sports because social interaction may help fuel goal achievement and thus produce good results. Creating of a system of buddy partner, youth leader, mentor where members of family, a classmate or a friend or relative can be engaged as a motivator and flag bearer for exercise. This creates a strong social support system for enhanced participation experience for athletes and those who are engaged in exercise behaviour.
- 4. Contract:** While acute bout of exercise has been associated with positive effects, chronic exercise habits or regular exercise behaviour are important for maintaining these benefits. Therefore, promoting participants for signing an intent to comply through a written contract which has specified expectations, responsibilities and contingencies for behavioural changes have found to be more effective in exercise adherence among the participants.
- 5. Reinforcement Interventions:** Positive as well as negative reinforcement approaches have found to be effective in exercise adherence. Use of incentives and rewards for appreciating attendance and participation or awarding with badges have been proved effective in maintaining exercise behaviour among participants as well as motivation from many to initiate and engage in physical activity.





6. **Feedback:** Providing feedback to the participants in physical activity provides much needed direction and energy for prolonging and continuing exercise behaviour. Individualized feedback to the participants on the quality of progress and other positive aspects about them can create higher levels of motivation and prove effective towards exercise adherence.
7. **Process Orientation:** Exercise programmes based on outcome goals or product goals like weight loss, physique and appearance etc. are found to be effective in the initial stages of exercise adoption, but it is difficult to maintain the drive with prolonged exercise behaviour. Helping people to shift from process goals to product goals which are more intrinsic in nature will be more helpful towards becoming lifelong exercisers.
8. **Problem Solving:** This intervention is based around identifying the obstacles and barriers that stand between the participant and her/his physical activity goals. It is important to generate and implement solutions, evaluate the outcomes and choose different solutions if needed.
9. **Health Risk Appraisals:** Health risk appraisals of participants provide them with relevant information about their current health, risk factors and level of fitness. This helps to enhance motivation and can be used to monitor changes over time. It can also help with regards to the goal setting process as areas they need to improve are identified.
10. **Health Education:** It is important that participants seek information from experts on the benefits of exercise, proper exercise techniques and the results that should be expected during exercise. This will ensure that they truly understand why and what they are doing and it will give them the confidence and motivation required to participate in long-term physical activity as well as to prevent injury or discouragement. Research has also expressed the importance of health-care provider's and influence they have over participant's physical activity and the implementation of the aforementioned interventions.

I. Tick the correct answers.

1. Which of the following is effective for prevention of Coronary Heart Disease?
 - (a) Regular Exercise
 - (b) Sedentary Lifestyle
 - (c) Medicine
 - (d) Dieting
2. Which one of the following is NOT a result of regular exercise?
 - (a) Increased bone density





- (b) Increased cholesterol level.
 - (c) Strong immune system.
 - (d) Increased longevity.
3. Normally people do not adhere to a regular exercising programme due to
- (a) lack of proper goals
 - (b) adding a variety of exercises
 - (c) social support enhancement
 - (d) feedback from instructor
- II. Answer the following questions briefly.**
1. Briefly list the benefits of exercise.
 2. Mention the strategies to enhance exercise adherence.
 3. What are the psychological benefits of exercise? Explain.
- III. Answer the following questions in 150-200 words.**
1. Explain the various reasons to exercise.

9.5.1 Aggression

Players convicted of on-field violence	British boxer disqualified after biting opponent during heavyweight bout
<p>We have to delve back to 1988 to find the first example in the English game of a footballer being convicted in a court of law over on-field violence. In this case, Sky Sports' excitable pundit Chris Kamara was the culprit; 'Kammy', then of Swindon Town, caught Shrewsbury Town's Jim Melrose with his elbow, breaking Melrose's cheekbone in the process.</p>	<p>A British heavyweight boxing match ended in chaos after a fighter bit his opponent and was disqualified on Saturday. The 10-round bout between David Price and Kash Ali at Liverpool's MandS Bank Arena came to its abrupt conclusion the 27-year-old Ali grabbed hold of his opponent before falling on top of him. He then bit Price near his rib cage.</p>

Do try to remember any sports match where players have been highlighted in media, newspapers or by commentators for hitting the opponents or abusing the officials, spectators or their own team members and being referred to as displaying unsporting and





aggressive behaviour. Surely, we can recollect various occasions when athletes' behaviour on the field has been aggressive. In cricket, a bowler bowling a bouncer or intimidating a batsman by walking down the pitch towards him threateningly, a batsman's offensive reaction towards the umpire after his dismissal are few examples of aggressive behaviour. Why do athletes become aggressive on or off the field? What are the different behaviour outcomes associated with aggressive behaviour? How can these be reduced? These are the few important questions which most of the teachers, coaches and even parents, who deal with athletes of different age groups are worried about. Let us try to understand the concept of aggression as accepted by the world of psychology and used by sports professionals in the past several years.

Do you know?

Aggression – Aggression is behaviour that is hostile and violates other people's rights.

Reactive aggressive behaviour is unplanned and impulsive, and is usually a response to feelings of anger, fear, or a need to retaliate against someone.

Proactive aggressive behaviour is calculated and planned action that has some motive other than harming someone.

According to the American Psychological Association, aggression is a type of behaviour aimed at causing physical or psychological harm to another. Most psychologists refer to aggression as any behaviour intended to harm or injure any living being who is trying to avoid it. This definition includes three important features. First, aggression is a behaviour that can be seen. It is not an emotion that occurs inside a person, such as anger. Thus, aggression is a behaviour and needs to be distinguished from anger which is an emotional expression towards someone we feel has done something wrong. Anger, again, need not be expressed through harm or destruction, but aggressive behaviour will have an intent to cause physical or mental harm. Second, aggression is intentional. Aggression is not accidental. It is a deliberate behaviour to harm or injure and can be either physical or psychological, i.e., hitting, pushing or abusing someone purposely, with an intent to hurt. Third, the victim wants to avoid the harm.

Sport psychologist Gill (2000) produced a four-part criterion which aimed to help us interpret whether an action is aggressive in sport. His criteria were:

- There must be physical or verbal behaviour.
- It must involve causing harm or injury whether it is physical or psychological.
- It must be directed toward another living thing.
- There must be the intention to cause harm or injury.

Few more definitions of aggression:

Behaviour that results in personal injury or destruction of property. (Bandura, 1973)⁸





Behaviour directed towards the goal of harming or injuring another living being who is motivated to avoid such treatment. (Baron and Richardson, 1994)⁹

The intentional infliction of some form of harm on others. (Baron and Byrne, 2000)¹⁰

During last many years much debate and deliberations have been made in the field of sports and exercise psychology as well as sports sciences towards an acceptable definition of aggression. An acceptable concept of aggression along with its two types of aggression has been cited by Husman and Silva in 1984 as 'hostile' and 'instrumental' aggression to differentiate between two types of aggression.

9.5.2 Types of Aggression

- 1. Hostile Aggression:** The term 'hostile' refers to being 'opposed', therefore hostile aggression refers to violent and angry behaviour where the intent and primary goal is to harm the other. A boxer who punches the opponent below the belt with the primary aim of injuring him because he is losing or an athlete who uses abusive words to mentally harm another player who has angered him with better skills are examples of hostile aggression. ***Hostile aggression is a type of aggression that is committed in response to a perceived threat or insult. It is unplanned, reactionary, impulsive, and fuelled by intense emotion as opposed to desire to achieve a goal. Aggressors typically have a sense of a loss of control during outbursts, and characteristically experience physiological hyperarousal.*** Thus, it is also sometimes known as **reactive aggression**. In the examples given above, the intent of action is to physically or mentally harm the other person due to dislike, enmity or due to the person being on the opposing team or side. Along with the intent, the goal is also to harm the other, therefore non-legitimate measures or illegal methods to physically or mentally harm the other person are employed. Another important aspect of hostile aggression is the kind of explanation given by the athletes after the aggressive behaviour. Most of the athletes don't apologise for their behaviour, instead they tend to give self-justification for their act of violent behaviour.

Prospect of Losing Makes Me Aggressive, says Viswanathan Anand

India Today | 21 June 2012

Speaking at a function for young chess players, the world chess champion Vishanathan Anand said, "The insecurity of loosing made me aggressive. I don't show it openly but the prospect of losing to some player is so horrifying your might want an extra bit."

"Against Topalov (in 2010 world championship) I was able to channel that feeling into a willingness to play long games. I was able to feel motivated."

"The hunger is still there to go for the next one," says Anand. "I am often asked how I maintain my motivation even after five world titles. Frankly, I never took to chess





because it was on some kind of a checklist. I will keep playing till I enjoy it. The desire is still there," he said.

(<https://www.indiatoday.in/sports/other-sports/story/viswanathan-anand-chess-world-champion-niit-delhi-110525-2012-07-21>)

- 2. Instrumental Aggression:** The term 'instrumental' refers to 'serve as a means' i.e., aggression is being used just as an instrument to gain advantage or win and not because of anger or enmity. Therefore, instrumental aggression refers to aggressive behaviour meant or used to attain some non-aggressive goals like winning, getting money, prestige or gaining any other advantage. ***Instrumental aggression is harmful behaviour engaged in without provocation to obtain an outcome or coerce others.*** An instrumental aggression does consist of an aggressive intent to harm an opponent physically or psychologically without necessarily being angry. Instrumental aggression is a behaviour directed at the target as a means to an end. For example, elbowing and injuring a player to gain a competitive advantage, or late tackling to stop an opponent from scoring a goal. Another example of instrumental aggression is that of a basketballer playing a foul against an opponent with the purpose of scoring a basket. Instrumental aggression that has no goal to harm is also considered as an aggressive act because of the aggressive intent. Most of the players prefer to offer apologise for their act or behaviour of instrumental aggression.

Development of Relational Aggression

A science brief published in Psychological Science Agenda in August 2013 by APA deals with development of relational aggression associated with young children due to media exposure. The research work after examining different types of aggressive behaviour discussed the two types of aggression. Along with physical aggression like kicking, pushing, it mentions about second type of aggression known as Relational Aggression. According to the study, relational aggressive behaviour has an intent to hurt, harm and injure others using the relationship. It also uses threat of relationship against other individuals through social exclusion, friendship withdrawal, spreading rumours, false news etc. are used as goals for the intent of harming.

<https://www.apa.org/science/about/psa/2013/07-08/relational-aggression>

An important distinction between hostile and instrumental aggression is that instrumental aggression is learned behaviour, where hostile aggression is impulsive. In the majority of situations, neither is an ideal response or solution to your problem.

From the above concept of aggression, we reach a consensus that from the perspective of a sports psychologist, there is no 'good' aggression or 'bad' aggression. Any behaviour with an intent to physically or mentally harm another individual is aggression and is not acceptable





on the sports field. An important concept mentioned by the sports psychologists is *assertive* behaviour. Most athletic events involve interaction between people. There is some interchange of words, feelings and behaviours. While confrontation is often manifest through **assertion** and **aggression**, these two approaches have distinguishing factors and lead to very different outcomes. Assertive behaviour is generally seen as a positive form of expression, whereas aggression is a negative form of expression. Assertive behaviour has its roots in respect for the other individual, while aggression does not; for example, if you voice your opinion through aggressive acts, you are conveying that your feelings are more important. Aggression also is often counter-productive, while assertive behaviour leads to a more positive resolution. Finally, assertive behaviour is all about standing up for yourself and your values in an unthreatening manner, while aggression puts others down.

	Hostile	Instrumental	Assertive
Intent	Harm or Suffering	Harm or Suffering	No harm
Primary Goal	Harm or injure	Win or advantage	Win or Advantage
Process	Non-Legitimate	Non-Legitimate	Legitimate
Emotion	Anger	No Anger	Unusual effort and energy expenditure
Explanation	Self-justification instead of apology	Offer apologies	

Aggression Management : A Challenge in Sports

Behaviour of aggression by players is an area of concern for coaches, parents across the society which need to be minimized if not stopped or curtailed completely. Few of the strategies which could be effective in managing aggression among athletes have been mentioned below:

1. *Social acceptable discharge medium*: Aggression is an inborn drive, according to the drive theory people have the innate instinct to be aggressive and it builds up till it is discharged (catharsis). There need to be opportunities and space for people to displace or express aggression through a socially acceptable means, for example bout of aerobics, swimming, martial arts kicking pads or punching bags.
2. *Positive Reinforcement*: Aggression has a circular effect, one act lead to another because the people especially athletes learn the way to release it. The circle need to be broken by positive reinforcement and not letting it continue. Providing space for players to speak and express their opinion is an effective example.
3. *Negative Reinforcement*: During competitions, any act of violence should not be





tolerated or exempted and must have strict rules of punishment for offending players and the team, whereas fair play point can be awarded for players and teams showing restraints during aggressive situations.

4. *Modelling*: People emulate their heroes and seniors, young players grow up watching them receive awards, prizes and recognitions, therefore try to copy their behaviour to a large extent. Hence aggressive behaviour should not be promoted or appreciated at the top level and by the seniors as it will help in reducing the trickle effect.
5. *Training and role playing*: Athletes can learn to control their hostile feeling along with anger through role play and training with experts. Training is effective in regulating the emotion of anger that leads to hostile behaviour.
6. *External Cues*: Stimulus which puts preference of winning over participation can lead to various hostile as well as instrumental aggression. Coaches, parents must focus and promote participation over performance, appreciate fair play than winning, discuss fun over results.

I. Tick the correct answers

1. Which of the following is a legitimate behaviour?
 - (a) Hostile Aggression
 - (b) Instrumental Aggression
 - (c) Assertiveness
 - (d) Proactive Aggression
2. In instrumental aggression, the main aim is to using aggression.
 - (a) cause harm to the opponent
 - (b) achieve a positive goal
 - (c) express your feeling of jealousy
 - (d) show your hostility to an opponent
3. Aggression is displayed in sports through
 - (a) assertion of views
 - (b) use of abusive words
 - (c) walking away from the opponent
 - (d) strictly following the rules

II. Answer the following questions briefly.

1. What do you understand by aggression in sports?





2. Define hostile aggression.
 3. Define instrumental aggression.
- III. Answer the following questions in 150-200 words.**
1. Differentiate between Hostile aggression, Instrumental aggression and Assertiveness?
 2. Describe various reaction of athletes which can be classified as aggression and assertive behaviours?

Art Integration

Look at the following caricatures. What do they depict?



Working in groups, design a caricature about a sportsperson from India who has displayed *either*

AGGRESSION or ASSERTIVE BEHAVIOUR on the field.

How to make a caricature.

There are three essential elements that transcend style and medium and must be present in a caricature:

Likeness - If you can't tell who it is supposed to be, then it is not successful. All good caricatures incorporate a good likeness of their subjects.

Exaggeration - Without some form of exaggeration, or a departure from the exact representation of the subject's features, all you have is a portrait. The level of exaggeration can vary wildly, but there must be some departure. A straight portrait is not a caricature.

Statement - I believe a caricature must editorialize in some way. The artist must be trying to say something about the subject. It might be something to do with the situation the subject is drawn in, it may just be a play on their personality through expression or body language, it might be as simple as making visual fun of some aspect of their persona or image. Exaggeration itself can accomplish this in some cases. The best caricatures say something more about the subject than that they have a big nose.





Case Study

Read the following Case Study carefully.

A state sports team was winning all the tournaments and was highly praised for its efforts. An interview with the team to find and explore the reasons for its continuous success highlighted the following reasons. As per the report, the team had many new players who were wellorganised, responsible, self-disciplined and precise in their task and contributed to the success of the team. The Captain had been selected by the team members themselves, and he was most interactive, sociable and optimistic on the field as well as off it. This made him a good leader.

The best part of the team was that, all its senior players were helpful and cooperative with their juniors and were always willing to listen to them. The team's coach mentioned few essential elements that had contributed to the team's success. According to him, the ability to motivate people plays a crucial role in the team's success more often than the technical skills, and this is what separates a good coach from an average one. The coach also referred to occasions when players went through the phase of lack of intrinsic motivation. The coach realised that while there are some athletes have an innate drive to constantly strive for success and enjoy their task, there are others who seem to lack internal motivation and need extrinsic factors like rewards, prize, money etc. to create the required drive or required behaviour. The team's psychologist spoke about the aggressive behaviour among the team players against the opponents. It was interesting to listen to various instances where the players had instigated opponents or charged at them violently, in anger, but had later tried to justify their actions.

Sometimes, players were found to be abusing opponents not in anger, but to get an advantage or for the sake of winning, though this behaviour is not acceptable and they were awarded punishments as per the code of conduct and rules of sport.

Read the above story of a sports team and answer the following questions?

1. Which trait best reflected the personality of junior players?
 - (a) Introvert
 - (b) Conscientiousness
 - (c) Neuroticism
2. Which member of the team reflected most of the Extrovert traits?
 - (a) Coach
 - (b) New Members
 - (c) Captain
3. Which type of players were recommended for special training with Sports Psychologist?
 - (a) Extrovert
 - (b) Introvert





- (c) Mesomorph
4. The team sports psychologist is referring to which type of behaviour as non-threatening but confident.
- (a) Assertive
(b) Hostile
(c) Instrumental
5. Which are the two types of motivation discussed in the above story? Which, according to you, is the better form? Why?

Answers to Personality Quiz

1. Extraversion (Q1, Q6R); Agreeableness (Q2R, Q7); Conscientiousness (Q3, Q8R); Emotional Stability (Q4R, Q9); Openness to Experiences (Q5, Q10R).
2. 'R' denote reverse-scored item, recode the reverse-scored items (i.e., recode a 7 with a 1, a 6 with a 2, a 5 with a 3, etc.). The reverse scored items are 2, 4, 6, 8, and 10.
3. Take the AVERAGE of the two items (the standard item and the recoded reverse-scored item) that make up each scale.
4. The maximal score can be 14 and minimum score 1.

Example using the Agreeableness scale: A participant has scores of 5 on item 1 (Extraverted, enthusiastic) and 2 on item 6 (Reserved, quiet). Start with recoding the reverse-score items (ie. Item 2 score was 5) replacing the 5 with 3. Second, take the average of the score for item 7 (eg.6) and the recoded score for item 2. So the Agreeableness score would be: $(6 + 3)/2 = 4.5$.





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UNIT-X: SPORTS TRAINING

Contents

- Strength: Definition, Types and Methods of Improving Strength- Isometric, Isotonic and Isokinetic
- Endurance: Definition, Types and Methods to Develop Endurance- Continuous Training, Interval Training and Fartlek Training
- Speed: Definition, Types and Methods to Develop Speed- Acceleration Run and Pace Run
- Flexibility: Definition, Types and Methods to Improve Flexibility
- Coordinative Abilities: Definition and Types
- Circuit Training- Introduction and Importance

Learning Outcome

At the end of this unit students will be able to:

- classify Isometric, Isotonic and Isokinetic training
- understand different methods of endurance development
- differentiate different method to improve flexibility
- explain Coordinative Abilities
- describe Circuit Training

Discussion

Choose any sport that you would like to play. Research 5 exercises you can do to increase your performance in the sport. You will need to include what the exercise is, how to properly perform the exercise (include pictures if needed), what muscles are used, and why this exercise will improve your sports performance.

Name of Exercise	How to properly perform the Exercise	The muscles that are used in the Exercise	Why this Exercise will improve your sports performance





10.1.1 Introduction

Sports training is a multidimensional process for preparing athletes on several aspects like technical skills, tactical efficiency, fitness proficiency and various other physical, mental and social aspects required for optimal performance. Fitness is one of the very essential aspects for all athletes for improving performance and preventing injury while developing skill proficiency. Fitness components like Strength, Speed, Endurance, Flexibility and Coordinative ability does play an integral role in athlete performance but it needs scientific training for development and improvement at desired level and optimal level. There are various scientific methods of training and developing the different fitness component, lets try to understand the training aspect of each of the basic Sports fitness components.

10.1.2 Strength

According to **Singh, (1991)¹**, *“Strength is the ability to overcome resistance or to act against resistance.”*

According to **Barrow and McGee²**, *“Strength is the capacity of whole body or any of its part to exert force.”*

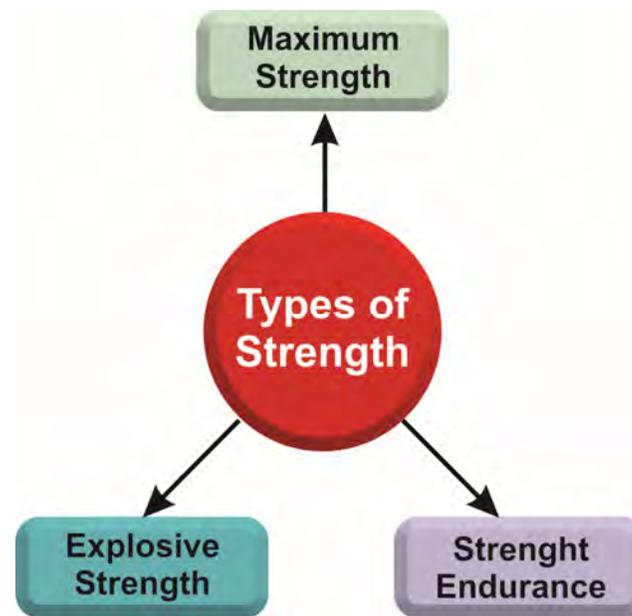
Strength is one of the most important motor components of fitness and plays a major role in all sporting events. It is the amount of force that muscles can produce to complete a task. In simple words, strength is the ability of a muscle or a group of muscles to act or overcome resistance. The development of strength also influences the other motor components of fitness like speed and endurance.

As all movements in sports are caused by muscular contraction, therefore, it can be said that strength is a part and parcel of all the motor abilities, technical skills and tactical actions.

10.1.3 Types of Strength

Almost all sports and games require some amount of strength according to their nature. For example, a weightlifter requires different kind of strength in different amount as compared to a basketballer shooting a ball in the ring. Thus, different sports require different types of strength, which can be classified as follows:





- 1. Maximum Strength:** It is the ability of a muscle to overcome maximum resistance in a single repetition or single maximal voluntary contraction. Maximum strength means to exert force against resistance in maximal effort. Though maximum strength does not hold much importance in majority of sports but is certainly required in sports like long jump, shot put, javelin throw, weightlifting, discuss throw, etc.
- 2. Explosive Strength:** It is the ability of the muscles to overcome resistance as fast as possible. In other words, it can be said that it is a combination of strength and speed. Explosive strength is highly specific to the nature of movement and is greatly influenced by motor coordination. This type of strength is mainly used in spiking of volleyball, jumps in basketball, sprint events, etc.
- 3. Strength Endurance:** It is the ability of a muscle to overcome resistance under the condition of fatigue or as long time as possible. Strength Endurance is the ability of a muscle to perform repeated contractions and withstand fatigue. Just like explosive strength, strength endurance is a product of two motor abilities namely; strength and endurance. Strength endurance can be static or dynamic strength depending upon whether the movement is isometric (static) or isotonic (dynamic). This type of strength is mainly used in long distance races, swimming, distance cycling, Tug of War (static) etc.

Do You Know?

Factors Determining Strength

1. Muscle composition
2. Gender
3. Age



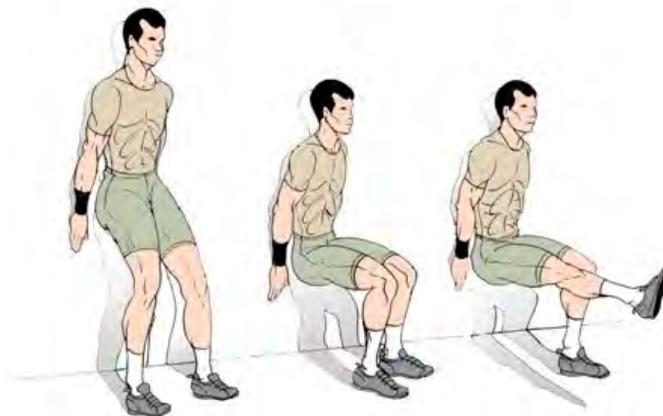


4. Size of the muscle
5. Number of muscle fibres.
6. Body weight
7. Muscular coordination

10.1.4 Methods to Develop Strength

As stated earlier, strength is a highly trainable motor component and therefore, there are certain methods that help an athlete to develop or improve strength. These methods are discussed below:

1. **Isometric Exercise:** The term *isometric* combines the Greek words *isos* meaning **equal** and *metria* meaning **measuring**. This means that in these exercises the length of the muscle and the angle of the joint do not change, though contraction strength may be varied. In isometric exercises muscle and joint movement is not visible as there is no direct movement and the work performed cannot be seen directly eg., pushing a wall. Although work is done when pushing a wall, ie., force is exerted, but the work done cannot be seen as the wall remains at the same place and doesn't move a bit. When such exercises are done there is no change in the length of the muscle, hence they are called "isometric." These exercises need less time and equipment and can be performed practically anywhere and everywhere. These exercises, if performed regularly, may result in the change of muscle size and shape.



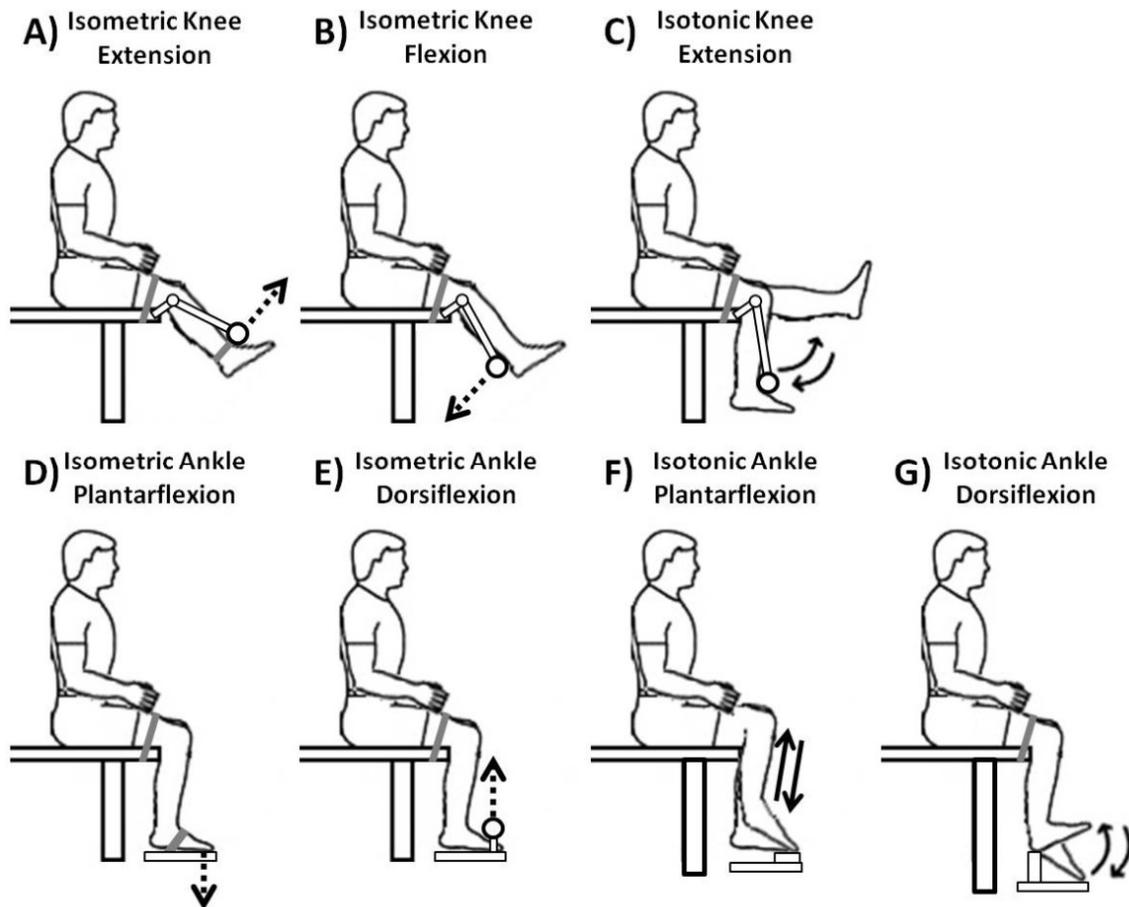
Picture Source³

2. **Isotonic Exercise:** The term *isotonic* comes from the Greek *isos* meaning **equal** and *tonos* or **tone**. The word isotonic means **maintaining equal (muscle) tone**. The muscle maintains equal tone while shortening in isotonic exercise. These are exercises in which movements can be seen directly. Isotonic exercises result in toned muscles and increased muscle length. These exercises have great importance in sports. Running





and jumping on the spot, weight training exercises, calisthenics exercises are some of the examples of isotonic exercises. This method is considered to be the best method to develop strength.



Picture source⁴ (Gwin & Ferris, 2012)

- 3. Isokinetic Exercises:** The term *isokinetic* comes from the Greek *isos* meaning **equal** and *kinetic* means **movement**, so isokinetic stands for **equal movement**. This method of exercise was introduced by J.J. Perrine in 1968 and involves special type of muscle contraction called isokinetic contraction generally used in sporting events like rowing and swimming. These exercises are performed on specially designed instruments. In isokinetic contraction, the muscles apply maximal force throughout the range of motion around the joint. Whereas, in isotonic contraction, the force is applied at a particular angle. The use of isokinetic contraction is very limited hence, the contribution of isokinetic contraction in developing strength is yet to be scientifically proved.





Do you Know?

Preventive Measures in Strength Training

While doing strength training appropriate supervision is a must as it is always accompanied with a high risk of injury. Therefore, it is very important to know the ways of preventing such incidents. These are:

1. Strength training must be done after proper warming up.
2. Strong and stable joints are a prerequisite for strength training. Therefore, strength and stability of Musculo-Skeletal system must be ensured by doing general strength training with low intensity.
3. While exercising with heavy weights, correct technique is required. Otherwise it will result in serious injuries.
4. A strength training programme includes a variety of exercises. These exercises must be done in a proper sequence preferably agonists and antagonists muscles one after the other.
5. The load must be increased gradually and as per the athlete's ability and requirement.
6. Recovery or rest plays a vital role in strength training. Proper and effective use of recovery period helps in preventing injuries.
7. Improper breathing while exercising with heavy weights lead to serious disturbance in the blood circulation. Hence, as a rule, a sportsperson must breathe continuously and if he/she holds the breath, it should be for a minimum duration possible.
8. Safety equipment like belts, boots, wrist bands etc. should be used when necessary.
9. In case of children, the load should be low till the age of 16 years as chances of injuries are very high in children.





Extension Activity

Under the supervision of your physical education teacher form yourselves into two groups. Tell one group to do isometric and the other to do isotonic exercises one hour in a day for 3-5 days in a week. Test their strength after two months. Prepare a table and evaluate which method is better.

Date _/ _/ _ _ _/ to _/ _/ _ _/

Name:						
Objective:						
Warm up Activity						
	Set	Repetition	Time	Distance	Intensity	Remarks
Strength Training Exercise						
	Set	Repetition	Weight	1 RM	Rest	Remarks
Cool Down Activity						
	Set	Repetition	Time	Distance	Intensity	Remarks

I. Tick the correct options.

Q1. Isokinetic method was developed by .

- (a) HC Buck
- (b) Joy Perrny
- (c) **J.J. Perrine**
- (d) JJ Coubertin





Q2. In Exercise no movement takes place.

- (a) **Isometric**
- (b) Isotonic
- (c) Isokinetic
- (d) Isonomic

Q3. Under which kind of strength would you put Shotput?

- (a) Strength Endurance
- (b) Explosive Strength
- (c) **Maximum strength**
- (a) Speed Strength

II. **Answer the following questions briefly.**

1. What is Strength?
2. Explain Isometric exercise with suitable examples.
3. Write a short note on the different types of Strength.

III. **Answer the following questions in 150-200 words.**

1. Explain the preventive measures to be kept in mind during strength training.
2. What is Strength? What are various methods for developing Strength? Write in detail.

10.2.1 Endurance

Harre (1986)⁵ defines endurance as “the ability to resist fatigue.”

Barrow and **McGee**⁶ define endurance as “the result of a physiologic capacity of an individual to sustain movement over a period of time.”

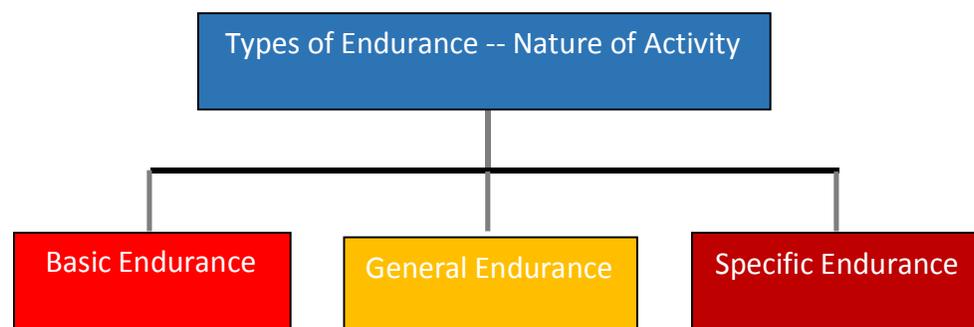
Endurance is, thus, the ability of an individual to sustain an activity for a long period without undue fatigue. Like strength, endurance is also a conditional ability. Endurance has been studied thoroughly and deeply because it holds great importance in health, training and competition. Endurance play a vital role in almost every activity directly or indirectly. It is either measured by the number of repetitions of a task or the time for which an activity is performed.





Picture source : (douglas, 2018)⁷

10.2.2 Types of Endurance



Different games and sports require different type of endurance which majorly can be classified into the following categories:

1. Classification according to the Nature of the Activity:

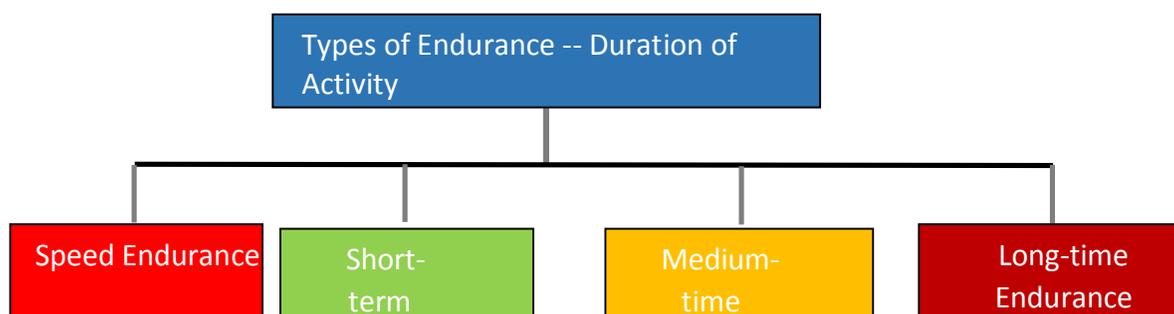
This classification is based on the kind of activity for which endurance is required. It can be classified into following types:





- (a) **Basic Endurance:** Basic Endurance is the ability of a person to resist fatigue in which the load is of medium intensity and involves aerobic muscular metabolism. Therefore, it can be said that it is the ability to do movements that involve a large number of muscles at a slow pace for a prolonged period of time. For example: jogging, cycling, swimming for more than 30 minutes. Basic endurance forms the base for all other types of endurance.
- (b) **General Endurance:** General Endurance is the ability to do such sporting movements, for prolonged duration, that are general in nature. This type of endurance is not specific to any sport and can be developed by performing general exercises. Unlike basic endurance, in which the intensity of the activity is medium, general endurance activities may incorporate high intensity exercises. But the duration for general endurance is much shorter than basic endurance.
- (c) **Specific Endurance:** Specific Endurance is the ability that is required by a sportsperson to perform movements of a particular sport in order to resist fatigue. Specific endurance varies from activity to activity as it depends on the nature of fatigue. For example: specific endurance of a hockey player is different from a marathon runner or a cyclist as the need of the activity is different.

2. Classification according to the Duration of the Activity



This classification takes into consideration only cyclic sports activities and is based on physiological factors. From the view point of Harre (1986), this classification can be divided into following sub-categories.

- **Speed Endurance:** Speed Endurance is the ability to resist fatigue in cyclic activities that last up to 45 seconds. A classic example for this type of endurance is 400m sprint in track and field events. This type of endurance is largely dependent on the power and capacity of an individual to produce energy.
- **Short Term Endurance:** Short Term Endurance is needed for the activities that last from 45 seconds to about 2 minutes. The most appropriate example for short term

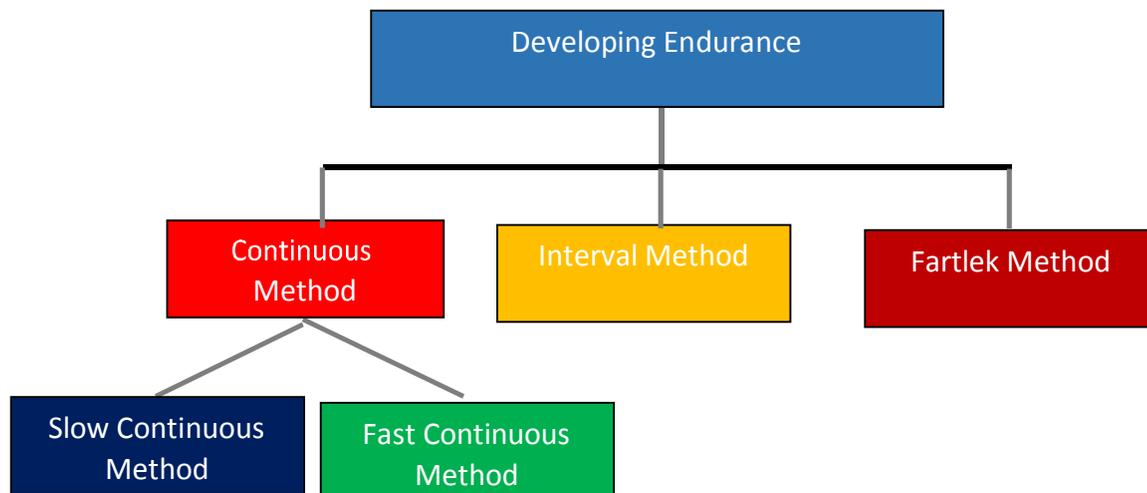




endurance is 800m run. This endurance depends majorly on speed endurance and strength endurance.

- **Medium Time Endurance:** To resist fatigue in activities that lasting from 2 minutes to about 11 minutes medium time endurance is used. The most common example of this type is 1500m and 3000m run and 100m rowing. Similarly, as short-time endurance, this type of endurance also depends on speed and strength endurance but to a limited extent.
- **Long Time Endurance:** Long Time Endurance is needed for the activities that last for more than 11 minutes. This type of endurance is required in events like marathons, cross country races etc.

10.2.3 Methods for Developing Endurance



The various methods to develop endurance are discussed below:

1. Continuous Method



Picture Source⁸





As the name suggests, this method is about continuity. In this method, an exercise is done for a long duration of time without any rest. Because the duration of the activity is long and continuous in nature, the intensity of the activity is set to be low. This method has following sub categories:

- (a) **Slow Continuous Method:** in this method, the activity is performed at a certain speed without any break for a long duration. The speed of exercise is usually determined according to heart rate. For a trained athlete, heart rate during activity should be between 140-160 beats per minute. The duration of the activity should not be less than 30 minutes. This method is used for activities like walking, running, cycling etc.
- (b) **Fast Continuous Method:** in this method, the activity is performed at a comparatively fast pace but the speed will remain uniform throughout the activity. Heart rate during the activity should be between 160-180 beats per minute. Because the intensity is high and is more strenuous and exhaustive than slow continuous method, the duration of the activity should be at least 20 minutes.

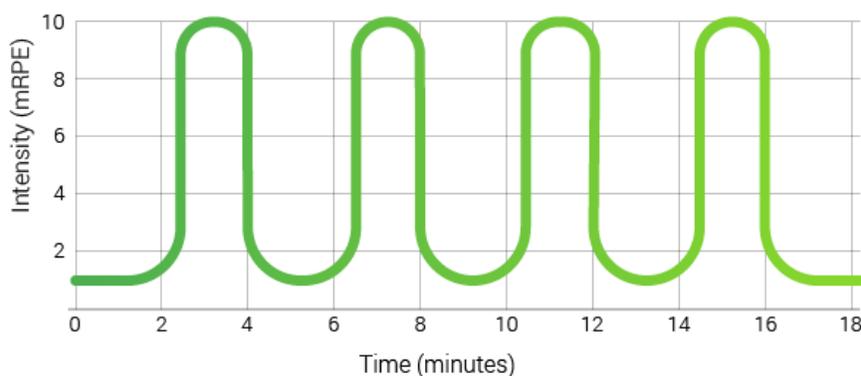
Extension Activity

Working in groups, plan a video of exercises to improve endurance.
Record the video and put it on YouTube.

2. Interval Method

This is the most versatile method used for improving endurance. In this method, the activity is done at a comparatively high intensity with intervals or breaks of incomplete recovery. It is based on the principle that, “work should be done with sufficient speed and duration so that the heart rate goes up to 180 beats per minute. After this there should be a short interval and when the heart rate drops down at to 120- 130 beats per minute the work should be started again.”

Sprint interval training protocol: intensity vs time



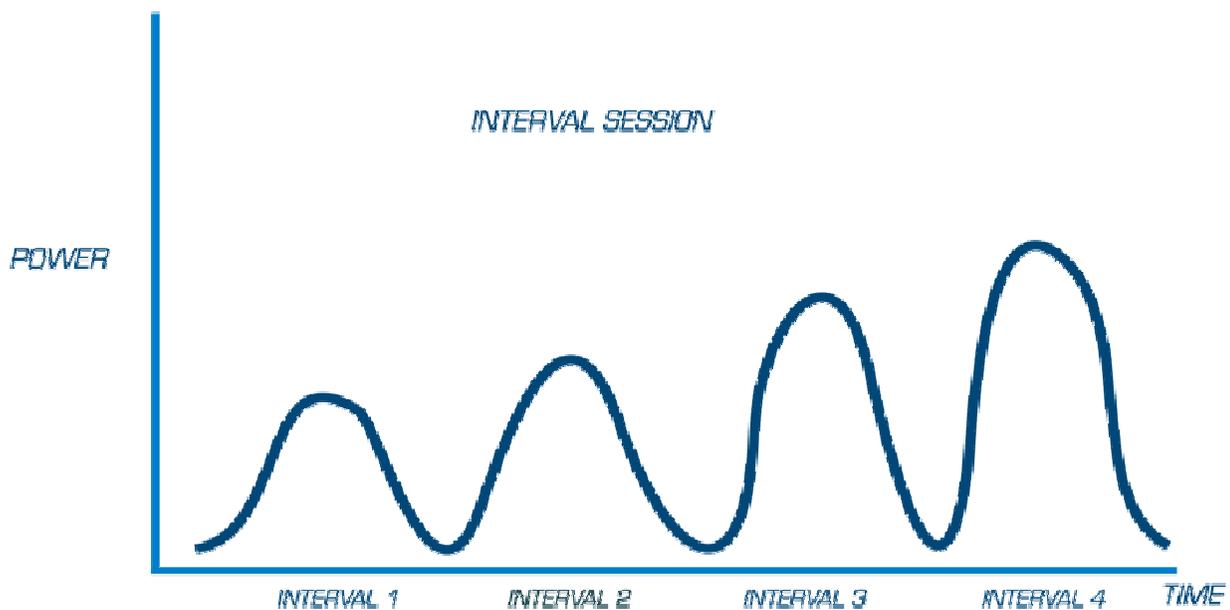
Picture Source⁹





3. Fartlek Method

Fartlek is a Swedish word which means 'speed play'. In other words, it is another variation of variable pace method. The difference between the two is, in the Fartlek method the speed variation is not planned. The athlete changes the speed with his own accord during the activity due to the changes in terrain, surroundings and his feelings. The heart rate usually ranges between 140-180 beats per minute during this method. The duration of this method may range from 15 minutes to 1 hour. Due to the varied pace, this exercise is very strenuous and should be done by trained athletes.



Picture Source¹⁰

Do you Know?

Volume: It is primary component of training which include duration or time of training, distance covered, volume load (sets in weight training), number of repetition, or performed work in given time. It is a quantitative component of work.

Intensity: It is a qualitative component of work. More work or efforts done by the athlete in per unit of time. Assessment of intensity vary sports to sports. Speed is assessed by meters per second, resistance in kilogram, in team games or distance races may be assess by heart rate etc.





I. Tick the correct option.

Q1. Which is not a type of endurance according to nature of activities

- (a) Basic Endurance
- (b) General Endurance
- (c) Specific Endurance
- (d) **Speed Endurance**

Q2. 400m sprint event comes under

- (a) **Speed Endurance**
- (b) Short Endurance
- (c) Medium Endurance
- (d) Long Endurance

Q3. There will be no variation in pace in activity in

- (a) Fartlek Method
- (b) **Continuous Method**
- (c) Interval Method
- (d) None of Above

II. Answer the following questions briefly.

1. Define Endurance.
2. Write about the different types of Endurance based on duration of activity.

III. Answer the following questions in 150-200 words.

1. Explain types of endurance according to the duration of the activity.
2. Explain types of endurance according to the nature of the activity.
3. What do you mean by endurance? Explain methods to develop endurance in detail.

10.3.1 Speed

Theiss and **Schnabel**¹¹ defined speed as “*the prerequisite to do motor actions under given conditions (movement task, external force, individual prerequisite) in minimum of time.*”

Johnson and **Nelson**¹² defined speed as “*the capacity of an individual to perform successive movement of the same pattern at a fast rate.*”

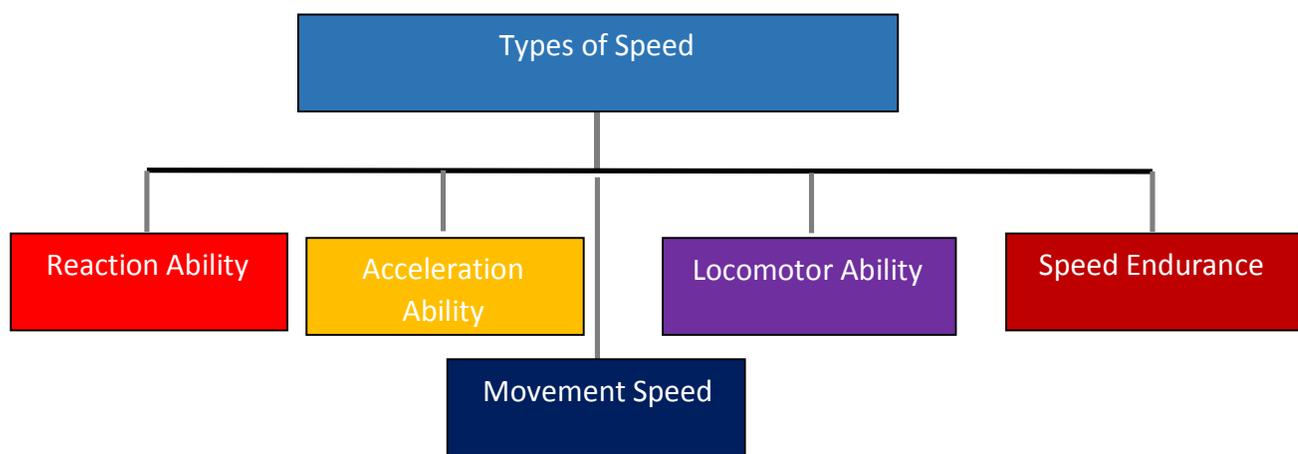
Speed is an ability to do task in minimum possible time. Speed has a complex nature and depends considerably on the central nervous system. Speed ability, in sports, signifies the ability to execute motor movements as quickly as possible. These movements can be cyclic or acyclic in nature.





There are certain factors that help in determining the speed of an individual. These include mobility of the nervous system, explosive strength of an individual, correct technique of performing a task, bio-chemical reserves and metabolic power of an individual, flexibility, and certain psychic factors like optimum arousal, attention, motivation, concentration, ability to relax etc.

10.3.2 Types of Speed



From general point of view there are five different types of speed that are discussed briefly as follows.

- 1. Reaction Ability:** Reaction Ability is the ability to react quickly to a stimulus or signal. It depends entirely on the coordinative abilities of an individual. Different games and sports have different types of signals like visual, auditory and tactile to name a few. And to respond to such signals accurately and as quickly as possible is known as reaction ability. It can be further classified into simple and complex reaction ability.
- 2. Acceleration Ability:** Acceleration Ability is the ability to achieve high speed of locomotion from a stationary position. It depends greatly on the explosive strength, technique and movement frequency of a sportsperson. This ability is important in almost every game and sport, but holds a great influence in sprinting events.
- 3. Movement Speed:** Movement Speed can be defined as the ability to perform a single movement in the minimum possible time. It is highly related to acyclic sports, though in cyclic sports its importance is limited to the initial phase. It is dependent on the technique and explosive strength of the sportsperson.
- 4. Locomotor Ability:** Locomotor Ability is the ability to maintain maximum speed when in motion for maximum possible duration or distance. It is important in sports like 100m and 200m sprints, speed skating and short sprints in cycling. Locomotor ability



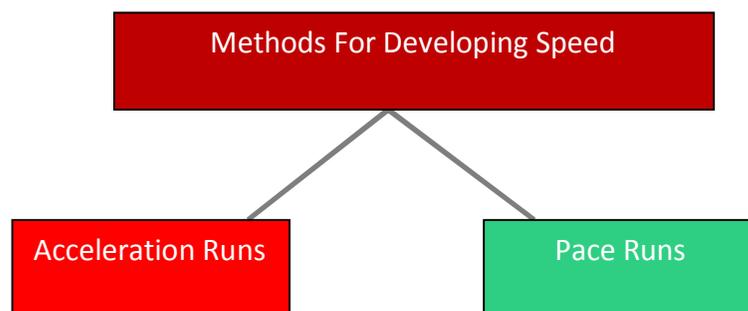


depends highly on the mobility of the nervous system. The chances of improving locomotor ability is relatively low.

5. **Speed Endurance:** Speed Endurance is a combination of two words speed and endurance. It is the ability to move at a high speed for a longer duration of time i.e., under the condition of fatigue. It depends highly on anaerobic capacity, technique and psychic factors.

10.3.2 Methods for Developing Speed

Speed is a motor ability that depends on genetic and environmental factors. Genetic factors, as we all know, cannot be manipulated. An individual having fast twitch fibres in a comparatively higher percentage than slow twitch fibres will have more speed. Whereas the individual who has a high percentage of slow twitch fibres will have better endurance. The ratio of these muscle fibres cannot be changed. Therefore, it can be said that the genetic make-up of an individual sets the limit on the speed of an individual, but the role of environmental factors on speed cannot be denied as well. The following are the most commonly used methods to develop speed of an individual.



1. **Acceleration Runs:** This method is generally used to develop speed while attaining maximum speed from a static position. In acceleration run, a sportsperson is required to run a specific distance. After the start, the athlete tries to gain maximum speed at the earliest and finishes the specified distance at that speed. These runs are repeated with sufficient rest between the runs. It usually takes 50-60 meters for a sprinter to attain maximum speed after the start. According to the researchers, it is observed that even well-trained athletes can maintain their maximum speed for 20 meters only.

The number of acceleration runs can be set according to the age, capacity and level of fitness of an athlete. It may vary from 6-12 repetitions with intervals for complete recovery in between. The acceleration runs must be done after proper warm up.

2. **Pace Runs:** Unlike acceleration runs, pace runs incorporate the method of running the set distance at a uniform speed. It usually includes races of 800 meters and above. It is





a fact, that an athlete can run a distance of 300 meters at full speed and in case of longer races he must conserve his energy by reducing speed. Therefore, in middle and long- distance races it is important to keep the pace in mind. In the beginning of such races the speed should not be too high and the pace should be maintained throughout the race. For this type of training the athlete should run at a maximum steady speed for a distance 10-20% more than the actual racing distance. Repetition for pace run training can be fixed as per the fitness level of the athlete with complete recovery in between repetitions.

Do you Know?

Muscles are responsible for body movement. These muscles are made up of fast and slow twitch muscle fibres.

Fast twitch fibres: They execute fast movement for short distance also known as anaerobic muscle. It helps in short distance races, weight lifting, jumping etc.

Slow twitch fibres: They promote long duration activity in slow pace, also known as aerobic muscles. Example are long distance running, swimming, cycling etc.

I. Tick the correct option.

Q1. Which is not a type of Speed

- (a) Reaction
- (b) **Sprinting**
- (c) Acceleration
- (d) Speed endurance

II. Answer the following questions briefly.

1. What are acceleration runs?
2. Define Speed.

III. Answer the following questions in 150-200 words.

1. Explain types of Speed and methods to develop speed.





10.4.1 Flexibility

Flexibility is also known as range of motion around a joint. It is the ability to execute a movement with greater amplitude or range. Flexibility is a motor component which is not clearly a conditional or a coordinative ability. In general usage, flexibility often corresponds to stretchability, elasticity, liveness, mobility, pliancy etc. But as a scientific term flexibility means much more than what is conveyed by any of these terms. Flexibility can be defined as the ability to execute movements with greater amplitude or range. Flexibility is affected by muscle strength, structure of the joint, tendons, ligaments and other factors. A person possessing a good degree of flexibility can perform daily tasks with greater ease and comparatively more efficiently and effectively. Moreover, the personality and posture of such individuals seems to be more attractive.

Flexibility is related to the genetic factors as well as physical activity programme. Tight joints affect smooth and efficient movements whereas flexibility ensures smooth and efficient movements. Therefore, it can be said that flexibility is helpful in many ways such as in preventing injuries, improving posture, reducing back pain, maintaining healthy joints, improving balance while making movements and in learning various skills easily, for example, backstroke in swimming.

10.4.2 Importance of Flexibility

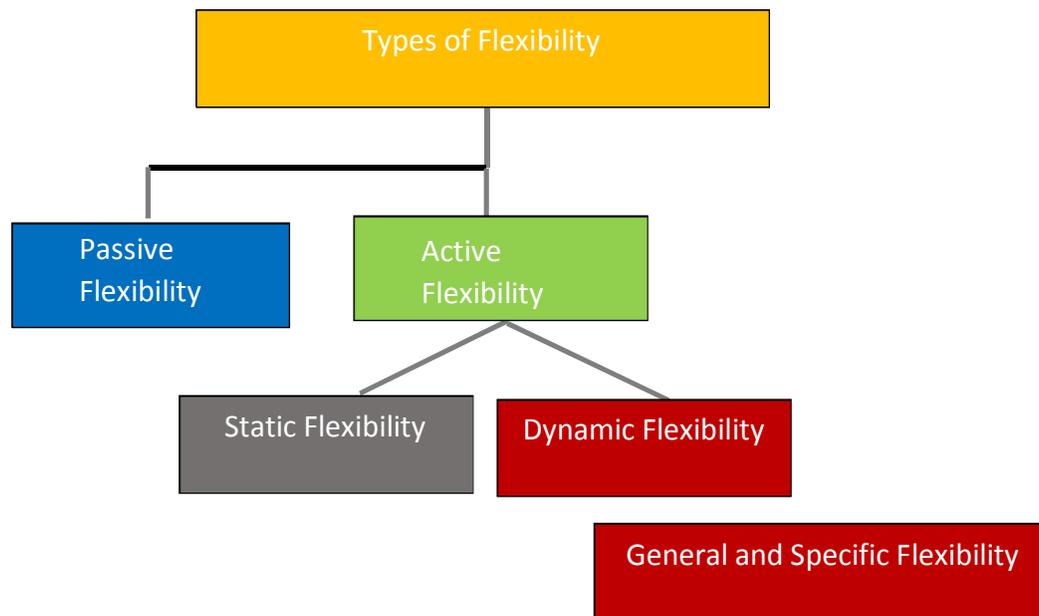
Flexibility has an important inter-relationship with other factors that improve performance. Hence, it is important in determining other factors to a lesser or greater extent. The importance of flexibility is briefly discussed below:

1. Greater range of motion ensures more force and speed developed by the muscles.
2. Greater flexibility helps the sportsperson to perform movements with minimum muscular tension, thereby facilitating higher movement economy.
3. It reduces stiffness in joints.
4. It reduces the risk of injuries as muscles are more pliable.
5. It helps in maintaining appropriate posture while performing.



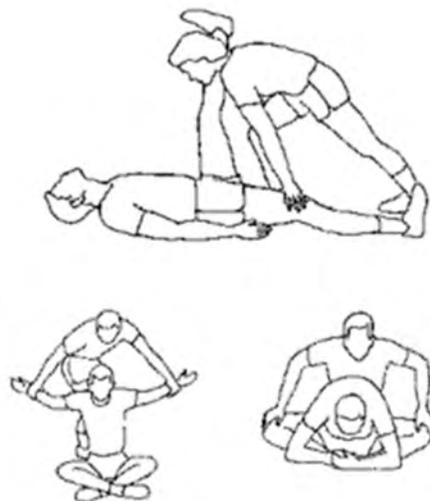


10.4.3 Types of Flexibility



Flexibility is of following two types:

1. **Passive Flexibility:** The ability to do movements with greater amplitude with external help is known as passive flexibility eg., stretching with the help of a partner, an accessory, or a prop. You can also use the floor or a wall. Passive flexibility allows you to stretch more than active flexibility and is determined largely by the structure of the joint and stretchability of the muscles and ligaments. Actually, passive flexibility is the base of active flexibility.



Picture Source¹³





2. **Active Flexibility:** The ability to perform a movement with greater amplitude without an external help is called active flexibility. It is the range of motion that you can achieve by using your muscles to put your joint there, eg., using your shoulder muscles to pull your arm back behind your ear as far as you can. Active flexibility is always less than passive flexibility and the difference between the two indicates lack of muscular strength or coordination or both. Active flexibility is further classified into following two categories:

- (a) **Static Flexibility:** it is required for movements done while the individual is in a static position i.e. standing, sitting or lying.
- (b) **Dynamic Flexibility:** it is required for executing movements when an individual is moving.

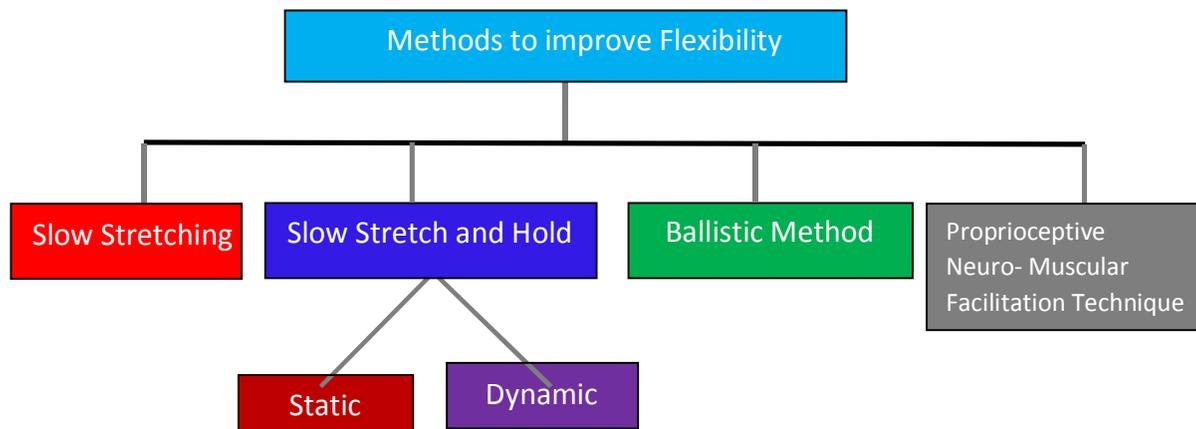


Picture Source ¹⁴

10.4.4 Methods of Improve Flexibility

In addition, the terms General and Specific Flexibility are also used often to refer to the types of flexibility. **General flexibility** refers to the level of flexibility of all the important joints of the body such as shoulder, hip and trunk. It is not used in reference to any sporting event or physical activity. However, **specific flexibility** should be understood to be the ability to perform specific movement or movements related to specific sports.





The various methods that can help to improve flexibility are discussed below.

1. **Slow Stretching:** The first and the foremost way to improve flexibility is stretching the muscles around the joint slowly. The key point to note here is the stretching should be slow and without any jerky movements.
2. **Slow Stretch and Hold:** The next stage after the stretching is to hold for about 6-8 seconds at the maximum stretching point. This method is considered to be the most commonly used methods in the field of games and sports.

*Stretching can be done either in a **static** manner or in a **dynamic** manner.

Static stretching involves slowly easing into stretching and holding the position. The time period required for static stretch depends on the purpose. If it is for cooling down, the stretch should be held for about 10 seconds. If it is for improving flexibility, then the hold is recommended for about 30 seconds.

Dynamic stretching requires controlled movements, usually of legs and hands, and where the event requires dynamic movement, it is suitable to perform dynamic stretching exercises.

3. **Ballistic Method:** This form of stretching uses body's momentum in an effort to extend range of motion. In this method, the movement is performed with a swing and in a rhythmic way. As the stretching is done in a rhythmic manner, it is called Ballistic Method. Ballistic method was once quite popular but has now come under the scanner with many physical therapists condemning it as they believe that ballistic stretching can lead to injury.
4. **Proprioceptive Neuro-Muscular Facilitation (PNF) Technique:** This is also known as the post-isometric stretch and is based on the principle of proprioceptive neuro-muscular facilitation. This principle states that, if a muscle is contracted maximally for a few seconds, then after the contraction the muscle gains the maximum relaxation. Thus, the muscle is first contracted for 5-7 seconds and then gradually stretched to its





maximum limit and held in this position for about 8-10 seconds. The process is to be repeated 4-8 times for each muscle group.

Do You Know?

Important Tips for Developing Flexibility

1. The right age for flexibility development is considered to be before puberty as it is hard to develop flexibility after puberty.
2. Flexibility tends to deteriorate once improved, if the stretching routine is not continued.
3. Stretching exercise performed in fatigue affects flexibility negatively. Hence, a person should perform such exercises when fresh. The ideal time to perform stretching exercise is after warm-up.
4. Flexibility exercise tends to work best after a proper warming up. If the warm up is not performed properly it may lead to overstretching of the muscles.
5. Flexibility training should aim for optimum flexibility and not for maximum flexibility. Too much flexibility results in less joint stability and therefore chances of injury increase.
6. A muscle group must be stretched several times for improving flexibility effectively. Usually 10-15 repetitions are recommended for a muscle group to gain flexibility.
7. A stretching exercise should be accompanied by a conscious effort to relax antagonist muscles.
8. It is important to avoid jerky movements while performing stretching exercise.
9. Age has an inverse relationship with flexibility. Therefore, do not compete with others while working on one's level of flexibility.
10. For faster improvement in flexibility, the routine can be followed daily or twice a day with involving variety of exercises for each joint.

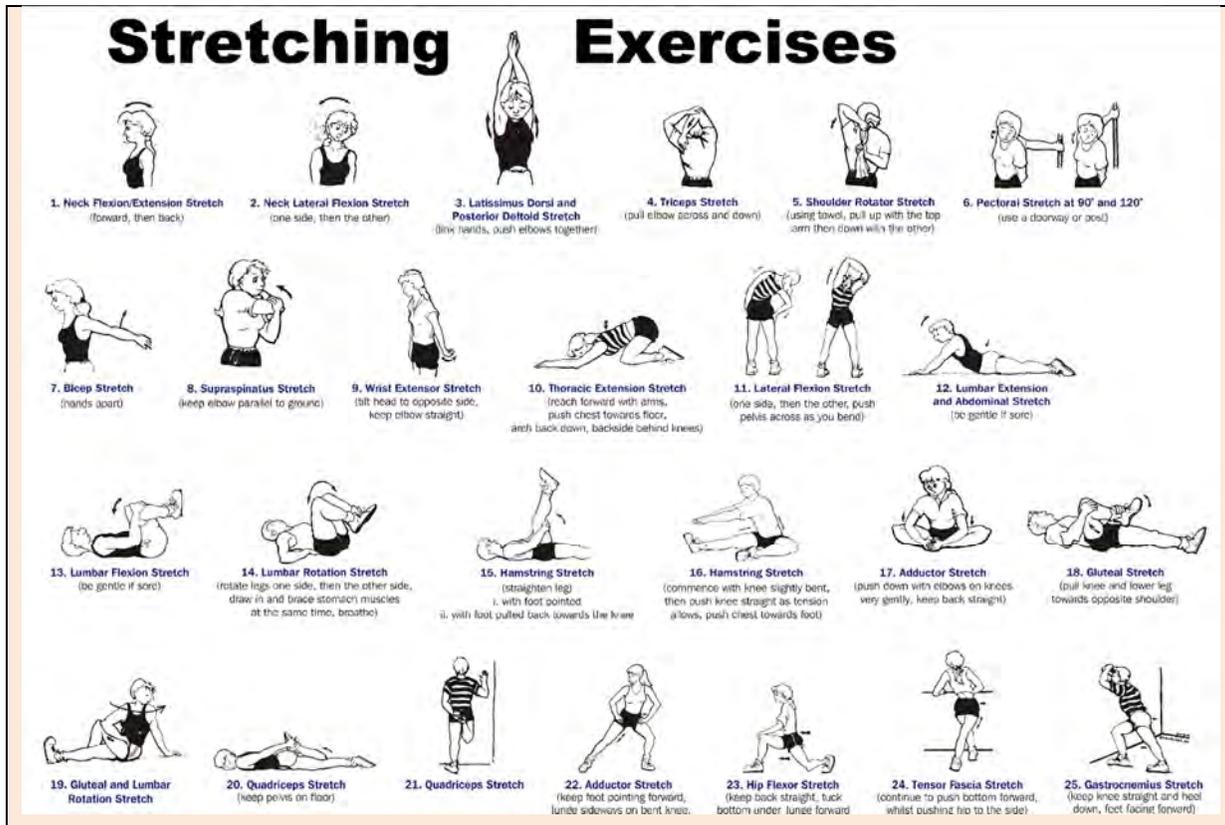
Extension Activity

Good flexibility can improve sports performance and reduce risk of injury. Look at the following exercises for improving flexibility.

Do as many as you can, increasing the number of exercises and number of repetitions.

Chart your progress.





Picture source ¹⁵

I. Tick the correct option.

Q1. Which is not a type of Flexibility?

- (a) Active
- (b) Passive
- (c) Ballistic
- (d) Stretch

Q2. In which method is stretching done in a rhythmic way?

- (a) Slow stretch
- (b) Slow stretch and hold
- (c) **Ballistic method**
- (d) PNF

II. Answer the following questions briefly.

1. Define flexibility.





2. What do you mean by Passive Flexibility?

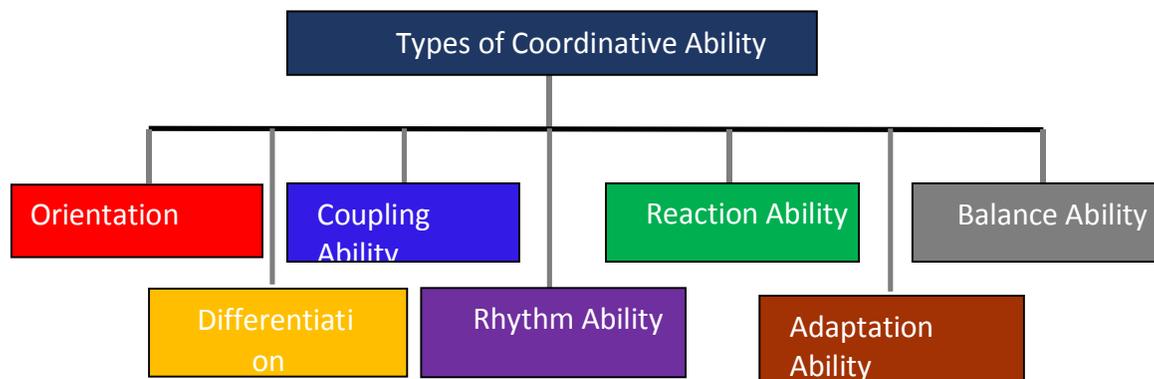
III. Answer the following questions in 150-200 words.

1. Explain types of Speed and methods to develop speed.
2. Discuss methods to improve flexibility.
3. **Define Flexibility. Explain its types and any two methods to develop flexibility.**

10.5.1 Coordinative Abilities

Zimmerman et al. state that *“Coordinative abilities are understood as relatively stabilised and generalised patterns of motor control and regulation processes. These enable the sportsman to do a group of movements with better quality and effect.”*

The term coordinative abilities has come into existence replacing the earlier used term agility. The concept of coordinative abilities should be understood as the ability expediently to form, coordinate and, link into an integrated whole the motive actions on one hand and secondly the ability to transform action already worked out under dynamic situations. Coordinative abilities are primarily dependant on the motor control and regulation process of central nervous system and of one of its properties which Ivan Pavlov called plasticity. For a coordinative ability, the control regulation processes are required to function in a particular manner, which is automatized to a great extent during skill performance. The coordinative abilities are those abilities of an individual which enable the individual to perform a variety of skill activities properly as well as efficiently



In sports, following seven types of coordinative abilities are important. The use of these abilities is however different in different games.

1. **Orientation Ability:** Orientation ability is the ability to determine and change the position and movements of the body in required time and available space in relation to a definite field of action (such as a volleyball court, skating rink, or football ground) and/or a moving object (like a ball, opponent, or partner). The use and demands on orientation ability is vast in sports. For example: in gymnastics, the body movement





and position is important for orientation. Whereas in team games, vision, especially peripheral vision, is decisive for orientation.

2. **Differentiation Ability:** Differentiation Ability is the ability to attain high level of fine tuning of movement phases. It is the ability to achieve high level of accuracy, perfection and economy of separate body movement and movement phases in a motor action. The high level of differentiation depends on movement experience and the degree of mastery over motor action. High differentiating ability is used in sports in sensing or implementing movement such as movement sense eg., in gymnastics differential ability enables highly precise and accurate movements according to a given set of movements, or in football, there needs to be coordination of head and feet.
3. **Coupling Ability:** Coupling ability is the ability to coordinate body part movements with one another and in relation to a definite goal-oriented body movement. Coupling ability is important in sports in which movements with a high degree of difficulty have to be performed with a great deal of accuracy and precision such as gymnastics and team games. In a team game like football foot movements for ball control or dribbling have to be coupled with the whole-body movement of running and jumping. Coupling ability depends on the functional capacity of kinaesthetic and optic sense organs.
4. **Rhythm Ability:** Rhythm ability is the ability to perceive the rhythm of a movement and to perform the movement with the required rhythm. It also denotes the ability to reproduce rhythm, stored in motor memory, in motor action. In some sports like gymnastics and figure skating the sportsperson has to perceive an external rhythm, music, and to express it in his movements. Sports in which rhythm is not given from outside, the sportsperson has to make use of the rhythm stored in his memory.
5. **Reaction Ability:** This is the ability to react quickly and effectively to a stimulus. Different games and sports have different types of signals like visual, auditory and tactile to name a few. And to respond to such signals accurately and as quickly as possible is known as reaction ability. It can be further classified into simple and complex reaction ability.
6. **Adaptation Ability:** Adaptation ability is the ability to adjust or completely change the movement programme on the basis of changes and anticipated changes in the situation. These situational changes may be expected ones or may take place suddenly. It depends considerably on the speed and accuracy of perception of changes in the situation.
7. **Balance Ability:** it is the ability to maintain equilibrium or balance throughout the movement and to regain balance quickly after balance disturbing movements. It is further classified into two types:





- (a) Ability to maintain balance during stationary position or slow movements. It depends on kinaesthetic, tactile and to some extent on vestibular sense organs.
- (b) Ability to maintain or regain balance during rapidly changing positions. It depends primarily on the functional capacity of the vestibular sense organs.

I. Tick the correct option.

Q1. Ability to coordinate body part movements with one another and in relation to a definite goal oriented body movement is known as:

- (a) Balance Ability
- (b) Adaptation Ability
- (c) Rhythm Ability
- (d) **Coupling Ability**

Q2. Ability to attain high level of fine tuning of movement phases is known as:

- (a) **Differentiation Ability**
- (b) Orientation Ability
- (c) Adaptation Ability
- (c) Coupling Ability

II. Answer the following questions briefly.

1. What do you mean by the term coordinative abilities?
2. What is coupling ability?

III. Answer the following questions in 150-200 words.

1. Write about coordinative abilities in detail.
2. What is coordinative abilities and explain different types of coordinative ability?

10.6.1 Circuit Training

According to **Adamson** and **Morgan**¹⁶, "Circuit training is the training method in which certain exercises of various kinds are performed with or without apparatus with given dosage."





Circuit training method was designed by Adamson and Morgan of Leeds University in the year 1957. It is a scientific arrangement of exercises performed systematically and repeatedly in such a way that it looks like a circuit. Therefore, it is called circuit training.

It is a method of training and conditioning that involves multiple stations that make a complete *circuit* (or circle). It usually consists of 10-12 training stations according to the need and intensity required for the training programme. Recovery period between the stations and between the circuits is controlled.

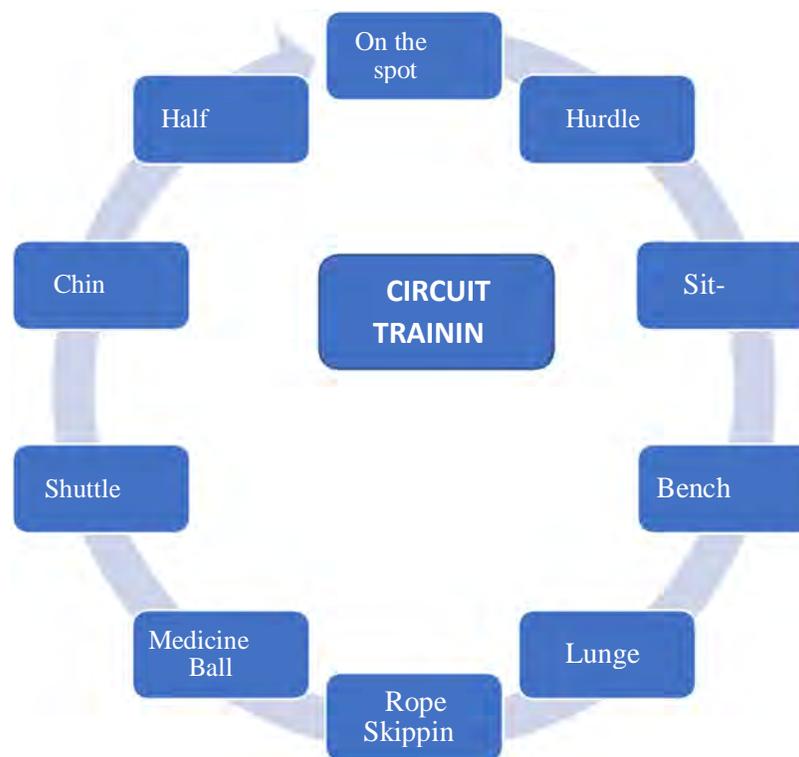


Fig. 1: A Circuit

Description:

- Purpose of the circuit training is to develop Muscular endurance. Activities include
On the spot running: 1 minute
Hurdles: 10 jumps over the hurdles
Sit-ups: 10 repetitions
Bench press: weight 60 % of 1RM x 10 repetition
Lunges: 10
Rope skipping: 50 skipping
Medicine Ball Throw: 10 throws of 10 kgs weight ball
Shuttle run: 10m x4





Chin ups: 10 repetitions

Half Squat: 10 repetitions

- No rest between exercises
- One minute rest after one cycle
- One to three cycles may be performed

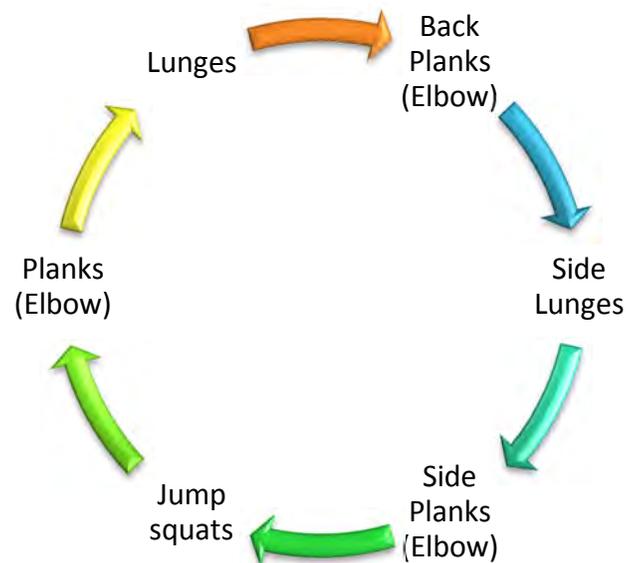


Illustration-2

Description:

- Purpose of the circuit training is to develop power of lower body.
- Duration of different Planks: one minute each
- Lunges and Squats jumps: 20 repetitions each
- No rest between exercises
- One minute rest after one cycle
- One to three cycles may be performed

10.6.2 Main Characteristics of a Circuit

1. Exercises in a circuit are simple to learn and execute.
2. Exercises are usually performed with medium resistance or medium weight.
3. Frequency or number of repetitions vary as per the need of the programme.
4. Aim of circuit training is to develop endurance and strength.
5. It takes into account exercises of the whole body.





6. It is generally given in the preparatory phase of developing basic endurance and strength.
7. The load must be gradually increased.

10.6.3 Impact of Circuit Training

1. It improves cardiovascular fitness of a sportsperson.
2. It improves general fitness by incorporating exercise that involves the whole body and, hence, improves a variety of motor components like strength, flexibility and endurance.
3. It enhances VO₂ max (maximal oxygen consumption) which means the body can take more oxygen to be utilized by muscles.
4. It further enhances consumption of oxygen by muscles.
6. It improves muscle strength. But it does not improve maximum strength or explosive strength.
7. It improves muscular endurance. However, circuit training alone cannot train a long-distance runner for the peak performance.

Case Study

After getting their fitness levels assessed, and with understanding of mechanical analysis of their movement, the three boys, Ram, Shyam and Vinay decide to improve the different components of fitness. Since they are in class XII, and involved in competitive sports, their focus is also admission to the top colleges and universities on the basis of their sports performance. Their physical education teacher has informed them that most of the colleges give importance to physical fitness and sports skill tests. Their teacher felt their current fitness level was not up to the mark and stressed on the need for implementation of scientific sports training methods. The students were eager to know how this was different from the way they were training earlier. Their teacher explained the concept of 'Sports training' as a planned and controlled process in which, for achieving a goal, changes in complex motor performance, ability to act and behaviour are made through measures of content, methods and organisation. He emphasised that, sports training is the basic form of preparation of sportsmen, and that the preparation of a sportsperson represents a multidimensional process of purposeful utilisation of the factors – means, methods and conditions – which help in enhancing the physical fitness levels of the sportsperson and ensure the required level of his sports performance ability. The boys started their training for speed, flexibility, coordination, strength with a scientific approach under the guidance of their teacher who created specialized and specific training plans for them along with periodization of their schedule for each of the three individuals. Maximal Strength, Explosive





Strength and Strength Endurance were planned through Isometric, Isotonic and Isokinetic exercises. Another essential component of training was specific endurance, for which continuous method, and Fartlek training methods were used. PNF stretching along with ballistic stretching method, static and dynamic stretching methods were also adopted in the training session. A training method with variety of exercises at multiple stations with controlled recovery period was also implemented with planned dosage, which was thoroughly enjoyed by the athletes and proved effective in developing aerobic capacity through increased Vo₂ max and cardiovascular endurance.

- Q. Which method is best suited for developing strength?
- (a) Interval method
 - (b) **Isometric method**
 - (c) Ballistic method
 - (d) Continuous method
- Q. To develop muscular endurance; which method will be most suitable?
- (a) **Circuit training**
 - (b) Isokinetic training
 - (c) Repetition method
 - (d) Static method
- Q. Aerobic capacity can be increased by _____ method
- (a) **Circuit training**
 - (b) Isokinetic training
 - (c) Isotonic training
 - (d) Static method
- Q. Ballistic method can be used to develop _____
- (a) Strength
 - (b) Endurance
 - (c) **Flexibility**
 - (d) Speed
- Q. Which is the training referred with 'multiple stations'?
- (a) Interval Training
 - (b) **Circuit Training**
 - (c) Continuous Training
 - (d) Fartlek Training





I. Tick the correct option.

Q1. Circuit Training Method was designed by:

- (a) **Adamson and Morgan**
- (b) Morgan and Morgan
- (c) Adamson and Adamson
- (c) None of Above

Q2. Ability to attain high level of fine tuning of movement phases is known as:

- (a) **Differentiation Ability**
- (b) Orientation Ability
- (c) Adaptation Ability
- (d) Coupling Ability

II. Answer the following questions briefly.

1. What do you understand by circuit training?
2. Write characteristic of circuit training.

III. Answer the following questions in 150-200 words.

1. **Write in detail about circuit training.**

Art Integration

Physical Education is a required program that is offered to every student in your school. The purpose of Physical Education is to promote lifelong learning in both the physical and cognitive domains. Physical Education is a sequential educational program that teaches students how to understand and participate in physical activities that can assist in developing and maintaining physical fitness throughout their lifetimes. It teaches students to understand and improve their motor skills. It encourages students to enjoy using their skills, knowledge and good decision- making abilities to establish a healthy lifestyle and to understand how their bodies work.

Physical Education ... it's about life.

Deliver a speech to students taking admission in Classes 6-11 about the importance of Physical Education in life and the expectations the school has of them in the daily PE programme.





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