

CHAPTER-1

MANAGEMENT OF SPORTING EVENTS

Topic-1

Functions of Sports Events Management.

Concepts Covered • Sports event management - Planning, Organizing, Staffing, Directing & Controlling. To know about Pre -During - Post responsibilities of various sports committees.



Revision Notes

► "Planning is a process of setting objectives and deciding how to accomplish them".

Proper planning includes:

- (i) Improving the success rate.
- (ii) Completing the task within the given time period.
- (iii) Finding out causes of failure.
- (iv) Working efficiently.
- (v) Remaining within the budgets while achieving the pre-determined targets.

Functions of Sporting Events Management consist of few important steps:

- (a) **Planning:** Planning is a process of achieving pre-determined goals and decide what is to be done, how it is to be done, when it is to be done and by whom it is to be done.
- (b) **Organising:** Organising is the management function of assigning duties, grouping tasks, establishing authority and allocating resources to carry out a specific plan.
- (c) **Staffing:** This function is concerned with finding the right person for the right position at the right time.
- (d) **Directing:** Directing is the process of supervising, motivating, leading and communicating with the subordinates to achieve the organisational objectives.
- (e) **Controlling:** The task of controlling involves establishing standards of performance, measuring current performance, comparing it with established standards and taking corrective actions, if there is any significant deviation between actual and planned performance.



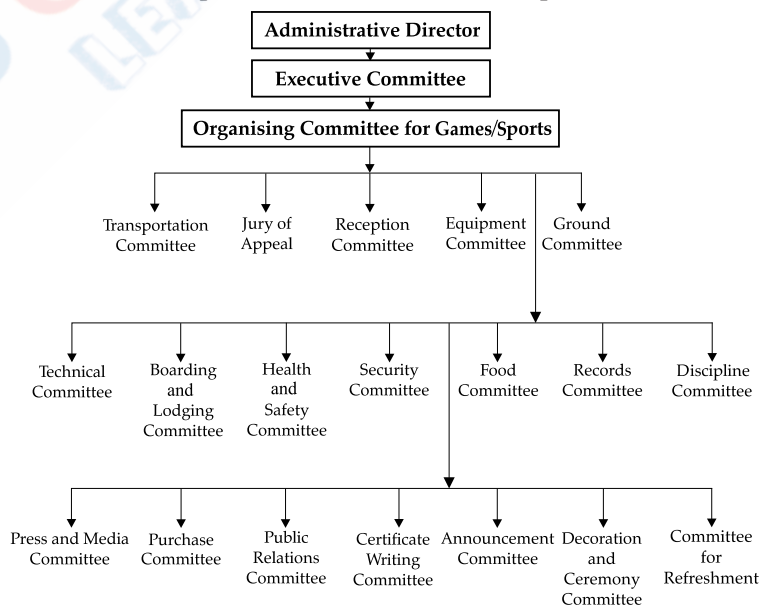
Key Words

Physical process: Great skill or ability.

Goals: Target to be achieved.

Jury of Appeal: Committee responsible for handling protest and overall fair-play in tournament.

Various Sports Committees and their Responsibilities



- ▶ **Some important committees and their responsibilities :**
 - **Press and Media Committee :** Its main duty is to publish and advertise the sports events.
 - **Transportation Committee :** Its main responsibility is to make necessary arrangements for transportation.
 - **Equipment Committee :** This committee is responsible for making the grounds or laying out the track and field.
 - **Committee for Refreshment :** This committee takes the charge of supplying refreshments and drinks to the guests, officials, competitors, etc.
 - **Decoration and Ceremonies Committee :** The members of this committee are responsible to welcome the chief guests at the opening and closing ceremonies.
 - **Registration Committee :** This committee sends entry forms to the various institutions early. It also arranges seats for guests and spectators. It sometimes also prepares fixtures of teams participating in the competition.
 - **Technical Committee :** This committee selects various officials such as referees, judges, umpires, etc.
 - **Announcement Committee :** This committee is responsible for making all the announcements during the period of sports events.
 - **Health and Safety Committee :** This committee provides first aid to the victim or affected sportsman/athlete.
- ▶ For successful organisation of the sports meet, committees are formed under three heads These are Pre-meet committee; like publicity, ground and equipment, reception committee During meet committees like refreshment, transport committee and Post-meet committees like award committee.

Topic-2

Fixtures and Tournaments

Concepts Covered • Knock-out & League tournaments • Procedure to draw fixtures - Bye & Seeding, Stair-case & Cyclic method.



Revision Notes

- ▶ **Tournament** is a competition held among various teams in a particular activity according to a fixed schedule where we have to decide a winner.
- ▶ There are various methods for organising a tournament which depends upon various factors such as
 - The number of participating teams.
 - Facilities of ground.
 - Equipment and number of officials available.
 - Days in which the tournament is to be completed.
- ▶ **Seeding** is a procedure by which good teams are placed in fixtures in such a way that stronger teams do not meet each other at the very start of the tournament. Seeding can be done only if the standards of the teams are known before the tournament starts.
- ▶ **Bye** is a privilege given to a team which is decided generally by seeding it or by draw of lots.



Key Words

Bye: Privilege given to a team on random basis.

Seeding: Privilege given to previous best performer teams.

- ▶ **Knock-out or Elimination Tournament :** It is a type of elimination tournament where the loser of each bracket is immediately eliminated from the tournament. In such tournaments, if the number of competitors or competing teams are not a multiple of 2 (i.e. 4, 8, 16,..) then some teams may be given a 'bye' and some teams are given 'seeding'.
 - **Advantages**
 - Minimum number of officials are required in organizing tournaments.
 - Owing to lesser number of matches, it takes less time to complete the tournaments.
 - It helps in enhancing the standard of sports.
 - **Disadvantages**
 - Good teams can get eliminated because of their poor performance even in the first round.
 - There are maximum chances of weak teams to enter into the final round.
- ▶ **League or Round Robin Tournaments :** A league tournament is a type of tournament in which each contestant meets all other contestants in turn. In this type of tournament, there has to be sufficient time to complete the tournament.

- **Types:**

- **Single league :** In a single league round robin schedule, each participant plays with every other participant once. Number of matches played is equal to $\frac{N(N-1)}{2}$, where N is the number of teams.

- **Double league :** If each participant plays with others twice, this is called a round robin double league tournament. Number of matches played is equal to $N(N-1)$, where N is the number of teams.

- ▶ **Fixture:** Every tournament is arranged according to a set procedure which is known as fixture.

- For knock-out tournament, the procedure to draw fixture is through bye and seeding. For league tournaments, the procedure to draw fixture is through staircase and cyclic method.
 - The success of a tournament depends upon planning of suitable fixture.
 - Tournaments are played in various forms of fixtures.

- ▶ **Fixtures in Knock-out Tournament**

- **Seeding Method :** Seeding is a procedure by which good teams are placed in fixtures in such a way that stronger teams do not meet each other at the very start of a tournament. It is done to overcome the drawbacks of a single knockout tournament.
 - Seeding can be done only if the standards of the teams are known before the start of the tournament.
 - The draw may result between the strong competitors at early level competition, so they are 'seeded' to prevent this.
 - The top competitors do not meet until the quarter-final, semi-final or final round.
 - It represents the tournament committee's subjective rating of the various players, and chances of winning the tournament.
 - **Special Seeding :** It is a method of seeding in which the players or teams directly participate in the quarter-final or semi-final matches thus avoiding their participation in the initial rounds.
 - **Bye Method :** Some teams may get bye in first round, by which they get promoted to next round competition. This may be given as a reward for their some previous achievements.
 - Byes are given in 1st round only.
 - The number of byes that should be given in a tournament is decided by finding the difference between the number of teams and the next power of two.

- ▶ **Method of Drawing Fixtures in Knock-out Tournament**

- Calculate total number of matches that will be played during the entire tournament. The number of matches to be played is calculated by subtracting 1 from total number of teams (N - 1).
 - Calculate number of Rounds - Rounds include the initial rounds, quarter-finals, semi-finals and finals. If the number of teams is a power of 2, then number of rounds will exactly be multiple of 2 up to that number.

Example : In case of 8 teams, there are 2^3 teams, so, number of rounds will be 3.

If number of teams is not a power of 2, then number of rounds will be equal to the multiple of next power of two.

Example : In case of 14 teams, there are (2^3+6) teams, so, number of rounds will be 4.



Key Words

Fixtures: A proper schedule of matches for tournament.

Knock-out: Type of tournament on elimination basis.

Round-Robin: Type of tournament on league basis.

- Calculate Number of teams in each half - All the teams are divided into two halves. If the number of teams is even, then the number of teams in upper and lower half will be equal. Example: In case of 12 teams, number of teams in each half will be

$$\frac{N}{2} = \frac{12}{2} = 6$$

If the number of teams is odd, then the number of teams in upper and lower half will be as under:

Example: In case of 15 teams, number of teams in upper half will be

$$\frac{N+1}{2} = \frac{15+1}{2} = \frac{16}{2} = 8$$

and, number of teams in lower half will be

$$\frac{N-1}{2} = \frac{15-1}{2} = \frac{14}{2} = 7$$

- **Calculate Number of byes :** Teams getting the byes do not play in the initial round. They are given by subtracting the number of teams by the next power of 2.

Example:

Total number of teams = 11

Next power of two after 11 = 16 ($2^1 = 2, 2^2 = 4, 2^3 = 8, 2^4 = 16$)

Number of byes will be $16 - 11 = 5$

- Calculate the number of byes in upper and lower half

$$\text{Number of byes in upper half} = \frac{N_b - 1}{2} = \frac{5 - 1}{2} = \frac{4}{2} = 2$$

$$\text{Number of byes in lower half} = \frac{N_b + 1}{2} = \frac{5 + 1}{2} = \frac{6}{2} = 3$$

- **Method of fixing byes**

- The last team of lower half gets first bye.
- The first team of upper half gets second bye.
- The first team of lower half gets third bye.
- The last team of upper half gets fourth bye.
- The second last team of lower half gets fifth bye.
- Like this, the order continues.

► Fixtures in League Tournaments

- **Staircase method :** In this method, the fixtures are made like a staircase. It is arranged in sequential form, there is no bye, no problem of odd or even and therefore it is easiest to arrange.

1-2											
1-3	2-3										
1-4	2-4	3-4									
1-5	2-5	3-5	4-5								
1-6	2-6	3-6	4-6	5-6							
1-7	2-7	3-7	4-7	5-7	6-7						
1-8	2-8	3-8	4-8	5-8	6-8	7-8					
1-9	2-9	3-9	4-9	5-9	6-9	7-9	8-9				
1-10	2-10	3-10	4-10	5-10	6-10	7-10	8-10	9-10			
1-11	2-11	3-11	4-11	5-11	6-11	7-11	8-11	9-11	10-11		
1-12	2-12	3-12	4-12	5-12	6-12	7-12	8-12	9-12	10-12	11-12	

- **Cyclic method**

I round	II round	III round	IV round	V round	VI round
9 B	8 B	7 B	6 B	5 B	4 B
8 1	7 9	6 8	5 7	4 6	3 5
7 2	6 1	5 9	4 8	3 7	2 6
6 3	5 2	4 1	3 9	2 8	1 7
5 4	4 3	3 2	2 1	1 9	9 8
VII round	VIII round	IX round			
3 B	2 B	1 B			
2 4	1 3	9 2			
1 5	9 4	8 3			
9 6	8 5	7 4			
8 7	7 6	6 5			

CHAPTER-2

CHILDREN AND WOMEN IN SPORTS

Topic-1

Common Postural Deformities

Concepts Covered • Different types of postural deformities-Knock knees, flat foot, bow legs, kyphosis, lordosis, round shoulders and scoliosis.



Revision Notes

➤ **Some Common Postural Deformities are :**

1. **Knock Knee** : Knock Knee is a postural deformity in which both the knees touch or overlap each other in the normal standing position. Due to this deformity, an individual usually faces difficulty during walking.

Corrective exercises:

- (i) Butterfly flatters
- (ii) Sumo squats
- (iii) Side lunges
- (iv) Cycling
- (v) Horse riding



Knock Knees

Causes :

- (i) Weakness of ligaments and muscles
 - (ii) Overweighted body
 - (iii) Lack of balanced diet
 - (iv) Lack of Vitamin D
2. **Flat Foot** : It is a deformity in which there is no arch in the foot and the foot is completely flat. The individual faces problem in standing, walking, jumping and running.



Flat Foot

Corrective measures:

- (i) Foot roller
- (ii) Calf raise

(iii) Heel raise

(iv) Toe crawl

Causes :

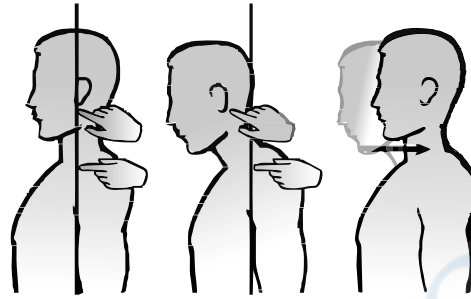
(i) Heaviness of the body.

(ii) Standing for a long time.

(iii) Faulty posture.

(iv) Use of poor quality footwear not having arch.

3. **Round Shoulders :** It is a postural deformity in which the shoulders are drawn forward, the head is extended and the chin points forward.



Correct

Forward Head
Round Shoulders

Correct

Forward

Head

Corrective measures:

(i) Lateral neck flexion.

(ii) Chest doorway stretch.

(iii) Reverse shoulder stretch.

(iv) Band pull-apart.

Causes :

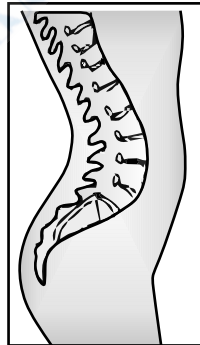
(i) Due to poor posture in work, particularly in desk job.

(ii) Faulty furniture.

(iii) Carrying heavy load on shoulders.

(iv) Poor posture while sitting and standing.

4. **Lordosis :** It is the inward curvature of spine. It is an increased forward curve in the **lumbar region**. It creates problems in standing and walking.



Lordosis



Key Words

Ligaments: Bands of tissue that hold bones, joints and organs in its place.

Lumbar Region: Area of vertebral column around abdomen above pelvic region.

Corrective measures:

(i) Plank

(ii) side plank

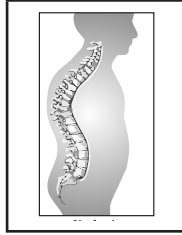
(iii) Superman exercise

(iv) Bhujangasana

Causes :

(i) Habitual overeating

- (ii) Improper environment
 - (iii) Lack of exercise
 - (iv) Diseases affecting vertebrae
 - (v) Improper development of muscles
5. **Kyphosis** : It is a deformity of the spine in which there is an increase of exaggeration of a backward curve or a decrease of a forward curve. It is also called round upper back.

**Kyphosis****Corrective measures:**

- (i) Superman exercise
- (ii) Chakrasana
- (iii) Bhujangasana
- (iv) Cat and camel exercise

Causes :

- (i) Reading in dim light.
- (ii) Carrying heavy load on shoulders.
- (iii) Wearing light and shapeless clothes.
- (iv) Habit of bending while walking.

6. **Scoliosis** : It is a postural deformity of spine in which a person's spinal axis has a three-dimensional deviation. The meaning of scoliosis is bending, twisting or rotating. The simple or single curve to the left or convexity left is commonly called as C-curve.

Causes of Scoliosis:

- (i) Hereditary defects
- (ii) One side flat foot
- (iii) One side vision and hearing defects
- (iv) Short leg of one side
- (v) Paralysis of spinal muscles

Corrective measures:

- (i) This can be cured by doing and repeating various exercises and voluntary efforts.
- (ii) By hanging oneself from the hands.
- (iii) By developing strength in spinal extensors.
- (iv) Applying backstroke technique while swimming.

7. **Bow legs** : It is a deformity just the reverse of the knock knee position. In fact, if there is a wide gap between the knees, the deformity can be observed easily when individual walks or runs.

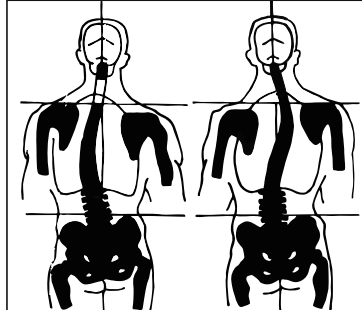
**Bow Legs****Corrective measures:**

- (i) Wall squat
- (ii) Side abduction
- (iii) Side lunges
- (iv) Gaumukhasana

Causes :

- (i) Putting extra weight on leg muscles.

- (ii) Lack of balanced diet.
 - (iii) Lack of calcium or phosphorus in bones.
 - (iv) Improper way of walking.
 - (v) Forcing baby to walk at a very early age.
8. **Scoliosis** : It is a postural defect in which there is one large lateral curve extending through the whole length of the spine, or there may be two curves. This type of deformity is also called 'S' shape curve.



Scoliosis

Corrective measures:

- (i) Plank
- (ii) Cow and cat
- (iii) Ardh matsyendrasana
- (iv) Pelvic tilt

Causes :

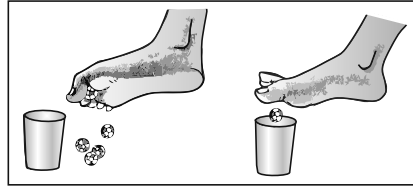
- (i) Short leg of one side
- (ii) One side flat foot
- (iii) Heredity defects
- (iv) One side paralysis of spinal muscles

Topic-2**Corrective Measures for Postural Deformities**

Concepts Covered • Types of postural deformities, measures for correcting postural deformities along with their exercises.

**Revision Notes**

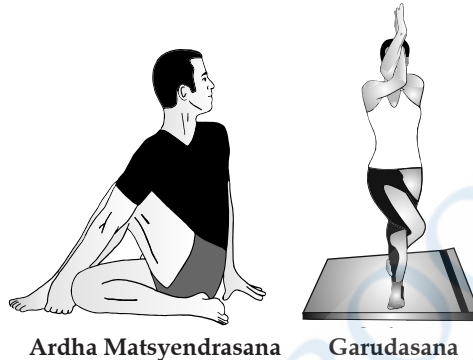
- **Postural Deformities** : There are two types of postural deformities i.e., functional and structural. In functional deformities, only the soft tissues i.e., the muscles and ligaments are affected. In this case, correction of postural deformities is possible through various physical activities.
- **Exercises for Kyphosis** :
 - (i) Swimming, **Bench press**, Push-ups are beneficial as remedial measures.
 - (ii) In corner exercises, the patient stands facing a corner with one hand on each wall, arms at the shoulder level and elbow at 90° from this position, the body moves forward mainly from the angle joint. This is a very good exercise for stretching the **pectoral muscles**.
 - (iii) Lying on the back on a narrow bench with ring weight hanging from elbows, the arms may flex to avoid any stress to elbows.
 - (iv) Holding a towel or stick in a wide hand grips with arm extended above the hand and shoulder gives a good stretch to pectoral muscles and also strengthens posterior neck.
- **Exercises for Flat foot** :
 - (i) By rising on the toes, by climbing stairs, by cycling.
 - (ii) The emphasis should be upon the exercises involving the flexor, foot and ankle flexion.
 - (iii) Exercise like sitting on a chair, grasp a pencil under the toes of one foot and try to write the alphabets with long strokes.
 - (iv) One should wear special shoes properly fitted with arch support made by orthopedic centre.



Exercise for Flat Foot

➤ **Exercises for Bow Legs :**

- (i) Walking by bending the toes inwards.
- (ii) Walking for some distance on the inner edge of the feet.
- (iii) Performing Ardha Matsyendrasana and Garudasana.



Ardha Matsyendrasana

Garudasana

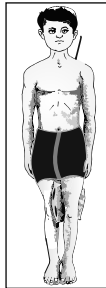
🔑 **Key Words**

Quadriceps: Muscles of thighs.

Torso: Chest, abdomen, pelvis, and back.

➤ **Exercises for Knock Knees :**

- (i) Use of walking callipers.
- (ii) Horse riding is the best option for this deformity.
- (iii) Keeping a pillow between the knees and standing erect for some time.
- (iv) Performing Padmasana and Gomukhasana.
- (v) Seated **quadriceps** contraction and hamstring curls.



Exercise for Knock Knees

➤ **Exercises for Round Shoulders :**

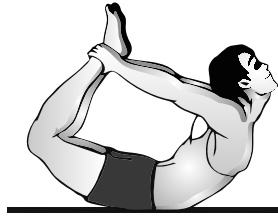
Round shoulders is a common postural deformity. It can be corrected with the help of following exercises :

- (i) Keep your tips of fingers on your shoulders and encircle your elbows in clockwise and anti-clockwise direction for some time.
- (ii) Hold the horizontal bar for some time regularly.
- (iii) Perform Chakrasana and Dhanurasana for some time.

🔑 **Key Words**

Bench press: Exercise for chest muscles

Pectoral muscles: Muscles of Chest



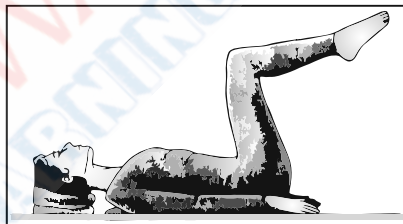
Dhanurasana



Chakrasana

➤ **Exercises for Lordosis :**

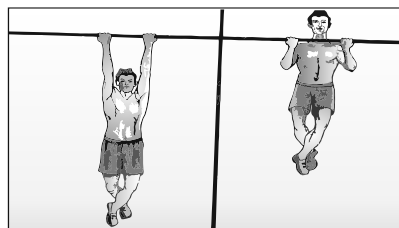
- (i) Lunge forward with knee on a mat. Take position of the foot beyond knee. Place both hands on knee. Straighten hips of rear leg by pushing hips forward and hold stretch. Repeat with opposite side.
- (ii) Sit on a chair with feet wide apart. Bend and position your shoulders between knees. Then reach to the floor under back of chair. Hold this position for some duration.
- (iii) Lie in prone position on the floor. Keep the palms of your hands on the floor according to shoulders' width. Push **torso** up keeping pelvis on floor. Hold this position for some time.
- (iv) Sit down with knees extended, feet together and hands at sides. After that, bend forward, touching the fingers to toes. Hold this position for some time. Then come back and repeat.



Exercise for Lordosis

➤ **Exercises for Scoliosis :**

- (i) To swimming by breast stroke technique.
- (ii) Hanging from horizontal bar.
- (iii) Holding the horizontal bar with your hands and swing your body to left and right side.
- (iv) Bending exercise should be performed in opposite side of 'C' shaped curve.



Exercise for Scoliosis

Topic-3**Special Consideration (Menarche, Menstrual Dysfunction) Female Athletes Triad (Osteoporosis, Amenorrhoea, Eating Disorders.)**

Concepts Covered • *Special Consideration (Menarche, Menstrual Dysfunction) and Female Athletes Triad (Anaemia, Osteoporosis, Amenorrhoea).*

**Revision Notes**

- **Menarche** : Menarche is a young woman's first menstrual cycle and bleed. Throughout history, menarche has been an important social rite, making a girl's passage to adulthood. However, it happens during a time of physical activity or sexual maturation when a girl usually has her first period between the age of 9 to 15. In 5 percent of cases, menarche occurs between the age of 16 to 18.
- **Menstrual Dysfunction** : It is defined as abnormal bleeding in the absence of intra cavity or uterine pathology. Menstrual dysfunction in athletes may include primary amenorrhoea, secondary amenorrhoea, oligomenorrhoea and luteal phase deficiency. In adolescence, it is considered to have delayed puberty when breast development has not begun by 13.5 years of age.
- **Female Athletes Triad**: The 'female athletes' triad' is a syndrome of three related conditions generally seen in teenage or adult female athletes who aren't meeting their energy requirements, which ultimately leaves them undernourished.

These are :

 - (i) **Anaemia** : It is usually defined as a decrease in the amount of Red Blood Cells (RBC's) or haemoglobin in the blood.
 - (ii) **Osteoporosis**: Estrogen is lower in girls with female athletes triad. Low estrogen levels and poor nutrition, especially low calcium intake, can lead to osteoporosis. Osteoporosis is weakening of the bones due to less of bone density and improper bone formation. This condition can ruin a female athlete's career because it may lead to stress, fractures and other injuries.
 - (iii) **Amenorrhoea**: It is a menstrual disorder or illness in females in which females of 18 years of age and above either never begin menstruating or there is absence of menstruation for 3 months or more.
- **Disordered Eating** : Most girls with female athletes triad try to lose weight as a way to improve their athletic performance. The disordered eating that accompanies female athletes triad can range from not eating enough calories to keep up with energy demands to avoiding certain types of food the athlete thinks are 'Bad' (such as foods containing fat) to serious eating disorders like anorexia nervosa or bulimia nervosa.

CHAPTER-3**YOGA AS PREVENTIVE MEASURE FOR LIFESTYLE****DISEASE****Topic-1****Introduction to Asanas and Obesity**

Concepts Covered • *Introduction to Yoga, Asanas to cure obesity, their procedure benefits and contraindications.*

**Revision Notes**

- **Introduction to YOGA:**

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 for modern lifestyle diseases like stress, diabetes, Asthma, hypertension, etc. The power of yoga lies in its simplicity, flexibility, and diversity.

Yoga has been the subject of global popularity and research in the past few decades.

As the modern world is facing a pandemic of lifestyle disorders that require changes to be made consciously by individuals themselves, and yogasanas can act as 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.

Asana: The term asana means sitting in a particular posture, which is comfortable and which could be maintained steadily for a long time. Asana gives stability and comfort, both at physical and at mental level.

Some guidelines for the practice of Asanas are :

- (i) Generally, the asanas are practiced in the sequence of standing, sitting, prone-lying and supine-lying position.
 - (ii) Asanas must not be practiced in haste or by applying any sort of undue force. Jerks should be avoided.
 - (iii) Asanas should be performed with body and breath awareness. There should be co-ordination between breath and the movements of the body parts.
 - (iv) As a general rule, inhale while raising any part of the body and exhale while bending down.
 - (v) The practitioner has to follow instructions sincerely and practice them with optimal attention.
 - (vi) Final position of asanas must be maintained for as long as one is comfortable.
 - (vii) One should maintain the final posture according to one's own limitations and should not go beyond one's capacity.
 - (viii) An utmost care must be taken in increasing the time for maintaining success.
 - (ix) Regular practice is essential. Body starts listening to your command only after a regular and diligent training for a sufficient period of time.
 - **Obesity :** Obesity is a condition in which excess body fat accumulates to the extent that it may have a negative effect on health. People are generally considered obese when their body mass index (BMI) is more than 30.
- Causes of obesity :**
- (a) Increased calorie intake :
 - (i) **Binge eating.**
 - (ii) Frequent intake of sugary and fatty foods, fast food.
 - (iii) Emotional problems related to **bulimia** and other abnormal eating patterns.



Key Words

Binge eating: People with binge-eating disorder frequently consume unusually large amounts of food and feel unable to stop eating.

Bulimia: Bulimia is an eating disorder. It is characterised by uncontrolled episodes of overeating, called bingeing.

- (b) Decreased energy expenditure, lack of exercise:
 - (i) Sedentary lifestyle e.g., watching TV, playing computer games.
 - (ii) Heavy homework, use of leisure time for study.
 - (iii) Avoiding regular exercises, etc.

➤ Asanas to Cure Obesity:

Paschimottanasana:

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 Paschimotanasana 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.

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 Paschimottasana 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.



Paschimottasana

Katichakrasana: Katichakrasana (often spelled Kati Chakrasana) is a standing yoga posture. It is a part of Shankha Prakshalana, the yogic process of cleansing of the intestines. Moreover, it is a dynamic yoga exercise. It is entirely different from Chakrasana or Wheel Pose.

Procedure:

Step 1. Stand with both legs two feet apart. First, keep the arms by the sides.

Step 2. Raise both the arms to the shoulder level. While raising the arms, inhale. Now, exhale and twist the body to the left. Bring the right palm to the left shoulder and extend the left-hand wrapping around the waist. Now, turn the head towards the left side and look over the left shoulder.

Step 3. Stop exhaling and retain the breath for a while.

Step 4. After a while, inhale and come back to the original position. Then, repeat on the right side. This constitutes one round. Perform five to ten rounds.



Katichakrasana

Duration:

Normally, performing ten rounds require nearly five minutes.

Benefits:

The regular practice of Katichakrasana provides the following benefits to the performer.

- (i) This yoga pose tones up the waist, hips, back, neck, and shoulders. Moreover, it makes the region more flexible.
- (ii) Since this yoga pose is a dynamic one, it helps to burn extra calories and fat. Additionally, it helps in managing body weight.
- (iii) As a part of yogic cleansing of intestines, it addresses many stomach-related health conditions. For instance, it helps to remove constipation and indigestion.

- (iv) Moreover, it is good for back stiffness and corrects postural problems.

Contraindications: You should avoid performing this Asana:

- (i) If you have undergone recent spinal or abdominal surgery.
- (ii) In presence of slip disc.
- (iii) Chronic spinal disorders.
- (iv) In presence of abdominal inflammation.
- (v) In presence of hernia.
- (vi) During pregnancy.

Tadasana :

In this asana, body imitates like a palm tree known as Tada in Sanskrit.

Procedure :

- (i) Stand erect, legs together, hands by the side of the thighs.
- (ii) Stretch the arms upward, over the head and parallel with each other, with palms facing each other.
- (iii) Slowly raise the heels and stand on the toes. Stay for a few seconds in this final position.

Benefits :

- (i) It strengthens thighs, knees and ankles.
- (ii) It helps in improving height of growing children.
- (iii) It helps to remove laziness.

Contraindication : Those who have complaints of reeling sensation should not practice this Asana.

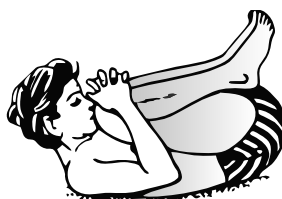
Pavanmuktasana:

The name Pavanmuktasana comes from the Sanskrit word 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 Pavanmuktasana, practice Supta Baddha Konasana (Reclining Bound Ankle Pose), Matsyasana (Fish Pose), Savasana (Corpse Pose).



Pavanmuktasana

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 :**

The name Ardha Matsyendrasana is derived from the Sanskrit words "ardha" (half), "matsya" (fish), "Indra" (king), and "asana" (posture). Ardha Matsyendrasana (Half Lord of the Fishes Pose) is a deep, restorative twist that calms the mind and helps in the detoxification the body.

Procedure:

- (i) Bend the right leg and place right foot near the buttock. The outer edge of the foot should touch the ground.
- (ii) Bend the left leg at the knee and place left foot flat on the floor near outside of the right knee.
- (iii) Bring the right arm over the left knee and hold the left foot with right hand. Slowly twist the trunk to the left side and take the left arm behind the back and wrap it around the waist.
- (iv) Turn the head towards the left and look back. Maintain the position for 5-10 seconds.

Benefits :

- (i) It improves concentration.
- (ii) Every vertebra of the spine gets fully stretched.
- (iii) It reduces digestive problems.
- (iv) It brings the trunk muscle in proper tone.



Ardha-Matsyendrasana

Contraindications :

Person suffering from peptic ulcer, hernia, enlarged liver, or having any surgery in abdominal region should not practice this asana.

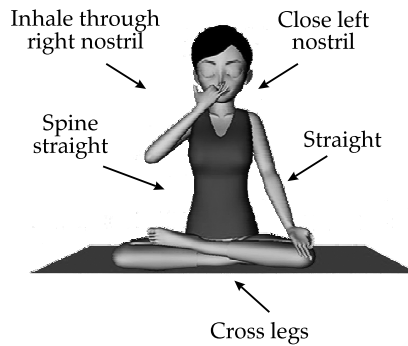
Suryabedhan Pranayama:

Surya Bhedana is a warming pranayama, or breath work, focused on one nostril: the right. Surya, or sun, refers to the right nostril of the nose, which is connected to the Pingalanadi of the body. Bhedana means to pierce or pass through. By closing one nostril and forcing prana to pass through just one side, a warming affect is achieved on the body – appropriate for correcting an imbalanced coolness, which is more common during the cooler Vata and Kapha seasons.

Procedure: Sit in a comfortable asana and make Mrigi Mudra. For Surya Bhedana, block your left nostril and inhale through your right. Then close the right and exhale through the left. Continue in this manner, inhale right, exhale left, for 1 to 3 minutes.

Benefits: SuryaBheda Pranayama activates the body and the bodily functions. It increases the digestive fire. It destroys all diseases that are caused by insufficiency of oxygen in the blood. The Gheranda Samhita says that Surya Bheda pranayama destroys decay and death, awakens Kundalini Shakti and increases digestive fire.

Contraindications: Surya Bhedana Pranayama is contraindicated in epilepsy, heart disease, anxiety, and high blood pressure. Avoid it at night as it may lead to difficulty in falling asleep. Consult a yoga instructor and physician before starting a new practice if you have any chronic health conditions.



Topic-2

Diabetes

Concepts Covered • Introduction to Diabetes, types of Diabetes, Symptoms, Asanas to cure Diabetes, their procedure, Benefits and contraindications.



Revision Notes

- Diabetes is a defect in the body's ability to convert glucose (sugar) into energy. Glucose is the main source of fuel for our body. When food is digested, it is changed into fats, proteins or carbohydrates. Foods that affect blood sugar are called carbohydrates.



Key Words

Erectile dysfunction: Erectile dysfunction, also known as impotence, is defined as the difficulty in getting and keeping an erection.

Posterior muscles: The posterior chain muscles live on the backside of our body and include the glutes, hamstrings, calves, erector spinae, and rear shoulder muscles.

Types of diabetes :

There are two main types of diabetes:

- Type -1 Diabetes :** It occurs most frequently in children and young adults, although it can occur at any age. It is caused due to genetic reasons.
- Type- 2 Diabetes :** This is much more common and account for 90-95 % of all diabetes. Type – 2 diabetes primarily affects adults. Main causes are physical inactivity and obesity.

Symptoms of Diabetes :

- Blurred vision.
- Unusual thirst.
- Slow healing cuts.
- Erectile dysfunction.
- Unexplained tiredness.
- Frequent urination.
- Rapid weight loss.
- Numbness or tingling in hands or feet.

- **Asanas to Cure Diabetes:**

Bhujangasana : Bhujanga in Sanskrit means 'Cobra'. In Bhujangasana, one imitates a cobra with its hood fully expanded.

Procedure :

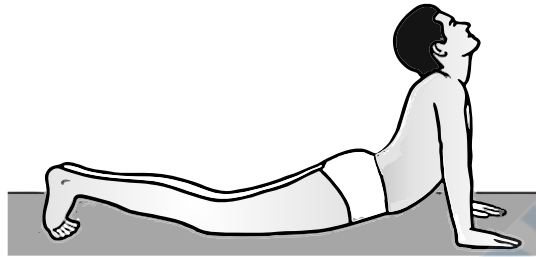
- Bend the arms at the elbow, place the palms by sides of the shoulders on the floor.

- (ii) Inhaling slowly, raise the head, neck and shoulders. Raise the trunk upto navel and arch the back. Maintain the posture for 10-15 seconds.

Benefits :

- (i) This asana makes spine flexible.
- (ii) It solves many digestive problems.
- (iii) It helps in enhancing focus.

Contraindications: Person suffering from peptic- ulcer, hernia and intestinal tuberculosis should not practice this asana.



Bhujangasana

- **Paschimottanasana:** Paschimottansana means stretching the posterior region. In this posture, **posterior muscles** of the body get stretched hence, it is called Paschimottanasana.

Procedure :

- (i) Bend the elbows, make hoops with the index fingers.
- (ii) Bend the body forward and catch hold of the toes with the hooks of the fingers.
- (iii) Place the head between the arms.
- (iv) Keeping a little bend in the elbows and without bending knees, maintain the position for 5-10 seconds

Benefits:

- (i) It gives a good posterior stretch to the spinal column.
- (ii) It helps to increase the flexibility of the spinal and abdominal muscles.
- (iii) It helps to improve the blood circulation in organs situated in the abdominal region.
- (iv) It helps to correct postural deformities.

Contraindications :

- (i) Those suffering from heart diseases, ulcer in abdomen should not practice it.
- (ii) People with lower back problems or slip disc should not perform this asana.



Step 1



Step 2



Step 3

Paschimottasana

- **Pavanmuktasana** : The Sanskrit word Pavan means 'air' or 'wind', mukta means 'freedom' and asana means 'posture'. This is called as the wind relieving posture as it assists in releasing trapped digestive gas from the stomach and the intestines.

Procedure:

- (i) Inhaling, fold both the legs at the knees over the belly.
- (ii) Hold the knees with the interlocked arms and press them on the belly.
- (iii) While exhaling, raise the head and let the chin touch the knees.

Benefits:

- (i) It increases digestive power.
- (ii) It helps to release trapped gas from the stomach.
- (iii) It helps to dissolve extra fat deposited in the abdominal region.

Contraindications : Do not practice, if suffering from severe back pain or abdominal injuries.

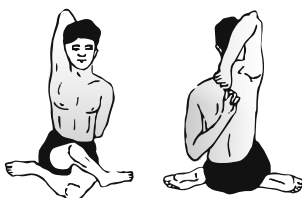


Pavanmuktasana

- **Ardha Matsyendrasana** : Refer Revision Notes, Topic-1 pg. 50

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.



Gomukhasana

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.
Knees one above the other Feet equidistant from hip on either side, hand clasped behind back
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.

Kapalabhati:

"Kapalabhati" is a compound word. "Kapala" means "skull"; "bhati" means "to shine or to be lustrous."

Procedure:

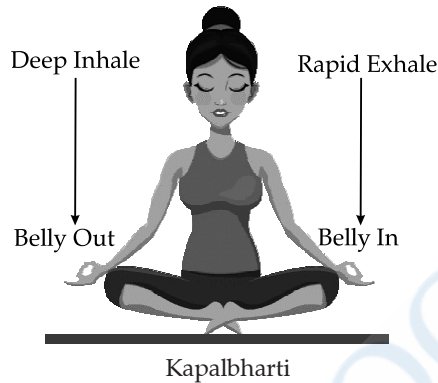
- (i) Sit in any meditative posture.
- (ii) Close the eyes and relax the whole body.
- (iii) Inhale deeply through both nostrils, expand the chest.
- (iv) Expel the breath with forceful contractions of the abdominal muscles and relax.
- (v) Do not strain.
- (iv) Continue active/forceful exhalation and passive inhalation.

Benefits:

It improves digestive issues and eliminates all gastric problems. Practicing kapalbhati helps to relieve gas, heartburn, and constipation. Practicing this yoga asana can also cure insomnia. It boosts the production of endorphins, thereby helping to uplift your mood.

Contraindications:

It is also contraindicated for individuals with high or low blood pressure, heart disease, hernia, gastric ulcer, epilepsy, vertigo, migraine headaches, significant nosebleeds, detached retina, glaucoma, history of stroke, and for anyone who has undergone recent abdominal surgery.

**Topic-3****Asthma**

Concepts Covered • Causes and Symptoms of Asthma, Asanas to cure Asthma, its procedure, Benefits and contraindications.

**Revision Notes**

- **Asthma** : A chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. This chronic inflammation is associated with airway hyper responsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness and coughing particularly at night to early morning.

**Key Word**

Serenity: the state of being calm, peaceful, and untroubled.

Causes of Asthma :

- (i) Occurs when exposed to a trigger.
- (ii) Muscles surrounding bronchiole contract and produce excess mucus.
- (iii) Airways become red, inflamed (swollen) and narrow.

Symptoms of Asthma:

- (i) Coughing or wheezing.
- (ii) Difficulty in breathing, shortness of breath.
- (iii) Chest tightness.
- (iv) Excessive fatigue.
- (v) Difficulty in talking, while walking due to shortness of breath.

➤ **Asanas to Cure Asthma:**

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. Smashtithi, 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.
Arms raised; fingers interlocked, Gaze fixed at a point, Chest lifted, standing on toes.
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 : Vrikshasana (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.

➤ **Gomukhasana :**

Go means 'Cow' and mukh means 'face'. In this asana, the position of legs looks like the face of a cow, hence, it is called Gomukhasana.

Procedure :

- (i) Bend the right leg at the knee, bring the right foot to the left side and place it close to the left buttock.
- (ii) Fold the left leg at the knee. Bring the left foot to the right side and place it close to the right buttock.
- (iii) Take the left arm over the left shoulder and right behind the back. Clasp the fingers of both hands at the back.
- (iv) Sit in the position for 10-15 seconds.

Benefits :

- (i) It increases concentration and induces inner peace.
- (ii) It is beneficial for improving lung capacity.
- (iii) It is useful in arthritis.
- (iv) It relieves backache.

Contraindication : Those who are suffering from bleeding piles should not practice this asana.

Bhujangasana : Refer to Revision Notes page 55

➤ **Matsyasana :** Matsya means 'fish'. In this asana, body takes the posture of a floating fish.

Procedure:

- (i) Sit in Padmasana in a comfortable position.
- (ii) Bend backward, supporting the body with arms and elbow. Lift the chest, take the head back and lower the crown of the head on the ground.
- (iii) Place middle part of the head on the ground. Hold the big toes. Elbow should touch the ground.



Matsyasana

Benefits:

- (i) This posture has therapeutic value for mild backache and fatigue.
- (ii) This is useful in throat problems like tonsillitis.
- (iii) Good massager for the spine.

Contraindications : Avoid practicing the asana in case of peptic ulcer, heart disease, hernia and back problems.

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.



Vakrasana

Topic-4**Hypertension**

Concepts Covered • Causes and symptoms of Hypertension, Asanas to cure Hypertension, its procedure, Benefits and contraindications.

**Revision Notes**

- Hypertension is a long term condition in which the blood pressure in the arteries is persistently gets elevated.

Causes of Hypertension :

- (i) Smoking
- (ii) Obesity
- (iii) Too much salt in diet
- (iv) Stress
- (v) Genetics
- (vi) Too much alcohol consumption

Symptoms of Hypertension: There are only rare symptoms for this:

- (i) Dizzy spells
- (ii) Headaches
- (iii) Nose bleeds
- (iv) Sweating

When symptoms do occur, it is usually when blood pressure spikes suddenly and extremely enough to be considered a medical emergency.

- **Asanas to Cure Hypertension:**

- **Tadasana :** In this asana, body imitates like a palm tree known as Tada in Sanskrit.

Procedure :

- (i) Stand erect, legs together, hands by the side of the thighs.
- (ii) Stretch the arms upward, over the head and parallel with each other, with palms facing each other.
- (iii) Slowly raise the heels and stand on the toes. Stay for a few seconds in this final position.

Benefits :

- (i) It strengthens thighs, knees and ankles.
- (ii) It helps in improving height of growing children.
- (iii) It helps to remove laziness.

Contraindication : Those who have complaints of reeling sensation should not practice this.



Tadasana

➤ **Ardha-Chakrasana :**

Procedure :

- (i) Stand straight with feet together and arms alongside the body.
- (ii) Balance your weight equally on both feet.
- (iii) Breathing in, extend your arms overhead, palms facing each other.



Ardha-Chakrasana

- (iv) Breathing out, gently bend backwards pushing the pelvis forward, keeping the arms in line with ears, elbows and knees straight, head up and lifting your chest towards the ceiling.

Benefits :

- (i) It stretches the front upper torso.
- (ii) It tones the arms and shoulder muscles.

Contraindications :

- (i) Pregnant women should avoid this pose.
- (ii) Hernia patient should avoid this pose.

➤ **Bhujangasana :** Refer to Revision Notes pg. 55

➤ **Pavanmuktasana:** Refer to Revision Notes, pg. 56

Katichakrasana:

Katichakrasana (often spelled Kati Chakrasana) is a standing yoga posture. It is a part of Shankha Prakshalana, the yogic process of cleansing the intestines. Moreover, it is a dynamic yoga exercise. It is entirely different from Chakrasana or Wheel Pose.

Procedure:

Step 1. Stand with both legs two feet apart. First, keep the arms by the sides.

Step 2. Raise both the arms to the shoulder level. While raising the arms, inhale. Now, exhale and twist the body to the left. Bring the right palm to the left shoulder and extend the left-hand wrapping around the waist. Now, turn the head towards the left side and look over the left shoulder.

Step 3. Stop exhaling and retain the breath for a while.

Step 4. After a while, inhale and come back to the original position. Then, repeat on the right side. This constitutes one round. Perform five to ten rounds.

Duration

Normally, performing ten rounds require nearly five minutes.

Benefits:

The regular practice of Katichakrasana provides the following benefits to the performer:

- (i) This yoga pose tones up the waist, hips, back, neck, and shoulders. Moreover, it makes the region more flexible.
- (ii) Since this yoga pose is a dynamic one, it helps to burn extra calories and fat. Additionally, it helps in managing body weight.
- (iii) As a part of yogic cleansing of intestines, it addresses many stomach-related health conditions. For instance, it helps to remove constipation and indigestion.
- (iv) Moreover, it is good for back stiffness and corrects postural problems.

Contraindications:

You should avoid performing this Asana:

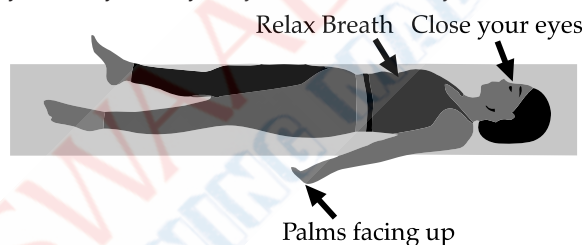
- (i) If you have undergone recent spinal or abdominal surgery.
- (ii) In presence of slip disc.
- (iii) Chronic spinal disorders.
- (iv) In presence of abdominal inflammation.
- (v) In presence of hernia.
- (vi) During pregnancy.

➤ **Shavasana :**

It is also known as "Corpse Pose". It calms the mind and reduces stress.

Procedure :

- (i) Lie comfortably on your back.
- (ii) Relax your neck and shoulders.
- (iii) Rest your arm on each side of your body and have a gap as wide as mat between your legs.
- (iv) Hands should face in upward direction and eyes should be closed.
- (v) Feel each part of your body and try to synchronise it with your breathing.



Shivasana

Benefits:

- (i) It calms the body and mind.
- (ii) It normalises blood pressure, relaxes heart and reduces anxiety.

Contraindications:

- (i) Those who are not advised to lie on their back should avoid this pose.
- (ii) Person suffering from severe acidity should avoid this pose.

Vakrasana :

Procedure :

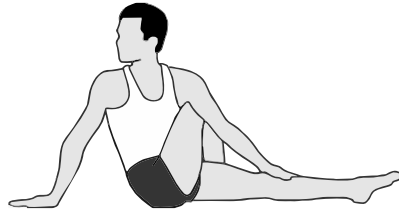
- (i) Sit down stretching your legs forward on the ground. Keep your hands beside your thighs or buttock.
- (ii) Bend your right leg straight and stretched, keep the left foot beside the right knee raised upward.
- (iii) Inhale and raise the arms shoulder high, keeping the elbows straight.
- (iv) Exhaling twist to the left, place the right arm by the outer side of the left knee and hold the left ankle with the right hand.
- (v) Look backward towards left side, hold on this final position.

Benefits :

- (i) It increases elasticity of spine.
- (ii) It stretches the muscles.
- (iii) It reduces belly fat.
- (iv) It loosens the hip joint.
- (v) It massages the abdominal organs.

Contraindications :

- (i) Avoid the asana if suffering from severe back pain.
- (ii) This asana is also not recommended for people suffering from ulcer and hernia.

**Vakrasana**

Sitlipranayam: Sitali Pranayama, often called “the cooling breath,” is a breath practice that cools the body and has a calming effect on the nervous system. In Ayurveda, Sitali breath is encouraged during the summer months and hottest parts of the day to pacify the heat that builds in your body.

Procedure:

- (i) Sitting comfortably on a cushion or a chair, make sure the spine is neutral.
- (ii) Take a few natural breaths to centre.
- (iii) Then curling your tongue and extending it out a little, inhale through the tunnel of the tongue.
- (iv) Release the tongue, close the mouth and exhale out through the nose.

**Sitlipranayam****Benefits:**

- (i) Cooling for the body and mind.
- (ii) Calming.
- (iii) Can help to focus.
- (iv) Can help reduce agitation or anger.
- (v) Lowers body temperature
- (vi) Useful during hot flushes.
- (vii) Great during hot weather.

Contraindications:

Sheetali and sheetkari are contraindicated for individuals with low blood pressure, respiratory disorders (such as asthma, bronchitis, or excessive mucus), and anyone with chronic constipation. Those with heart disease should practice without the breath retention.

CHAPTER-4

PHYSICAL EDUCATION AND SPORTS FOR CWSN (CHILDREN WITH SPECIAL NEEDS-DIVYANG)

Topic-1

Organisations promoting Disability Sports (Special Olympics; Paralympics; Deaflympics)

Concepts Covered • Organisations promoting Disability sports (Special Olympics, Paralympics, Deaflympics).

**Revision Notes**

- 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.

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. Special Olympics Bharat: Special Olympics Bharat is a National Sports Federation registered in 2001 under the Indian Trust Act, 1882. It is accredited by Special Olympics International to conduct Special Olympics Programs in India. The Government of India has accredited it as a National Sports Federation in the Priority Category, for development of Sports for persons with special needs intellectually. It is the Nodal Agency for the purpose due to national presence and experience, particularly in rural areas that account for around 75% of the population with special needs of India.



The mission of Special Olympics is to provide year-round sports training and athletic competition in a variety of Olympic-type sports for children and adults with special needs intellectually, giving them continuing opportunities to develop physical fitness, demonstrate courage, experience joy and participate in sharing of gifts, skills and friendship with their families, other Special Olympics athletes and the community.

Paralympics:

The Paralympic Games are the world's largest sporting event for the people with special needs physically, visually and intellectually. The Paralympic Movement was started by Sir Ludwig Guttmann and the movement finally developed into Paralympic Games. Guttmann was a firm believer that sports was the most appropriate method of therapy for those who have special needs physically to help them in building physical strength and self-esteem. In 1948, he organised a sports competition for British World War II veteran, patients with spinal cord injuries. These games were known as the Stoke Mandeville Games and were recognised by International Olympics Association.

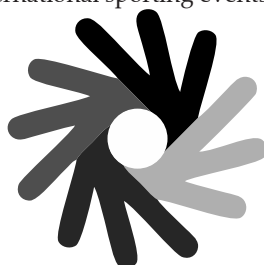


In 1960, these games were held in Rome after the Rome Olympics. However, they were still known as the Mandeville Games. These games were the first official Paralympic Games. In these games, 400 athletes participated from 23 countries. After 1960 Paralympic Games, things began to improve and the Paralympic movement continued to grow, modernise and include more and more sports for other differently abled groups also. In 1976 Paralympic Games, events for amputees and visually impaired athletes were organised for the first time. After the gap of few years, the events for the athletes with cerebral palsy were included in 1980 Paralympic Games. In spite of these improvements, the Paralympic Games were still not considered equal or parallel to the Olympic Games.

There was a rapid growth in the Paralympic Movement. In 1980, the first governing body for the Paralympic Movement was formed. It was known as International Coordination Committee of World Sports Organisations for the Disabled (ICC). In 1989, ICC was replaced by International Paralympic Committee (IPC). These games were a great success and boosted the movement's momentum.

Deaflympics:

The 'Deaflympics' are games for deaf athletes. Previously they were called the International games for the Deaf. These games are organised by "The International committee of sports for the Deaf" since the first event and they are sanctioned by International Olympic Committee. The deaflympion can not be guided by sounds for example, the starter gun, bullhorn commands or referee whistles. The Deaflympics were held in Paris in 1924 and were also the first ever international sporting events for athletes with disability.



DEAFLYMPICS

The Deaflympic winter games, was added in 1949. The games began as a small gathering of 148 athletes. Now these games are grown into a global movement.

To qualify for the games, athletes must have a hearing loss of atleast 55db in their "better ear". Hearing aids, cochlear implant are not allowed to be used in competition.

Deaflympions can not be guided by sounds so alternative methods are used to address the athletes. For example: the football referees wave a flag instead of blowing a whistle, on the track, races are started by using a light, instead of using a starting pistol.

Topic-2

Advantages of Physical Activities for Children with Special Needs and Strategies to Make Physical Activities Assessable for Children with Special Needs:

Concepts Covered • Physical activities for CWSN, Strategies to make physical activities assessable for children with special needs.



Revision Notes

- **Physical Activities for Children with Special Needs:**
 - **Physical Activity:** According to the Department of Health and Human Services, USA, physical activity generally refers to movement that enhances health. It means the movement of the body that uses energy. Walking, running, dancing, swimming, yoga and gardening are a few examples of physical activity. For health benefits, physical activity should be moderate or vigorous intensity.
 - Exercise is a type of physical activity that is planned and structured. Lifting weights, taking an aerobics class and playing on a sports team are examples of exercise.
 - **Advantages of Physical Activities for Children with Special Needs**
 - (i) It strengthens the heart muscle thereby improving cardiovascular efficiency, lung efficiency and exercise endurance. This helps in controlling repetitive behaviours among disabled children.
 - (ii) Besides improving fitness, physical activity develops social relationships with other children, teammates and teachers.
 - (iii) This brings positive changes in the social behaviour of these children.
 - (iv) It helps to improve energy level in the body. Regular physical activity often makes children more energetic and allows them to become active.
 - (v) It regulates blood pressure, cholesterol level and diabetes.
 - (vi) Physical activity reduces stress level.
 - (vii) It helps to control weight. The children with disabilities are not physically active or may have deficit of calories, which takes fat away and lowers weight and regular exercises help in regulating weight.
 - (viii) Physical activities help in improving muscle strength, coordination and flexibility among disabled children.
 - (ix) This also improves motor skills, brings better balance and body awareness which is lacking in these children.
 - (x) Physical exercise finds an outlet to channelise the physical energy which helps these children to cope with stress, anxiety and depression.
 - (xi) Physical activity enhances the metabolism of brain in the children. It leads to cognitive improvement in children with special needs allowing them to acquire new skills, learn new things and focus on specific goals.
 - (xii) Physical activity decreases anxiety, reduces depression, and improves mood and outlook in children. In addition, their quality of sleep is also improved.
- **Strategies to Make Physical Activities Assessable for Children with Special Needs:** The various strategies or ways by which physical activities can be made accessible for children with special needs are as follows:
 - **Sensory Integration:** The first two things we always notice about physical education classes are the loud music and fluorescent lights in the gym. These are major barriers to students with some type of neurological differences. Many students are also sensitive to light like bright sunlight outdoors and the sound of squeaking sneakers on the gym floor. The music problem is easy to solve-lower the volume or turn it off. Sound proof headphones may also be used indoors and sunglasses can be used outdoors. Schools may find other indoor lighting options that are most cost effective, taking advantage of green energy incentives for LED light bulbs or simply shutting of some light and relying more on natural lighting.
 - **Positive Behaviour:** Behaviour is always a concern in physical education classes where there's plenty of movement and incidents can happen in rapid succession. Positive Behaviour Interventions or Support (PBIS) is a systematically proven method to prevent negative behaviours and increase healthy interactions. Behavioural expressions are explained from the beginning with support such as picture scheduler. Then the class material is taught through positive interactions.

- **Team building:** Physical Education is the perfect opportunity for team building exercises. Instead of competitive games, the class can focus on creative games that only succeed when a whole team works together.
- **Accessibility:** Hard surfaces such as concrete and asphalt may be dangerous for individuals with dyspraxia and softer such as sand or wood chips make it difficult to manoeuvre a wheelchair. Gym surfaces and outdoor mats can be used to make physical activity more accessible for the children with special needs. Another way is to level the playing field by having the whole class play a game such as sitting volleyball or scooter soccer.
- **Inclusive Classrooms:** It means development of education laws in such a way that children with special needs get education within the normal classrooms along with other children so that they are well accepted in society.
- **Assistive Technology:** It refers to creating devices, tools or equipment that help children with special needs to participate in learning activities like bigger balls, balls with bells, balls attached to strings to bring it back to the students etc.
- **Adaptive Physical Education:** Depending on student's disability, a separate, adaptive class or modifications within a game, changing the rules of the game or sport to some extent can help the students in a big way.
- **Creating Specific Environment:** Students with special needs can be provided with specific play area with special requirements as needed by them. Loud music, glaring lights often cannot be tolerated by these children, so a lot of natural lighting should be there.
- **Focus on Creative Games:** Instead of competitive games and physical activities, the strategy is to develop creative games. This helps in team building and cooperation and prevents unnecessary competition and boosts the confidence of these children.
- **Accommodations and Modification:** Since the individual needs of the children with special needs are different, it is essential for the teachers to modify the teaching strategies in order to accommodate the children with disabilities. Therefore, constant modification and accommodation is required.
- **Professional Courses:** Developing more professional courses and teacher certification programs for teaching physical education to children with special needs is essential to popularise the adaptive physical education programme.

CHAPTER-5

SPORTS AND NUTRITION

Topic-1

Balanced diet and Nutrition, Macro and Micro Nutrients

Concepts Covered • *Balanced Diet, Nutrition, Micro and Macro nutrients, Food sources and their functions in the human body.*



Revision Notes

- **Nutrition:** Nutrition is defined as the science of food and its relationship to health. In other words, it can be said that nutrition is the science of food which deals with the dynamic process in which the consumed food is digested.
- **Nutrients:** Essential substances present in the food for e.g., carbohydrates, proteins, fats, vitamins and minerals.
- **Diet:** Contains variety of foodstuffs. This helps in protecting us from diseases and in the repair of worn out tissues and gives energy.
- **Balanced Diet :** A diet that contains adequate amount of carbohydrates, proteins, fats, minerals, salts, vitamins, roughage and water required for the growth and maintenance of the body is called a balanced diet.
- **The various components of Balanced Diet are:**
 - **Cereals and Millets:** These include wheat, rice, jowar, bajra, ragi, etc. These are the sources of Carbohydrates, Proteins, Vitamin B - Complex, Iron and Calcium.
 - **Pulses:** These include red gram (lobia), Bengal gram (chana), lentils, green gram (moong), etc. These are sources of proteins, Carbohydrates, Vitamin B-Complex, Vitamin C and Iron.
 - **Milk and Milk Products:** These include milk, curd, cheese, paneer, khoya, etc. These are the sources of Proteins, Carbohydrates, Fats, Calcium and Vitamin B2.

- **Meat and Meat Products:** These include meat, fish, chicken, egg and products made from these sources. These are sources of Proteins, Vitamin B-Complex and Calcium
- **Nuts and Oil Seeds:** These include ground nuts, almonds, cashew nuts, til seeds, pistachio, etc. These are sources of Proteins, Vitamin B-Complex, Calcium, etc.
- **Green Leafy Vegetables (GLVs):** These include mustard (sarson), bathua, fenugreek (methi), spinach (palak). These are good sources of Vitamin A, Vitamin B-Complex, Vitamin C, Iron and Fibre.
- **Root Vegetables:** These include potato, *colocasia*, sweet potato, yam, etc. These are rich sources of Carbohydrates.
- **Other Vegetables:** All other vegetables like brinjal, ladyfinger, beans, cauliflower, etc., provide fibers, vitamins, some amount of minerals.
- **Fruits:** Fruits are the sources of different nutrients. So, a combination of different fruits must form part of the balanced diet so as to cover all essential nutrients.



Key Words

Amino Acids: Amino acids are the building blocks of proteins.

Tissues: Tissues are made up by specialised group of cells.

Fatty Acids: Building blocks of fats.

- **Roughage :** The fibers present in the food help to eliminate wastes from the body.
- **Macro & Micro Nutrients :** Function and food sources.

Nutrients can be broadly classified as per their daily requirement :

Macro Nutrients: These include carbohydrates, proteins, fats and water. These are required in large amount and works as an energy provider.

Micro Nutrients: These include vitamins and minerals. These are required in small amount but are very essential to maintain and develop immunity in the human body.

- Carbohydrates :** Carbohydrates gives us energy to work. Sugar and starch are carbohydrates. Potato, rice, bread, banana and grapes are rich sources of carbohydrates. These are called energy giving foods. Simple and complex are two types of carbohydrates.
 - **Carbohydrates are further divided into three types:**
 - **Monosaccharides :** These refer to simple sugars like glucose, fructose and galactose.
 - **Disaccharide :** These refer to sugar units which are formed when two monosaccharides combine together. These generally consist of maltose, lactose and sucrose.
 - **Polysaccharide :** These refer to carbohydrate units which are formed when more than two units of monosaccharides combine together. These generally consist of starch, fiber and cellulose.
- Proteins :** Proteins are nutrients that help to build the body and make new cells. They help us in the repair of worn-out **tissues**. They are especially important for growing children. They are called body building food. Milk, eggs, cheese, pulses, meat and fish are rich in proteins. Some essential proteins or **amino acids** are Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan and Valine. Some non-essential proteins or amino acids are Alanine, Arginine, Asparagine, Aspartate, Cysteine, Glutamate, Glutamine, Proline, Serine and Tyrosine.
- Fats:** Fats provide us with twice as much energy as carbohydrates. We can store extra fat in our body which can be used later. Butter, ghee and nuts are rich sources of fats, but too much of fats can lead to diseases like high blood pressure, heart problem and obesity.
 - Fatty acids are the building blocks of fats and oils. Fatty acids can be categorised as:
 - **Saturated fatty acids (SFA) :** These **fatty acids** do not contain double bonds. These fats are called as animal fats. These fats give increased health risks. Overconsumption of these fats increases the risk of cardiac issues and it results in increased cholesterol levels.
 - **Unsaturated fatty acids (UFA):** The consumption of these fatty acids results in lowering the cholesterol levels in blood. As a result, there is a reduction in risk of heart-related complications. These are further classified into:
 - * Monounsaturated fatty acids (MUFA) contain one double bond.
 - * Polyunsaturated fatty acids (PUFA) contain more than one double bond.

Micro Nutrients

- Minerals :** Minerals are also needed in a very small quantity to keep us fit and healthy. These are called protective foods.
 - Some important minerals are:
 - (a) Iron :** It is important for the formation of haemoglobin. Its deficiency leads to anaemia and sources are meat, eggs and dry fruits.

- (b) **Calcium** : It is needed for the formation of strong bones, teeth and also for clotting of blood and muscle contraction. Its deficiency causes rickets, asthma and sources are milk, egg yolk, cheese and orange.
- (c) **Phosphorus** : It is required for the development of strong bones and teeth and also for producing energy. Its sources are egg, fish, meat and unpolished rice.
- (d) **Potassium**: It is important for growth and keeping cells and blood healthy. Its deficiency weakens the muscles of the body. The sources are carrot, beetroot, onion, tomato, orange and mango.
- (e) **Sodium**: It is needed for the proper functioning of the nervous system. Its sources are milk and milk products, meat and eggs.
- (f) **Iodine**: It is essential for proper thyroid function. Its deficiency causes goitre and sources are sea-food and salt.
- (g) **Fluorine**: It is important to make the enamel (polish) of the teeth hard and prevents dental decays.
- (h) **Copper**: It is helpful in the formation of **red blood cells**, connective tissue and nerve fibre formation and functioning.
- (i) **Zinc**: It is required for insulin production and also for functioning of male prostate, digestion and metabolism.
- (j) **Magnesium**: It is required for development of immune system and nerve transmission.
- (k) **Sulphur**: It is required for formation of proteins in the body.
- (v) **Vitamins**: Vitamins are needed by our body in a very small quantity. They keep us healthy by helping the body to fight against the diseases. They also help our eyes, nerves, gums, skin, etc., to work properly. Vitamins consist of two groups- fat soluble and water soluble groups.



Key Words

Wounds : It occurs due to soft tissue injury.

Red Blood Cells : responsible for the transportation of oxygen and nutrients.

Nervous System : Deals with nerves and sensory organs.

- (a) **Vitamin 'A'** : Keep eyes and skin healthy.
- (b) **Vitamin B1 (Thiamine)** : Helps to release energy from foods, promotes normal appetite and is important in maintaining proper nervous system function.
- (c) **Vitamin B2 (Riboflavin)** : Helps to release energy from foods, promotes good vision and healthy skin, helps to convert the amino acid tryptophan into niacin.
- (d) **Vitamin B3 (Niacin)** : Metabolises food and provides energy for the body, involved in energy production, normal enzyme function, digestion, promoting normal appetite, healthy skin and nerves.
- (e) **Vitamin B6 (Pyridoxine)** : Key factor in protein and glucose metabolism as well as in the formation of haemoglobin.
- (f) **Vitamin B12 (Cobalamin)** : Aids in the building of genetic material, production of normal red blood cells and maintenance of the **nervous system**.
- (g) **Vitamin 'C'** : Make gums strong and heals our **wounds** faster.
- (h) **Vitamin 'D'** : Makes teeth and bones strong.
- (vi) **Water** : Almost two-third of our body is made up of water. Water helps our body to work well and maintain our body temperature. We need to drink at least 10-12 glasses or approx, 6-7 litres of water every day.

Topic-2

Nutritive and Non-Nutritive components of diet

Concepts Covered • *Nutritive and Non-Nutritive components of diet and their benefits.*



Revision Notes

➤ Components of Diet:

- **Nutritive components of diet** : Food contains a variety of nutritional components that can be categorised as macro-nutrients and micro-nutrients. Macro-nutrients are nutrients needed in large quantities that provide calories or energy for growth, metabolism and other functions in our body. These include carbohydrates, fats, and proteins. Micro-nutrients, such as vitamins, minerals and antioxidants are involved with cellular and chemical processes in our body and are needed in small quantities.
- **Non-Nutritive components of diet** : Food contains some components that are not classified with the basic nutrient groups. All sorts of substances can be found in food-natural, intentional, and unintentional. Non-nutritive components of diet mean, components which do not add or supply energy or calories. Non-nutritive components of diet are discussed below :

- (a) **Colour components** : Food is made more appetizing and interesting by the wide spectrum of colours made possible through pigments. Most natural pigments are found in fruits and vegetables, the colours of food from animal products and grains are less varied and bright. The dominant pigment found in plants are carotenoid (orange, yellow and red), chlorophyll (green) and flavonoid (blue, cream and red).
- (b) **Flavour components** : The flavour in foods are derived from both nutritive and non-nutritive components. These are sometimes too numerous to track as the source of a specific flavour. Among the non-nutrient components in foods are the organic acids that determine whether foods are acidic or basic. An acidic pH in foods not only contributes to a sour taste, but the colour of fruit juices, the hue of chocolate in baked products, and the release of carbon dioxide in a flour mixture. An alkaline pH contributes a bitter taste.
- (c) **Plant components** : In addition to colour and flavour components, some plants contain other non-nutritive substances that, when ingested, may have either beneficial or normal effects. Many of the possible anticarcinogens, or compounds that inhibit cancer, come from plants. In particular, phytohormones, called indoles is found in vegetables, which is found in plants. The vegetables like cabbage, cauliflower, kale, mustard greens and collards have this. Laboratory animals which were given in doles and then exposed to carcinogens developed fewer tumours than animals exposed to some carcinogens , but not given in doles.
- Non-Nutritive Factors or Anti-Nutritional Factors (ANFs) interfere with absorption of nutrients by the body. Some ANFs are:
- **Phytates** : These are found in unrefined cereals and millets. These phytates bind iron, zinc, calcium and magnesium and make these nutrients unavailable for digestion.
 - **Tannins** : These are present in legumes and millets. These interfere with absorption of iron and protein by the body cells.
 - **Trypsin Inhibitors** : These prevent the activity of trypsin in the body. These reduce the digestibility of proteins and their utilisation by the body cells.
 - **Oxalate** : These are present in green leafy vegetables and legumes. These interfere with absorption of calcium in the body.
 - **Goitrogen** : These hinder the absorption of iodine by **thyroid gland** which results in the development of iodine **deficiency** in the body.



Key Words

Thyroid Gland: Situated in throat, responsible for growth.

Deficiency: Losing efficiency in working of body due to lack of nutrition.

- **Beneficial Non-Nutritive Factors of Foods**
- **Phytochemicals** : Phytochemicals are compounds produced by plants, to prevent themselves from their natural enemies. They are found in fruits, vegetables, grains and beans.
 - **Anthocyanin** : The grapes, blueberries, cranberries, etc. get their dark colour due to the presence of Anthocyanin.
 - **Flavonoid or Isoflavones** : These are found in vegetables, fruits and grains. They act as preventives for heart disease and breast cancer.
 - **Artificial Sweeteners:** These taste sweet like sugar but provide less or no energy to the body. These are used in diet food products to make them sweet without increasing their calorie value.
 - **Water:** Water is also an essential component of diet. Even blood comprises 90% of water. Water in the blood helps in the transportation of the nutrients to various cells of the body. Water is also significant in the excretion of waste products. It also regulates the body temperature. Our body loses approximately 2% of our body weight as water per day. We recover this loss of water by drinking water and by intake of food substances. Water also functions as a lubricant, keeps the skin moist and protects the body from shock. Generally, about 20% of water intake comes from food and remaining comes from drinking water. It is excreted from the body in various forms such as urine, faeces, sweat and water vapour in the exhaled breath.

CHAPTER-6

TEST AND MEASUREMENT IN SPORTS

Topic-1

Fitness Test – SAI Khelo India Fitness Test in school: for age group 5-8 years and 9-18 years.

Concepts Covered • SAI Khelo India Fitness Test, School Children Fitness Assessment



Revision Notes

- **SAI** : Sports Authority of India (SAI) was set up in 1984. SAI has been entrusted with the twin objectives of promoting sports and achieving sporting excellence at the national and international level.
 - **Khelo India Fitness Program for school children**: The Khelo India program has been introduced to revive the sports culture in India at the grass-root level by building a strong framework for all sports played in our country and establish India as a great sporting nation. Provide a comprehensive and inclusive “Physical Fitness and Health Profile for all school going children across India.
- (A) AGE GROUP 5-8 YEARS CLASS 1 to 3**: At Primary class 1-3, children should acquire Fundamental Movement Skills (FMS) leaving the learning of specific physical activities to later stages. FMS provide the building blocks for many physical activities, such as playing games, dance, and sport. Locomotor, Manipulative and Body Management abilities are key to success in most sports and physical activities. Abilities of children in class 1-3 which need to be measured and tracked are :
1. Body Composition (BMI)
 2. Coordination (Plate Tapping)
 3. Balance (Flamingo Balance)
- (1) Body Composition (BMI)** : Body Composition refers primarily to the distribution of muscle and fat in the body. Body size such as height, lengths and girths are also grouped under this component.
- **Purpose**: It is used to screen for weight categories that may lead to health problems. This calculator provides BMI and the corresponding weight category. **Equipments Required** : Flat, Clean surface, Weighing machine, Stadiometer/Measuring Tape pasted on a wall.
 - **Procedure** : Remove the participant’s shoes, bulky clothing, and heavy ornaments. Take the height measurement on flooring that is not carpeted and against a flat surface such as a wall with no molding. The participant should stand with feet flat together, and back against the wall. Make sure legs are straight, arms are at sides, and shoulders are in level.
 - Make sure the participant is looking straight ahead and that the line of sight is parallel with the floor. Use a metal tape to measure from the base on the floor to the marked measurement on the wall to get the height measurement. Accurately record the height to the nearest 0.1 centimeter.
 - **Measuring Weight Accurately** : Use a digital scale. Avoid using bathroom scales that are spring loaded. Place the scale on firm flooring (such as tile or wood) rather than carpet.
- Make sure that the participant has removed shoes and heavy clothing, such as sweaters. The participant should stand with both feet in the center of the scale. Record the weight to the nearest decimal fraction (for example, 25.1 kilograms).
- Scoring** - Height recorded in cm and mm. Weight will be recorded in kilogram (kg) and grams (gms). The data is calculated from body Weight (W) and height(H).
- $BMI = W / (H \times H)$, where W = body weight in kilograms and H = height in meters. Higher score usually indicates the higher levels of body fat.
- (2) Coordination (Plate Tapping)** : This test is about performing movement with coordination and speed.
- **Purpose** : Tests speed and coordination of limb movement.
- Equipment’s Required** - Table (adjustable height), 2 yellow discs (20 cm diameter), rectangle (30 × 20 cm), stopwatch If **Procedure** - possible, the table height should be adjusted so that the subject is standing comfortably in front of the discs. The two yellow discs are placed with their centers 60 cm apart on the table. The rectangle is placed equidistant between both discs. The non-preferred hand is

placed on the rectangle. The subject moves the preferred hand back and forth between the discs over the hand in the middle as quickly as possible. This action is repeated for 25 full cycles (50 taps).

Scoring - The time taken to complete 25 cycles is recorded.

(3) **Balance (Flamingo Balance Test)** : This test is about ability to balance successfully on a single leg.

- **Purpose** : To assess the strength of the leg, pelvic, and trunk muscle as well as static balance.
- **Equipments Required** : Non-slippery even surface, stopwatch, can be done on just standing on beam.
- **Procedure** : Stand on beam. Keep balance by holding the instructor's hand.

While balancing on the preferred leg, the free leg is flexed at the knee and the foot of this leg held close to the buttocks.

Start the watch as the instructor lets go of the participant/subject. Pause the stopwatch each time the subject loses balance. Resume over, again timing until they lose balance. If there are more than 15 falls in the first 30 seconds, the test is terminated. Count the number of falls in 60 seconds of balancing.

- **Scoring**: The total number of falls or loss of balance in 60 seconds.



Key Words

Hamstring : Muscles of legs opposite to quadriceps.

Flexors : A muscle that flexes a joint.

(B) **Age Group**: 9-18+ Years | **Class 4 to 12 -**

1. Body Composition (BMI)
2. 50 mt Speed test
3. 600 mt Run/Walk
4. Sit & Reach flexibility test
5. **Strength Test** - (a) Abdominal Partial Curl Up, (b) Push-Ups for boys, Modified Push-Ups for girls).

➤ **Test Description For Children**

(1) **Body Composition (BMI)** : Procedure will be same as that for 5-8 years children.

(2) **50 m Speed Test (Standing Start)**

Purpose : To determine acceleration and speed.

Equipment Required: 50m marked track, measuring tape, stop watch, wooden clapper or whistle.

Procedure: A thorough warm up should be given, including some practice starts and accelerations. Start from a stationary position, with one foot in front of the other. The front foot must be on or behind the starting line. This starting position should be static (dead start). The tester should provide hints for maximizing speed (such as keeping low, driving hard with the arms and legs) and encouraged to continue running hard through the finish line.

Scoring : Time taken for completion.

(3) **600 m Run/Walk**

Purpose : To assess cardiovascular fitness/cardiovascular endurance.

Equipment Required : Stopwatch, whistle, marker cone, lime powder, measuring tape, 400 m track with a marking of starting and finish line.

Procedure : Participants are instructed to run 600m in the fastest possible pace. The participants begin on signal, "ready, start" as they cross the finish line elapsed time should be announced to the participants. Walking is permitted but the objective is to cover the distance in the shortest possible time.

Scoring : Time taken for completion (run or walk) in min, sec, mm.

(4) **Sit and Reach flexibility Test**

Purpose : To measure lower back and hamstring flexibility.

Equipment Required : Sit and Reach box 12" × 12" (sides) 12" × 10" (front and back) 12" × 21" (top), flat clean cushioned surface/gym mats.

Procedure : This test involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the Sit and Reach box. Both knees should be locked and pressed flat to the floor - the tester may assist by holding them down. With the palms facing downwards, and the hands on top of each other, the subject reaches forward along the measuring line as far as possible.

Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice, the subject reaches out and holds that position for one-two seconds while the distance is recorded. Make sure there are no jerky movements.

Scoring : The score is recorded (difference between initial position and final position), in cm and mm, as the distance reached by the hand.

(5) Strength

(A) Abdominal (Partial Curl-up):

Purpose : Measures abdominal muscular strength and endurance of the abdominals and hip flexors, improves core stability.

Equipment Required : Flat clean cushioned surface with two parallel strips (6 inches apart), Stopwatch, Recording sheets, Pen.

Procedure : The subject lies on a cushioned surface with knees flexed, usually at 90 degrees, with hands straight on the sides, palms facing downwards, parallel to the body. The subject raises the trunk, keeping the arms in position, curling up the desired amount. The trunk is lowered back to the floor so that the shoulder blades or upper back touch the floor.

Scoring : Record the maximum number of Curl ups in a certain time period 30 seconds.

(B) Muscular Endurance (Push Ups for Boys, Modified Push Ups for Girls)

Purpose : To measure upper body strength endurance, and trunk stability.

Equipment Required : Cushioned surface/gym mat, paper to record score.

Procedure : A standard push up begins with the hands and toes touching the floor, the body and legs in a straight line, feet slightly apart, the arms at shoulder width apart, extended and at a right angles to the body. Keeping the back and knees straight, the subject lowers the body to a predetermined point, to touch some other object, or until there is a 90-degree angle at the elbows, then returns back to the starting position with the arms extended. This action is repeated, and test continues until exhaustion, or until they can do no more in rhythm or have reached the target number of push-ups.

For Girls: Push-up technique is with the knees resting on the ground.

Scoring: Record the number of correctly completed push-ups.

Topic-2

Computing Basal Metabolic Rate (BMR), Rikli and Jones: Senior Citizen Fitness Test

Concepts Covered • BMR & computation of BMR Chair Stand Test for lower body strength, Arm Curl Test for upper body strength, Chair Sit and Reach Test for lower body flexibility, Back Scratch Test for upper body flexibility, Eight Foot Up and Go Test for agility, Six Minute Walk Test for Aerobic Endurance.



Revision Notes

I. Basal Metabolic Rate : The BMR refers to the amount of energy your body needs to maintain **homeostasis**. Your BMR is largely determined by your total lean **mass**, especially muscle mass, because lean mass requires a lot of energy to maintain.

Anything that reduces lean mass will reduce your BMR. BMR is the total number of calories that our body requires to perform basic functions such as breathing, circulation, digestion, nutrient processing and protein synthesis. Basal Metabolic Rate is the amount of energy a human body uses when it is completely at rest. People regularly use more energy than their Basal Metabolic Rate. Your BMR accounts for about 60% to 75% of your Total Energy Expenditure (TTE), depending on your lifestyle and activity level. The Total Energy Expenditure is the total number of calories you burn every day. The rest of your TTE comes from the physical activities (walking, talking, eating, etc.) and food digestion.

II. Computation of BMR : We will have to use the BMR for man formula (Mifflin and St Jeor BMR equation for a man):

$$\text{BMR FOR MALE} = (10 \times \text{weight in kg}) + (6.25 \times \text{height in cm}) - (5 \times \text{age in years}) + 5 \text{ kcal/day}$$

BMR FOR FEMALE = $(10 \times \text{weight in kg}) + (6.25 \times \text{height in cm}) - (5 \times \text{age in years}) - 161 \text{ kcal/day}$

Example : Let's suppose that you want to calculate BMR for a 60 year old man, who is 5 foot, 4 inches tall and weighs 150 pounds.

Convert the values from imperial to metric.

5 feet 4 inches = 162.56 centimeters,

150 pounds = 68.04 kilograms

Input all data = $10 \times 68.04 + 6.25 \times 162.56 - 5 \times 60 + 5$

After solving an equation BMR will be = 1401.4 kcal/day



Key Words

Homeostasis : Body temperature and fluid balance

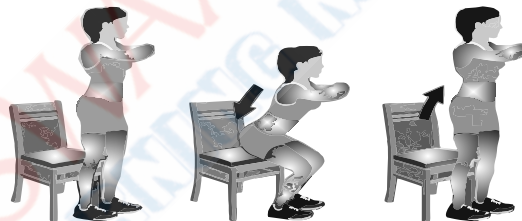
Mass : a large amount

➤ Rikli and Jones prepared various physical fitness tests for senior citizens. Senior citizens can't do exhaustive workouts, that is why easy tests prepared for different body parts are given as:

- Chair Stand test for lower body strength.
- Arm Curl Test for upper body strength endurance.
- Chair sit and reach test for lower body flexibility.
- Back scratch test for upper body flexibility.
- Eight foot up and go test for coordination and agility.
- Six minutes walk test for aerobic fitness and endurance.

➤ **Chair Stand Test for Lower Body Strength:**

- **Purpose:** This test assesses leg strength and endurance of senior citizens.
- **Equipment Required:** A straight or folding chair without arm rests (seat 17 inches or 44 cm high) and a stopwatch.



- **Procedure:** Put a chair against a wall to keep it from moving or causing accidental fall. The subject is to sit on the chair with both feet away from each other at a length of own shoulders. The wrists are held in a crossed position and held close to the chest. At the signal of the person taking the test, the subject stands up completely and then sits back completely. The process is repeated for 30 seconds. One complete cycle means standing up completely and sitting back. The number of completed cycles in 30 seconds are awarded as final score.

Age	Below average	Average	Above average
60-64	< 14	14 to 19	> 19
65-69	< 12	12 to 18	> 18
70-74	< 12	12 to 17	> 17
75-79	< 11	11 to 17	> 17
80-84	< 10	10 to 15	> 15
85-89	< 8	8 to 14	> 14
90-94	< 7	7 to 12	> 12

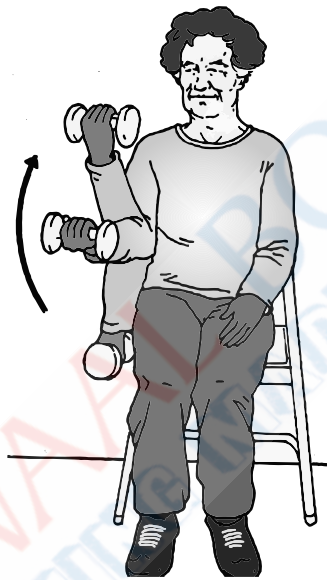
Norms for Men

Age	Below average	Average	Above average
60-64	< 12	12 to 17	> 17
65-69	< 11	11 to 16	> 16
70-74	< 10	10 to 15	> 15
75-79	< 10	10 to 15	> 15
80-84	< 9	9 to 14	> 14
85-89	< 8	8 to 13	> 13
90-94	< 4	4 to 11	> 11

Norms for Women

➤ Arm Curl Test for Upper Body Strength:

- **Purpose:** This measures the upper body strength and endurance.



- **Equipment Required:** 5-pounds weight for women, 8-pounds weight for men, a chair, stopwatch.
- **Procedure:** In this test, the subject sits on a chair. The subject then holds the weight in the dominant arm in the vertical down position from the shoulder. The other arm is raised in vertical up position above the shoulder which is kept there stationary either on own effort or with the help of the support from the person taking the test. The dominant arm carrying the weight is then required to be curled upto shoulder height and returned back to the starting position. The number of completed curl-ups in 30 seconds is awarded as the final score.

Age	Below average	Average	Above average
60-64	< 16	16 to 22	> 22
65-69	< 15	15 to 21	> 21
70-74	< 14	14 to 21	> 21
75-79	< 13	13 to 19	> 19
80-84	< 13	13 to 19	> 19
85-89	< 11	11 to 17	> 17
90-94	< 10	10 to 14	> 14

Norms for Men

Age	Below average	Average	Above average
60-64	< 13	13 to 19	> 19
65-69	< 12	12 to 18	> 18

70-74	< 12	12 to 17	> 17
75-79	< 11	11 to 17	> 17
80-84	< 10	10 to 16	> 16
85-89	< 10	10 to 15	> 15
90-94	< 8	8 to 13	> 13

Norms for Women

➤ Chair Sit and Reach Test for lower body flexibility:

- **Purpose:** This measures lower body flexibility.
- **Equipment Required:** Ruler, straight back or folding chair (seat 17 inches/44 cm high).



- **Procedure:** In the test, the subject sits on the edge of a chair with the feet flat on the floor. Place the hands on top of each other in a way that both middle fingers are on top of each other and the tips are touching. The subject is then required to exhale and bend towards the toes keeping the straight back and head up. The subject is not allowed to bounce or jerk the body. The position is maintained for 2 seconds and score awarded on the basis of the following table showing distance between the middle finger tips and the toes.

Age	Below average	Average	Above average
60-64	< - 2.5	- 2.5 to 4.0	> 4.0
65-69	< - 3.0	- 3.0 to 3.0	> 3.0
70-74	< - 3.5	- 3.5 to 2.5	> 2.5
75-79	< - 4.0	- 4.0 to 2.0	> 2.0
80-84	< - 5.5	- 5.5 to 1.5	> 1.5
85-89	< - 5.5	- 5.5 to 0.5	> 0.5
90-94	< - 6.5	- 6.5 to -0.5	> 0.5

Norms for Men

Age	Below average	Average	Above average
60-64	< - 0.5	- 0.5 to 5.0	> 5.0
65-69	< - 0.5	- 0.5 to 4.5	> 4.5
70-74	< - 1.0	- 1.0 to 4.0	> 4.0
75-79	< - 1.5	- 1.5 to 3.5	> 3.5
80-84	< - 2.0	- 2.0 to 3.0	> 3.0
85-89	< - 2.5	- 2.5 to 2.5	> 2.5
90-94	< - 4.5	- 4.5 to 1.5	> 1.0

Norms for Women

➤ Back Scratch test for Upper Body Flexibility:

- **Purpose:** This test measures upper arm and shoulder girdle flexibility.
- **Equipment Required:** None



- **Procedure:** In this test, the subject is required to stand. One hand is put behind the head and the other hand is put down the back with the palm facing the body. The other hand is put at the back from the bottom side with the palm facing away from the body. The subject is then required to try and touch the fingers. The process is repeated for both the shoulders.

Age	Below average	Average	Above average
60-64	> 6.5	6.5 to 0	< 0
65-69	> 7.5	7.5 to -1.0	< -1.0
70-74	> 8.0	8.0 to -1.0	< -1.0
75-79	> 9.0	9.0 to -2.0	< -2.0
80-84	> 9.5	9.5 to -2.0	< -2.0
85-89	> 10.0	10.0 to -3.0	< -3.0
90-94	> 10.5	10.5 to -4.0	< -4.0

Norms for Men

Age	Below average	Average	Above average
60-64	> 3.0	3.0 to 1.5	< 1.5
65-69	> 3.5	3.5 to 1.5	< 1.0
70-74	> 4.0	4.0 to 1.0	< 1.0
75-79	> 5.0	5.0 to 0.5	< 0.5
80-84	> 5.5	5.5 to 0	< 0
85-89	> 7.0	7.0 to -1.0	< -1.0
90-94	> 8.5	8.5 to -1.0	< -1.0

Norms for Women

➤ Eight foot up and go test for Agility:

- **Purpose:** This test measures speed, agility and balance while moving.
- **Equipment Required:** Stopwatch, straight back or folding chair (seat 17 inches/44 cm high), cone/marker, measuring tape, area clear of obstacles.



- **Procedure:** Place the chair next to a wall for safety and the marker used for eight feet test in front of the chair. Clear the path between the chair and the marker. The subject starts fully seated, hands resting on the knees and feet flat on the ground. On the command 'Go' the stopwatch is started and the subject stands and walks (no running) as quickly as possible to and around the cone, returning to the chair to sit down.

Age	Below average	Average	Above average
60-64	> 5.6	5.6 to 3.8	< 3.8
65-69	> 5.7	5.7 to 4.3	< 4.3
70-74	> 6.0	6.0 to 4.2	< 4.2

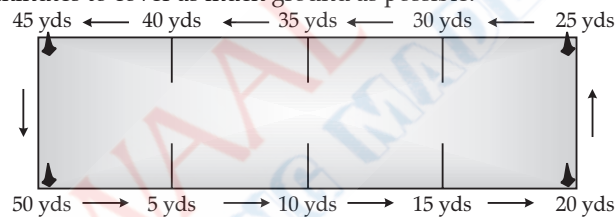
75-79	> 7.2	7.2 to 4.6	< 4.6
80-84	> 7.6	7.6 to 5.2	< 5.2
85-89	> 8.9	8.9 to 5.3	< 5.3
90-94	> 10.0	10.0 to 6.2	< 6.2

Norms for Men

Age	Below average	Average	Above average
60-64	> 6.0	6.0 to 4.4	< 4.4
65-69	> 6.4	6.4 to 4.8	< 4.8
70-74	> 7.1	7.1 to 4.9	< 4.9
75-79	> 7.4	7.4 to 5.2	< 5.2
80-84	> 8.7	8.7 to 5.7	< 5.7
85-89	> 9.6	9.6 to 6.2	< 6.2
90-94	> 11.5	11.5 to 7.3	< 7.3

Norms for Women➤ **Six Minute Walk test for aerobic endurance:**

- **Purpose:** This test measures aerobic fitness.
- **Equipment Required:** Measuring tape to mark out the track distances, stop watch and chairs positioned for testing.
- **Procedure:** The walking course is laid out in a 50 yard 45.7 metres rectangular area (dimension 45× 5 yards) with cones placed at regular intervals to indicate distance walked. The aim of this test is to walk as quickly as possible for six minutes to cover as much ground as possible.

**CHAPTER-7****PHYSIOLOGY AND INJURIES IN SPORTS****Topic-1****Physiological Factors Determining the Components of Physical Fitness**

Concepts Covered • *Physiological factors determining Strength, Speed, Endurance, Flexibility.*

**Revision Notes**

- The components of Physical Fitness like strength, speed, endurance, flexibility, etc., can be determined with the help of various physiological factors.

I. Physiological Factors Determining Strength:

(i) **Muscle Size:** The size of the muscle is largely responsible for the strength of the muscle. It is an acknowledged actuality that more force can be produced by bigger and larger muscles. In males and females, the similar size of muscle produces the similar force even though males are found to be stronger in comparison to females for the reason that they have larger and bigger muscles.

(ii) **Body Weight:** Body weight determines the strength of an individual as well. It is known that the heavier individuals are stronger in comparison to the lighter individuals. Among international weight lifters, there is a positive correlation involving body weight and strength as because of this, the heavier weight lifters lift heavy weights.

(iii) **Muscle Composition:** It can be said that the proportion of the fibres determines the strength. Fundamentally, each muscle consists of two types of muscle fibres i.e., white fibres (fast twitch fibres) and red fibres (slow twitch fibres). The fast twitch fibres produce more force as they can contract faster. On the other hand, the slow twitch fibres are capable to contract for a longer duration as they do not contract faster. The muscles which can produce more strength have more percentage of fast twitch fibres.

II. Physiological Factors Determining Speed:

(i) **Explosive Strength:** Explosive strength is essential for all rapid and explosive movements. Explosive strength depends on the muscle composition, size, co-ordination and on the metabolic process as well. Apart from muscle composition, the left behind factors can be developed in the course of training which eventually increases the speed upto a limited extent.

(ii) **Flexibility:** Flexibility enables complete utilisation of explosive strength as well. To some point, flexibility determines the speed as well. Actually, flexibility allows utmost range of movement with not much of internal resistance.

(iii) **Bio-Chemical Reserves and Metabolic Power:** The muscles need more quantity of energy at an extremely high rate of utilisation for maximum speed performance and for this reason the phosphagen ATP and CP stored in the muscles should be sufficient. The muscles contraction due to inadequate energy supply turn out to be slow after a short time, if ATP and CP are less in quantity, in contracting muscles. The energy supply depends on definite enzymes which increase the metabolic power. Training can enhance the amount of ATP and CP.



Key Words

ATP : Adenosine triphosphate

CP : Phosphocreatine

III. Physiological Factors Determining Endurance:

(i) **Aerobic Capacity:** The muscles require energy to perform an activity continuously which can be supplied in the presence of oxygen. Therefore, for endurance performance, the ability to uphold the sufficient supply of oxygen to the working muscles for energy liberation is vital.

(ii) **Lactic Acid Tolerance:** The ability to tolerate higher concentration of lactic acid can help in improving endurance performance and is a vital factor in determining anaerobic capacity. For activities that last for about 40 seconds or more, the lactic acid tolerance is important.

(iii) **Movement Economy:** For significant endurance performance, the movements performed should be economical. With less energy expenditure, a runner can run at a set speed for longer duration. In endurance sports, a good technique can save energy.

IV. Physiological Factors Determining Flexibility:

(i) **Muscle strength:** To make the movement possible, especially against gravity or external force, the muscles should have a bare minimum level of strength. In reality, for achieving the higher range of movement, feeble muscles can become a limiting factor. Strength of muscles is extremely trainable, hence, it can improve the flexibility.

(ii) **Joint structure:** In human body, there are numerous types of joints. A number of joints intrinsically have a larger range of motion in comparison to others. For instance, the ball and socket joint of the shoulder has the maximum range of motion in contrast to a knee joint.

(iii) **Previous Injury:** Thickening or fibrosing on the affected spot may result in injuries to connective tissues and muscles. Since, fibrous tissues are less elastic, it can lead to limb shortening and eventually towards reduced flexibility.

Topic-2

Effect of Exercise on Muscular System

Concepts Covered • Muscular System and Effects of exercises on the physiology of muscular system.



Revision Notes

- In our body, there are 650 muscles producing a particular movement. Muscles, with the help of bones, help our body to move. The cardiac muscles producing a particular movement help to pump blood throughout our body. These are important muscle contractions:

- (i) Isotonic Contraction
- (ii) Isometric Contraction
- (iii) Isokinetic Contraction

(i) Isotonic contraction: It is a type of muscle contraction in which, while lifting a constant load, the muscle shortens with different tensions.

(ii) Isometric contraction: It is a muscle contraction in which there is no change in the length of the muscle though the tension is developed.

(iii) Isokinetic contraction: It is a muscle contraction performed at an unvarying pace. Moreover, in such a way, that muscle tension develops while shortening in maximal more than the complete range of joint motion.

- **Muscle Hypertrophy:** Hypertrophy is an increase in width of individual muscle fibre. The size of the muscle fibre is usually responsible for gain in strength and muscular endurance. Weight training causes the hypertrophy of muscles.
- **Biochemical Changes in Muscles:**
 - **Alteration in Aerobic Capacity:**
 - (i) Amount of mitochondria increases consequently producing more muscular energy.
 - (ii) Breakdown of carbohydrates and fat increases.
 - (iii) Oxygen binding compound called Myoglobin, found in muscle tissues, increases.
 - (iv) Quantity of glycogen store increases consequently because of training, which is vital for energy production in the muscles.
 - **Alterations in Anaerobic Capacity:**
 - (i) ATP + CP System capacity increases in a way releasing more energy.
 - (ii) As a result of training, glycolytic capacity increases as well.
- **Body Composition Changes:**
 - (i) The body composition changes significantly, but in case of majority of individuals, weight training produces little or no change in the total body weight.
 - (ii) The muscle mass increases.
 - (iii) Alteration in muscle and joint motion occurs.
 - (iv) Flexibility increases as a result of training, thereby enhancing the performance and preventing serious muscle injury.
 - (v) There can be a noteworthy loss of relative and absolute body fat.

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 require 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.

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.

Topic-3

Effect of Exercise on Cardio-Respiratory System

Concepts Covered • Cardio-Respiratory System - Heart, blood vessels, respiratory functions and effects of exercises.



Revision Notes

➤ Cardio-Respiratory System:

The cardiorespiratory system operates to obtain and circulate vital compounds throughout the body—specifically, oxygen and nutrients, such as food energy, vitamins, and minerals.

Cardiovascular refers to your heart, blood vessels and blood. Cardio-Respiratory includes all this and your breathing apparatus, too.

Immediate Effects of Exercises:

- (1) **Heart Rate Increases:** In healthy adults, resting heart rate ranges from 60-80 beats per minute. It may be high as 100 beats per minute in sedentary middle-aged individuals. It has been recorded that in elite endurance athletes, the heart rate is as low as 40-60 beats per minute. The heart rate increases in expectancy even before exercise begins, this is acknowledged as the anticipatory response which occurs through the release of neurotransmitter called epinephrine and norepinephrine. Subsequently to the early anticipatory response, until the maximum heart rate is reached, heart rate increases in the direct amount to intensity of the exercise. Maximum heart rate is calculated with method of deducting age from the beats at the time of birth (220 - Age). The only direct method is to exercise at increasing intensities for determining maximum heart rate until a plateau in heart rate is found in spite of the increasing rate of work.
- (2) **Cardiac Output Increases:** Cardiac output increases if either heart rate or stroke volume increases. With the response of heart rate and stroke volume to activity, cardiac output increases proportionately with intensity of exercise as well. At resting condition, the cardiac output is about 5 liters/min whereas, during intense exercise it may increase to 20-40 litres/min.
- (3) **Blood Flow Increases:** The vascular system is capable of redistributing blood to the tissues where the maximum instant demand for oxygen increases and safely divert away the blood flow from the areas that have less demand. During rest, skeletal muscles are supplied with 15-20% of the circulating blood. Through dynamic or vigorous exercise, it increases up to 80-85% of cardiac output. Blood is carried away from major organs i.e., kidneys, liver, stomach and intestines.
- (4) **Stroke Volume Increases:** With exercise intensity there is proportionate increase in the stroke volume. At rest, stroke volume in untrained individuals ranges from 50-70 ml/beat rising up to 110-130 ml/beat in intense physical activity. Resting stroke volume ranges from 90-110 ml/beat rising to the extent of 150-220 ml/beat in elite athletes. With the onset of exercise, the stroke volume increases because the left ventricle fills up totally, stretching it more, producing a more forceful contraction with the elastic recoil, this phenomenon is known as the Frank Starling Mechanism.

➤ **Long Term Effects of Exercises on Cardio-Respiratory system:**

1. **Heart Size Increases:** The size of the heart and the strength of the cardiac muscle increases due to regular exercises as to the maximum extent the left ventricle adapts. The walls of the heart become stronger and thicker as shown in recent studies and the thickness of myocardial wall increases as well.
 2. **Resting Heart Rate Decreases:** The resting heart rate decreases due to regular exercises. After duration of 10-weeks training programme, the resting heart rate may reduce upto 10 beats per minute from the normal of 72 beats per minute. The heart becomes more efficient due to regular exercises. In highly conditioned athletes, the resting heart rate decreases to 30 beats/minute.
 3. **Blood Flow Increases:** The body increases its number of capillaries to the requirement of supplying more oxygen during exercise to the muscles. The existing capillaries open wider as well. Further, the redistribution of blood becomes efficient and effectual. As a matter of fact, blood circulation in the body increases.
 4. **Cardiac Output Increases:** The cardiac output tends to increase as a result of regular exercise. At resting conditions in untrained individuals, the cardiac output can possibly be 14 to 20 litres/minute, in trained individuals 25 to 35 litres/minute and cardiac output can be as high as 40 litres/minute in elite athletes.
 5. **Risk of Heart Disease Reduces:** Stress related hormones progressively get reduced from circulating in the blood due to regular exercises. This increases the blood vessel pathway, which consecutively reduces the risk for the increase of plaque that leads to coronary heart disease. Therefore, the risk of heart diseases reduces due to exercises.
 6. **Blood Volume Increases:** The blood volume increases due to the regular exercise. Actually, as the blood volume enhances, there is an increase in plasma volume. Additionally, during heavy exercise, in order to keep the muscle supplied with oxygen, the body produces a greater number of red blood cells.
- **Lung Volume:** The lungs' volume and capacity increases with endurance training. After endurance training, vital capacity is increased *i.e.*, maximal volume of air forcefully expires out subsequent to a maximal inspiration. The trained athlete may have vital capacity of 5-6 litres but, vital capacity of untrained individual is of 3-4 litres.
- **Breathing frequency:** Breathing rate is the number of breaths per minute. Breathing frequency decreases after training. In resting condition, normal untrained individual's breathing frequency is about 12-20 breaths/minute. In trained athletes or individuals, it reduces down to 7-8 breaths/minute. Exercise reduces respiratory rate that reflects superior respiratory efficiency.
- **Maximum minute ventilation:** The amount of air which is inhaled or exhaled in one minute is called minute ventilation. Maximum minute ventilation increases subsequent to training. In untrained individuals, maximum minute ventilation is about 100 litres/minute, while it increases to more than 150-160 litres/minute in trained athletes.



Key Word

Pulmonary: Related to lungs or carried out in lungs, such as pulmonary respiration.

- **Pulmonary Diffusion:** The exchange of gases that takes place in small air sacks of lungs (alveoli) is called pulmonary diffusion. For diffusion, more alveoli become active at the time of maximal level of exercise. The alveoli size increases as well which gives more space to diffusion of oxygen (O_2) and carbon dioxide (CO_2).
- **Ventilatory Efficiency:** The trained person gets the similar amount of oxygen (O_2) from less amount of air. Generally, 15 litres of air is required to obtain one litre of oxygen, however, trained individual gets the similar quantity of oxygen from 12 litres of air. Training or physical exercises, especially endurance training, increases the ventilatory efficiency.

Topic-4

Sports Injuries: Classification

Concepts Covered • *Soft Tissue Injuries, Sprain & Strain; Bone & Joint Injuries. Dislocation, Fractures - Green-stick, Comminuted, Transverse, Oblique and impacted.*



Revision Notes

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.

➤ **Classification of Sports Injuries**

Injuries among athletes may be classified into two categories:

1. Acute injuries
2. Overuse injuries

1. **Acute Injuries:** Acute injuries are caused by an unexpected shock. Common acute injuries among young sports athletes include sprains i.e., an incomplete or absolute tear of ligament, strains i.e., a partial or complete tear of a muscle or tendon.
2. **Overuse Injuries:** Not all injuries are sourced by a single, sudden twist, fall or collision. A sequence of small injuries to undeveloped bodies can cause minor fractures, minimal muscle tears or progressive bone deformities which are known as overuse activities.

➤ **Common Sports Injuries are:**

- | | |
|----------------|--------------|
| 1. Sprain | 2. Strain |
| 3. Dislocation | 4. Contusion |
| 5. Fracture | 6. Abrasion |

It is observed that only a single type of injury does not occur in sports. The injuries that take place may be in muscles, bones, joints, etc.

Likewise, sports injuries may be divided into various types. They are:

- | | | |
|-------------------------|------------------|-------------------|
| 1. Soft tissue injuries | 2. Bone injuries | 3. Joint injuries |
|-------------------------|------------------|-------------------|

➤ **Soft Tissue Injury:** The damage in the muscles, ligaments, tendons or nerves of the body is known as soft tissue injury. Some of soft tissue injuries are as follows:

- | | |
|----------------|---------------|
| (a) Abrasion | (b) Contusion |
| (c) Laceration | (d) Incision |
| (e) Sprain | (f) Strain |

Classification of Sports Injuries:

(A) Soft Tissue Injuries :

- (1) **Abrasion:** An abrasion is a superficial rub or wearing off of the skin, usually caused by a scrape or a brush burn. Abrasions are usually minor injuries that can be treated at home. The skin may bleed or drain small amounts at the time of the injury or at times over the next few days if rubbed or scratched.
- (2) **Contusion :** Contusions are one of the most common types of injuries occurring in active children. A contusion, or bruise, is caused by a direct blow to the body that can cause damage to the surface of the skin and to deeper tissues as well depending on the severity of the blow.
- (3) **Laceration :** A laceration is a wound that is produced by the tearing of soft body tissue. This type of wound is often irregular and jagged. A laceration wound is often contaminated with bacteria and debris from whatever object that caused the cut.
- (4) **Incision :** Incision is a soft tissue injury. It may occur due to sharp edged object of sports Equipments or spikes etc. Sometimes arteries or veins may be cut. Blood usually comes out freely from incision.
- (5) **Sprain and Strain:**



- (a) A sprain is a stretching or tearing of ligaments. The tough bands of fibrous tissue that connect two bones together in your joints. The most common location for a sprain is in your ankle. Initial treatment includes rest, ice, compression and elevation. Mild sprains can be successfully treated at home.
- (b) **Strain :** A muscle strain is an injury to a muscle or a tendon. The fibrous tissue that connects muscles to bones. Minor injuries may only overstretch a muscle or tendon, while more severe injuries may involve partial or complete tears in these tissues.

(B) Bone and Joint Injuries:

- (1) **Dislocation :** A dislocation is an injury in which the ends of your bones are forced from their normal positions. The cause is usually trauma resulting from a fall, an auto accident, or a collision during contact or high-speed sports. Dislocation usually involves the body's larger joints.

- (2) **Fracture** : A fracture is a break, usually in a bone. If the broken bone punctures the skin, it is called an open or compound fracture. Fractures commonly happen because of car accidents, falls, or sports injuries. Other causes are low bone density and osteoporosis, which cause weakening of the bones.

Type of fractures:

- Green Stick** : A greenstick fracture occurs when a bone bends and cracks, instead of breaking completely into separate pieces.
- Comminuted** : Comminuted fractures are a type of broken bone. The term comminuted fracture refers to a bone that is broken in at least two places.
- Transverse** : Transverse fractures occur when your bone is broken perpendicular to its length.
- Oblique** : A fracture of long bone in which the fracture line runs obliquely to the shaft of the bone.
- Impacted** : An impacted fracture occurs when the broken ends of the bone are jammed together by the force of the injury

CHAPTER-8

BIOMECHANICS AND SPORTS

Topic-1

Newton's Law of Motion and its Application in Sports

Concepts Covered • *Newton's Law of motion, • Law of Inertia, acceleration, reaction and its application in sports.*



Revision Notes

- **Meaning of Biomechanics:** 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.
- **Meaning of Sports Biomechanics:** 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. It refers to the description, detailed analysis and assessment of human movement during sport activities.
- **Newton's First Law of Motion or Law of Inertia:** According to this law, "A body at rest will remain at rest and a body in motion will remain in motion at the same speed and in the same direction unless acted upon by an external force."
Example: To take start in sprint races, to lift the opponent in wrestling, to start **hammer throw**.
- **Newton's Second Law of Motion or Law of Acceleration:** It is also called as Law of resultant force or law of momentum. According to this law, "A change in acceleration of an object is directly proportional to the force producing it and inversely proportional to its **mass**." If two unequal forces are applied to the objects of equal mass, the object that has a greater force applied will move faster. Conversely, if two equal forces are applied to objects of different masses, the higher mass will travel at a faster speed.
Example: In a baseball game, players hit the ball hard to throw it far away.
- **Newton's Third Law of Motion Law of Reaction:** It is also called as Law of reciprocal action force. According to this law, "For every action, there is an equal and opposite reaction."
Example: Walking: When a person walks, he presses the ground in the backward direction (action) by his feet. The ground pushes him in the forward direction with an equal **force** (reaction).



Key Words

Force: A push or a pull

Mass: Quantitative measure of inertia

Hammer throw: A sport in athletics (track and field) in which a hammer is hurled for distance, using two hands within a throwing circle.

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. 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.

Topic-2

Equilibrium – Dynamic & Static and Centre of Gravity and its application in sports

Concepts Covered • *Equilibrium - Static & Dynamic, Center of Gravity & its application in sports.*



Revision Notes

- **Equilibrium :** Equilibrium is a state of rest of the body either at stationary or in moving position. It is a state of **balance** or a stable situation, where opposite forces cancel each other out and where **no** changes are occurring. Equilibrium is necessary for performing skills. Naturally, the Centre of gravity shifts with each other in posture. Some important factors about equilibrium are as follows:
 - (a) **Stability** is directly proportional to the area of the base on which the body rests.
 - (b) Stability is indirectly proportional to the distance of the center of gravity of the body above the base.
 - (c) Stability is directly proportional to the weight of the base.



Key Words

Sprint state: It is a method which is applied at the beginning of the race to gain maximum speed as quickly as possible.

Archery: A sport involving shooting arrows with a bow, specially at a target in sports.

Fatty Acids: Building blocks of fats.

Stability: Stability is resistance to disruption of equilibrium.

Balance: Balance is the ability to control equilibrium during changing body's positions.

Types of Equilibrium: Generally, all objects rest in equilibrium. That means all the forces acting on them are equally balanced and sum of all the forces and of all torques equal zero. But all the objects are not equally stable.

1. **Dynamic equilibrium:** It is a balance of body during movement or actions. It frequently happens that the line of gravity of an athlete will fall outside the base of support for a moment. For example in a sprint start, the body weight is well ahead of the supporting foot, but before the body can fall forward, the other foot moves ahead to provide support and the process repeats itself. Other examples are exercises on balancing beam, low dribble in basketball and all kinds of sports movements.
2. **Static equilibrium:** It is the balance of the body during its rest or objects that are not accelerating or moving. Static stability mainly depends upon the enlarged base of support, lowered center of gravity, direction of an acting force and body weight. Stability in sports situations is quite unlike the stability of solid objects. For e.g., Wrestlers positions, Stance of batsman in cricket, shooting, archery, etc.

Center of Gravity

It is the "balance point" of the body. The point where the weight of the body acts. The point where all forces acting on the body equal zero. Linear forces must be balanced. Torques must be balanced.

Centre of gravity is that point in a body or system around which its mass or weight is evenly distributed or balanced and through which the force of gravity acts. The location of the Centre of Gravity remains fixed as long as the body does not change shape. If an object's shape or position changes, the location of the Centre of Gravity changes. The direction of the force of gravity through the body is downward, towards the center of the earth and through the COG. This line of gravity is important to understand and visualise when determining a person's ability to successfully maintain balance. When the line of gravity falls outside the base of support, then a reaction is needed in order to stay balanced.

Line of Gravity: It is an imaginary vertical line which passes through the center of the body. The location of the line of gravity will depend upon the location of the gravity which changes according to the body's position.

Application of COG in Sports:

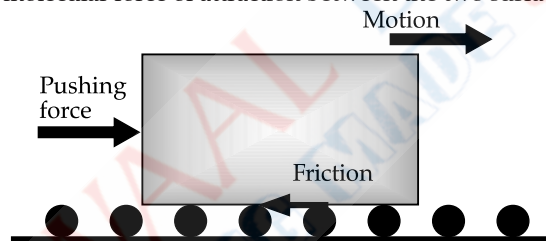
- The center of gravity moves according to the athlete's body position. For example, the center of gravity is lower and in front of athlete's body while he or she is running. Lower body is advantageous for acceleration.
- Low center of gravity also helps to increase stability because it needs to be lifted higher before it moves outside of the base of support. This becomes very useful in combat sports such as sumo wrestling. It is also used by in kabaddi, basketball etc.
- Lowering the center of gravity increases balance and stability in sports. This is why you can change direction faster by bending your legs and getting lower to the ground. It increases your stability, allowing you to adjust to greater force by the legs.

Topic-3**Friction and Sports**

Concepts Covered • Friction - Static and Dynamic (Rolling and Sliding) friction and its application in sports.

**Revision Notes**

- **Friction:** The force acting along two surfaces in contact, which opposes the motion of one body over the other is called the force of friction. It is important in sports. The larger the area of contact between the surfaces, the greater the force of friction. When both the surfaces are smooth, the force of friction reduces almost to zero. Generally, there are two causes of friction:
- The roughness or irregularities of the surface;
 - The strong atomic or molecular force of attraction between the two surfaces at the point of actual contact.



- **Characteristics of friction:**
- Friction is the force resisting the relative motion of solid surfaces, fluid layers, and material elements sliding against each other.
 - Friction is a force created whenever two surfaces move or try to move over each other.
 - Friction always opposes the motion or attempted motion of one surface area across another surface.
 - Friction is also dependent on the amount of contact force pushing the two surfaces together.

**Key Word**

Distortion: The act of twisting or altering something out of its true, natural, or original state.

- **Types of Friction:**
There are generally two types of friction:
- Static Friction
 - Dynamic Friction
- Static Friction:** Static friction is when a force is applied to an object but does not cause it to move. Example: Pushing a wall. Static friction comes into play when a body is forced to move along a surface and movement does not start. The magnitude of static friction remains equal to the applied external forces and direction of motion. The magnitude of static friction depends upon coefficient of static friction and N (Net normal reaction of the body).
 - Dynamic Friction:** Dynamic friction is a divergent force that comes into action when one body moves over the surface of another body. Additionally, dynamic friction is of two types *i.e.*, sliding friction and rolling friction. These are:
 - Sliding friction:** Sliding friction is the divergent force that comes into action as the body slides over the surface of the other body. For instance, ice skating and in pole vault, planting the pole.
 - Rolling Friction:** Rolling friction occurs when an object rolls over another (something with wheels or circular like a ball). Example: riding a motorcycle. Rolling frictional force is a force that slows down the motion of a

rolling object. Basically, it is a combination of various types of frictional forces at the point of contact of the wheel and ground or surface. When a hard object moves along a hard surface then static and molecular frictional force retard its motion. When a soft object moves over a hard surface then its **distortion** makes it slow down.

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.

Topic-4 Projectile in Sports

Concepts Covered • *Projectile, Projectile in sports*



Revision Notes

- **Projectile:** It checks with the motion of an object projected into the air at an angle. An object thrown into the space either horizontally or at oblique angle under the action of gravity is termed as a projectile. Within the field of games and sports, there are many samples of projectiles like putting the shot, throwing a hammer, discus, and javelin in athletics.



Key Words

Discus : sport in athletics (track and field) in which a disk-shaped object, known as a discus, is thrown from a distance.

Trajectory : Path followed by projectile.

Parabolic Path : The angle of projectile trajectory.

Factors affecting projectile trajectory:

- Propelling Force:** The propelling force produces certain effects depending upon its point and direction of application. Variation of spin like forward, backspin, clockwise, counterclockwise occurs thanks to propelling force.
- Force of Gravity:** Gravity acts to influence the vertical motion of the projectile. The factors that determine how soon gravity will cause the article to descend are –
 1. Weight (mass) of the item.
 2. Amount of force driving it upward.
 3. The effect of air resistance on the item.
- Effect of Air Resistance:** Air resistance affects the horizontal component of a projectile trajectory, the effect of which may be minimised by lowering the angle of release.
- Speed of Release:** Speed or velocity is directly associated with distance. The greater the speed of release, the greater the gap covered on the wind.
- Angle of Release (Trajectory of Relax) :** The angle of release changes the link between the horizontal and vertical components of a projectile.
The perfect angle of release is 45 degrees, assuming there's no air resistance and also the kick off and landing points are at the identical heights.
- Height of Release:** The peak above the bottom level, or the peak above the purpose of landing, of the Centre of gravity of a projectile immediately before it leaves the bottom.

Projectile in Sports

There are some samples of projectile motion application in sports.

- Bow and arrow/sling-shot:** When an arrow is fired at an angle to the bottom, it follows a parabolic path of a projectile and then it hits the target.

- (b) In the baseball game, a ball is hit by the bat and then it starts moving in the air but the ball doesn't follow a standardised circular path. The trail is probably going to be parabolic in nature betting on the angle at which it's launched.
- (c) When a football is kicked then it travels a specific distance within the air and it falls at an angle to the base or ground, this can be an example of projectile motion.
- (d) To achieve maximum distance, the person goes into circular motion to apply a force and then throws the hammer. The hammer should be thrown at a particular angle so that it covers maximum distance. The laws of projectile motion are applied here to induce the most benefit out of the throw.
- (e) In an exceedingly game of golf, a golf equipment is hit by a Golf stick, after this the ball follows the parabolic motion and then lands at a particular location. The angle and also the force applied are important for the ball to land at the specified location.
- (f) In Gymnastics, plenty of stunts and jumps are performed by gymnasts. The motion of the gymnast as he jumps is parabolic.
- (g) When a basketball is thrown into the basket, the ball travels a parabolic trajectory and then goes into the basket.
- (h) **Volleyball:** In a Volleyball game, the ball follows a parabolic motion from one side of the web to the opposite, it's an example of projectile motion.

CHAPTER-9

PSYCHOLOGY AND SPORTS

Topic-1

Personality; its definition & types (Jung Classification & Big Five Theory)

Concepts Covered • *Meaning and Definition of Personality, Types of Personality, Jung Classification & Big Five Theory*



Revision Notes

- **Meaning of Personality :** The word personality has been derived from the Latin word PERSONA. In the beginning, the word PERSONA was used as the mask worn by the actors to change their appearance but later on, it began to be used for the actors themselves. This common notion of personality is very much the same as the concept of psychology. Personality includes the totality of one's behaviour that should be taken into consideration.
- **Definitions of Personality:**
 - (i) **According to Allport ,** "Personality is a dynamic organisation within the individual of those psychophysical systems that determine his unique adjustments to his environment."



Key Word

Notion: A conception of something

- (ii) **According to Morton Prince,** "Personality is the sum total of activities, tendencies, appetites, instincts of the individuals and the dispositions and tendencies required by experience."
- (iii) **According to Watson,** "Personality is the sum of activities that can be discovered by actual observation over a long enough period of time to give reliable information."
- **Dimensions of Personality:**
 - (i) **Physical Dimension :** The primary feature or dimension of human personality is the physical body structure or the physique and all other dimensions are meek to it. For the development of this aspect of personality, heredity has a very significant role. A proper environment is necessary for the development of physical aspects of personality. A lone environment cannot take the credit for moulding a personality, as genetic

support forms the base of personality development. The individuals who have frail, pale, and malformed physique are not confident of themselves in comparison to individuals who have tall, healthy, and muscularly built personalities. There is a positive relationship between a good physique and health.



Key Words

- **Meek:** Gentle or can be easily Imposed on
- **VATA** is comprised of Ether and Air
- **PITTA** is comprised of Fire and Water
- **KAPHA** is comprised of Earth and Water

(ii) **Mental and intellectual dimension** : A well-built individual, lacking in mental and intellectual abilities, is just similar to a statue without life. Human beings have been bestowed with higher mental and intellectual abilities. Human personality loses its significance without mind and intellect. Well-known psychologists, scientists, philosophers, and leaders are known for their mental and intellectual abilities.

The mental and intellectual capabilities of an individual facilitate him in adjusting to circumstances and life in a more suitable way.

(iii) **Social Dimension** : Naturally, by nature, man is a social being. He has learned from the society in which he lives. He will not be able to survive for long if he is completely isolated from society. Human beings have an innate tendency to get them noticed favourably. Besides fulfilment of his biological needs and values, man fulfils emergent social values such as status, power, affection, and goodwill. Each individual is psychologically born with precise innate attitudes, interests, tendencies, and capacities. He moulds and modifies his behaviour, learns etiquettes, follows the rules, customs, and traditions of the society to be an acceptable member of the society.

(iv) **Emotional Dimension** : Emotion occupies a very high-flying place in our everyday life. Life without emotions is dull and unappealing. Our life is made worth living by emotions like love, affection, etc. Our life becomes exciting as well as boring, cheerful as well as miserable due to emotions. In all the stages of development and in the life of each and every living organism, emotions play a very dominant role. Emotions differ from individual to individual. A child learns to show different emotions by learning from experiences. As a result of emotions, every person responds to situations differently. Our body involves many physical and physiological changes in every emotional experience, as the energy mobilisation in our body increases due to emotions. The outcome of emotions on our body may be positive or negative.

➤ According to **Charak Samhita**, individuals can be classified into three types - **vata**, **pitta** and **kapha** on the basis of three humoral elements.

➤ It refers to personality typology based on trigunas meaning three qualities:

- **Sattva Guna:** Relates to qualities related to spirituality, such persons are good, clean, truthful, disciplined, constructive and caring.
- **Rajas Guna:** Relates to qualities related to passion and desire, such persons are greedy, active, restless, dissatisfied and envious.
- **Tamas Guna:** Relates to relaxation and luxury, such persons are lazy, inactive, destructive, arrogant and angry.

➤ **Types of Personality** : Personalities of individuals can be classified based on the universal factors that are found as the central part of each type. Human behaviour is a complex issue to understand and often unpredictable. The general classification of personality types is given below:

"Mayer Friedman and Ray Rosenman Conducted study in 1950 and divided personality of a person into Four types"

(i) **Type 'A' personality** : Individuals of this type are extremely independent, competitive, ambitious, and optimistic in nature. They are self-driven and know the significance of positive thinking, motivation, and goal setting. These individuals are impatient and tend to be rude and aggressive. Type A personality individuals are adventurous and risk-takers and possess the problem-solving ability.

(ii) **Type 'B' personality** : Type B personalities are the literal contradictory of type A personalities. Even in stressful situations, they are almost not stressed out. They can be described as being happy - go - lucky, who are particularly undisturbed in any circumstance. They are by and large cheerful, light-hearted and fun to be around. It is usually entertaining to be with them. They love to relax and accept things as they approach. Individuals under this type are considered by their lack of urgency, as they do the work at their own pace.

- (iii) **Type 'C' personality** : This personality type typically includes introverts and those concerned with facts. To find a fact they are interested in, they may perhaps spin heaven and hell upside down or inside out. They are engrossed in finding out how things work precisely. They are extremely sensitive and thoughtful. Type C personalities are reserved in nature and alert as well.
- (iv) **Type 'D' personality** : These individuals deem in apathy. They have a preference to join the trampled ways and establish routines over the ambiguity of alteration. These are executors of the direct instructions and supporters of the used-up deeds. When it comes to taking risks and responsibility, they tend to back out of the situations. These individuals are afflicted by pessimism such as gloom, worry, irritability, and barely self-confidence. They avoid sharing their negative emotions to avoid rejection.



Key Words

- **Apathy:** Lack of interest or concern.
- **Pessimism:** Tendency to believe that worst will happen.

➤ Jung has classified personality on the basis of sociability character as:

● **Introverts:**

- (i) People who have characteristics like shyness, social withdrawal, and tendency to talk less.
- (ii) People appear to be self-centered.
- (iii) They are not easily approachable.
- (iv) They are future-oriented, very sensible and rigid in ideas.

● **Extroverts:**

- (i) People who tend to be outgoing, friendly, talkative, and social in nature.
- (ii) They prefer social contacts. They are generous, sportive, and courageous.
- (iii) They are happy-go-lucky persons and show more interest in present reality than the future.
- (iv) They express their feelings openly.
- (v) Take decisions quickly and act upon them quickly.
- (vi) They are not affected easily by difficulties.

● **Ambiverts:**

People who possess both the qualities of introverts and extroverts.

➤ **Big Five Theory of Personality:**

The "big five" are broad categories of personality traits.

● **Openness:**

- (i) This trait features characteristics such as imagination and insight.
- (ii) People who are high in this trait tend to be more adventurous and creative.
- (iii) People who are low in this trait are traditional and abstract thinkers.

● **Conscientiousness:**

- (i) Standard features of this dimension include high levels of thoughtfulness, good impulse control, and goal-directed behaviors.
- (ii) Highly conscientious people tend to be organised and mindful of details.

● **Extraversion:**

- (i) This is characterised by excitability, sociability, talkativeness, and assertiveness.
- (ii) People who are high in extraversion are outgoing and tend to gain energy in social situations.
- (iii) People who are low in extraversion tend to be more reserved and have less energy to expend in social settings.

● **Agreeableness:**

- (i) This personality dimension includes attributes such as trust, kindness, affection, etc.
- (ii) People who are high in agreeableness tend to be more cooperative.
- (iii) People who are low in this trait tend to be more competitive and manipulative.

● **Neuroticism:**

- (i) This trait is characterised by sadness, moodiness, and emotional instability.
- (ii) Individuals who are high in this trait tend to experience mood swings, anxiety, irritability, and sadness.
- (iii) Those low in this trait tend to be more stable and emotionally resilient.

Topic-2**Meaning, Concept and Types of Aggression in Sports**

Concepts Covered • *Meaning of Aggression, Concept of Aggression, Types of Aggression- 1. Hostile Aggression 2. Instrumental Aggression 3. Assertion.*

**Revision Notes**

- **Meaning of Aggression** : Terry and Jackson in 1985 defined aggression in sports as “ harm – inducing behaviours bearing no direct relationship to the competitive goals of sports, and therefore relates, to incidents of uncontrolled aggression outside the rules of the sport, rather than highly competitive behaviours within the rule boundaries.
- **Concept of Aggression** : Aggression is an interpersonal behaviour intended to cause physical harm or mental distress to a person or persons. In the context of sports, aggression can be defined as an unprovoked physical or verbal assault, and aggressiveness is the intent to commit such an assault. Aggression today is part of any contemporary sport. Over the past twenty years, most sports have been going under drastic changes, and several problem areas have been located and addressed.

**Key Word**

Assertion: Here in this context 'confident and forceful aggression'

- **Types of Aggression** :
 - **Assertion Aggression** : Hurting others by gossips, rumours, Internal murmuring, etc.
 - **Instrumental Aggression** : In instrumental aggression, the main aim is to achieve a goal by using aggression. It is a positive form of aggression. Here the aim of the player is to excel in the sport that he is playing through high intensity output and competitive spirit. For example, a football player using aggression to tackle his opponent and win the ball. He is not harming any player but only using his aggressiveness to gain the ball. Experienced players show instrumental aggression on the field as they have greater self-control to manage their aggression.
 - **Hostile Aggression**: In hostile aggression, the main aim is to cause harm or injury to your opponent. Where the athlete can abuse face to face directly or hurt somebody by actions or words. It is usually an unplanned, impulsive reaction towards a player who may have become a threat in achieving the goal. However, it may also be planned to cause injury to intended player on the field. This kind of aggression often arises from insult, hurt, bad feelings, jealousy and threat. For example, a bowler throwing a bouncer to deliberately injure the batsman or to shake up his concentration. In some extreme cases, hitting an opponent or deliberately obstructing his path leads to his fall on the ground. This kind of aggression is usually seen in new players who want to achieve success quickly. The difference between the two is that instrumental aggression is positive where the aim is to excel by own efforts while hostile aggression is negative. Here the aim is to excel by causing harm to others.

Topic-3**Psychological Attributes in Sports – Self Esteem, Mental Imagery, Self Talk, Goal Setting**

Concepts Covered • *Psychological Attributes, Self-esteem, Mental Imagery, Self Talk Goal Setting.*

**Revision Notes**

- **Psychology** : The word Psychology has originated from Greek. In Greek, psyche mean soul and logos means to study science. Earlier psychology was a part of philosophy. John B Watson and his colleagues define psychology as the study of behavior but earlier it was considered the study of mind, consciousness, and soul.
- **Sports Psychology** : Sport psychology is the branch of psychology that deals with the behavior of sportspersons.
- **Psychological Attributes in Sports** : Psychological attributes are multi-dimensional and depend upon the assessment. In assessment, some major psychological attributes have to assess like cognitive, social, and emotional. In Psychological assessment, systematic testing procedures should be used to evaluate the abilities, behaviors,

and personal qualities of individuals. These all are applicable in sports.

There are some psychological attributes which are explained as follows:

1. **Self-esteem** : Self-esteem can be defined as how much you appreciate and like yourself regardless of the conditions. If a person has healthy self-esteem, it can influence motivation, mental well-being, and overall quality of life. If self-esteem is balanced it is considered good rather than too high or too low.

Self-esteem can be defined by these factors also: Self-confidence, the feeling of security, identity, a sense of belonging, and a feeling of competence. These words are similar to self-esteem like self-worth, self-regard, and self-respect. Generally, self-esteem and personality traits both are similar because in childhood self-esteem is found lower in comparison to adulthood. In adulthood, a person becomes more stable in the level of strength and endurance. There is some importance of Self-esteem as it enhances your decision-making process, and your overall well-being, and influences motivation.

According to Maslow : "Individuals need both appreciations from other people and inner self-respect to build esteem. Both of these needs must be fulfilled in order for an individual to grow as a person and reach self-actualisation." Some factors are also affected self-esteem like age, disability, genetics, illness, physical abilities, socio-economic status and thought patterns, racism, and discrimination.

For a better and healthy self-esteem:

- A person should avoid his past life negative experiences.
- Never think yourself alone and underrated.
- Always be expressive.
- Never lose hope and feel confident.
- Keep yourself ready and positive for further life.
- Believe in your strength and accept the weakness.
- Say no when you want.



Key Words

Genetics : Heredity

Racism : Separatism

2. **Mental Imagery** : Mental imagery refers to the athletes who imagine themselves in an atmosphere and performs a particular activity like sight, hearing, feeling, and smell before, during and after competition. The images should have the athlete performing successfully and feeling performance. Imagery is also known as visualisation rehearsal. It means all of your senses should be practiced or rehearses according to your sports in your mind.

Need and Importance of Mental imagery:

- Mental imagery helps you get your best outcome from training.
 - To compete more effectively by reducing anxiety levels and maintaining confidence levels during competitions.
 - To keep in top form when training is difficult to conduct.
 - Helpful in adaptation and acclimatisation in different playing conditions.
 - Recalling images related to past successful performance or upcoming goals give motivation.
 - Help in reducing negative thoughts before or during competitions.
 - It helps in planning, strategies, and tactical preparation.
 - It is helpful in learning of sports skills in proper sequence.
 - Athlete can see further success if they perform skill correctly or in correct sequence.
 - Through mental imagery, an athlete can set the stage for a performance.
 - It is helpful in re-focussing the athlete when the need arises.
3. **Self-Talk** : Self-talk is considered as our inner thoughts, consisting of theories we say to ourselves, either in our mind or out loud. Most of us use self-talk in our lives like just before interview or in cricket batsman waiting for their chance to bat and after match self-analysis. This kind of practice of self-talk helps us to regulate our thoughts and emotions. It can help to reduce stress and anxiety in certain situations.

Athletes and team also engage in self-talk during training and in playing situations, saying thoughts like, "Keep it up" and "stay confident", "We can do it' We are a team". In sports, self-talk has two functions:

- Enhancing athlete motivation and appreciate them to put in more effort.
- Gives proper direction for attention to the relevant actions that the athlete must perform quality movement or performance. This psychological attributes helps in improve fine motor control, such as basketball, rather than gross motor control, such as running.

There are three broad categories of self-talk:

1. **Self-expression:** Self-talk is based on athletes' self-expression. It consists of different thoughts and expressions related to past and upcoming events.
2. **Interpretive:** Athletes should be expressive by thoughts and it also helps to reduce stress levels and remove negative thoughts before the competition.
3. **Self-regulatory:** It allows athletes to build self-confidence by intentionally guide his/her behavior for self-motivation.

Self-talk depends upon some psychological traits as follows:

- Level of Motivation
- Self-esteem
- Skill level
- Competition level
- The type of sport, and its culture
- Prior experience
- The audience
- Where the sport is played.



Key Words

Vigorously: Forcefully and energetically

Self-esteem: Self-pride.

Importance of Self-Talk in Sports :

- According to research and individual experiences of players and coaches, shows that self-talk is effective for improving and maintaining athletic performance.
- Greater enjoyment, self-confidence, and higher perceived self-competence are linked with self-talk.
- It may help in reducing performance-related anxiety level among athletes, particularly when it is positive.
- Positive self-talk is most effective for performance but some individuals improve more than others through negative self-talk due to individual differences in motivation and self-esteem.

Goal Setting: Generally a Goal is defined as objective or target that someone is trying to reach or achieve. A goal should be specific, measurable, attainable, realistic and time based. Goal setting is one of the most effective tools when it comes to providing athletes with a psychological progress. Essentially goal setting is a technique of mental training that can be used to increase an individual's commitment towards achieving a personal goal and this can be divided into short, medium and long term goals. There are some different definitions and thoughts about the goal setting as follows:

Edwin Locke gave the Goal-setting theory of motivation in the 1960s. This theory explains that goal setting is essentially linked to task performance. It proves that specific and challenging goals along with appropriate feedback contribute to higher and better task performance.

According to Pablo Picasso, "Our goals can only be reached through a vehicle of a plan, in which we must fervently believe, and upon which we must **vigorously** act. There is no other route to success."

According to Locke (2019) "Every person's life depends on the process of choosing goals to pursue; if you remain passive you are not going to thrive as a human being."

These goals can be broken down into three categories:

- **Outcome goals :** related to specific results in competition,
- **Performance goals :** helping an athlete make improvements over a period of time.
- **Process goals :** refers to a process in which a competitor concentrates on carrying out a specific skill.

Importance of Goal Setting in Sports:

- Proper Goal setting is helpful in optimising sports performance.
- It can help them focus on what is important and essential in sports performance.
- Correct goal directs them and give a sense of control and positive self-direction.
- If goals are specific, measurable, attainable and realistic it can help athletes to gain confidence and believe in their ability to succeed.
- Goal setting can improve overall sports performance.
- It influence motivation when the goal setting based on time.
- It helps athletes to reach their potential.

CHAPTER-10

TRAINING IN SPORTS

Topic-1

Concept of Talent Identification and Talent Development in Sports

Concepts Covered • *Concept of Talent Identification, Physical attributes, Social skills, Psychological skills, etc. Talent Development in sports (The Sports Talent search Scholarship Scheme).*



Revision Notes

➤ Concept of Talent Identification:

Talent Identification is the major responsibility of sports authorities or coaches and selection committees. Talent identification is totally different from team selection and talent identification depends upon some factors like physical attributes, social, psychological, physiological, technical and cognitive skills. Talent search process should have clear aim and purpose about the needed talent.

Physical attributes: Health, posture, voice, and appearance are some physical attributes which are assessed during talent identification.

Social skills: Respect, empathy and communication skills are the examples.

Psychological skills: Goal setting, mental imagery, relaxation and activation, etc.

Physiological skills: efficient physiological functions required.

Gender: Talent search on the basis of gender category due to physiological and psychological differences.

Age : Age is also a dominant factor in talent identification. Talent identification should be in process during early stages of players.

Talent is the natural endowment of a person. It means a special ability for doing something and it often implies special favour by God or nature. Talent is an inherent ability of a person. Without proper sports training and coaching, talent becomes worthless. Talent refers a natural ability that needs to be developed. As talent identification is often confused with talent development. Talent identification is the first step in the progression from beginner to successful international athlete. It can be argued that the best form of talent identification is competition. Talent will search on the basis of a result of competitive performance.

It can be classified into three different stages or age categories. First category of talent identification is below 10–12 years of age. The second category of talent identification would need to be carried out between 13 and 16 years of age. The third phase of talent identification mainly deals with high level athletes for example, national level team members.

➤ Talent Development in Sports:

Talent Development in sports in India is based on proper talent identification. There are various schemes run by Government of India for the talent development. According to research study and evaluation of scheme, children of India has presented that the starting weight and physiological capacity of talented children is at higher level.

There are some talent search schemes of India for sports:

- The Sports Talent search Scholarship Scheme** was introduced in 1970-71. The scheme provides facilities to talented young boys and girls studying at the secondary level of education and proficient in sports to develop their talent in sports.
- SAI National Sports Talent Contest Scheme (SAI NSTC)** – It provides the school environment to play and study for talented 8-14-year old who are at the right age for higher level training in competitive sports.
- The sports authority of India has launched **National sports talent Search scheme 2022**.
- Khelo India Program** for Young Sports Talent launched in 2018 (“Khelo India – National Programme for Development of Sports” has a dedicated vertical ‘Talent Identification and Development’). Under this scheme, Khelo India School games and Khelo India University games are organised every year.

Topic-2 Introduction to Sports Training Cycle - Micro, Meso Macro Cycle.

Concepts Covered • Sports Training Cycle, Micro, Meso and Macro Cycle.



Revision Notes

➤ Introduction to Sports Training Cycle :

In sports training, everyone knows about the physical fitness and their components but it's difficult to understand the implication of training methods and their management. Sports training program which is also known as periodisation of training totally depends upon the principles of sports training. In principles of sports training, 'Principle of periodisation' is one of the most important components to organise proper training plan for an athlete or team.

Periodisation is the organised and systematic planning of athletic or physical training. The aim is to reach the best possible performance in the most important competition of the year. It involves progressive cycling of different aspects of a training program during a specific period.

Sports training program is developed through a series of training periods or cycles. Usually, there are three training periods such as:

- (a) **Micro Cycle** : Micro cycles are the simplest and the shortest training cycle. It is a single week or 7 days training plan. Although, in this plan workouts will vary from day to day. This training plan focuses on the specific aspect of sports performance. Each micro cycle is planned based on where it is in the over all macro cycle.
- (b) **Meso Cycle** : The mesocycle may be anywhere from 2 weeks to a few months, but is typically a month. It is a training phase in the yearly training plan that contains usually of 3-6 microcycles. It refers to the main training target for specific period like anaerobic power, muscular endurance, etc. This phase is also divided into preparatory, competitive and transitional period.
- (c) **Macro Cycle** : A macro cycle refers to the overall training period, usually it is a yearly plan. This is the longest training cycle of 3 to 12 months. There are three phases in the macro cycle:
 - **Preparatory period** : This is preparation phase for the athletes or team to prepare for the upcoming competition. This period consists of three phases i.e., I, II and III-phase in which general conditioning and fitness program, specific sports training program and tactical preparation is conducted respectively. Strategies and tactical training are also provided in this period. Duration of this period in one macro cycle may be 4 to 8 weeks.
 - **Competitive Period** : It consists warming-up matches and implication of strategies and tactical planning with efficiency. In this period, players and coaches focuses on mental strengthening and team work. Duration of this period may be 3 to 6 weeks.
 - **Transitional Period** : This period consist rehabilitation and recreation through different games and sports or vacations etc. The transition phase is important for psychological reasons; a year of training means a vacation is in order. It may be 45 days for proper rest and recovery.

Topic-3 Strength

Concepts Covered • Types of Strength & Methods to Develop – Strength



Revision Notes

- Training is a process of preparing an individual for any event, activity or job.
- According to Mathew (1981), "Sports training is the basic form of preparation of a sportsman."
- **Objectives of sports training:**
 1. Personality development
 2. Physical fitness and development

3. Skill/Technique development
4. Tactical development
5. Mental Training

➤ **Meaning of strength** : Strength is possibly the essential **motor** ability in sports because it is a direct result of muscle contractions. Strength is a conditional capability that depends mainly on the energy liberation process in the muscles.

For good posture, general health, and for prevention of injuries, if the role of strength training is habitually ignored, then it may prove harmful in the long run.



Key Words

Motor : Movements

Voluntary : In Control

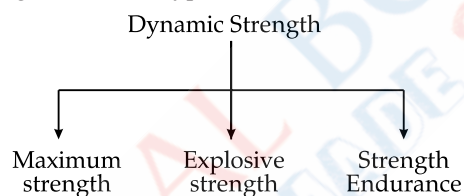
Neuromuscular : Nervous and muscular System

➤ **Definition** : "Strength is the ability to overcome resistance or to act against resistance". Strength must not be considered as a result of muscular contraction only. It is actually a result of contraction of **voluntary** muscles caused by stimulus of the **neuromuscular** system.

➤ **Types of Strength** : Generally there are two types of strength i.e., Static strength and Dynamic strength.

Experts have again classified Dynamic strength into three types which are as follows:

Experts have classified strength into three types :



Static Strength : It is a type of contractions of a particular muscle for an extended period of time. It is also called Isometric strength. For e.g., Shooting, horse riding, gymnastics.

Dynamic Strength : It is the ability of a person to apply a force repeatedly over a period of time. It is also known as Isotonic strength. For e.g., push-ups, biceps-curls etc.

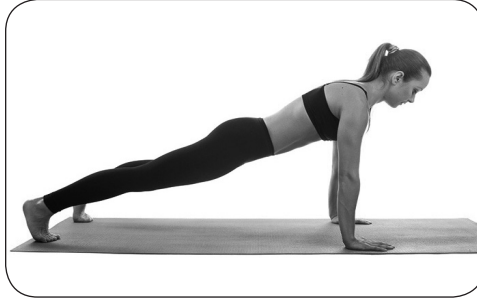
- (a) **Maximum Strength** : In a single muscle contraction, the muscle contract over the resistance of utmost intensity or stimulus. The most excellent examples are weight lifting and throwing events in track and field.
- (b) **Explosive Strength** : It can be stated as the ability to prevail over resistance through high speed. It combines strength and speed abilities and based on the nature of the blend of strength and speed, the explosive strength can be subdivided further into start strength, power, and speed strength.
 - **Start Strength** : The ability to build up maximal muscle force is the start strength. For an instance, starting a sprint, weight lifting, etc.
 - **Power** : It is the strength generated during the starting of any muscle contraction activity.
 - **Speed Strength** : It is the ability to prevail over lesser resistance by high speed like team games and lower weight categories of combative sports.
- (c) **Strength Endurance** : It is the result of two motor abilities. Under conditions of fatigue, it is the ability to work against resistance. Depending on the actuality of whether the movement is static or dynamic, the strength endurance can be there in the form of static or dynamic strength.

➤ **Methods of Improving Strength** :

1. **Isometric Exercise** : Since there are no movements, so these are not visible. In Isometric exercises, an activity performed is not visible directly. In these exercises, joint angle and muscle length do not change during contraction. The muscles remain stable even though these do not entirely stay constant. For instance, while pushing a wall, the force is generated in our muscles, but the wall does not move from its place, so we consider that work done is zero. As work is done when the point of application of a force moves, i.e.,

Work Performed = Force × Distance moved in the course of force

Some isometric exercises are :



(i)



(ii)



(iii)

➤ **Advantages of isometric exercises:**

- (a) Develop static strength.
- (b) Need less time.
- (c) Can be performed anywhere because no equipment is required.

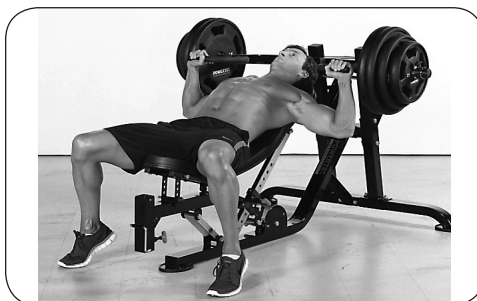
➤ **Disadvantages of isometric exercises:**

- (a) Muscles gain most strength at the angle used in exercise.
- (b) Avoid if you have heart problems as they cause a rise in blood pressure due to a drop in blood flow to the muscle during the contraction.
- (c) Do not develop dynamic strength.

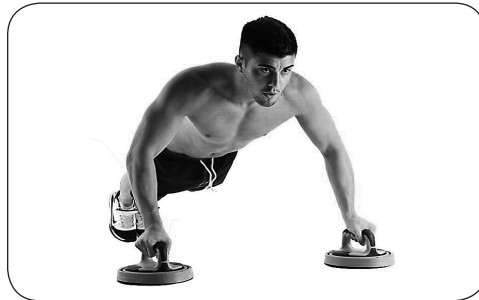
2. **Isotonic exercises** : Isotonic exercises tone up the muscles. Movements can be seen directly and work is done in isotonic exercises. By isotonic exercises, the length of muscle can be improved and muscles become flexible. In the field of sports, these exercises have numerous values.

Exercises with a medicine ball, calisthenics exercises, weight training exercises, running and jumping on the spot are the most appropriate examples of isotonic exercises.

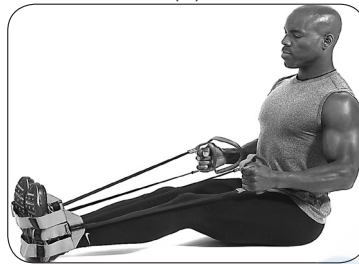
Some isotonic exercises are :



(i)



(ii)



(iii)

➤ **Advantages of isotonic exercises:**

- (a) Strengthen the muscle throughout the range of motion.
- (b) Can be adapted easily to suit different sports.

➤ **Disadvantages of isotonic exercises:**

- (a) Muscle soreness after exercise because of the high stress level.
- (b) Muscles gain the dynamic strength when they are at their weakest point of action.

3. **Isokinetic Exercises :** These exercises were developed in the year 1968 by Perrine. Isokinetic exercises are done on particularly designed machinery. These exercises engage a definite kind of muscle contraction that is generally not pertinent in sports and games apart from water sports like swimming and rowing. In isokinetic exercises, throughout the full range of movement, contraction of muscle applies maximal force at a particular position of its range of movement only. The speed of contraction can be adjusted according to the individual's capacity. Explosive strength and strength endurance can also be enhanced with the help of these exercises.



(i)



(ii)



(iii)

- **Advantages of isokinetic exercises:**
 - (a) They develop a high level of dynamic as well as explosive strength.
 - (b) These are effective for almost every game.
- **Disadvantages of isokinetic exercises:**

- (a) They require special types of equipment.
- (b) They must be performed under observation of a coach.

➤ **Precautions taken during Strength training:**

- Proper warming up must be done beforehand.
- Ensure the strength and stability of musculoskeletal system by starting strength training with low intensity exercises.
- Correct technique must be applied while exercising with heavy weights.
- A strength training programme includes a variety of exercises. Strength training exercises must be done in a proper sequence according to the strength training programme.
- There should be gradual increase in load in accordance with the strength and ability of the athlete.
- Proper and effective recovery periods must be there.
- Breathe continuously and hold the breath, only if needed as a part of the training and that must also be for the minimum possible time.
- Proper safety gear and equipment must be used.

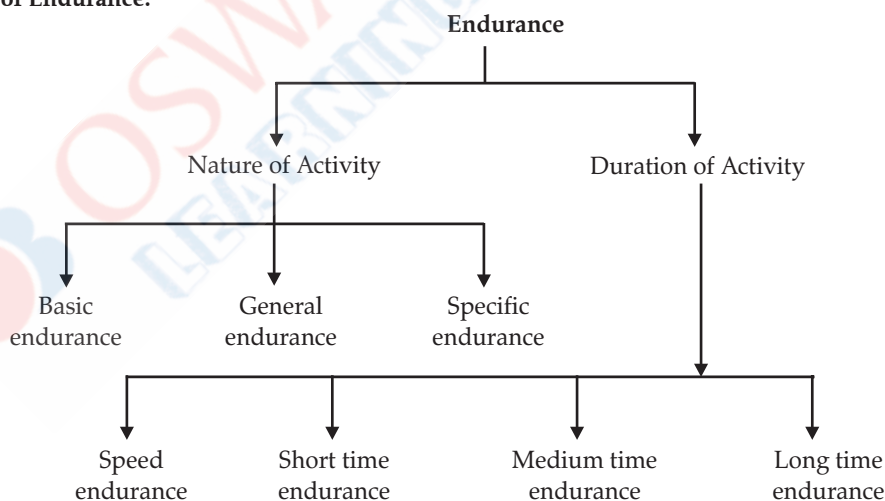
Topic-4 Endurance

Concepts Covered • Types of endurance & Methods to Develop endurance.



Revision Notes

- **Meaning:** Endurance is an imperative ability used in games and sports. Endurance is the result of the entire physical and mental organs and systems. To rapidly recover from training and competition load, it is essential to develop the capacity of endurance. It is the ability to continue prolonged workouts or resist fatigue for a longer duration. The aim of endurance training is to increase the energy production system to fulfil the demand of the event.
- **Definition:** "Endurance is the ability to do sports movement with the desired quality and speed, under the conditions of fatigue".
- **Types of Endurance:**



Experts in this field classify the endurance based on two criteria i.e., on the nature of the activity and the duration of activity.

I. According to the Nature of the Activity :

1. **Basic Endurance :** The formation of all types of endurance. It is the ability to carry out movement at a reasonable pace for a duration of more than 30 minutes involving a large number of muscles. e.g., jogging, walking and swimming.
2. **General Endurance :** General Endurance helps a sportsman to perform different types of exercises without getting excessively fatigued. In general endurance exercises, the energy liberation depends on a combination of aerobic and anaerobic metabolism therefore, it can be done with high or low intensity. It is developed through general exercises and is not precise to one sport.

3. **Specific Endurance** : The specific endurance can be equated with basic endurance in endurance sports, in which movements are executed at a slower speed, for a lengthy duration, namely in cross-country and marathon. The specific endurance may be determined by aerobic or anaerobic metabolism or by a combination of both depending on the nature of the sport.

II. According to the Duration of Activity :

1. **Speed Endurance** : Speed Endurance is the capability to defend against fatigue in activities enduring up to 45 seconds. e.g., 400m sprint. This capability is extremely reliant on the power and glycolytic mechanism capacity of energy production.
2. **Short time endurance** : Short time endurance capability is desirable for cyclic activity enduring as of about 45 seconds to 2 minutes, for instance in an 800 m race. In endurance activities of a short time, the energy is created by a combination of oxidation and glycolysis.
3. **Medium time endurance** : Medium time endurance is requisite for cyclic activities enduring from 2-11 minutes. For e.g., 1500 m and 3000 m run. It depends on strength endurance and speed endurance as well, however to a limited extent.
4. **Long-time endurance** : Long-time endurance is required for cyclic activities with a duration of more than 11 minutes, as in races of 5,000 meters and 10,000 meters.

➤ **Methods for Development of Endurance** : To develop endurance, the following methods are implemented-
Continuous training can be of two types:

- (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 depends upon the heart rate of the athlete. During a 30-minute activity, the heart rate of trained athlete should be between 140-160 beats per minute. The activities involved in this method are like walking, running, cycling etc.
- (b) **Fast Continuous Method**: In this method, the activity is performed at a comparatively faster speed but the speed remains uniform throughout the activity. During a 20-minute activity, the heart rate of trained athlete should be between 160-180 beats per minute.

1. **Continuous Training** : One of the most excellent methods for improving endurance is continuous training. In this method of training, an activity is carried out with no break for an extensive period with low intensity. A suitable example of the continuous method is cross-country race. The rate of the heart remains between 140-160 beats per minute in this method and the overall time length of the activity should not be less than 30 minutes.

Advantages of Continuous Training :

- (i) Glycogen in muscles and liver increases.
- (ii) Intensity can be increased for a better outcome.
- (iii) The number and size of mitochondria increase.
- (iv) The efficiency of the heart and lungs improves.
- (v) Under the condition of fatigue, it makes the individual strong-minded and improves determination and self-confidence.

2. **Interval Training** : It is the training of the heart through endurance training. In this training method, you run your heartbeats at a faster rate. Pihkala, the famous athletic coach of Finland, introduced this training method in 1910. He stressed the importance of rhythm between work and rest in the method and called it the Terrace method. Actually, this training method is based upon "effort and recovery". But by reducing the recovery period, the load can be increased. For a 400 meter athlete, the following examples can be related to this training :

- (a) 400m race by 80% speed.
- (b) Until the heart rate approximately falls to 120 - 140 beats, walking or jogging needs to be continued.
- (c) 400m race by 180% speed.

Advantages of Interval Training :

- (i) Both respiratory and circulatory systems can be improved.
- (ii) The athlete's improvement can be measured without difficulty.
- (iii) Coach can give suggestions regarding any fault during the recovery phase to an athlete.
- (iv) It helps an athlete to achieve peak performance in a short time.
- (v) In a short duration more workouts can be performed.

3. **Fartlek Training** : Fartlek is a Swedish term that means, 'speed play' and has been used by distance runners for years. Fartlek is a form of road running or cross-country running in which the runner usually changes the

pace significantly during the scrum. This training is done to improve performance and lessen the chances of injury, hence proper warm-up should be done at the beginning and appropriate cooling down at the end of the training. A pattern of the Fartlek training schedule is as follows :

- (i) Warm up by jogging for 5 to 10 minutes followed by a freehand exercise for diverse parts of the body for about 4 to 6 minutes.
- (ii) Run at speedy stable speed over a distance of 800 m to 1200 m.
- (iii) Fast walking for 5 minutes.
- (iv) Perform easy running, separated by 40- to 50- meter sprint, repeating until symptoms of fatigue become visible.
- (v) Slow jogging for about 3 to 5 minutes.
- (vi) Run up the hill at full speed over a distance of 80 to 100 meters. Run down the hill at a jogging speed after to every repetition.
- (vii) Walk for 5 minutes.
- (viii) Run at a quick speed for about one minute.
- (ix) Jog about 1 to 1.5 km, for cooling down.
- (x) Finish with a freehand and stretching exercises.

Advantages of Fartlek Training :

- (i) Fartlek training allows adding a variety of intervals to the aerobic workouts, which helps to keep one stimulated.
- (ii) Fartlek let runners enhance the aerobic and anaerobic training systems equally.
- (iii) Fartlek can be particularly modified and personalized to fit the requirements of diverse types of athletes and games.
- (iv) For people, Fartlek is a grand alternative because the fat-burning part makes it an extremely efficient exercise.
- (v) Implementing Fartlek regularly keeps the body physically powerful as much as necessary to uphold the technicalities of racing.

4. **Circuit Training:** Circuit training is an excellent way to impose mobility, strength, and stamina. The training comprises 6 to 10 strength exercises that are completed one exercise after another. Each exercise is performed for a specified number of repetitions or for a set time before moving on to the next exercise. The exercises within each circuit are separated by a short rest period and the circuit is separated by a longer rest period.

Impact of Circuit Training :

- (i) **Improves muscular strength:** Circuit training improves muscular strength or in other words, your ability to produce force. For example, strength determines how many groceries you can carry at one time or the heaviest amount of weight you could lift during a bench press exercise.
- (ii) **Improves muscular endurance:** Weekly circuit training enhances muscular endurance, or your ability to perform a muscular activity at any time. At first muscular endurance dictates how many push-ups you can perform consecutively. Performing up to 20 repetitions at your workout stations, with little rest throughout your workout, forces your muscles to work through fatigue and build endurance.
- (iii) **Body composition:** Circuit training can improve your body composition, or the percentage of your total body weight comprised of fat, by burning calories and building muscles. Additionally, increased muscle mass boosts the number of calories burned during test and exercise.

5. **High Altitude Training:** Athletes choose to train at high-altitude due to the underlying benefits of intermittent hypoxia training in essence with regular exposure to an environment where oxygen availability is reduced due to natural or artificial methods. At higher altitudes as atmospheric pressure decreases, the air has a reduced partial pressure of oxygen, meaning less oxygen is available in the environment to be used in the body. The consequence of this change in oxygen pressure is for the body to produce greater amounts of erythropoietin in the kidneys, which subsequently means an increase in Red Blood Cells produced.

Impact of High Altitude Training: By training at high-altitude, athletes aim to allow their bodies to produce extra red blood cells. Then, they head a competition at lower elevations to take advantage of their changed physiology, which lasts for approx. 10 to 20 days.

Topic-5**Speed****Concepts Covered** • Speed and type of speed, training methods to improve speed.**Revision Notes**

- **Meaning** : Speed ability is extremely movement-specific. It is the ability to perform motor actions in a minimum possible time under certain situations. Speed is a conditional ability as well, similar to strength and endurance, but to a considerable point, speed depends on the nervous system unlike the conditional abilities i.e., strength and endurance.
- **Definition** : "Speed is the capacity of an individual to perform successive movements of the same pattern at a fast rate".
- **Types of speed** : Speed is classified into five types :

(i) Reaction ability	(ii) Acceleration ability
(iii) Locomotor ability	(iv) Movement speed
(v) Speed endurance	

**Key Words****Locomotor** : In motion or able to move.**Fatigue** : Weariness or stress

These are explained below:

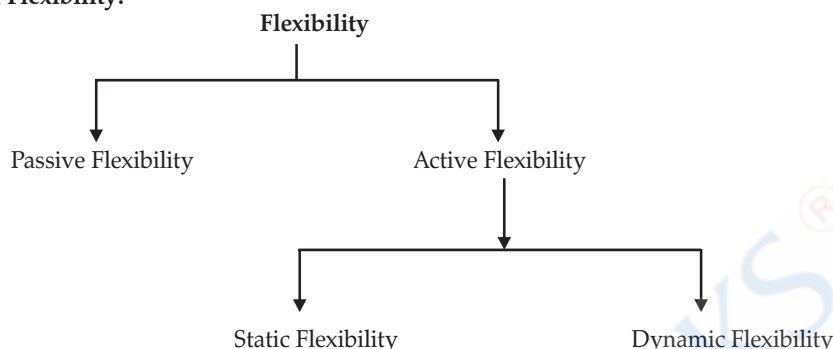
- (i) **Reaction Ability** : In sports, signals/stimulus can be of diverse form e.g. visual, tactile, auditory. It is the ability to respond or react efficiently and promptly to a signal. The reaction ability depending on the degree of complexity can be further differentiated as simple or complex.
- (ii) **Acceleration Ability** : To a large extent, acceleration ability depends on technique, movement frequency, and explosive strength. From a slow-moving position, it is the ability to attain a high pace of locomotion as of a stationary position. In sprint events, performances are determined to a great extent by acceleration ability.
- (iii) **Locomotor Ability** : Capability to sustain the most speed of locomotion for the highest possible duration or distance is called locomotor ability. **Locomotor** ability is imperative in only some sports or events e.g., swimming, rowing, etc. In these sports, speed endurance is of high importance since all events last for more than 40 seconds, locomotor ability is not much of significance on the other hand.
- (iv) **Movement speed** : It is the ability to carry out a particular movement in least the amount of time. Movement speed is of high bearing in cyclic sports. In cyclic sports, technique and tactical action are very strongly bound with movement speed.
- (v) **Speed endurance** : It is the ability to carry out sports with high speed in the condition of fatigue. It is a growth of speed and endurance abilities. In cyclic and non-cyclic sports, it is of a diverse form. Instead of the rapid **fatigue** accumulation at some stage in the activity, the speed endurance in cyclic sports is requisite to carry on movements at high speed.
- **Methods to develop speed** :
 - (i) **Acceleration Runs** : Accelerated runs are usually adopted to develop speed, especially to attain maximum speed from a stationary position. Before acceleration runs, a proper warm-up must be done. After every acceleration run, there should be a proper interval so that the athlete may start the next run without any fatigue.
 - (ii) **Pace runs** : Pace runs mean running the whole distance of a race at a constant speed. In pace races, an athlete runs the race with uniform speed, generally 800 m and above. Very young children can maintain their maximum speed for 15 to 20 m, whereas a well-trained athlete can maintain speed for 40 m.

Topic-6**Flexibility****Concepts Covered** • Flexibility and its types, Training methods to develop flexibility.**Revision Notes**

- **Meaning** : Flexibility is the ability to perform a joint action through a range of movement.
- Importance of flexibility:**
 - It reduces stiffness in joints.

- It reduces the risk of injuries as muscles are more pliable.
- It helps in maintaining appropriate posture while performing.
- Greater range of motion ensures more force and speed developed by the muscles.
- Greater flexibility helps the sports person to perform movements with minimum muscular tension, thereby facilitating higher movement economy.

➤ **Types of Flexibility:**



1. **Passive Flexibility** : Passive flexibility is the base of active flexibility. Passive flexibility is the ability to do a movement with greater amplitude using external assistance e.g., helping partner doing stretching exercises .
2. **Active Flexibility** : Active flexibility is the ability to perform a movement with a greater range without external help e.g., : the sportsman stretches a joint with external help.

There are two types of active flexibility:

- (a) **Static flexibility** : While the sportsman is lying , standing, or sitting static flexibility is essential for movements done.
- (b) **Dynamic flexibility** : Dynamic flexibility is vital for performing movements when the sportsman is moving with superior amplitude.



Key Words

Ballistic : relating to projectiles

Puberty : physical and hormonal changes

➤ **Methods to Improve Flexibility:**

- (i) **Ballistic Method** : The name **ballistic** method means stretching movement is done with a swing. Ballistic means a joint is expanded steadily to its utmost range.
- (ii) **Slow stretch and fold method** : It is the extension of the slow stretching method. Here the muscle is stretched to its maximum limit and then the position is held for few seconds.
- (iii) **Post isometric stretching** : This method of flexibility development is based on the principle of proprioceptive neuromuscular facilitation. In this procedure, the muscle is first contracted maximally for 6-8 sec using isometric method.

Additional information for improving flexibility:

- (i) Additional pressure on flexibility should be given in the period before **puberty** as it is the most excellent age for the improvement of flexibility.
- (ii) During adolescence, if there is a gap in stretching exercises, flexibility tends to deteriorate.
- (iii) Each muscle group must be stretched numerous times for good quality effect.
- (iv) The aim of flexibility training should be at optimal flexibility and not maximum flexibility.

Topic-7

Co-ordinative Ability

Concepts Covered • Co-ordinative Abilities and its types, Training Methods.



Revision Notes

- **Meaning** : The ability of an individual which assists him to do a variety of interconnected activities correctly is called Coordinative ability.
- **Definition** : "Coordinative abilities are understood as relatively stabilised and generalised patterns of motor control and regulation process". They enable the sportsman to do a group of movements with better quality and effect.

- **Coordination** is one of the main components of physical fitness. It is the ability to perform smooth and accurate movements involving different parts of the body. It requires good awareness of relative limb and body positions, and good **integration** between the senses and muscles involved in the movement.



Key Words

Integration : Process of uniting different things.

Coupling : To join

- **Types of coordinative abilities are:**

1. **Orientation ability:** It is an ability to realise position of the body or its parts in space and time.
2. **Coupling ability:** Coupling ability is the ability to combine the movements of different body parts for performing perfect sports movements.
3. **Reaction ability:** It is the ability to react quickly and effectively to a signal
4. **Balance ability:** Balance ability is the ability to keep body and its parts are in stable position in both static and dynamic conditions
5. **Rhythm ability:** It is the ability to understand the rhythm of movement and to do the movement with the required rhythm.
6. **Adaptation ability:** It is the ability to adjust or bring about an effective change in the movement on the basis of changes or anticipated changes in the situation.
7. **Differentiation ability:** The ability to attain a high degree of accuracy and economy of separate body movements and movement phases.

