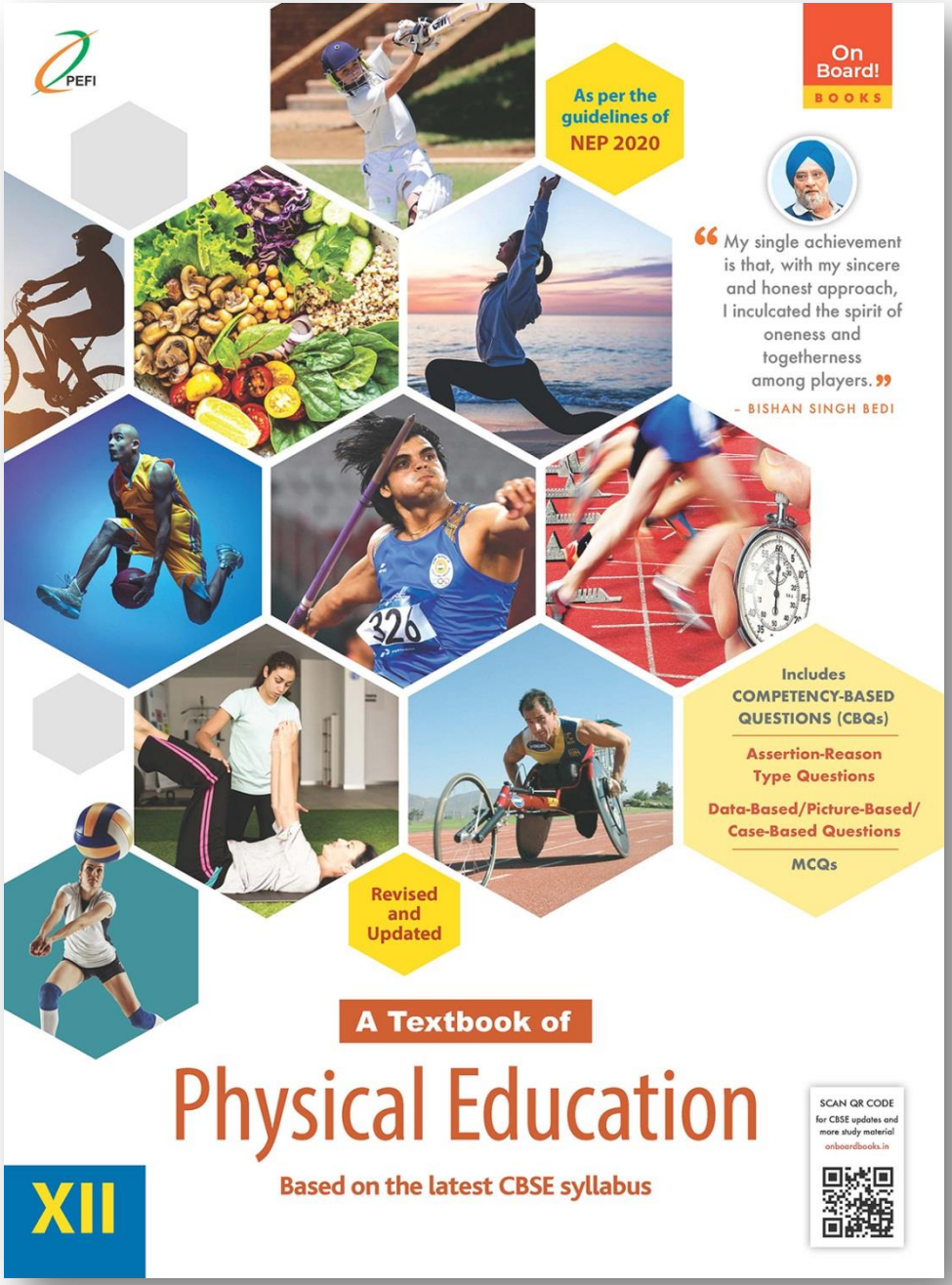
A TEXTBOOK OF PHYSICAL EDUCATION CLASS 12

Chapter 7

PHYSIOLOGY AND INJURIES IN SPORTS



PHYSIOLOGICAL FACTORS DETERMINING COMPONENTS OF PHYSICAL FITNESS

Physiological Factors Determining Strength

Size of the Muscle:
Length of Limbs and Muscles:
Gender:
Body Weight:
Point of Tendon Insertion:
Muscle Composition:
Intensity of the Nerve Impulse:

Physiological Factors Determining Speed

1.Mobility of the Nervous System:

2.Muscle Composition:

3.Explosive Strength:

4.Flexibility:

5.Biochemical Reserves and Metabolic Power:

Figure 7.1 Speed is a measure of how fast an object is moving.

Physiological Factors Determining Endurance

1. Aerobic Capacity: Oxygen Intake; Oxygen Transport; Oxygen Uptake and Energy Reserves.

2. Lactic Acid Tolerance:

3. Movement Economy:

4. Muscle Composition:

Physiological Factors Determining Flexibility

1. Muscle Strength:

2. Muscular Bulk and Size:

3. Joint Structure:

4. Connective Tissues:

5. Age and Gender:

6. Extensibility of Muscles:

7. Internal Environment:

8. Previous Injury:

Figure 7.3 Muscle strength and flexibility

EFFECT OF EXERCISE ON MUSCULAR SYSTEM

With the right amount and form of exercises, our muscular system can be strengthened and made more efficient.

1. **Change in Anatomy of the Muscles:**
2. **Increase in Number of Capillaries:**
3. **Improving the Strength of Connective Tissues:**
4. **Improving Efficiency:**
5. **Delaying Fatigue:**
6. **Activation of Non-functioning Fibres:**
7. **Correct Body Postures:**
8. **Improvement of Reaction Time:**

Figure 7.4 Human muscular system

EFFECT OF EXERCISE ON CARDIO-RESPIRATORY SYSTEM

The cardio-respiratory system consists of the heart, blood vessels and blood. It regulates the vital process of supplying our body with nutrients, cellular waste, hormones and O_2 for its smooth functioning.

Human Respiratory System

The respiratory system consists of the nose, the larynx, pharynx, trachea, bronchi, diaphragm and the lungs. The process of respiration itself is different from the function of breathing.

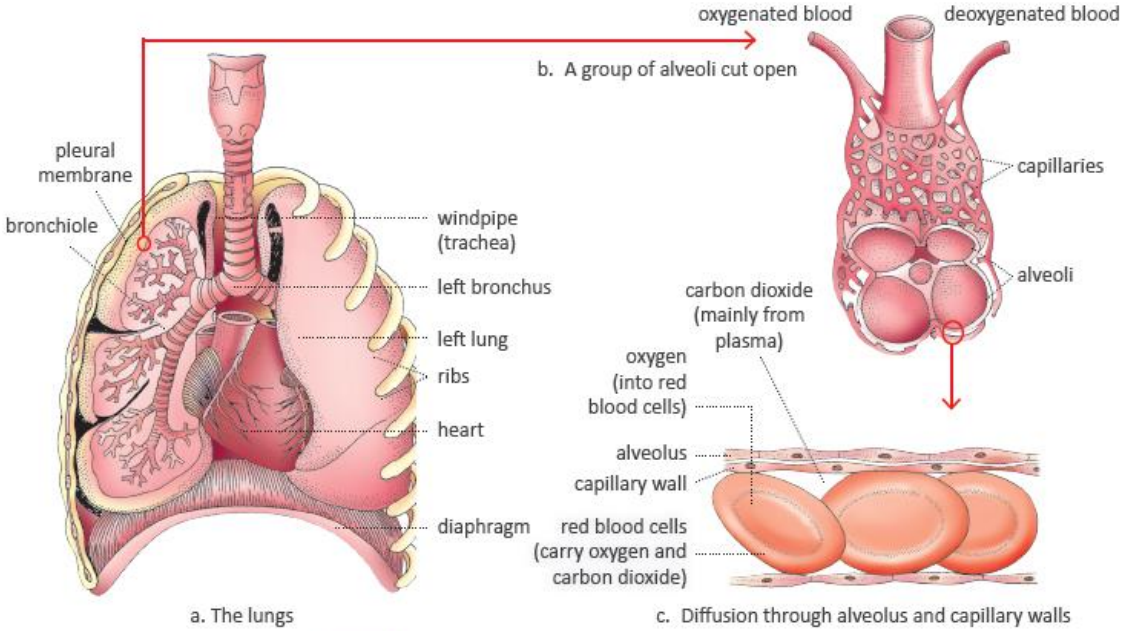


Figure 7.5 Structure of human respiratory system

Effect of Exercise on Cardio-respiratory System

1. Increase in the Size of Heart:
2. Decrease in Resting Heart Rate:
3. Stroke Volume Increases at Rest:
4. Increase in Cardiac Output:
5. Increased Blood Flow:
6. Decrease in Blood Pressure:
7. Increase in Blood Volume:
8. Quick Recovery Rate:
9. Increase in Tidal Air Capacity:
10. Decrease in Rate of Respiration:
11. Strengthens Respiratory Muscles:
12. Efficient Gaseous Exchange:
13. Unused Alveoles Become Active:
14. Increase in Endurance:
15. Increase in Residual Air Volume:
16. Increase in Size of Lungs and Chest:
17. Prevention of Diseases:
18. Increase Vital Air Capacity:

SPORTS INJURIES – CLASSIFICATION, CAUSES, PREVENTION AND TREATMENT

Injuries are common in every sport. They cannot be always avoided even if we take strict precautions. Athletes can only minimise the occurrences of these injuries with the help of their coaches and medical experts.

Classification of Sports Injuries

1. Direct Injury:
2. Indirect Injury:
3. Overuse Injury:

Figure 7.6 Injury is a part of game.

Depending on the location of the injury, sports injuries may be classified as:

1. Soft Tissue Injuries: Soft tissue includes all muscles, ligaments, tendons, skin, organs, etc. except bone and teeth.

2. Bone Injuries: Bone injuries are fractures caused by forces or pressures greater than the strength of the osseous tissue.

3. Joint Injuries: Injury to any joint in the body is joint injury and dislocation is one of the most common joint injuries.

Soft Tissue Injuries

Contusion: Contusion is a muscle injury caused by a blow to the skin. The affected area becomes red, then blue and then purple.

Strain: Strains are caused by excessive use or forced stretching of the muscles or tendons. Strain can be of first, second and third degrees.

Sprain: Sprain is the result of injury to the ligaments because of overstretching or tearing.

Abrasion: It is a superficial injury to the skin when something rubs against it. It does not penetrate deeper than the epidermal layer of the skin. It can be of first, second and third degrees.

Laceration: It is the tearing of skin which results in an irregular cut. It is caused by injury with a sharp sports equipment. Lacerations are generally seen in skating, basketball, fencing, etc.

Incision: It is a smoothly-cut skin wound made by a sharp sport equipment, spikes, etc. In this type of cut, usually blood comes out freely.

Hematoma: It is caused due to internal tissue rupture where there is a large collection of blood. It is also known as internal blood clotting.

Bone Injuries

The different types of bone injuries are:

1. Simple Fracture:
2. Compound Fracture:
3. Complicated Fracture:
4. Stress Fracture:
5. Green Stick Fracture:
6. Comminuted Fracture:
7. Impacted Fracture:
8. Transverse Fracture:
9. Oblique Fracture:

Figure 7.11 Types of bone fractures

Joint Injuries

Joint injuries usually occur in contact sports such as football, hockey, skiing,
gymnastics, volleyball, etc. The different types of joint injuries are:

1. Dislocation of the Jaw:
2. Dislocation of Shoulder Joint:
3. Dislocation of Hip Joint:
4. Dislocation of the Wrist:

Causes of Sports Injuries

1. Poor Training Methods and Duration:
2. Lack of Preparation:
3. Improper Warming-up:
4. Lack of Scientific Knowledge:
5. Lack of Fitness:
6. Nutritional Deficiency; and

for many other causes refer to textbook.

Prevention of Sports Injuries

1. Proper Warming-up:
2. Proper Conditioning and Preparation:
3. Balanced Diet:
4. Proper Knowledge of Sports Skills:
5. Use of Protective Equipment:
6. Proper Sports Facilities; and

for many other measures refer to textbook.

Treatment of Injuries

Treatment of soft tissue injuries, bone and joints injuries are explained below:

Treatment of Soft Tissue Injuries

Treatment of Abrasion: Refer to page 137 for steps to be followed.
Treatment of Contusion: Refer to page 137 for steps to be followed.
Treatment of Laceration: Refer to page 137 for steps to be followed.
Treatment of Incision: Refer to page 138 for steps to be followed.
Treatment of Sprain: It can be treated by two methods called PRICE and MICE procedure.

PRICE: Protection, Rest, Ice, Compression, Elevation
MICE: Mobilization, Ice, Compression, Elevation

Treatment of Strain: Treatment of strain should be done using the PRICE method. It is important to take precautions to avoid heat during the first 72 hours after the injury, such as hot baths, sauna baths or heat packs, etc. Refer to page 139 for more information.

Figure 7.16 Ice packs reduce bleeding and pain.

Treatment of Bone and Joint Injuries

Treatment of Dislocation

Initial care and treatment for any dislocation involves RICE (Rest, Ice, Compression and Elevation). After this treatment, sometimes, the dislocated joint might naturally go back into place. While taking the patient to the physician for evaluation, the injury should be properly splinted and supported to prevent any further damage to the area.

Treatment of Fractures

Treatment of Stress Fracture: A break or crack in a bone is termed as stress fracture. It is very common in sports which include high impact actions or contacts. Refer to page 139 of the textbook for steps to be followed.

Treatment of Green Stick Fracture: Arms and legs are more susceptible to this type of fracture and require movement restriction to allow the bone to repair itself naturally. Refer to page 140 for steps to be followed.

Treatment of Comminuted Fracture: Due to presence of several broken pieces of bones, such fractures should be treated with caution. Use a splint or plaster cast to restrict movements above and below the injured part. Refer to page 141 of textbook.

Treatment of Transverse Fracture: The thoracic spine and lumbar region are vulnerable to such injuries. There may be single or multiple fractures at a time. Refer to page 141 of the textbook for more information.

Treatment of Oblique Bone Fracture: Refer to page 140 of the textbook.

Treatment of Impacted Fracture: Refer to page 140 of the book.

SUMMARY

1. The strength of an individual is determined by various physiological elements, such as muscular strength and composition, body weight, length of limbs and muscles, intensity of nerve impulses, etc.

2. The speed of an individual is influenced by physiological factors like mobility of the nervous system, explosive strength, muscle composition, etc.

3. Physiological factors responsible for endurance include aerobic capacity, lactic acid tolerance, movement economy and muscle composition.

4. Aerobic capacity is determined by oxygen intake, oxygen transport, oxygen uptake and energy reserves.

5. Flexibility is shaped by muscular size, mass, extensibility and strength; state of joint structure and connective tissues; age and gender; internal environment and previous injury.

6. Exercise also has impacts on the muscular system. It enlarges muscles, raises the number of capillaries, strengthens connective tissues, delays fatigue and activates non-functioning fibres.

7. The effects of exercise on the respiratory system are increase in tidal air capacity, the size of lungs and endurance, strengthening of respiratory muscles, efficient gaseous exchange, decrease in rate of respiration, activation of unused alveoles, etc.

SUMMARY

8. Sports injuries can be divided into direct, indirect and overuse injuries based on their cause, and soft tissue injuries, bone injuries and joint injuries, based on their location.

9. Soft tissue injuries are further divided into contusion, strain, sprain, abrasion and bruises.

10. The different types of bone injuries are simple fracture, compound fracture, complicated fracture, green stick fracture, comminuted fracture, impacted fracture, transverse fracture and oblique bone fracture.

11. Dislocation may occur at the lower jaw, hip joint, shoulder joint and the wrist in sports.

12. Sports injuries are caused by many factors such as poor training methods, lack of preparation and proper nutrition, improper warming-up, inadequate scientific knowledge, etc.

13. Preventive measures for sports injuries include proper warming-up and cooling down, thorough knowledge of sports skills, balanced diet, use of protective equipment and correct technique, etc.