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"My single achievement is that, with my sincere and honest approach, I inculcated the spirit of oneness and togetherness among players."
– BISHAN SINGH BEDI

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A TEXTBOOK OF

Physical Education

Based on the latest CBSE syllabus

XII

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A TEXTBOOK OF PHYSICAL EDUCATION CLASS 12

Chapter 10

TRAINING IN SPORTS

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STRENGTH – DEFINITION, TYPES AND METHODS OF IMPROVING STRENGTH – ISOMETRIC, ISOTONIC AND ISOKINETIC

Training is a process to prepare for some tasks.

Definition of Strength

Strength is the ability of a muscle or a group of muscles to exert maximum force against a resistance in a single contraction. The strength of a body is measured in pounds or dynes.

Muscular strength is determined by the cross sectional area of muscle fibres, the volume of fast-twitch (phasic) muscle fibres, and phosphagen storage, body weight, limb length, muscle length, etc.

Figure 10.1 Muscular strength

Types of Strength

Muscular strength can broadly be classified as follows:

1. **Isotonic Strength**
2. **Isometric Strength**

Isotonic Strength

Isotonic strength, also known as dynamic strength, is the type of strength that comes into play in the movement of muscles, i.e. shortening and lengthening of muscles.

1. Maximum Strength: It is the ability of a muscle to overcome resistance of maximum intensity of stimulus in a single contraction.
2. Explosive Strength: It is the ability of a muscle when exerting force against a strong stimulus within a short period of time – that is, the ability to overcome resistance at high speed.
3. Strength Endurance: It is the ability of a muscle to overcome resistance for as long as possible.

Isometric Strength

Also known as static strength, it is the ability of the muscle to apply a force against an immovable object without considerably shortening its length.

Methods of Improving Strength – Isometric, Isotonic, Isokinetic

To develop strength, the following three types of exercises may be used.

Isometric or Static Exercises

In isometric exercises, a group of muscles develops tension against another group of muscles without any changes in the length of the muscles.

Isotonic Exercises

In isotonic exercises, the muscles visibly contract with varying tension while working against a constant load.

Isokinetic Exercises

Isokinetic exercises were proposed by James Perrine in 1968. In these exercises, the muscles contract with maximum force through every point in the range of motion.

ENDURANCE – DEFINITION, TYPES AND METHODS TO DEVELOP ENDURANCE – CONTINUOUS TRAINING, INTERVAL TRAINING AND FARTLEK TRAINING

Definition of Endurance

"Endurance is the result of the physiological capacity of the individual to sustain movement over a period of time." – *Barrow and McGee*

"Endurance is the ability to resist fatigue." – *Herre*

Types of Endurance

By using the nature of the activity as the parameter, endurance is categorised as:

1. Basic Endurance: Basic endurance is an individual's ability to resist fatigue when applied to loads of medium intensity stimulus and aerobic muscular metabolism.

2. General Endurance: General endurance is the ability to tolerate endurance exercises and resist fatigue caused by various kinds of activities.

3. Specific Endurance: Specific endurance can be defined as the ability to resist fatigue caused by a specific or particular sports activity.

According to the duration of activity, endurance can be categorized as:

1. Speed Endurance: Speed endurance can be defined as the ability to prolong resistance to fatigue with maintenance of near maximal speed.

2. Short-term Endurance: Short-term endurance is required to resist fatigue in sports activities that are cyclic and last from 45 seconds to 2 minutes.

3. Middle Term Endurance: Middle term endurance is required for cyclic activities which last from 2 minutes to 11 minutes.

4. Long-term Endurance: Long-term endurance is required in sports activities that last for more than 11 minutes.

Methods to Develop Endurance Continuous Training Method

In the continuous training method, a load is applied for a long duration without any break.

Interval Training Method

The interval training method is executed with repeated efforts at a fast pace, with intervals of incomplete recovery in between.

Fartlek Method

In this method, the change in intensity is decided by the surface of running, the surroundings, the athlete's physical strength and limitations, the climate, etc.

SPEED – DEFINITION, TYPES AND METHODS TO DEVELOP SPEED – ACCELERATION RUN AND PACE RUN

Definition of Speed

In the context of sporting activities, speed refers to the ability to produce the greatest possible impulse at the shortest possible time.

Types of Speed

Speed can be divided into the following types:

1. Reaction Ability: Reaction ability is the ability to respond quickly and correctly to a stimulus, whether it is visual or tactical.

2. Acceleration Ability: As is evident in the name itself, this ability deals with changing speed from static or low to a maximal state.

3. Locomotor Ability: It is the ability to maintain maximal speed for maximal distance and maximal duration.

4. Movement Ability: It is the ability of a muscle or a group of muscles to contract at maximal speed in a single course of movement.

5. Speed Endurance: Speed endurance is the ability to perform motor movements quickly under conditions of fatigue.

Methods to Develop Speed

Speed can be enhanced to a certain extent by a variety of training methods. The most popular ones are discussed below:

Acceleration Run

When an athlete sprints, she/he does not simply start running at maximal speed; it is attained through gradual increment. This principle is used in acceleration run mode of developing speed. The athlete runs for a specific distance, starting at zero speed and then working towards maximal velocity during the course of running.

Figure 10.11 Acceleration run

Pace Run

Unlike accelerated runs, paced runs are characterized by uniform speed. This means that the athlete runs the course of the race at a steady and definite speed. This method is applied to races of 800 m and above.

Figure 10.12 Pace run

FLEXIBILITY – DEFINITION, TYPES AND METHODS TO IMPROVE FLEXIBILITY

Definition of Flexibility

Flexibility is the ability to exhibit a wide range and amplitude of movements by an individual's joints.

Types of Flexibility

Flexibility can be divided into two types:

1. Passive Flexibility: Passive flexibility is the ability to perform a range of movements with greater ease through external help.

2. Active Flexibility: In active flexibility, no external help is required. The range of motions is performed using the individual's own muscular force.

- Static flexibility: It is the ability to perform a movement with large amplitude while remaining in a static position.
- Dynamic flexibility: It is the ability to perform a movement with large amplitude while the body is in motion.

Methods of Improving Flexibility

The following methods are used to improve flexibility:

1. Ballistic Method: In this method, the movement is performed with rhythmic swinging in the maximum range that can be obtained.

2. Static Stretching Method: In this, the muscle is stretched to its maximum limit and then released gradually to return to its original position.

3. Dynamic Stretching Method: This method uses active muscular movement that brings about stretching but is not held in the end position.

4. Post-isometric Stretch: This method is based on Proprioceptive Neuromuscular Facilitation (PNF) technique, which raises the active and passive range of motion and improves motor performance.

Guidelines for How to Develop or Improve Flexibility

- The development of flexibility should start early, preferably before the conclusion of puberty.
- Irregular exercise is just as ineffective as no exercise when it comes to development of flexibility.
- Slow and deep breathing help while performing stretches, and many other points.

COORDINATIVE ABILITIES – DEFINITION AND TYPES

Definition of Coordinative Abilities

"Coordinative abilities are understood as relatively stabilised and generalised patterns of motor control and regulation processes. These enable the sportsman to do a group of movements with better quality and effect."

Characteristics and Significance of Coordinative Abilities

- Coordinative abilities are directly linked to the technical aspects and skills of sports.
- For efficient coordinative abilities, the central nervous system and the various sense organs should work in tandem.
- A sportsperson's coordinative abilities decide the quality of their performance and these abilities can only be improved with constant practice and exposure, etc.

Kinds of Coordinative Abilities

1. Combinatory Ability:
2. Orientation Ability:
3. Reaction Ability:
4. Balance Ability:
5. Adaptation Ability:
6. Differentiation Ability:
7. Rhythm Ability:

SUMMARY

1. Strength is the ability of a muscle or a group of muscles to exert maximum force against a resistance in a single contraction. It is a vital ingredient of physical fitness.

2. Muscular strength is determined by factors such as the volume of fast-twitch (phasic) muscle fibres and phosphagen storage, body weight, limb and muscle length, etc.

3. Muscular strength can be classified as isotonic strength and isometric strength.

4. Isotonic strength involves movement of muscles and it can be classified as maximum strength, explosive strength and strength endurance.

5. Isometric strength is also known as static strength as the muscle applies a force against an immovable object without considerably shortening its length.

6. Strength can be improved by isotonic, isometric and isokinetic exercises.

7. In isometric exercises, a group of muscles develops tension against another group of muscles without any changes in the length of the muscles. In isotonic exercises, the muscles visibly contract with varying tension while working against a constant load. In isokinetic exercises, the muscles contract with maximum force through every point in the range of motion.

SUMMARY…

8. Endurance is the ability to resist fatigue for a prolonged duration of time. Muscular endurance is an individual's capacity to perform a task repeatedly over an extended period of time.

9. Endurance can be classified according to (a) the nature of activity as basic endurance, general endurance and specific endurance, and (b) duration of activity as speed endurance, short-term endurance, middle term endurance and long-term endurance.

10. Endurance can be developed by a continuous training method, interval training method and the Fartlek method.

11. Speed is the ability to produce the greatest possible impulse at the shortest possible time. It is influenced by the structure of the muscle fibres, explosive strength, successful coordination between motor and sensory nerves and flexibility and durability of the muscles.

12. Types of speed are reaction ability, movement ability, locomotor ability, acceleration ability and speed endurance.

SUMMARY…

13. Speed can be enhanced by acceleration run method or pace run method.

14. Flexibility is the ability to exhibit a wide range and amplitude of movements by an individual's joints. It is determined by the anatomical structure of a joint, extensibility of the ligaments and muscles, proper warming-up, the right exercises, body temperature and the age, gender and physical strength of the individual.

15. The two types of flexibility are active flexibility and passive flexibility.

16. Flexibility can be increased by the ballistic method, static stretching method, dynamic stretching method and post isometric stretch.

17. Coordinative abilities are abilities that enable an individual to do various related activities correctly and efficiently. For efficient coordinative abilities, the central nervous system and the various sense organs should work in tandem.

18. Types of coordinative abilities include combinatory ability, orientation ability, reaction ability, balance ability, adaptation ability, differentiation ability and rhythm ability.