

Chapter at a Glance

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INTRODUCTION

Sports training is a planned and systematic programme of motor activities that helps individual to develop and control their bodies. Physical education and training is an organised instruction of motor activities that contribute to the physical growth, health and body image of the individual. Training is an art of preparing to overcome a task or a test of skill. It is the process of making an individual carry out his every effort towards success. Each activity requires specific type of physical fitness components. To improve these components a specific type of training is required. The programme of training process is known as sports training. It is the branch of science which helps increase sports performance. There are various type of training methods to improve performance by developing physical fitness in a proper way along with health and wellness. The programmes of sports training guide us about the preventive, safe and the correct way of performing physical activity. Sports training consists of the technical, tactical, physical and psychological preparations of a sportsman for achieving success in sports.

12.1 STRENGTH: DEFINITION, TYPES AND METHODS OF IMPROVING STRENGTH—ISOMETRIC, ISOTONIC AND ISOKINETIC**Strength**

Strength allows us to live our lives easily and efficiently. Strength can increase the quality of performance in sport because we need power to sprint, lift weight and also in strength. We find endurance as we are more able to push ourselves using the energy stored within our muscles. When our muscles are strong they can perform better with less oxygen, means that the heart does not have to pump hard when we are active. Pilates is a particularly good way to build strength. We can improve our strength in different ways, by increasing our lean muscle tissue and also building our core stability. Building muscle tissue is a wise idea for everyone, as it is a fact of life that as we get older we lose muscle mass. This affects sports performance, leading to a decline in performance and also daily problems.

Definition of Strength

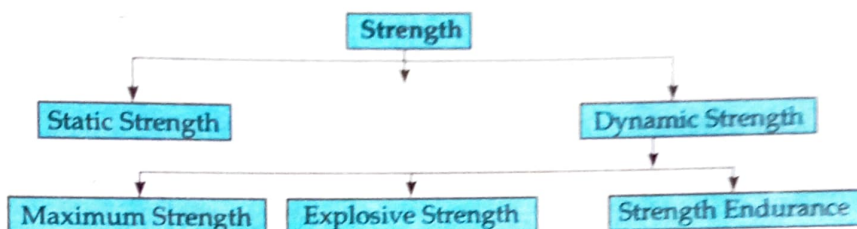
Strength is defined as the amount of force a muscle can exert.

Strength is that energy obtained by our muscles by which we are capable of doing a work. It is the ability of muscles to exert force during an activity and overcome resistance.

According to Mathews, "Muscular strength is the force that a muscle or a group of muscles can exert against a resistance in one maximum effort."

Types of Strength

The type of strength depends on the kind of games and sports. Strength can be improved by systematic training, depending upon the nature of activity, sex, age, etc. We can classify strength into two categories as: (i) Static (ii) Dynamic strength.



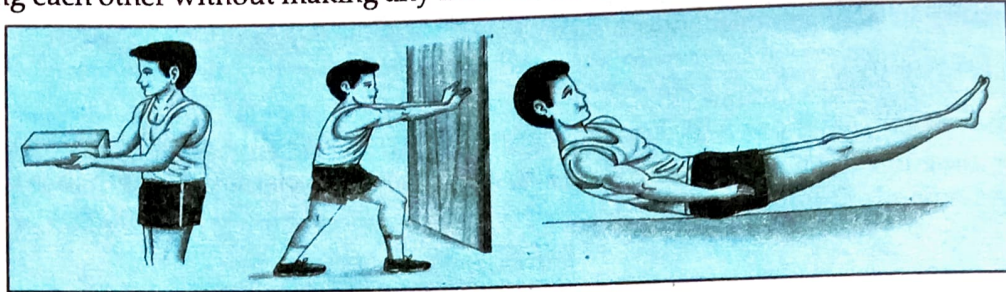
1. **Static strength:** This is also called isometric strength. It can be measured by dynamometer. Static strength is a force that can be held in one place. It is the ability of the muscle that acts against resistance in which no movement takes place. It is that ability where the muscles exert force without changing length and, thus, no visible movement at the joint takes place. This strength is used in wrestling, judo and several other sports.
2. **Dynamic strength:** This is called as isotonic strength. This strength is essential for movement and length of the muscle changes during contraction. In case of lifting or throwing an object we apply dynamic strength. It is of three types:
 - (i) **Maximum strength:** The ability to act against maximum resistance. This strength is required in weight lifting, throwing and wrestling.
 - (ii) **Explosive strength:** It combines both strength and speed abilities. It is the ability to overcome resistance with high speed. It is required in take off in long jump, high jump and crouch start in sprint races.
 - (iii) **Strength endurance:** It combines both strength and endurance ability. It is the ability to overcome resistance under fatigue condition. This is required for long distance races, swimming and cycling, etc.

Methods of Strength Development

Strength training is an important aspect of physical conditioning. The training should be directed towards the development of all the three types of strength called maximum strength, explosive strength and strength endurance. Usually the same exercise helps development of each quality but with different load parameters. There are three methods of strength development: Isometric, isotonic and isokinetic.

1. **Isometric Strength Exercise:** The isometric exercises were introduced in 1953 by Hittinger and Muller in Germany. Later in 1967 Brunner explained that isometric training increases static strength more as compared to dynamic strength. Isometric is derived from two words: 'iso' which means 'same' and 'metric' means 'muscle length.' So isometric exercises are those exercises in which the length of the muscle remains the same during isometric work out. No external movement is

visible to the third person. During an isometric contraction muscle develops tension but does not change length. This type of strength training is valuable only in sports like archery, gymnastics, yoga, judo, wrestling and weight-lifting, *etc.* where the players might need to hold a position for several seconds. Isometric strength exercises are used only for maximum strength development. Pushing wall for few seconds; training an object which is very heavy to lift; partners pushing/pulling each other without making any movement, *etc.* are known as static contraction of muscle.



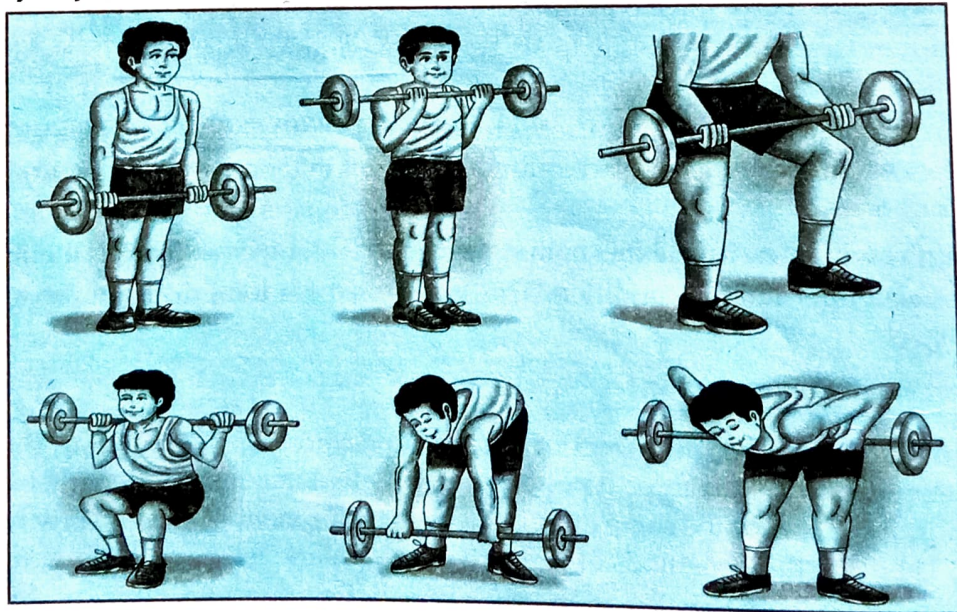
Isometric Strength Exercise

Advantages of Isometric Exercises

- (i) They need less time and less equipment.
- (ii) These exercises are good for development of static strength.
- (iii) These methods can be used in spite of injury.
- (iv) These exercises can be done anywhere.

Disadvantages of Isometric Exercises

- (i) These exercises create great compression on heart.
- (ii) These exercises not or merely less develop dynamic strength.
- (iii) Loss of interest after few days due to the result of the of same types of exercises is performed day by day.



Isotonic Exercises

2. **Isotonic Strength Exercises:** The Isotonic exercises were introduced by De. Lorme and Watkins in 1948. They emphasised the use of heavy resistance and lower repetition for the development of strength and hypertrophy of the muscles and low resistance with high repetition develops muscular

endurance. Isotonic is a Latin word in which 'Iso' means 'same' and 'tonic' means 'movement'. If a muscle contracts and changes its length to produce force the contraction is isotonic. By this method all the three types of strength—maximum strength, explosive strength and endurance can be developed. Weight training, running, jumping throwing and playing games all can be categorised as isotonic exercise.

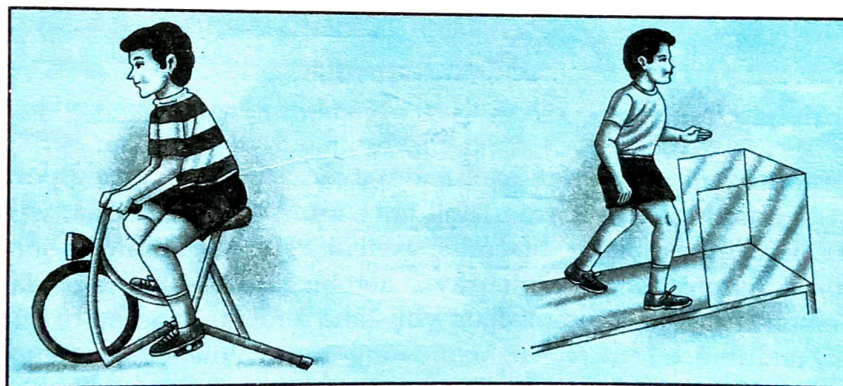
Advantages of Isotonic Exercises

- (i) These exercises develop dynamic strength as well as muscular endurance.
- (ii) Hypertrophy of the muscle takes place.
- (iii) These exercises improve flexibility.

Disadvantages of Isotonic Exercises

- (i) Due to maximal muscular contraction, the chances of muscular endurance are more.
- (ii) Special equipment is required to perform these exercises.
- (iii) Chances of muscle soreness and injury are more in this type of exercise.

3. **Isokinetic Strength Exercises:** Isokinetic exercise were introduced by Perrine in 1968. This is more advanced as compared to Isometric and Isotonic methods. It is defined as maximum contraction with constant speed over the full range of movement. In this exercise muscle is made to contract maximally through the whole range of joint. This is derived from the two words in which 'Iso' means 'same' and 'kinetic' means 'motion.' This type of training exercises requires expensive equipment; such as nautilus, hydrogym or cyber, to adjust the speed of movement of the muscles. It can be used for the development of maximum strength or explosive strength. In this exercise a special type of muscular contraction takes place. The individual should constantly apply his maximum force throughout the movement in these exercises.



Cycling

Treadmill running

Isokinetic Strength Exercises

Advantages of Isokinetic Exercises

- (i) It develops the strength of over full range of motion.
- (ii) It can be performed on variety of speed.
- (iii) Endurance can be improved.
- (iv) Fastest way to improve muscle strength.

Disadvantages of Isokinetic Exercises

- (i) Equipment requires are very expensive.
- (ii) A trainer is required to perform these exercises.

(iii) They are considered to be most exhaustive in nature.

Comparison Between The Isometric, Isokinetic and Isotonic Method

Isometric	Isotonic	Isokinetic
It means the same muscle length.	It means the same movement.	It means the same motion.
It involves no movement.	It involves movement but not at constant speed.	It involves movement at constant speed.
Movement of exercising body parts are not visible.	Movement of exercising body parts are visible.	Movement of exercising body parts are visible.
It develops static strength.	It develops explosive strength.	It develops explosive strength and strength endurance.
No or less equipments are required.	Equipments are required but are not so costly.	Equipments are very costly.
They creates boredom.	They are interesting and self-testing.	They are interesting but requires trainer.
It contributes to the development of strength.	It contributes to the development of strength and endurance.	It contributes to the development of strength, endurance and speed.
Example: Pushing a wall.	Example: Push-ups/pull-ups.	Example: Running on a treadmill.

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

Endurance

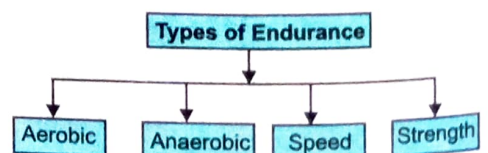
It is the ability of an organism to exert itself and remain active for a long period of time, as well as its ability to resist, withstand, recover from, and have immunity to trauma, wounds, or fatigue. In humans, it is usually used in aerobic or anaerobic exercise. The definition of 'long' varies according to the type of exertion – minutes for high intensity anaerobic exercise, hours or days for low intensity aerobic exercise. A person is able to accomplish or withstand a higher amount of effort than his original capabilities means his endurance is increasing expressing improvement. The act of gaining endurance through physical activity has been shown to decrease anxiety, depression, and stress, or any chronic disease in total. Although a greater endurance can assist the cardiovascular system, it does not imply that any cardiovascular disease can be guaranteed to improve. Endurance may also refer to an ability to keep going through a tough situation involving hardship, stress, etc.

Endurance is simply the ability to sustain a consistent level of exertion for a long period of time, and varied endurance training is an important part of developing different muscles and avoiding overtraining.

According to Harre, "Endurance is the ability to do sports movements, with the desired quality and speed, under the conditions of fatigue."

Types of Endurance

There are four types of endurance: aerobic, anaerobic, speed and strength. All involve using glucose in the bloodstream and glycogen stored in the muscles to produce adenosine triphosphate (ATP), a compound that gives the body energy for things like



muscle contraction. But each type of endurance has a different mechanism and places different demands on the body.

- (i) **Aerobic:** Endurance exercise is done at a level at which the body relies on fuel intake and oxygen, creating very little waste. The longer aerobic work continues, the more it relies purely on the aerobic systems and less on the anaerobic for energy. Aerobic endurance is built using long-term distance exercise, such as running and cycling, which improves the body's maximum oxygen uptake, known as VO_2 max, and interval training, which optimises the heart's ability to pump blood.
- (ii) **Anaerobic:** Endurance work occurs when the body is working at a high enough intensity that systems must use the fuel stored in muscles as glycogen, which causes the body to reach the anaerobic or lactate threshold. This quickly results in oxygen debt and lactic acid accumulation, which leads to muscle fatigue and eventual failure. Athletes needing to build their anaerobic endurance will typically do so with high-intensity intervals of resistance-based training, combined with short recovery periods.
- (iii) **Speed:** Endurance reflects the ability of muscles to contract more rapidly, such as in 800-meter races and other long sprints. Speed endurance is highly anaerobic, given that training to increase contraction speed involves heavy repetition at high intensity, typically multiple intervals at 80 per cent of maximum heart rate and also more than that higher.
- (iv) **Strength:** Endurance is about developing the ability to sustain the contraction force of muscles over time. This is vital for all athletes, as even marathoners and ultra-distance runners have a periodic need for "surges" of power during races. Strength endurance develops through disciplines such as weight training and circuit training. It is relevant for all sports, as it centers on the ability to repeat powerful muscle contractions for as long as possible before the muscles "fail."

Methods of Endurance Development

Endurance can be developed by the following methods:

1. **Continuous Method:** In this method the activities or exercises are performed continuously for a longer duration without any break. In this method the heart beat rate remains 120-160 per minute. The total time for the activity should not be less than 30 minutes. The intensity will be comparatively less (say 50-30) and the volume or the duration of the activity will be more if the activity is performed faster, the rest in between will be less. The variations in continuous method used are slow continuous method, fast continuous method and variable pace method.

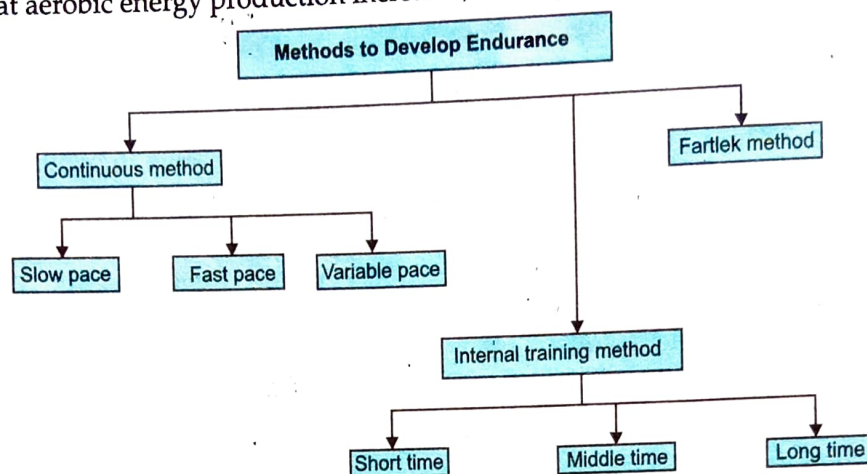
Continuous method can be performed in three ways:

- (i) **Slow Pace Continuous Method:** In this method pace or speed is set, duration and distance is long. The duration of the activity is about for 60-120 minutes, distance covered may be 15-25 km. Heart beat in this method remains about 140-180 per minute. Cross country runners use this method to develop their aerobic endurance.
- (ii) **Fast Pace Continuous Method:** This method is done as speed or pace. The duration of the activity in this method is 10-20 minutes and heart rate remains about 150-190 per minute. Short distance runners and middle distance runners use this method to develop their anaerobic endurance with speed.
- (iii) **Variable Pace Continuous Method:** This method is the combination of fast pace and slow pace method. In this method pace or speed keeps on changing from time to time. This method is performed for 25-60 minutes and heart beat remains around 140-190 per minute. This method helps develop aerobic and anaerobic endurance.

Advantages of Continuous Training Method

- (i) It increases glycogen in muscles and liver.
- (ii) It increases the maximal oxygen uptake and aerobic power.
- (iii) Efficiency of heart and lungs is improved.

- (iv) It improves will-power, self-discipline and confidence of sportsperson.
- (v) It increases the number and size of mitochondria and oxidative enzyme capacity in muscles so that aerobic energy production increases, leading to improved endurance.



Disadvantages of Continuous Training Method:

- (i) Repetition and maintenance of levels of activity become boring over time.
- (ii) Although it improves aerobic fitness, it does very little for anaerobic fitness.

2. Interval Training Method: This was developed by Woldemar and Greshler in 1939. Interval training method means interval period or rest between the activity. This method is widely used for the development of speed and endurance. It is a training that contains fast and slow period of exercise. In interval training, short periods of load are followed by short periods of rest; an athlete can perform greatest volume of work by breaking the total work in small periods. This method is used for training of heart. It is based on effort and recovery principle. During the exercises when the heart-beat reaches 180 beats per minute, the exercise is paused till the heart rate comes down to 120-140 beats per minute. Work out and recovery time is adjusted according to the person and capacity. The interval training methods can be used in any sports but is more useful in track events, cross country and swimming.

Following are the variables of Interval Training:

- (i) Rate and distance of work.
- (ii) Number of repetitions.
- (iii) Duration of rest.
- (iv) Type of activity during the rest interval.
- (v) Frequency of training per week.

Interval method can be performed in three ways:

- (i) **Short Time Interval Method:** In this method maximal heart rate is achieved within 2 minutes.
- (ii) **Middle Time Interval Method:** In this method maximal heart rate is achieved within 2-8 minutes.
- (iii) **Long Time Interval Method:** In this method the running is done in such a speed that maximal heart rate is achieved in 8-15 minutes.

Advantages of Interval Training

- (i) More work is performed in short duration.
- (ii) Circulatory and respiratory system can be trained at the same time.
- (iii) Improves ability to use oxygen by the muscle.
- (iv) Helps in increasing oxygen uptake.

(v) It improves speed endurance and strength endurance.

Disadvantages of Interval Training

- (i) Peak performance comes before the competition but cannot be retained till the competition time.
- (ii) Chances of injuries are more.
- (iii) Regular training lead to heart disease. So, work: rest ratio should 1:1 or for run of 3 minutes, the rest period should be 3 minutes.

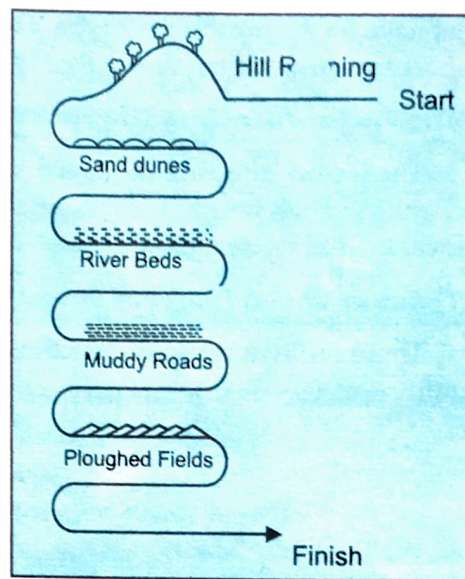
3. Fartlek or Speed Play Training Method: Dr. Per-Olof Astrand, a renowned Swedish physiologist developed conditioning programme with a combination of interval and fartlek training. 'Fartlek' is a Swedish word which means 'speed play' (playing with speed). The athlete changes the pace from high speed running to jogging. Fartlek training is normally performed in country side. Every athlete is made free to run at whatever speed he prefers. Fartlek training should start with slow warming up. Fartlek training is mostly liked by athletes as the route selected for fartlek is natural and pleasing. Here the activity is continuous for a longer duration. The training can be conducted from 20-60 minutes, according to the standard of the athlete or runner. The individual runs on different running surfaces such as forest, sand, shallow water and hilly area, etc. He can change his pace/steps according to his requirements purpose. Fartlek helps for the development of general endurance.

Advantages of Fartlek Training Method:

- (i) Balancing adjustments of ankles, knees and thugns are improved due to the uneven surface.
- (ii) It is best method to improve endurance in sports where endurance is basic requirement, e.g. cross-country running.
- (iii) It has a psychological advantage over the other training method, because the changing scenes help in delaying fatigue.

Disadvantages of Fartlek Training Method

- (i) The experience of actual running on the track is absent.
- (ii) The chances of injuries are more due to uneven track.
- (iii) It is difficult for coach to supervise the activity.



Route of Fartlek Training

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

Speed

Speed is the ability to perform actions/movements at a faster rate. In simple words "speed is the rate of motion." It depends on heredity but can be improved through proper training. It is the ability to move the body as fast as possible. It depends upon the white muscle fibers (fast twitch). Speed is required for sprints and games which demand fast response skills. It can be measured through reflex test. Speed is the quickness of



movement of a limb, whether this is the legs of a runner or the arm of the shot putter. Speed is an integral part of every sport.

Definition of Speed

Speed is the ability to move quickly across the ground or move limbs rapidly to grab or throw.

Speed is defined as the ability to cover a pre-determined distance in the shortest possible time.

According to Barrow and Mc Gee, "Speed is the capacity of an individual to perform successive movement of the same pattern at a fast rate."

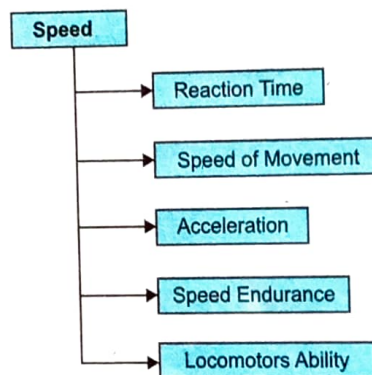
Speed depends on the ability of the nervous system. Speed ability is less trainable. Speed ability depends on the muscle fiber type. There are two types of muscle fibers in the human beings as fast twitch fibers and slow twitch fibers. Fast twitch fibers (white fibers) help for speed and strength activities.

The Factor Affecting the Speed

The factors affecting the speed are capacity of nervous system to act quickly, the explosive strength, technique, the energy reserves, the flexibility and the psychological factors. Speed should always be developed at a younger age.

Types of Speed (Parts of Speed)

There are five types of speed as reaction ability, movement speed, acceleration ability, locomotors ability and speed endurance.



- 1. Reaction Time:** It is the time taken to perform an action as quick as possible in shortest time. In other words, speed is that ability which responds immediately after the signal and brings the body into action.
- 2. Speed of Movement:** Speed of movement depends on the quickness of complete action or movement performed by the muscles. Speed can be measured through reflex test, short sprint, etc.
- 3. Acceleration:** It is the ability to gain maximum speed in minimum time. Acceleration ability depends on a great extent on explosive strength, technique and movement frequency.
- 4. Speed Endurance:** It is the ability to perform the movement at the fastest speed under the condition of fatigue. It is the combination of speed and endurance abilities.
- 5. Locomotors Ability:** It is the ability to maintain maximum speed for maximum time or distance.

Methods of Speed Development

- 1. Acceleration Runs/Sprints:** Acceleration ability is the capacity of an individual to attain maximum speed from a stationary position in quickest possible time. Acceleration sprints are conducted for less than five seconds. With the athletes in a variety of starting positions lying, sitting, kneeling or standing—depending on the sports. It is used to develop the acceleration ability, locomotor ability, and movement speed. In order to develop locomotor ability, the athlete should attain his

maximum speed within a distance of 50 meters and remaining 30 meters he should maintain that speed. While developing reaction time and movement speed stress should be given on proper technique.

- 2. Pace races:** Another method to develop speed is pace run. Pace is needed for setting a balanced speed which is very necessary for every race. Pace is very important in cross country, road and middle distance races. Unstable pace cannot produce the best results. So pace is most important in long distance races. The result of the long distance races depends upon the pace of the runner. So a well-adjusted pace is very much required for long and middle distance races. Constant speed is maintained during the race and before finishing the race; top speed is achieved so that one can finish the race nicely. Pace run has to be practised to achieve maximum. The real meaning of the pace run is to run the race at a constant speed throughout. 800 m and above races are called pace races. Generally, the runners do not keep pace in mind so they are not able to perform well. Pace running can be practised through Interval or Fartlek training method.

Differences between Acceleration Run and Pace Run:

Nature of Difference	Acceleration Run	Pace Run
Purpose	It helps develop acceleration part of speed.	It helps develop speed of movement and constant speed.
Procedure	Start running to very fast speed from crouch position to short distance.	Start running by keeping stable speed to longer distance.
Distance	10-20 meter distance.	100-800 metre distance at constant pace.
Speed or Intensity	90-100% of best ability.	60-90% of best ability depending upon distance.
Practice Session	It is practised near competition days.	It is practised near final phase of preparatory period.

12.4 FLEXIBILITY : DEFINITION, TYPES AND METHODS TO IMPROVE FLEXIBILITY

Flexibility: It is ability of joints to move in maximum range. It is not a general quality; it is specific to a particular joint, such as knee or to a series of joint. Commonly flexibility is known as stretch ability, elasticity, agility and mobility ability, *etc.* Flexibility varies from joint to joint due to its structure, surrounding or adjoining ligaments, tendons and muscles. It is measured through flexo-meter. To achieve best possible gains in flexibility one must perform exercises in a full range of motion. It improves ability and range of motion during dynamic movements, warm-up to stretch the muscles. Stretching exercise can be done only after proper warm-up, stretch after each work-out doing so will result in less soreness and quicker recovery between work-outs.

Definition of Flexibility

Flexibility is the capacity of a joint or muscle to move through its full range of motion.

Flexibility is specific to a particular movement or joints, and the degree of flexibility can vary around the body.

Flexibility is defined as the ability to move joints or muscles through their full-range of motion. Flexibility may also be specific to the joint of individual, allowing some people's joints to naturally surpass the range of motion in the same joint in another person.

Types of Flexibility

Many people are unaware of the fact that there are different types of flexibility. These different types of flexibility are grouped according to the various types of activities involved in athletic training.

The ones which involve motion are called dynamic and the ones which do not are called static.

1. **Dynamic Flexibility:** Dynamic flexibility (also called kinetic flexibility) is the ability to perform dynamic (or kinetic) movements of the muscles to bring a limb through its full range of motion in the joints.
2. **Static-Active Flexibility:** Static-active flexibility (also called active flexibility) is the ability to assume and maintain extended positions using only the tension of the agonists and synergists while the antagonists are being stretched. For example, lifting the leg and keeping it high without any external support (other than from your own leg muscles).
3. **Static-Passive Flexibility:** Static-passive flexibility (also called passive flexibility) is the ability to assume extended positions and then maintain them using only our weight, the support of our limbs, or some other apparatus (such as a chair or a barre).

Note that the ability to maintain the position does not come solely from our muscles, as it does with static-active flexibility. Being able to perform the splits is an example of static-passive flexibility.

Research has shown that active flexibility is more closely related to the level of sports achievement than passive flexibility. Active flexibility is harder to develop than passive flexibility (which is what most people think of as "flexibility"); not only does active flexibility require passive flexibility in order to assume an initial extended position, it also requires muscle strength to be able to hold and maintain that position.

Method for improvement of flexibility has been discussed below:

1. **Passive Stretching:** It is ability of joint to move to its maximum range with external help. Passive stretching techniques are usually performed with an outside force which applies a stretch to a relaxed joint, e.g. stretching exercise with partner. Slow application of the stretch is allowed in order to prevent injuries due to forceful handling of the body part.
2. **Active Method:** It is performed without external help or self-movement of a part of maximum range. It is of two types:
 - (i) **Static Stretching:** It is the flexibility performed from stationary position; e.g. toe touching by bending forward and sideward, chakrasana and trikonasana, etc.
 - (ii) **Dynamic Stretching:** It is the flexibility performed by motion and movement. This is required for gymnastics and diving, etc.
3. **Ballistic Stretching:** In this method the stretch movement is performed in a dynamic movement as in a swinging movement. This rhythm may be counted. At each count the related joint is stretched with the swing. The joint is stretched to its maximum limit at each count and then flexed. To avoid overstretching or injury warming up is essential before stretching.
4. **Proprioceptive Neuro-muscular Facilitation (PNF) Technique or Contract-relax Technique:** This is a technique used in advanced flexibility training. In this method the muscle being worked on is strongly contracted against a strong resistance. When the resistance is removed the muscle is immediately stretched to the end of its range. The exercise is then repeated. This PNF technique is the most effective method of developing and increasing flexibility over a short period.



Static Stretching



Dynamic Stretching



PNF

Guidelines for Flexibility Development:

- (i) Static flexibility forms the base for dynamic flexibility. Dynamic flexibility is responsible for enhanced performance in sports and games.
- (ii) Before taking up exercise for flexibility, it is important to warm up. If proper warming up is not done, it could damage or injure muscle, ligaments or joints due to overstretching.
- (iii) Flexibility development should be done before teenage because development of hip and shoulder joint is most affected at that age. During adolescence and after, flexibility of the joint is not possible.
- (iv) Jerky movements should be avoided during exercises.
- (v) After completion of each exercise for flexibility, exercise to relax the aggressive muscle should be performed.
- (vi) In each session of training each exercise should be repeated 10-15 times for desired results.
- (vii) In case the exercise is performed with a partner he/she should have proper knowledge of techniques and skills of exercise.
- (viii) The sportsperson should not be tired or fatigued at the time of taking up flexibility exercise. In a fatigued condition the muscles cannot be stretched to their maximum limit.
- (ix) The exercise taken up during a training session for dynamic flexibility should be related to the specific sport undertaking by the sportsperson.
- (x) In case regular exercise schedule is not maintained then flexibility gets reduced. To maintain flexibility regular exercise is a must.

12.5 COORDINATIVE ABILITIES : DEFINITION AND TYPES

Coordinative Abilities

It is the ability of the body to perform movements with perfect efficiency. There are many kinds of abilities involving in coordination. It is neuromuscular coordination and depends upon the central nervous system. Coordinative ability is essential for every sports and games. It is a combination of strength, speed, endurance, visualisation, response, balance and reflexes while in motion. Body coordination is a performance-related fitness component that describes the smooth, efficient movement patterns of sport skills and tasks. Our stage of learning influences how well we can perform skills.

Developing smooth movements is important for completing everyday tasks. If we are athletes, how quickly we can develop sport skills means the differences between winning and losing. If we know how to speed up skill learning, we will breeze past our competition.

Definition of Coordinative Abilities

The ability to use the senses and body parts to perform tasks smoothly, efficiently, and accurately.

According to Zimmermen et al, "Coordinative abilities are understood as relatively stabilized and generalized patterns of motor control and regulation processes. These enable the sportsman to do a group of movements with better quality and effect."

Coordination ability is repeatedly executing a sequence of movements smoothly and accurately. This may involve the senses, muscular contractions and joint movements.

Everything that we participate in, requires the ability to coordinate our limbs to achieve a successful outcome – from walking to the more complex movements of athletic events like the pole vault.

Types of Coordinative Ability

1. **Fine motor skills:** Such a keyboarding.

It requires coordinated movements of small muscles like that of hands and face. It also includes writing, drawing, buttoning a shirt, blowing bubbles.

2. **Gross motor skills:** Using larger muscles, such as running. It requires coordinated movement of large muscles or a group of muscles like that of the trunk and extremities. It also includes walking, running, lifting a grocery bag.
3. **Hand-eye skills:** Hand-eye coordination is required for skills such as catching a ball. Precision describes the accuracy of movement. The ability of the visual system to coordinate visual information received and then control or direct the hands in the accomplishment of a task. It also includes catching a ball, sewing, computer mouse use.
4. **Balancing skills:** Balance is the ability to control the center of gravity over the base of support in a given sensory environment. Coordination ability is closely related to balance.



Types of coordinative skills

Conclusion

Coordinative ability is to perform smooth and controlled movements (optimal interaction of muscle function) effortlessly. Agility is the combination of coordination and speed that allows the ability to perform activities that require a rapid change in movement or direction. If we are coordinated, we can make our muscles work together at just the right time to produce the exact amount of force we need to accomplish a skill smoothly.

12.6 CIRCUIT TRAINING AND HIGH ALTITUDE TRAINING: INTRODUCTION AND ITS IMPACT

Circuit training is an excellent way to improve mobility, strength and stamina. The circuit training comprises of 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 each circuit is separated by a longer rest period. The total number of circuits performed during a training session may vary from two to six depending on the training level (beginner, intermediate, or advanced), period of training (preparation or competition) and training objective.

Planning of Circuit

Identify on paper 3 to 4 circuits of 6 to 10 exercise that can be performed with the available resources. In each circuit try to ensure that no two consecutive exercises exercise the same muscle group. For example, do not have press ups followed by pull-ups.

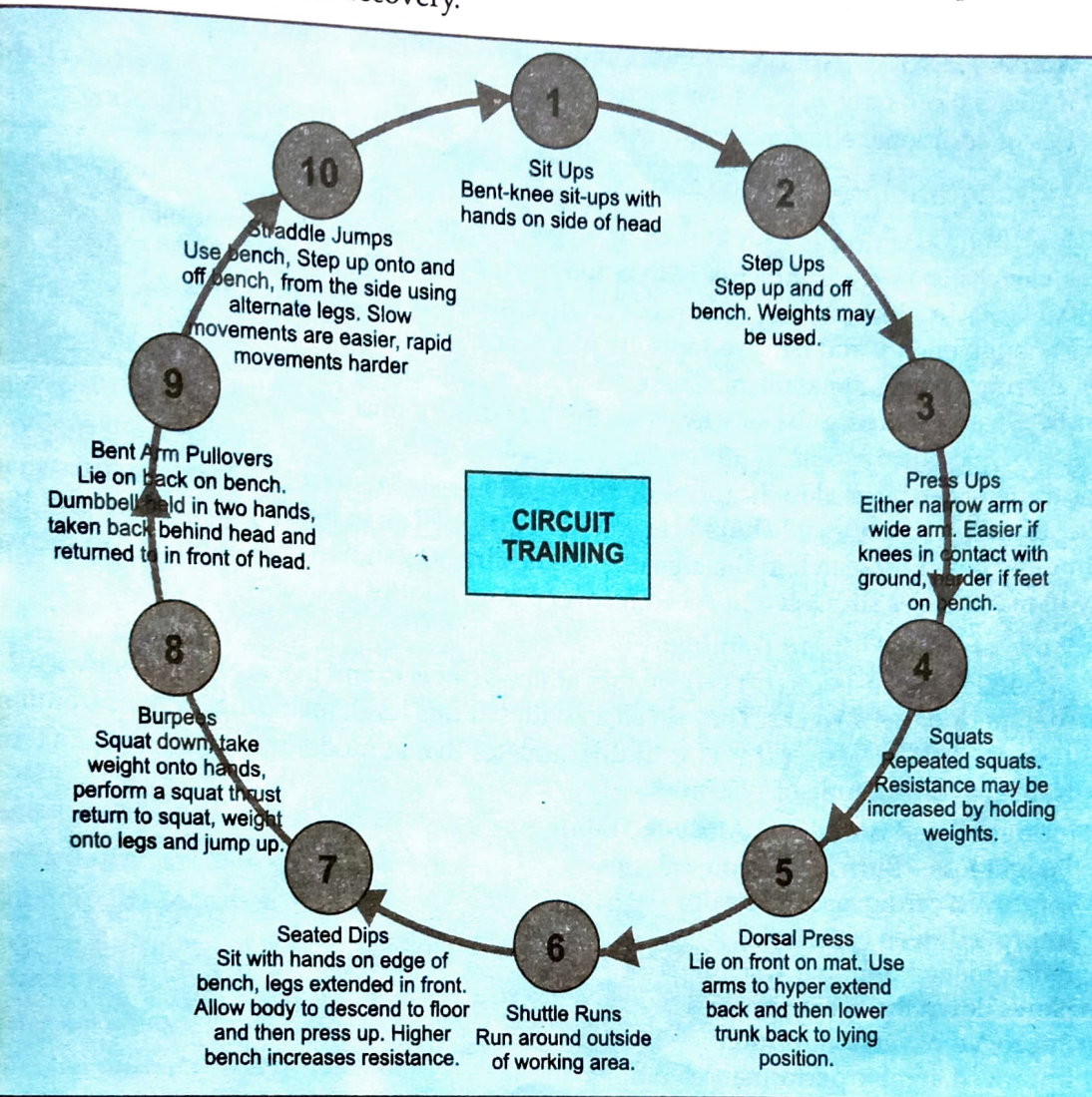
The exercise circuit should be set up so that you work each body part as follows: total body, upper-body, lower-body, core and trunk, and Total-body etc.

It is important to conduct a warm up at the start of the session and a cool down at the end of the session.

The following are examples of exercises that can be used in a circuit training session.

- (i) **Upper-body:** Press ups, bench dips, pull ups, medicine ball chest pass, Bench lift, Inclined press up
- (ii) **Core and trunk:** Sit-ups (lower abdominals), stomach crunch (upper abdominals), back extension chest raise
- (iii) **Lower-body:** Squat jumps, compass jumps, astride jumps, step-ups, shuttle runs, hopping shuttles, bench squat
- (iv) **Total-body:** Burpees, treadmills, squat thrusts, skipping

Following is an example circuit of ten exercises. Exercise cards could be made up for each station showing the exercise, duration and recovery.



of Circuit Training Method

gives maximum results in the minimum time.

exercises every major and minor muscle group along with cardio-vascular system.

forces heart to pump blood around the body, which has impressive impact on circulation.

helps in burning fat quickly and improves metabolism.

beats the boredom is exercise. It is flexible and one can make changes in exercise.

is a best way to prevent injuries occur due to overuse or repetitive exercises.

helps one to make him/her strong, prevent him/herself from disease and also to reduce weight

and in turn bring positive self-esteem and body image in him/herself.

is suitable for everyone whether a professional or a non-professional.

Advantages of circuit training:

develops strength and endurance.

appropriate form of training for most sports.

can be adjusted to suit age, fitness and health of the athlete.

exercises are simple enough to make each athlete feel a sense of achievement in completing them.

wide range of exercises to select from which will maintain the athlete's enthusiasm.

Disadvantages of circuit training:

- (i) Many exercises require specialised equipment, e.g. gym equipment.
- (ii) Ample space required to set up the circuit exercises and equipment.
- (iii) In general can only be conducted where appropriate facilities/equipment are available.
- (iv) Use of additional equipment requires appropriate health and safety monitoring.

High Altitude Training

High altitude training is also known as hypoxic training, altitude training involves exercising in environments with a reduced level of oxygen. When an individual trains in a low oxygen, or hypoxic environment, their body struggles to produce enough energy and hence adapts, by increasing the number of red blood cells or altering muscle metabolism. These adaptations allow the body to utilize oxygen better and increase the efficiency of the respiratory and cardiovascular systems.



High Altitude Training

This training can be used for health and fitness and weight loss and also to improve oxygen efficiency. It is scientifically proven to assist medical conditions as well as in helping to lose weight. It also makes the skin glow better. Research in the area of bone healing has shown that hypoxia can increase mineral density to make bones stronger and speed recovery from injuries.

Methods of High Altitude Training:

- (i) **Live-High, Train-High (LHTH):** In this, athletes travel to and live at altitude between 2000-2500 m for a period of 3-4 weeks. They do all activities at this level, including all their training.
- (ii) **Live-High, Train-Low (LHTL):** In this, athletes live at moderate altitudes of 2500 m, however train at a low altitude of 1250 m.

Major Benefits of Simulated Altitude Training:

- (i) Weight loss – Burn 200% more calories
- (ii) Improved cardiovascular health
- (iii) Improved sleep cycle
- (iv) Strengthened immune system
- (v) Slows down the ageing process
- (vi) Improved oxygen utilization
- (vii) Improved aerobic performance, and
- (viii) Increased bone density

Problems Associated with High Altitude Training

1. The increase in red blood cells makes the blood thicker and can make blood flow sluggish. This makes it harder for heart to pump round the body, and can actually decrease the amount of oxygen getting to where it is needed.
2. Weight loss is unavoidable because body actually consumes muscles in order to provide energy.
3. There is even a risk that the body's immune system will become weakened, leading to an increased risk of infections.
4. There may be adverse changes in the chemical make-up of the muscles.
5. The body cannot exercise as intensely at altitude. This results in reduced training intensity, which can reduce performance in some sports.
6. Loss of appetite.
7. Inhibition of muscle repair processes.
8. Excessive work of breathing.
9. There is the problem of altitude illnesses, which can dramatically reduce the capacity to be active of altitude, or foreshorten the exposure to the high altitude altogether.

IMPORTANT QUESTIONS

Very Short Answer-type Questions

1. What do you understand by training in sports? (2005, 2006)
2. Define strength?
3. In which sports we require more strength? .
4. Name the different types of strength and in which sports do they require?
5. Which method is used to improve static strength?
6. Which method is used to improve dynamic strength?
7. Suggest any two isometric exercises for shoulder region. (Delhi, 2015)
8. What does the isometric training mean and who developed this training method?
9. What does the isotonic training mean and who developed this training method?
10. What does the isokinetic training mean and who developed this training method?
11. Define endurance?
12. Name the different types of endurance?
13. What does the term fartlek means and who developed this training method? (2017)
14. What does the continuous method mean and who developed this training method?
15. What does the interval method mean and who developed this training method?
16. Define speed?
17. Name the different parts of speed?
18. What are sprints?
19. What does the pace race means?
20. "Pace race means, running the whole distance of race at constant speed" which are the races included in pace race? (All India, 2015)
21. Define flexibility?
22. Name the different types of flexibility?
23. What is passive stretching?
24. What does the active method means?
25. What is PNF technique?
26. Give the meaning of ballistic stretching?
27. What is coordinative ability? (C.B.S.E. Sample paper, 2016)
28. Name the types of coordinative ability?
29. What is agility?
30. What is circuit training?
31. What is high altitude training?
32. Name the methods used to develop high altitude training?

Short Answer-type Questions

1. Explain what strength is and write the methods of improving strength? (Delhi, 2016)
2. What is isometric method of training and what are its advantages and disadvantages?
3. What is isotonic method of training and what are its advantages and disadvantages?
4. What is isokinetic method of training and what are its advantages and disadvantages?
5. What are the different types of endurance?