UNIT X TRAINING IN SPORTS

Overview

- Concept of Talent Identification and Talent Development in Sports
- Introduction to Sports Training Cycle – Micro, Meso, Macro Cycle.
- Types & Methods to Develop – Strength, Endurance, and Speed
- Types & Methods to Develop – Flexibility and Coordinative Ability

LEARNING OUTCOMES

Students will

- understand the concept of talent identification and methods used for talent development in sports
- understand sports training and the different cycle used in the training process.
- understand different types & methods to develop –strength, endurance, and speed in sports training.
- understand different types & methods to develop – flexibility and coordinative ability.

FLYING SIKH, HIS TOUGH FITNESS ROUTINE

Milkha Singh was born in 1929 in Gobindpura village in the Muzaffargarh district of Pakistan. He spent most of his childhood in poverty. Singh lost his 14 siblings to poverty, poor health, and lack of medical attention. During the 1947 partition, he became an orphan and moved to India. He earned his living by working in a roadside restaurant before joining the army in 1951. During his military training, he realized his sprinting abilities. Hawaldar Gurudev Singh persuaded him to run a cross-country race as a part of military training. He practiced hard and came to the limelight during the National Games at Patiala in 1956. He broke the 200 m and 400 m records in the National Games at Cuttack in 1958.

Milkha Singh, the Flying Sikh, remained passionate about his fitness routine throughout his life, including playing 18 holes of golf at the 7,202-yard-long Chandigarh Golf Course and running light sprints at Sukhna Lake; the legendary athlete would also offer his insights to budding and national athletes.

'No royal road goes till success. To reach the world level, I at least did not find any such road. Running is such a meditation that one must leave all the world's goods to achieve success and make your body ready to take on the challenge. Concentration, strategy, and effort are long processes. I used to run 365 days a year, whether on rainy or windy day; nothing could stop me from running. I did not find any work more important than my practice, and there was a time when I would see myself running even in my dreams," Singh writes in his memoir.

From running three miles ranging from running the first mile slowly and then increasing pace each mile before his training in the off-season schedule, Singh would run three 400m races followed by one slow-paced 200m race followed by three 400m races fast followed by another 200m race slowly in the morning.

During the season schedule, 10 sprints of 150m on Mondays, six 200m sprints on Tuesdays, four 300m sprints on Wednesdays, two 500m races on Thursdays, two 600m races on Friday, running 350m or 500m once on Saturdays followed by complete rest on Sundays. According to the memoir, Singh would alternate training days to adjust to various strategies during his Olympic training.

He is the only athlete to win a gold medal in the 400 meters race at the Commonwealth Games and the Asian Games. Milkha Singh set a national record in the 1960 Olympics by winning fourth place in the 400m race in 45.73 seconds. This record remained for almost 40 years.[1]

During his sports career, Padma Shree Milkha Singh achieved many medals, including the gold medal in 200 meters in 1958 Asian Games, 400 meters in 1958 Asian Games, 440 yards in 1958 Asian Games, 400 meters in 1962 Asian Games, the 4×400-meter relay in 1962 Asian Games, and silver in 400 meters 1964 Calcutta National Games.[2]

Apart from these achievements, in 1960, he was persuaded by then Prime Minister Pandit Jawaharlal Nehru to run against Abdul Khaliq in Pakistan, whom he defeated. He then received the title of "the Flying Sikh" by General Ayub.[3]

Introduction

Talent identification and development have become increasingly relevant in sports performance (Sarmento, Anguera, Pereira, Araújo, 2018), especially in the last 20 years. A significant body of scientific research discusses longitudinal and nonlinear talent identification and development processes, the qualities that underpin elite sports performance, and how coaches could facilitate talented athletes' development through the sports system.

Discussion

Select anyone sports of your choice and identify four qualities required for optimum performance in those sports. Write down the advantages of the qualities in the table below. Discuss why talent identification is essential in sports and games

S.No.	Qualities	Advantage	Why this will improve your sports performance

Concept of Talent Identification and Talent Development in Sports

Talent can be defined as adequate aptitude or ability in one direction, above the normal average. Thus, someone who has talent can do something without trying hard.

Talent identification can also be defined as "the process by which children are encouraged to participate in the sport they are most likely to succeed, based on selected parameters. These parameters are designed to predict performance capacity, considering the child's current level of fitness and maturity." As talent identification is often confused with latent development, keeping the above definition clearly in mind is necessary. Identifying is the first step in progressing from beginner to a successful international athlete; talent development follows this as the next critical phase in achieving sporting success.

The figure below illustrates the various stages comprising the long-term talent identification system in sports and games.

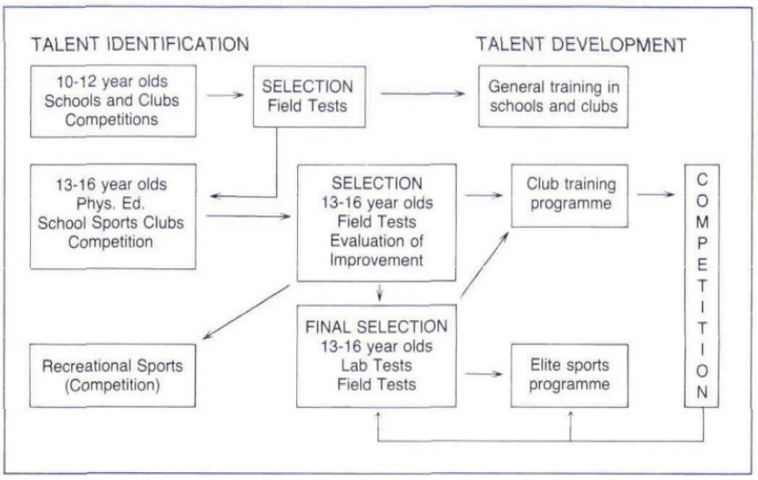


Table 10.1: Talent Identification System Related to Talent Development and Recreational Sports

The best way to ensure that a talent identification programme reaches the maximum possible number of children is to cooperate closely with schools.

The first stage of the process could occur between the ages of 10 and 12, using essential fields tests that are easy to administer. These tests should be carried out in schools and administered by the teachers if the selection is made early. Those who seem talented could then be encouraged to participate in general training in schools and clubs.

The second phase of the selection procedure could occur between 13 and 16. Again, the tests should be carried out in schools and be easy to administer. Those selected at this stage would then be invited to undergo more sophisticated tests, administered by specialists in the area or state centres, consisting of field tests and laboratory tests depending on the facilities available. The test battery should include background information, training history, competition results, anthropometric measurements, and psychological and physiological tests.

Finally, those selected should be allocated to elite junior programmes on an event-group basis. Those who show promising results in the second-stage tests but are not ultimately selected should be encouraged to participate in club training programmes. There should always be the possibility of entering the selection to produce good competition performance. All the tested youths should be encouraged to participate in recreational sports. It is essential to promote the youth competition structure in developing countries. Tests in these countries should be adapted to take into account local conditions, but should be standardized across the whole country.

Process of **Talent Identification and Development** is classified into five stages as follows:

1. **Talent Detection:** This is the discovery of potential performers who are not currently involved in the sport in question.
2. **Talent Identification:** Recognizing participants with the potential at an earlier age to become elite performers in the future.
3. **Talent Development:** Provides athletes with a suitable learning environment to accelerate or realize their potential
4. **Talent Selection:** The ongoing process of identifying individuals at various stages of development who demonstrate pre-requisite performance levels.
5. **Talent Transfer:** Focuses on transfer from one sport to another sport where there are more significant opportunities to succeed

These five steps are common across sporting in Talent Identification and Development System and are often operationalized within the everyday practice (i.e., identification or selection for the next step of a programme is influenced by performance in the previous development environment).

Importance of Talent identification

- Discovery of the great talent
- Recognition of the hidden talent
- By recognizing the talent at the early stage, the children can show their skills at their extreme
- Talent identification helps in finding a significant asset for the country

Components of Talent Identification

The main components of Talent Identification (TID) can be divided into the following categories:

- Physiological attributes
- Physical attributes
- Psychological attributes
- Technical/Tactical attributes
- Results
- Intangibles

Do you Know

Steps for talent and its promotion include:

Step I

Aim: Screening of children for essential training stage Screening is done based on: -

- Health and physique
- General physical performance capacity
- Motives interest in mental capabilities
- Interests of parents etc.

Step-II

After 3-4 years of basic training

Aim: selection for a group of sports (Advance training stage). Selection based on the following

- Physique and Motor abilities
- Ability to tolerate load
- Performance
- Cognitive, emotional, and personality traits

Step-III

After 3-4 years of advanced training

Aim: selection for a sport (high-performance training stage). Selection based on the following: -

- Physique
- Performance and the potential for performance
- Talent indicators
- Cognitive, emotional, and personality traits

I. Tick the correct options

1. The performance enhancement in the future can be predicted based on
   a. Physiological factor
   b. Physical factor
   c. Talent indicators
   d. All of the above

2. Psychological factors contributing to talent identification is
   a. Cognitive
   b. Emotional
   c. Personality traits
   d. All of the above
3. Talent identification is a _____ process
   a. General process
   b. Scientific process
   c. Specific process
   d. None of the above

II. Answer the following questions briefly.

1. List the names of components of talent identification in sports.
2. Identify the importance of talent identification in sports and games?

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

1. Adopting Components of Talent Identification will enhance performance factors in games and sports. Discuss.
2. 'Talent identification is the first step in the progression from beginner to successful international athlete' Elaborate.
3. Classify the Process of Talent Identification and Development in detail.

Introduction to Sports Training Cycle – Micro, Meso, Macro Cycle

Several planning systems are available in sports training; a sportsperson has to follow all the procedures to ensure high performance in a specific sport. When we look into the sports training planning format, we will be able to find plans like a long-term plan, Olympic plan, annual plan, sectional plan, and day's plan. All the projects form a unified training basis, and the pursuit of several years indicates the main line of development. Training content is more concrete and specific in a plan of shorter duration. All the short duration sports training plans are worked according to the requirements of more extended duration plans, called long-term plans. It is the largest unit in the system of planned training. The duration of this plan is approximately 8 to 15 years. This plan begins with the basic training of the sportsperson and continues until the attainment of optimum performance standards in a specific sport.

Do you know?

An Olympic plan is divided into small time units.

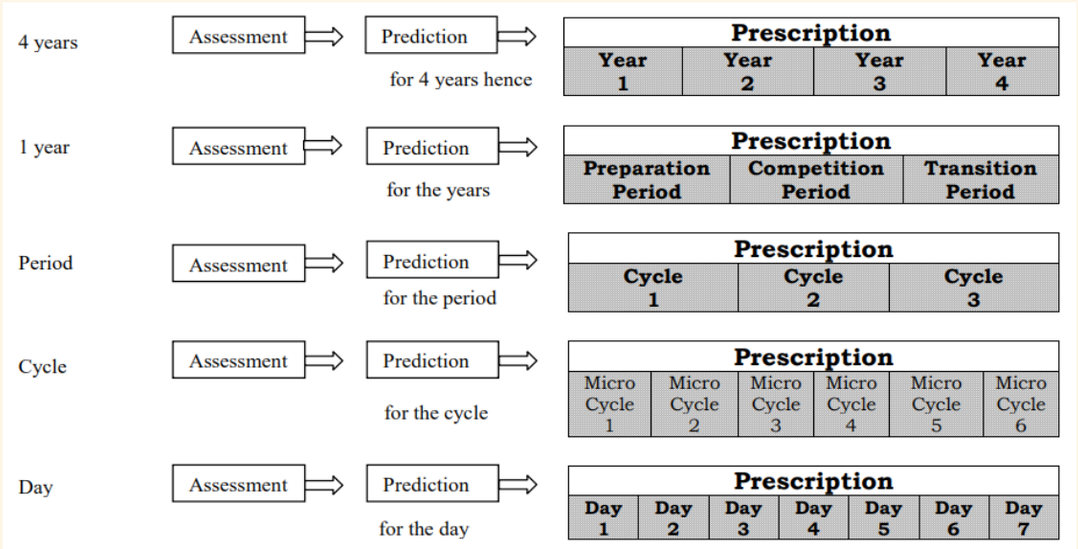


Fig. 2. An Olympic Plan Broken into Smaller Time Units (adapted from Kinsman, 1983)

Another set of planning most common in sports training is a sectional plan. Sectional plans are termed as plans of phases, periods, and weeks. Different periods of the training year, namely preparatory periods, competition periods, and transitional periods; various training cycles, i.e., microcycle, mesocycle, and macrocycle, are all sectional plans. They are prepared based on the needs and recommendations of the annual plan. These plans being shorter in duration, the details regarding the training of different performance components are more specific.

The three cycles of training are:

(a) **Micro Cycle:** The duration of this cycle is 3 to 10 days and is thus considered the shortest cycle of training. In the case of an intermediate and high-performance sportsperson, this cycle lasts 5 to 10 days. The last day of the micro cycle provides active recovery and relaxation to the sportsperson to prepare him for training in the next micro cycle. Even though 5 to 10 days is not adequate to achieve most training tasks, it forms an integral part of the entire training process. The following three proportions of high and medium or low load are adopted in the microcycle.

- 1:1, i.e., every day of the high load is followed by a day of medium load.
- 2:1, i.e., every two days of high load are followed by a day of medium load.

- 3:1, i.e., every three days of high load are followed by a medium or low load day.

(b) **Meso Cycle:** The duration of this training cycle is 3 to 6 weeks and is thus termed a cycle of medium duration. The purpose of this cycle is to tackle specific training tasks. These tasks are:

- Learning and acquiring mastery of skills
- Maintenance and stabilization of performance
- Development of physical and motor fitness components
- Preparation for a specific competition
- Attainment of optimal level of performance
- Preparation for the next mesocycle by providing recovery and relaxation.

A mesocycle of 4 weeks is considered the best because this is the minimum period within which significant change is affected in the physiological and psychological factors. The last week of the training mesocycle is considered a transitional phase that ensures recovery and relaxation.

(c) **Macro Cycle:** The duration of this cycle is 3 to 12 months and it is, thus, considered the most extended cycle of training. The purpose of the macrocycle is to enable the sportsperson to improve the performance capacity to put up an optimal performance, at a specific time, during the competition. A macrocycle comprises several mesocycles; the last mesocycle ensures recovery and realization for a smooth transition to the following macrocycle.

Do you Know

Anders Ericsson, a psychologist, writes that it takes 10,000 hours of practice to become an expert. In other words, an athlete training for 5 hours a day, seven days a week over 365 days a year, would take about 5.5 years to acquire expertise in their chosen sport or game.

Extension Activity

Preparing for an Annual Zonal Competition is long-term planning,

It consists of various stages

Working in groups, interview ten sports persons from your school, or another nearby school, who have participated in CBSE's Zonal Competitions (or any equivalent Competition). Find out details of their planning process for the annual zonal competition and list any five below.

S.No.	Process of Planning
1.	
2.	
3.	
4.	
5.	
6.	

I. Tick the correct options

1. Meso cycle is training of
   a. one week
   b. 4 to 10 days
   c. 3 to 6 weeks
   d. Three 3 months
2. Transitional Phase is a
   a. rest and recovery period
   b. training period
   c. competition period
   d. fitness period
3. Micro cycle is
   a. 3 to 10 weeks
   b. 3 to 10 days
   c. 3 to 10 hrs
   d. None from above

II. Answer the following questions briefly.

1. What do you understand by Macro Cyclicity?

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

1. All players diligently follow the periodization process. Why do coaches and players follow periodization cycles during training to attain good results in a championship?
2. Identify the specific training tasks in Mesocycle?

Strength, Endurance, and Speed

Strength

Strength is one of the most crucial motor components of fitness and plays a significant role in sporting events as it is a direct product of muscle contraction. It is a conditional ability that depends on the energy liberation process in the muscles. The amount of force muscles can produce to complete a task is known as strength.

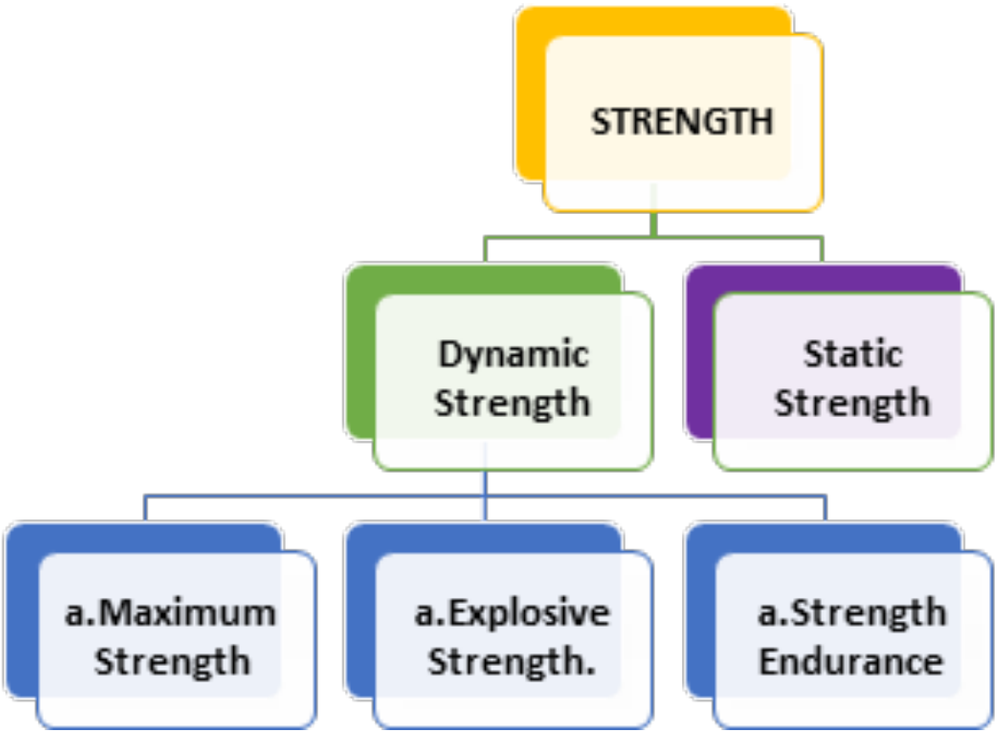
In simple words, strength is the ability of a group of muscles to overcome resistance.

As all the movements in sports are caused by muscular contraction, it can be said that strength is part and parcel of all motor abilities, technical skills, and tactical actions.

Definition

- According to **H. Singh,** *"strength is the ability to overcome resistance or to act against resistance."*
- According to **Barrow** and **McGee,** *"strength is the capacity of the whole body or any of its parts to exert force."*
- According to **Mathews,** *"The force that a muscle or group of muscles can exert against a resistance in one maximum effort."*.

Different sports need different types of strength, and the requirement and application of strength in sports differs according to sports-specific needs. Commonly, strength is classified and studied into two forms: static and dynamic stability.



Static Strength

Static strength is also called isometric strength. It is the ability of the muscles to act against resistance. Static strength can be measured with a dynamometer. This type of strength is not seen directly. Some static strength is not usually applied in sports, but it is used in phases in weightlifting. Example: plank or yoga asanas.

Dynamic Strength

Dynamic strength is also known as isotonic strength. In pull-ups and push-ups, we required dynamic strength. In performing such a workout, there is a diminishing tendency in dynamic strength, and as a result, muscles refuse to do work after some time. The man cannot do even one extra pull-up or push-up at this stage. Movements are visible when someone uses dynamic strength. It is recognized by rhythmic muscular contractions with changes in muscle length, using a relatively small force. Example: push up and full squats.

Dynamic strength can be divided into three parts.

a. Maximum Strength

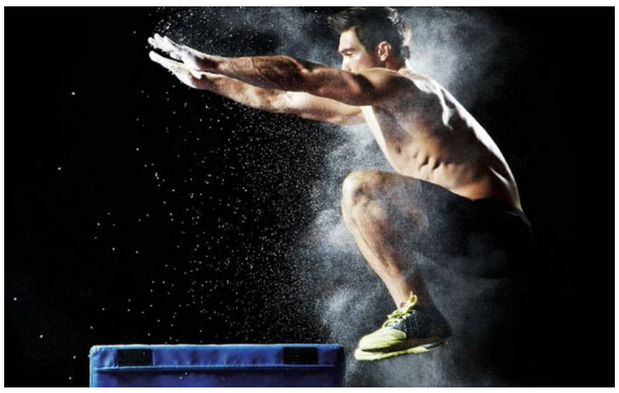
The muscle can overcome maximum resistance in a single repetition or muscular contraction. Maximum strength means exerting force against resistance in the maximal effort. A muscle can overcome the resistance of maximum stimulus intensity in a single muscular contraction.

Though maximum strength does not hold much importance in most sports but is undoubtedly required in sports like long jump, shot put, javelin throw, weightlifting, discus throw, etc. These sporting events require the tacking of heavy resistance.[4]

b. Explosive Strength.

The muscles can overcome resistance as fast as possible. In other words, it can be said that it is a combination of strength and speed. Explosive strength is always used in motor movements and is a form of dynamic strength. Muscle can get over the resistance of sub-maximum intensity of stimulus as possible.

Explosive strength is particular to the nature of movement and is greatly influenced by motor coordination, i.e., inter and intramuscular coordination. This strength is mainly used in volleyball spiking, jumps in basketball, sprint events, etc.[5]



c. Strength Endurance

The muscle can overcome resistance under fatigue or for as long as possible. Same as explosive strength, strength endurance is a product of two motor abilities: strength and endurance. A muscle can get over the resistance of a medium-intensity stimulus for as long as possible.

Strength endurance can be a form of static or dynamic strength depending upon whether the movement is isometric (static) or isotonic (active). This strength is mainly used in long-distance races of athletics, swimming, distance cycling, etc.[6]

Do you Know

To improve muscle strength, you should attempt to perform between 2 and 5 sets of approximately 2 to 6 repetitions at an intensity of at least 85 percent of your 1RM for that specific exercise. For individuals trying to improve muscle power, the ideal is to perform 3 to 6 sets of 3 to 6 repetitions at 30 to 60 percent of 1RM. A lighter percentage (30-45 percent of 1RM) should be used with power exercises that allow for the release of the mass being lifted (e.g., bench press throws). The proper rest period between each set for strength and power exercises is two and five minutes.

TABLE 6.1 Adjusting Training Load to Training Goals

	Frequency (times/wk)	Intensity (% RM)	Volume	Rest
Power	1-2	30-60	3-6 reps 3-6 sets	2-5 min
Strength	3-5	>85	2-6 reps 2-5 sets	2-3 min
Hypertrophy	4-6	67-85	6-12 reps 3-6 sets	30-90 s
Endurance	5-7	<65	15-25 reps 2-3 sets	<30 s

Improving muscular endurance requires approximately 2 or 3 sets of 15 to 25 repetitions. Muscular endurance exercises are performed at an intensity below 65 percent of 1RM, with short rest periods of one to two minutes for sets with higher repetitions and less than one minute for moderate repetitions. Finally, those looking to improve muscle mass (hypertrophy) should do 3 to 6 sets of 6 to 12 repetitions at 67 to 85 percent of 1RM, with rest periods of between 30 and 90 seconds. Table 6.1 provides a summary of these numbers.

Methods to Develop Strength

As **strength** is a highly trainable motor component, specific methods help an athlete develop or improve strength. These methods are discussed below:

1. **Isometric Exercise:** These are the exercises that are not visible as there are no direct movements. Therefore, isometric exercises cannot be observed. In these exercises, work performed cannot be seen directly, like pushing a wall. While pushing a wall, work is done, i.e., the force is being exerted, but the work done cannot be seen as the wall is still at the same place and doesn't move a bit. These exercises involve muscles carrying out tension against the other group of muscles. There is no change in the muscle length when such exercises are done, hence they are called "iso" metric. These exercises need less time and equipment and can be performed practically anywhere and everywhere. Moreover, isometric exercises can prove to be of great value for maintaining strength in case of an injury. These exercises, if performed regularly, may result in a change in muscle size and shape.[7]

2. **Isotonic Exercise:** These are exercises in which movements can be seen directly. Isotonic exercises result in toned muscles and increased muscle length. These exercises hold much importance when it comes to sports. This method is considered to be the best method to develop strength. Examples of isotonic exercises include running and jumping on the spot, weight training exercises, and calisthenics exercises.[8]

3. **Isokinetic Exercise:** this method was introduced by J.J. Perrine in 1968 and involves a particular type of muscle contraction called isokinetic contraction, generally used in sporting events like rowing and swimming. These exercises are performed on specially designed instruments. In isokinetic contraction, the muscles apply maximal force throughout the range of motion around the joint. Whereas in isotonic contraction, the pressure is applied at a particular angle. The use of isokinetic contraction is minimal. Hence, the contribution of isokinetic contraction in developing strength is yet to be scientifically proved.[9]

Do You Know?

Preventive Measures in Strength Training

While doing strength training, appropriate supervision is a must as there is always a high risk of injury accompanying it. Therefore, it is essential to know the means for preventing such incidents. These are:

1. Strength training must be done after proper warming up.
2. Strong and stable joints are a prerequisite for strength training. Therefore, the strength and stability of the musculoskeletal system must be ensured by doing general strength training with low intensity.
3. While exercising with heavyweights, a correct technique is required. Or else it will result in serious injuries.
4. A strength training program includes a variety of exercises. These exercises must be done correctly, preferably agonists and antagonists' muscles one after the other.
5. The load must be increased gradually as per the athlete's ability and requirement.
6. Recovery or rest plays a vital role in strength training. Proper and effective use of the recovery period helps in preventing injuries.
7. Improper breathing while exercising with heavy weights leads to serious disturbance in blood circulation. Hence, as a rule, a sportsperson must breathe continuously, and if he holds his breath, it should be for a minimum duration possible.
8. Safety equipment like belts, boots, wrist bands, etc., should be used when necessary.
9. In the case of children, the load should be low until the age of 16 years as the chances of injuries are very high.

Extension Activity

Under the supervision of your physical education teacher, form yourselves into two groups. Tell one group to do isometric and the other to do isotonic exercises for one hour a day for 3- 5 days a week. Test their strength after two months. Prepare a table and evaluate

which method is better?

Name:

Objective:

Warm-up Activity						
	Set	Repetition	Time	Distance	Intensity	Remarks
Strength Training Exercise						
	Set	Repetition	Weight	1 RM	Rest	Remarks
Cool Down Activity						
	Set	Repetition	Time	Distance	Intensity	Remarks

I. Tick the correct options.

1. The isokinetic method was developed by.
   a. HC Buck
   b. Joy Perrny
   c. J.J. Perrine
   d. JJ Coubertin

2. An exercise in which movement is visible.
   a. Isometric
   b. Isotonic
   c. Isokinetic
   d. Isonomic
3. Under which kind of strength would you put Shotput?
   a. Strength Endurance
   b. Explosive Strength
   c. Maximum strength
   d. Speed Strength

II. Answer the following questions briefly.

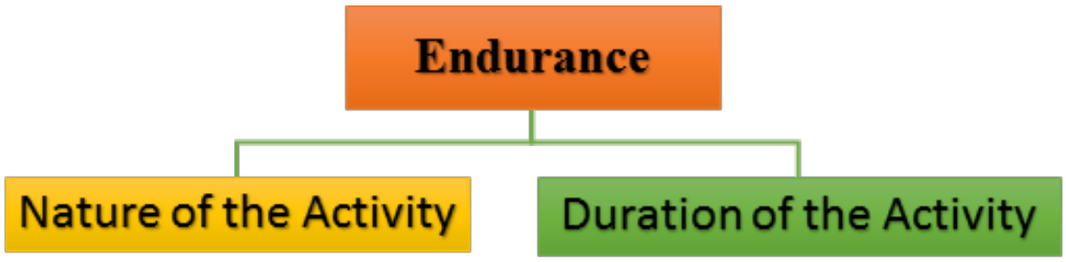
1. Define Strength?
2. Explain Isometric exercise with suitable examples.
3. Write a short note on the different types of Strength.

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

1. Explain the preventive measures to be kept in mind during strength training.
2. What is Strength? What are various methods for developing Strength? Write in detail

Endurance

Endurance is the ability of a person to maintain a certain level of energy production for a more extended period. It is the ability to sustain an activity. Like strength, endurance is also a conditional ability. Endurance has been studied thoroughly and deeply because it holds great importance in health, training, and competition. Endurance plays a vital role in almost every activity, directly or indirectly. It is either measured by the number of repetitions or the times an action is performed.



Definition

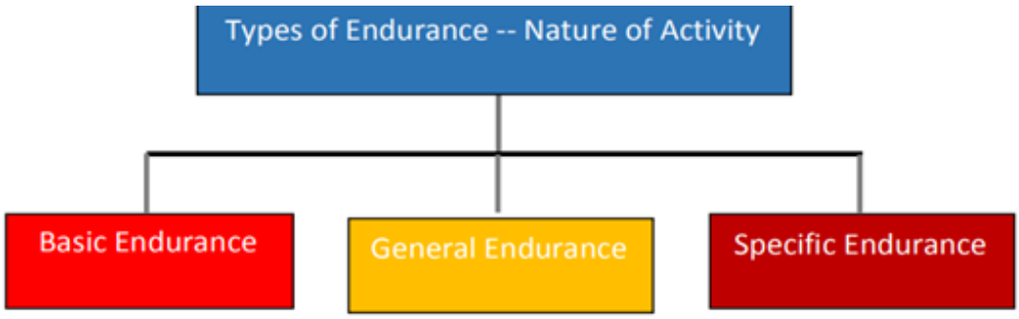
Harre defines endurance as *"the ability to resist fatigue."*

Barrow and McGee defined endurance as *"the result of a physiologic capacity of an individual to sustain movement over a period of time."*

H. Singh defines endurance as *"the ability to sustain an activity."*

Types of Endurance

Different games and sports require different types of endurance, which majorly can be classified into the following categories:



I. Classification according to the nature of the activity:

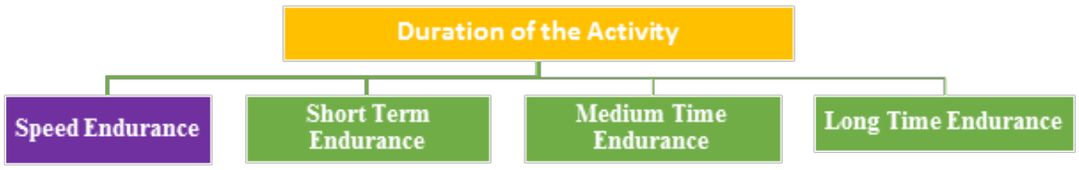
This classification is based on the kind of activity required for endurance. It can be classified into the following types:

- **Basic Endurance:** This is the ability of a person to resist fatigue in which the load is of medium intensity and involves aerobic muscular metabolism. Therefore, it can be said that it is the ability to do movements that involve a large number of muscles at a slow pace for a prolonged period. For example, jogging, cycling, and swimming for more than 30 minutes. Basic endurance forms the base for all other types of endurance.[10]

- General Endurance: it is the ability to do such sporting movements for a prolonged duration that are general. This type is not specific to any sport and can be developed by performing general exercises. Unlike essential endurance, in which the intensity of the activity is medium, general endurance activities may incorporate high-intensity practices. But the duration for general endurance is much shorter than essential endurance.[11]

- Specific Endurance: this is the ability to perform movements of a particular sport to resist fatigue. Specific endurance varies from activity to activity as it depends on the nature of fatigue. For example, the specific endurance of a hockey player is different from that of a marathon runner or a cyclist as the need for the activity is different.[12]

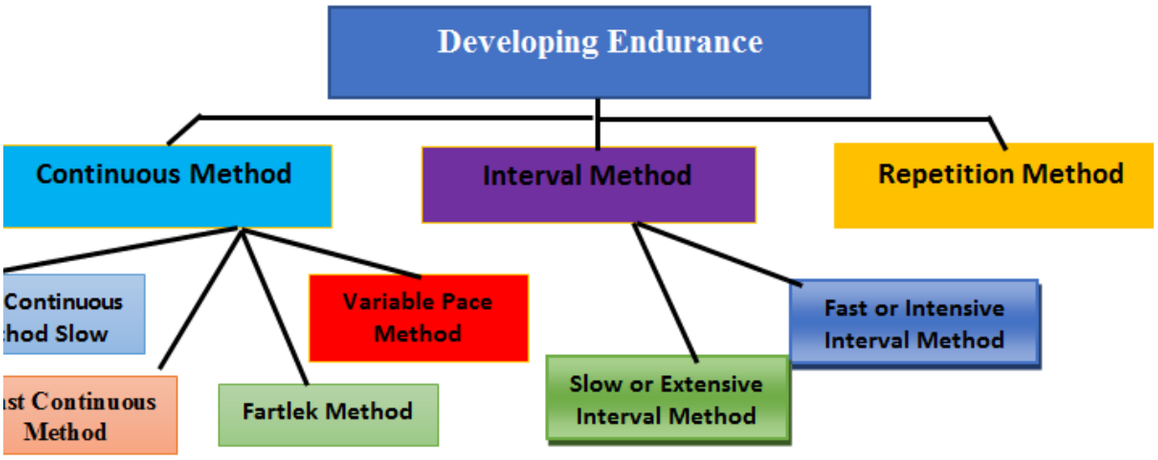
II. Classification according to the Duration of the Activity:



This classification considers only cyclic sports activities and is based on physiological factors. From the viewpoint of Harre (1986), this classification can be divided into the following sub-categories:

- **Speed Endurance:** This is the ability to resist fatigue in cyclic activities that last up to 45 seconds. The classic example of this endurance type is a 400m sprint in track and field. This type of endurance is majorly dependent on the power and capacity to produce energy.
- **Short Term Endurance:** This ability is needed for activities lasting 45 seconds to about 2 minutes. The most appropriate example for short-term endurance is an 800m run. This endurance depends majorly on speed endurance and strength endurance.
- **Medium Time Endurance:** Medium time endurance is needed to resist fatigue in activities lasting from 2 minutes to about 11 minutes. The most common example of this type is 1500m and 3000m run and 100m rowing. As in short-time endurance, this type of endurance also depends on speed and strength endurance, but to a limited extent.
- **Long Time Endurance:** This type of endurance is needed for activities that last for more than 11 minutes. This type of endurance is required in events like marathons, cross country, etc[13]

Methods to Develop Endurance



The various methods to develop endurance are discussed below:

1. **Continuous Method**

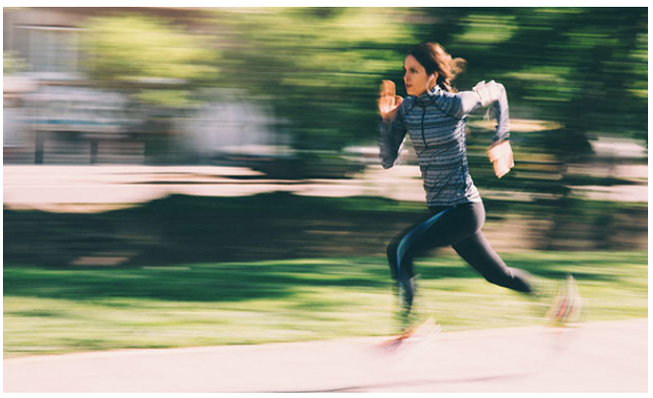
As the name suggests, this method is about continuity. In this method, an exercise is done for a longer time without any rest. Because the duration of the activity is long and continuous, the training intensity is low. This method has the following subcategories:

(a) **Slow Continuous Method:** In this method, the activity is performed at a certain speed without any break for a long duration. The speed of exercise is usually determined according to heart rate. A trained athlete's heart rate should be between 140-160 beats per minute during activity. The duration of the training should not be less than 30 minutes. This method is used for walking, running, cycling, etc.

Effect: due to relatively low intensity and long duration, the effect of this method is limited mainly to the muscles, but there are few psychic and positive effects on metabolism. Some of the most significant changes are:

- Increased muscle glycogen.
- Increased liver glycogen.
- Increased capillarization.
- Increased number and size of mitochondria.
- Improved thermal regulation.
- Quality of oxidative enzymes improves.
- Increased fat metabolism.
- Positive effect on heart and lungs.
- Psychological changes such as improved willpower, self-discipline, and self-conquest.

(b) **Fast Continuous Method:** The activity is performed comparatively fast, but the speed remains uniform throughout the training. Heart rate during the training should be between 160-180 beats per minute. Because the intensity is high and is more strenuous and exhaustive than the slow continuous method, the duration of the activity should be at least 20 minutes.



Effects: effects of the fast continuous method are:

- Effective for improving VO2 max.
- Improved capacity of muscles to consume oxygen
- Significant increase in the size and number of mitochondria.
- Improved anaerobic capacity

(c) **Variable Pace Method:** In this method, activity is performed at a changing pace, but this change in speed is pre-planned. The heart rate usually

ranges between 140-180 beats per minute during this method. The duration of this method may range from 15 minutes to 1 hour. Due to the varied pace, this exercise is very strenuous and should be done by trained athletes.

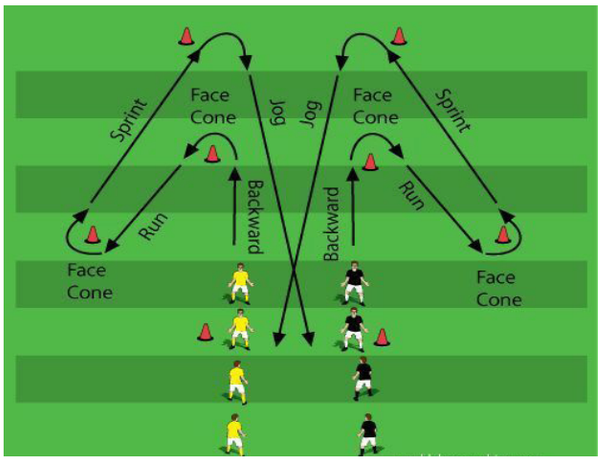
Effect of Variable Pace Method

- Increases glycogen in the muscles
- Increases the number and size of mitochondria
- Increases efficiency of heart and lungs
- Improves willpower and confidence
- Improve VO2 Max

(d) **Fartlek Method:** Fartlek is a Swedish word that means 'speed play.' In other words, it is another variation of the variable pace method. The difference between the two is in the Fartlek method the speed variation is not planned. The athlete changes the speed of his own accord during the activity due to changes in terrain, surroundings, and feelings. The heart rate and duration of the training are similar to the variable pace method.

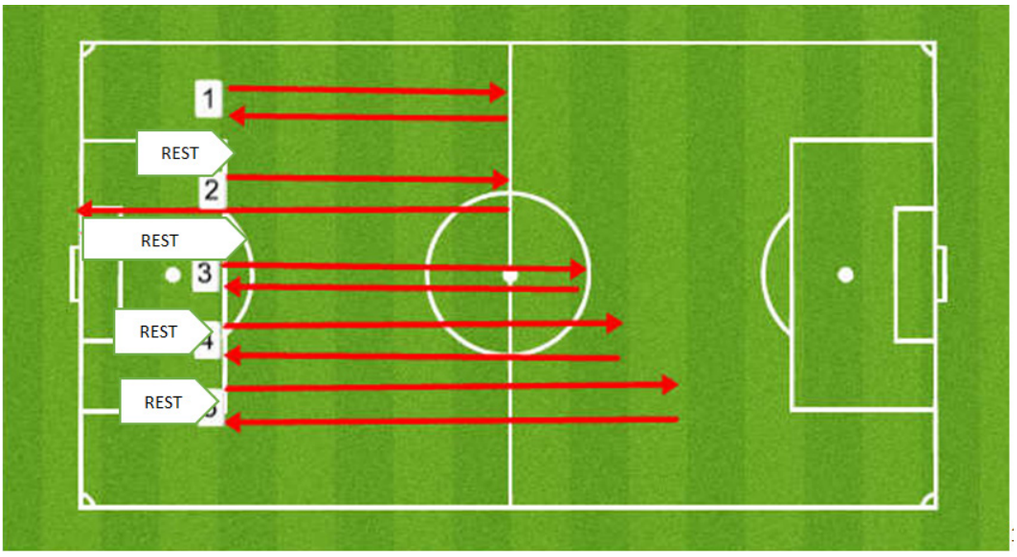
Major effects of this method:

- Promotes weight loss
- It's an excellent test for strength and endurance
- It improves speed and race tactics
- It improves the mind over matter game
- It is excellent for getting into the racing mindset as a fartlek session mimics the surges of speed you may put on in a race.
- Incorporating these speed surges helps runners measure and learn how much they can push their bodies over shorter segments.
- Increases physical and mental energy
- Improves flexibility
- Improves Fast and Slow Twitch Muscle Response



2. **Interval Method**

It is the most versatile method used for improving endurance. In this method, the activity is practiced at a comparatively high intensity with intervals or breaks of incomplete recovery. It is based on the principle that "work should be done with sufficient speed and duration so that the heart rate goes up to 180 beats per minute. After this, there should be a short interval, and when the heart rate drops down to 120-130 beats per minute, the work should start again."[14]

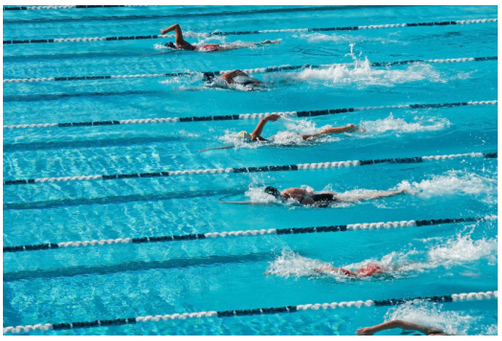


The most important effects of this method:

- Improved circulatory system
- Improved aerobic capacity
- Improved lactic acid tolerance
- Improved VO2 max

3. **Repetition Method**

The repetition method is characterized by a high intensity that ranges from 90-to 100% of work with an interval of complete recovery. It is the best method to develop speed endurance.



The Essential effects of this method are:

- Improved anaerobic capacity
- Improved lactic acid tolerance
- Improved phosphagen stores[16]

Do You Know?

Volume: Training volume is simply the amount of training you do. The primary training component includes duration or time of training, distance covered volume load (sets in weight training), number of repetitions, or performed work in a given time. It is a quantitative component of work.

Intensity: Training intensity refers to the effort by which a training session is completed. It is a qualitative component of work—more work or efforts done by the athlete per time. Assessment of intensity varies from sport to sport. Speed is assessed by metres per second, resistance in kilogram, team games, or distance races may be evaluated by heart rate, etc.

Density: Training density is simply the volume of training completed within a given time frame. As volume and intensity have an inverse relationship, density and intensity do. The less dense a session, the more intense it can be.

Extension Activity

With the help of physical education, teachers design medium-intensive exercise sessions to improve endurance. Participate in groups, Record the video and upload it on YouTube under ***Fit India Movement***.

I. Tick the correct option.

1. Which is not a type of endurance according to the nature of activities

i. Basic Endurance

ii. General Endurance

iii. Specific Endurance

iv. Speed Endurance

2. 400m sprint event comes under

i. Speed Endurance

ii. Short Endurance

iii. Medium Endurance

iv. Long Endurance

3. There will be no variation in the pace of inactivity in

i. Fartlek Method

ii. Continuous Method

iii. Interval Method

iv. None of the Above

4. The Swedish word meaning speed play is…….

i. Fartlek Method

ii. Continuous Method

iii. Pace Method

iv. None of the Above

II. Answer the following questions briefly.

1. Define Endurance.

2. Write about the different types of Endurance based on the duration of activity.

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

1. Explain types of endurance according to the duration of the activity.

2. Explain types of endurance according to the nature of the activity.

3. What do you mean by endurance? Explain methods to develop endurance in detail.

Speed

Speed has a complex nature and depends considerably on the central nervous system. Speed ability, in sports, signifies the ability to execute motor movements as quickly as possible. These movements can be cyclic or acyclic.

Theiss and **Schnabel** defined speed as *"the prerequisite to do motor actions under given conditions (movement task, external force, individual prerequisite) in the minimum of time."*

Johnson and **Nelson** defined speed as *"the capacity of an individual to perform successive movement of the same pattern at a fast rate."*

Certain factors help in determining the speed of an individual, such as mobility of the nervous system, explosive strength of an individual, correct technique of performing a task, bio-chemical reserves and metabolic power of an individual, flexibility, and certain psychic factors like optimum arousal, attention, motivation, concentration, ability to relax, etc.

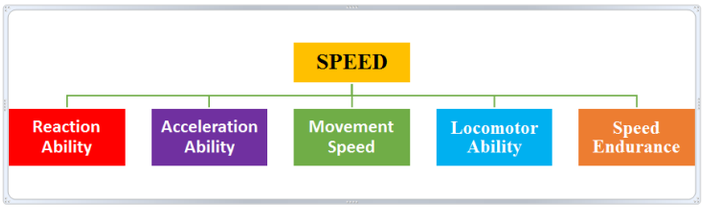
Types of Speed

From a general point of view, there are five different types of speed that are discussed briefly as follows:

1. **Reaction Ability:** Reaction ability is the ability to react quickly to a stimulus or signal. It depends entirely on the coordinative abilities of an individual. Different games and sports have other signs like visual, auditory and tactile, to name a few. And to respond to such signals accurately and as quickly as possible is known as reaction ability. It can be further classified into simple and complex reaction abilities.
2. **Acceleration Ability:** Acceleration ability is the ability to achieve a high locomotion speed from a stationary position. It depends significantly on the explosive strength, technique, and movement frequency. This ability is essential in almost every game and sport but greatly influences sprinting events.
3. **Movement Speed:** Movement speed can be defined as the ability to perform a single movement in the minimum possible time. It is highly related to acyclic sports, but its importance in cyclic sports is limited to the initial phase. It is dependent on the technique and explosive strength.
4. **Locomotor Ability:** Locomotor ability is the ability to maintain maximum speed when in motion for the maximum possible duration or distance. It is essential in sports like 100m and 200m sprints, speed skating, and short sprints in cycling.

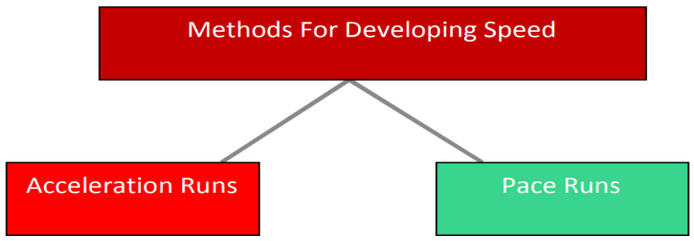
Locomotor ability depends highly on the mobility of the nervous system. The chances of improving locomotor ability are relatively low.

5. **Speed Endurance:** Speed endurance is a combination of two words, speed and endurance. It is the ability to do the movement with high speed for a longer duration, i.e., under fatigue. It depends highly on anaerobic capacity, technique, and psychic factors.



Methods Developing Speed

Speed is a motor ability that depends on genetic and environmental factors. Genetic factors, as we all know, cannot be manipulated. An individual having fast-twitch fibres in a comparatively higher percentage than slow-twitch fibres will have more speed. At the same time, the individual with a high rate of slow-twitch fibres will have better endurance. The ratio of these muscle fibres cannot be changed. Therefore, it can be said that the genetic make-up of an individual sets the limit on the speed of an individual, but the role of environmental factors on the speed cannot be denied as well. The following are the most commonly used method to develop the speed of an individual:

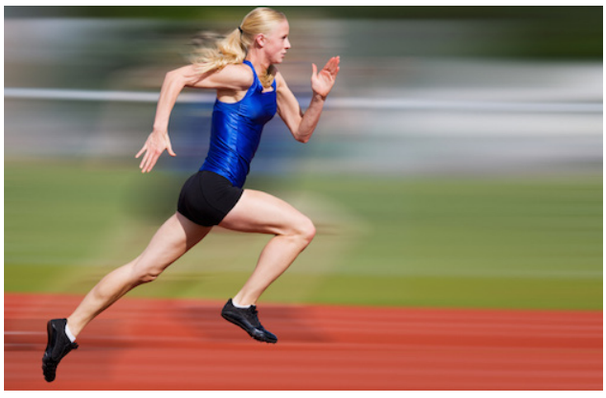


1. **Acceleration Runs** are generally used to develop speed while attaining maximum speed from a static position. In an acceleration run, a sportsperson must run a specific distance. After starting, the athlete tries to gain total momentum at the earliest and finishes the specified distance. These runs are repeated with sufficient rest between the runs. It usually takes 50-60 meters for a sprinter to attain maximum speed after the start. According to the research, it is observed that even well-trained athletes can maintain their top speed for 20 meters only.

The number of acceleration runs can be set according to an athlete's age, capacity, and fitness level. It may vary from 6-12 repetitions with intervals for complete recovery. The acceleration runs must be done after proper warm-up.[17]

2. **Pace Runs:** unlike acceleration runs, pace runs incorporate the method of running the set distance at a uniform speed. It usually includes races of 800 meters and above. It is a fact that an athlete can run a distance of 300 meters at full speed, and in the case of longer races, he must conserve his energy by reducing speed.

   Therefore, keeping the pace in mind in middle and long-distance races is essential. At the beginning of such races, the speed should not be too high, and the pace should be maintained throughout the race. For this type of training, the athlete should run at a maximum steady speed for a distance 10-20% more than the actual racing distance. Repetition for pace run training can be fixed as per the athlete's fitness level with complete recovery in between repetitions.[18]



Do you Know?

Skeletal muscles are made up of individual muscle fibres, and like muscles themselves, not all muscle fibres are the same. There are two types of skeletal muscle fibres, fast-twitch, and slow-twitch, and they each have different functions that are important to understand when it comes to movement and exercise programming.

Slow-twitch muscle fibres: Slow-twitch muscle fibres are fatigue-resistant and focused on sustained, smaller movements and postural control. They contain more mitochondria and myoglobin and are aerobic in nature compared to fast-twitch fibres. Slow-twitch fibres are also sometimes called type I or red fibres because of their blood supply. They promote prolonged duration activity at a slow pace, also known as aerobic muscles. Examples are long-distance running, swimming, cycling, etc.

Fast-twitch muscle fibres execute fast movement for short distances, also known as anaerobic muscles. It helps in short distance races, weight lifting, jumping, etc.

I. Tick the correct option.

1. Which is not a type of Speed
   - i. Reaction
   - ii. Sprinting
   - iii. Acceleration
   - iv. Speed endurance

2. What type of speed is defined as the ability to maintain maximal speed for maximal distance and maximum duration?
   - i. Acceleration ability
   - ii. Locomotor ability
   - iii. **Movement ability**
   - iv. Reaction ability

3. Acceleration run and pace run can be two methods of improving
   - i. Flexibility
   - ii. Speed
   - iii. Endurance
   - iv. Strength

II. Answer the following questions briefly.

1. What are acceleration runs?
2. Define Speed.

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

1. Explain types of Speed and methods to develop speed.

Flexibility

Flexibility is also known as the range of motion around a joint. It is the ability to execute a movement with greater amplitude or range. Flexibility is related to genetic factors as well as physical activity programmes. Flexibility is a motor component that is not a conditional or a coordinative ability. In general, usage flexibility often corresponds with stretchability, elasticity, litheness, mobility, pliancy, etc. Flexibility is affected by muscle strength, the structure of the joints, tendons, ligaments, and other factors. A person possessing good flexibility can perform daily tasks with greater ease and comparatively more efficiency and effectiveness. Moreover, the personality and posture of such individuals is more attractive.

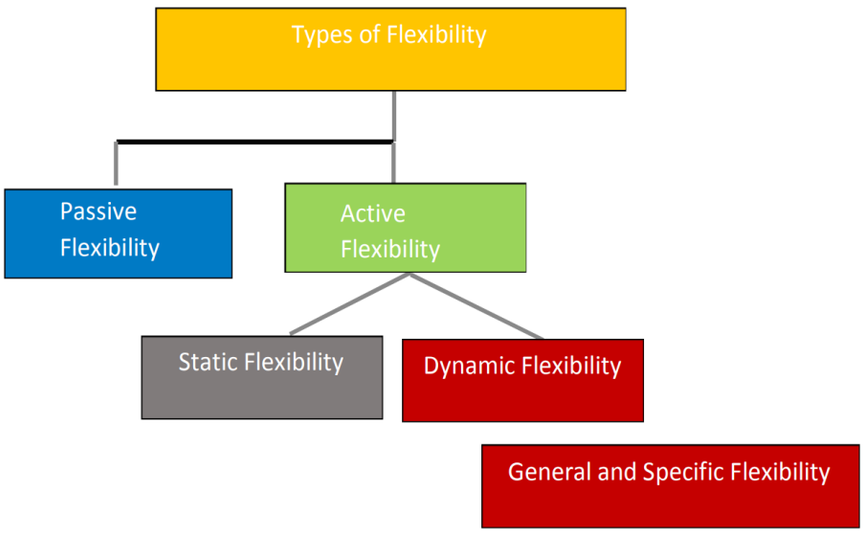
Tight joints affect smooth and efficient movements, whereas flexibility ensures smooth and efficient workouts. Therefore, it can be said that flexibility is helpful in many ways, such as preventing injuries, improving posture, reducing back pain, maintaining healthy joints, improving balance during making movements, and learning various skills quickly, such as backstroke in swimming.

Importance of Flexibility

Flexibility has an important inter-relationship with other factors that improve performance. Hence, it is essential to determine different aspects to a lesser or greater extent. The importance of flexibility is briefly discussed below:

1. Greater range of motion ensures more force and speed developed by the muscles.
2. It is due to the flexibility to perform movements with minimum muscular tension and, therefore, facilitates a higher movement economy.
3. It reduces stiffness in joints.
4. It reduces the risk of injuries as muscles are more pliable.
5. It helps in maintaining appropriate posture while performing.

Types of Flexibility



Flexibility is of the following two types:

(A.) **Passive Flexibility:** the ability to do movements with greater amplitude and with external help is known as passive flexibility. Example, stretching with the help of a partner. Passive flexibility is always more than active flexibility and is primarily determined by the joint structure and stretchability of the muscles and ligaments. Passive flexibility is the base of operational flexibility.[19]

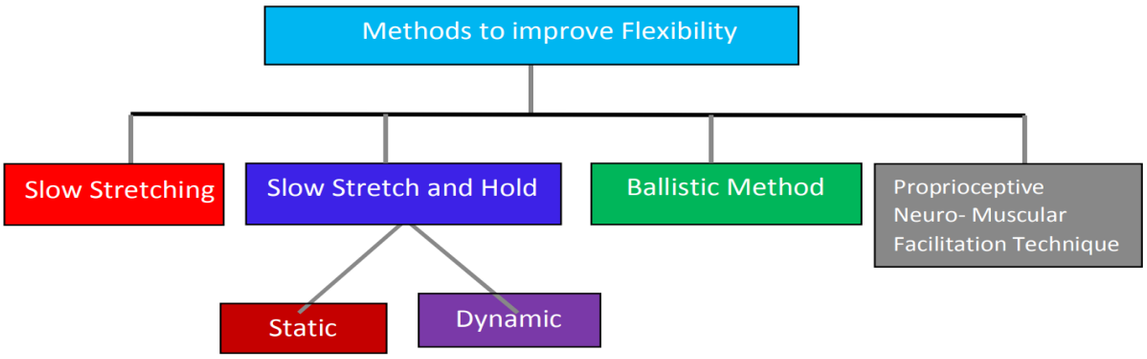
(B.) **Active Flexibility:** the ability to perform a movement with greater amplitude without external help is called active flexibility. For example, you are performing a stretching exercise by a sportsperson himself. Active flexibility is always less than passive flexibility, and the difference between the two indicates a lack of muscular strength or coordination. Active flexibility is further classified into the following two categories:

a. *Static Flexibility:* it is required for movements done while the individual is in a static position, i.e., standing, sitting, or lying.

b. *Dynamic Flexibility:* it is required for executing movements when an individual is moving.[20]

In addition, the terms General and Specific Flexibility are also used often. General flexibility refers to the flexibility of all the critical joints of the body, such as the shoulder, hip, and trunk. It is not used for any sporting event or physical activity. However, specific flexibility should be understood to be the ability to perform specific movements or movements related to specific sports.

Methods to Improve Flexibility



The various methods that can help to improve flexibility are discussed below:

1. **Slow Stretching:** The first and foremost way to improve flexibility is slowly stretching the muscles around the joint. The critical point to note here is that stretching should be slow and without any jerky movements.

2. **Slow Stretch and Hold:** The next stage after stretching is to hold for about 6-8 seconds at the maximum stretching point. This method is considered to be the most commonly used method in the field of games and sports.

Stretching can be done either statically or dynamically.

Static stretching involves slowly easing into extension and holding the position. The period required for static stretch depends on the purpose. The stretch should be held for about 10 seconds if it is for a cool down. If it improves flexibility, the hold is recommended for about 30 seconds.

Dynamic stretching requires controlled movements, usually of legs and hands, and where the event requires dynamic movement, it is suitable for dynamic stretching exercises.

3. **Ballistic Method:** This method performs the movement with a swing and rhythm. As the stretching is done rhythmically, it is called Ballistic Method. The ballistic method once experienced popularity but has come under the scanner by many physical therapists. This form of stretching uses the body's momentum to extend the range of motion. However, many experts believe that ballistic stretching can lead to injury. [21]

4. **Proprioceptive Neuro-Muscular Facilitation (PNF) Technique:** It is also known as the post isometric stretch and is based on the principle of proprioceptive neuromuscular facilitation. This principle states that if a muscle is contracted maximally for a few seconds, the muscle gains maximum relaxation after the contraction. In this method, the muscle is first contracted for 5-7 seconds and then gradually stretched to its utmost limit and held for about 8-10 seconds. The process is repeated 4-8 times for each muscle group.[22]

Do You Know?

The essential tips for developing flexibility

1. The right age for flexibility development is considered before puberty, as it is hard to develop flexibility after puberty.
2. Flexibility tends to deteriorate once improved if the stretching routine is not continued.
3. Stretching exercise performed in fatigue affects flexibility negatively. Hence, a person should perform such exercises when fresh. The ideal time to perform stretching exercises is after warm-up.
4. Flexibility exercise tends to work best after a good warming up. If the warm-up is not performed correctly, it may lead to overstretching of the muscles.
5. Flexibility training should aim for optimum flexibility and not for maximum flexibility—too much flexibility results in less joint stability and, therefore, chances of injury increase.
6. A muscle group must be stretched several times to improve flexibility effectively. Usually, 10-15 repetitions are recommended for a muscle group to gain flexibility.
7. A stretching exercise should be accompanied by a conscious effort to relax the antagonist's muscles.
8. It is essential to avoid jerky movements while performing stretching exercises.
9. Age has an inverse relationship with flexibility. Therefore, do not compete with others while working on one's level of flexibility.
10. For faster improvement in flexibility, the routine can be followed daily or twice a day, involving various exercises for each joint.

Extension Activity

Good flexibility can improve sports performance and reduce the risk of injury. Learn static and dynamic flexibility exercises in school with the help of your physical education teacher or coach and practice them. Teach the same to your friends in your neighbourhood and increase the number of exercises and repetitions with time. Please do a small project with pictures for the same and submit it to your school as a SEWA project.

I. Tick the correct option.

1. Which is not a type of Flexibility?
   - i. Active
   - ii. Passive
   - iii. Ballistic
   - iv. Stretch
2. In which method is stretching done rhythmically?
   - i. Slow stretch
   - ii. Slow stretch and hold
   - iii. Ballistic method
   - iv. PNF
3. Which of the following factors does not influence flexibility?
   - i. Structure of joints
   - ii. Proper warming-up
   - iii. Body temperature
   - iv. None of these
4. What are the necessary steps in improving flexibility?
   - i. Proper warm-up
   - ii. Proper stretching
   - iii. Repetition of exercise
   - iv. All of these

II. Answer the following questions briefly.

1. Define flexibility.
2. What do you mean by Passive Flexibility?

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

1. Explain types of Speed and methods to develop speed.
2. Discuss methods to improve flexibility.
3. Define Flexibility. Explain its types and any two methods to develop flexibility.

Coordinative Abilities

Coordinative abilities primarily depend on the central nervous system's motor control and regulation process. For a coordinative ability, the control regulation processes must function in a particular manner. The coordinative abilities are those abilities of an individual that enable the individual to do various activities correctly and efficiently.[23]

Zimmerman et al. stated that *"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."*

Types of Coordinative Ability

In sports, the following seven types of coordinative abilities are essential. The use of these abilities is, however, different in different games.

1. **Orientation Ability:** it is the ability to determine and change the position and movements of the body in the required time and available space in a definite field of action (such as a volleyball court, skating rink, a football ground) and a moving object (like a ball, opponent, partner). The use and demands on orientation ability are vast in sports. Example: body movement and position in gymnastics are essential for orientation. In team games, vision, especially peripheral vision, is decisive for orientation.

2. **Differentiation Ability:** It is the ability to attain a high fine-tuning of movement phases. It is the ability to achieve a high level of accuracy. The high level of differentiation depends on movement experience and mastery over motor action. High differentiating capacity is used in sports in sensing or implementing movement, such as movement sense.

3. **Coupling Ability:** it is the ability to coordinate body part movements with one another and about a definite goal-oriented body movement. Coupling ability is essential in sports where activities with a high degree of difficulty have to be done, such as gymnastics and team games. In a team game like football, foot movements for ball control or dribbling have to be coupled with the whole-body action of running and jumping. Coupling ability depends on the functional capacity of kinaesthetic and visual sense organs.

4. **Rhythm Ability:** Rhythm ability is the ability to perceive the rhythm of a movement and do the exercise with the required rhythm. It also denotes the ability to reproduce rhythm stored in motor memory, in motor action. In some sports like gymnastics and figure skating, the sportsperson has to perceive an external rhythm and music and express it in his movements. In sports where rhythm is not given outside, the sportsperson has to use the rhythm stored in his memory.

5. **Reaction Ability:** Reaction ability is the ability to react quickly and effectively to a stimulus. Different games and sports have different types of signals like visual, auditory, and tactile, to name a few. And to respond to such signals accurately and as quickly as possible is known as reaction ability. It can be further classified into simple and complex reaction abilities.

6. **Adaptation Ability:** Adaptation Ability is the ability to adjust or completely change the movement programme based on changes and anticipated changes.

The situational change may be expected or may take place suddenly. It depends considerably on the speed and accuracy of perception of changes in the situation.

7. **Balance Ability:** Balance Ability is the ability to maintain equilibrium or balance throughout the movement and regain balance quickly after disturbing balance movements. It is further classified into two types:

   (a) Ability to maintain balance during stationary position or slow movements. It depends on kinaesthetic, tactic, and to some extent on vestibular sense organs.

   (b) Ability to maintain or regain balance during rapidly changing positions. It depends primarily on the functional capacity of the vestibular sense organs.

I. Tick the correct option.

1. The ability to coordinate body part movements with one another and about a definite goal-oriented body movement is known as:
   a. Balance Ability
   b. Adaptation Ability
   c. Rhythm Ability
   d. Coupling Ability

2. The ability to attain a high level of fine-tuning of movement phases is known as:
   a. Differentiation Ability
   b. Orientation Ability
   c. Adaptation Ability
   d. Coupling Ability

3. What kind of coordinate abilities are defined as determining a body's position and its part in time and space concerning gravity and moving objects?
   a. Differentiation Ability
   b. Orientation Ability
   c. Adaptation Ability
   d. Coupling Ability