

Module 3

Exercise and Fitness training

INTRODUCTION

Fitness is a state when a person's physical health and mental health are at their best. Most people consider fitness is only attached to maintaining physique and mental health nothing to do with it. This is wrong, the mental health and physical health combined is called fitness. A person who maintains proper fitness will be healthier as compared to a person who does not. Fitness plays a very important role in our lives that is why keeping ourselves mentally and physically fit is very important. A person is said to be physically fit if this person has a healthy weight, body function and heart and is also able to perform different sporting activities such as exercising. To become physically fit, you have to exercise and remain active. Physical fitness related to a set of attributes that provide the individual with the ability to perform physical activity. Different people think differently regarding the physical fitness, according to common person "To have a good physique is a symbol of physical fitness" Mental fitness related to the emotional and mental health of a person. A person who is mentally fit is supposed to have a better ability to react positively I different situations. This also linked to the confidence, courage and other positive states of mind of a person. To remain mentally fit, you need to train your mind, relax properly and learn to deal with the different negative emotions and mental health issues.

Here are a few things that can help you better understand the importance of physical fitness:

- Fitness keeps you healthy and helps you to avoid lot of disorders.
- Keeping yourself fit allows you to enjoy life to its full. You do not have to worry about a lot of problems that overweight or unhealthy people have.
- Your body remains in shape, you look more attractive and your face glows, this also boost your confidence in yourself, thus further boosting your mental health.
- Fitness also impacts your mood and you become happier.
- Fitness also impact your social life, you are more in control and more confident, this helps you impress the people around you.
- You will have to create and follow a proper fitness routine.
- Exercise daily, even small exercise such as walking, jogging, and running can keep you fit.
- Try to remain active as much as possible, without pushing you limits hard. Remaining active helps your brain function properly and also helps to increase your metabolism.
- Take proper sleep and relax time. You physical and mental fitness also depends upon the quality of sleep you are getting. The time when you sleep, your mental activity lowers, this helps provide rest to your brain.
- Eat unhealthy food and avoid junk food. Food plays a very important role in your fitness. You should eat food that contains all the nutrients in the proper amount that you need.

DEFINITIONS

“Physical fitness is the capacity of the heart, blood vessels and lungs and muscles to perform at optimal efficiency”

Bud Getchell

“Physical fitness refers to the organic capacity of the individual to perform the normal task of daily living without undue fatigue having reserves of strength and energy available to meet satisfactorily any emergency demands suddenly placed upon him”

Nixon

“Physical fitness is the ability to perform moderate to vigorous levels of physical activity without undue fatigue and the capability of maintaining such ability throughout life”

ACSM

“Physical fitness is associated a person’s ability to work effectively, enjoy, leisure time, be healthy, resist hypokinetic diseases or conditions and meet emergency situations”

Charles B Corbin et.al

“Fitness is the ability of an individual to lead a full and balanced life. It includes physical, mental, emotional, social and spiritual factors and capacity for their wholesome expression”

Charles A Bucher (1958)

Factors affecting physical fitness

Gender(sex)	Physical disability
Age	Illness and fatigue
Emotional factors	Usage of drugs
Physical exercise	Environment
Alcohol consumption and smoking	Nutritional factors

HEALTH RELATED PHYSICAL FITNESS COMPONENTS

Physical fitness is an essential component of a health and satisfying life style. Health related physical fitness is defined as fitness related to some aspects of health. This type of physical fitness is primarily influenced by individuals exercise habits; in this way, it is a dynamic state and may change.

There are five components of health-related physical fitness, cardio respiratory endurance (cardio vascular endurance), muscular endurance, muscular strength, flexibility and body composition. These are directly related with good health and help to reduce the risk of hypokinetic diseases. For health promotion and diseases prevention, each of the components of health related fitness are important in moderation. A higher level of health related fitness is directly related to the degree of skill performance. E.g.; moderate level of muscular strength is required to maintain posture and to prevent neck, back or knee pain etc. But high amount of muscular strength helps to increase performance in weightlifting, powerlifting and throws.

1.Cardiovascular endurance/Cardio respiratory endurance

Cardiovascular endurance is how efficiently your heart, blood vessels and lungs to supply oxygen rich blood to working muscle during physical activity. Lack of cardio-respiratory fitness may cause restriction in daily activities due to inefficiency of the heart to supply blood

to different body parts. Cardio respiratory endurance activities are also called aerobic exercise. E.g.; walking, cycling, jogging, swimming etc.

Cardiorespiratory endurance is an indication of a person's overall physical health. The muscle requires an adequate supply of oxygen and other nutrients to work properly during high-intensity or extended periods of exercise. If the muscles do not get enough nutrients, waste products begin to accumulate and cause fatigue. Increasing cardiorespiratory endurance improves oxygen uptake in the lungs and heart can help a person sustain physical activity longer. People trying to lose weight may want to focus on increasing their cardiorespiratory endurance because doing higher-intensity aerobic activities can help a person burn more calories.

Tests for measuring cardiovascular endurance

- Cooper's 12-minute run/walk test
- Harvard step test
- Tuttle pulse ratio test

Cardiovascular endurance related to systematic blood circulation:

Left ventricle > aorta > arteries > arterioles > capillaries > venules > veins > inferior and superior venacava > right atrium

Factors affecting cardiorespiratory endurance

- Size of heart
- Oxygen diffusion capacity of lungs
- Capillary density of the muscle
- Sex, age, genetics
- Type of body
- Body fat percentage
- Smoking

Exercise for improving muscular endurance

Aerobic exercise

2. Muscular endurance

The ability of muscles to work over a long period of time without fatigue.

Ability of a muscle or group of muscles to repeat a specific movement over and over again. Exercise for improving muscular endurance are planks, squats, sit-ups, pull ups, walking lunges etc.

Tests for measuring muscular endurance

- Sit-ups test (1 minute)
- Pull up test (for men) (maximum number), flexed arm hang (for women) (maximum time)
- Squat test
- 30 second endurance jump test

- Multistage hurdle jump test

Factors affecting muscular endurance

- Temperature
- Blood circulation
- Accumulation of lactic acid
- Age, gender
- Inorganic phosphate (ATP-CP)

Exercise for improving muscular endurance

Circuit training exercises

3.Muscular strength

It is the ability of the muscles in the body to exert force against a resistance in a single maximal effort

The maximum amount of force that a muscle can produce in one contraction

Test used to measure maximum strength

- 1RM (one repetition maximum)-measured by how much weight you can lift one time.
- 1RM squat test
- Muscle fibre RM test

Factors affecting muscular strength

- Speed of muscular contraction
- Limb and muscle length
- Age of performer
- Muscle fibre type
- Cross-sectional area
- Gender
- Number of muscle fibre recruited
- Joint angle around the muscle
- Neural strength
- Point of tendon insertion

Exercise for improving muscular strength

Resistance training exercises.

4.Flexibility

The ability to move a body parts through a full range of motion

Flexibility is range of motion around the joint

Good flexibility in the joints can prevent can help prevent injuries through all stages of life.

Test for measuring flexibility

- Sit and reach test

Factors affecting flexibility

- The structure of the joint
- Ligaments and tendon
- Age, gender
- Temperature
- Tissue injury
- Physical activity
- Genetic factors
- Adipose tissue

Exercise for improving flexibility are:

Stretching (active and passive) exercises

5.Body mass composition

All the tissues that makes up your body are called your body composition. Lean body mass is fat free mass our body which covers muscles, bones, and other tissues that make up the body except fat. A healthy individual should have relatively low percentage of body fat in the body. People who do regular physical activity have a larger percentage of lean body weight.

“Body mass composition may be defined as the relative percentage of fat and lean body mass”.

“The relative ratio of fat mass to fat free mass in the body”.

The terms underweight and overweight do not provide a great deal of information about fitness or about person’s body composition. Underweight and overweight refer how much you weigh compare to others. You can weigh more than someone else of the same size because you are more muscular than the other person. You can weigh less than someone else of the same size because you have smaller bones.

The term over fat and under fat are very useful because they describe how much of your total body weight is made up of fat. Under fat means having too little body fat: over fat means having too much body fat. Obesity is term used to describe people who are very over fat. The minimum amount of body fatness is called essential body fat, if fat levels in the body drop below this amount, health problem result. Being under fat can result in abnormal functioning of various body organs. In fact, exceptionally low body fat levels can result in serious health problems, particularly among teenagers. Having too much fat can be unhealthful. People who are over fat have a higher risk of a heart diseases, high BP, diabetes and other diseases.

Test for measuring body mass composition

- Skinfold callipers
- Electronic body fat analyser
- Hydro-static weighing.

Factors influencing body mass composition

- Hereditary
- Metabolism

- Type of body
- Maturation
- Early fatness
- Nutritional intake
- Physical activity
- Usages of certain drugs

General fat percentage of the body

Classification	women	Men
Essential fat	10-12%	2-4%
Athletes	14-20%	6-13%
Fitness	21-24%	14-17%
Acceptable	25-31%	18-25%
At risk	32% plus	25%

PERFORMANCE /SKILL RELATED PHYSICAL FITNESS COMPONENTS

Skill or performance related fitness involves skills that will enhance one's performance in athletic or sports events.

Skill related fitness has six components namely agility, balance, coordination, reaction time, power and speed. The skill related physical fitness components are more related to certain athlete and associated with sports performance. An individual who has achieved good skill related fitness is able to achieve high level of motor skills. Which are prerequisite in sports and certain jobs. Skill related fitness is generally known as sports fitness or motor fitness, but it is very specific and multidimensional.

“Skill-related physical fitness consists of components that have a relationship with learning motor-skills quickly and the ability to achieve high performance in sports”

“Skill related fitness encompasses skills the student should acquire and improved through physical activity”

1. Agility

“Agility is the ability to move quickly and to easily change direction”

“The ability to change body direction position and direction quickly and efficiently”

“The ability to quickly and precisely change body position and direction”

Precision = movement in control

“Agility is the ability to change and control the direction and position of the body while maintaining a constant, rapid motion”

Tests for measuring agility

- Shuttle run test
- Illinois test
- Zig-zag test

Exercise for improving agility

- Ladder drills
- Cone drills

2. Balance

“Balance is the ability to maintain equilibrium while stationary or moving”

“The ability to maintain centre of mass over base of support”

“Balance is the ability to control or stabilize the body when a person is standing or sitting”

Static balance: Ability to maintain the state of equilibrium in stationary position.

Dynamic balance: ability to maintain equilibrium during motion.

Balance itself refers to your ability to adjust your body position to remain upright. It deals with the proprioception, or knowing where your body is in space and being able to make adjustment to your posture as your centre of gravity changes during movement. There are lots of activities where balance is required for enhancing performance. E.g.; gymnastics, line skating.

Tests for measuring balance:

- Flamingo balance test
- Stork- stand test
- Modified bass test for dynamic balance

Exercises for improving balance:

- Standing yoga poses
- Pilates training
- Using balance discs to perform squats.

3. Power

While strength training is the maximal force you can apply against a load, power is proportional to the speed at which you can apply the maximal force. Muscle power is one of the main fitness components, important for success in many sports. Certain sports, such as weight lifting, boxing and weight throwing, it is one of the main physical attributes. In many other sports, including football, good power is also very important as part of the overall fitness profile.

Power combines speed and strength. In essence it's how fast you can generate a maximal force.

“Power refers to an individual's ability to act fast with resistance”

“Ability to produce strength at speed”

“The ability to produce maximum force in shortest time”

Example: shot put, weightlifting, volleyball player up to the net and lifting their bodies high in to the air.

Tests for measuring power

- Standing broad jump
- Vertical jump
- 2-hop jump
- Power clean max lift test

Exercise for improving balance

- Plyometric exercises
- Kettlebell swings
- Clean and jerk lifts
- Medicine ball exercise

4.Coordination

Coordination is a complex skill that requires good level of other fitness components such as balance, strength and agility. On a sporting field, someone who appears to be well coordinated may also be displaying good timing.it is also a difficult skill to teach, rather it is something that is achieved through proper development throughout early life development.so many sports and activities requires well hand –eye (or foot-eye) coordination including badminton, basketball, football etc.

“Coordination is the ability to move two or more body parts under control, smoothly and efficiently.

“The use of the nervous and the muscular systems to produce correct, graceful and harmonious body movements”

Examples: dribbling a basketball, swinging a bat

Tests for measuring coordination

- Stick flip coordination test
- Wall-toss test
- Soda pop test
- Light board test

Exercise for improving coordination:

- Ladder training
- Steps workout
- Skipping rope/jump rope exercise

5.Reaction time

The sports man’s reaction time depends on the properties and characteristics of his nervous system, temperament, level of training, psychological state of mind. It deteriorates under the influence of fatigue, some stress genic (tension, fear, depression etc.).it also depends on the physical and technical training of a sportsman

Reaction time is an important aspect in athletic performance. Reaction time is the ability to respond quickly to a stimulus.it is important in many sports and day to day activities. Simple reaction time is the time taken between a stimulus and movement. SRT, a response to a single stimulus, is a widely used component in many sports. Simple reaction time depends on nerve

connection and signal pathways is 'hard wired' in your body composition and cannot be improved. Generally, athletes have faster SRT than non-athletes.

Another type of reaction time is choice reaction time, is the time taken between stimulus and action which requires a choice. Choice reaction time can be improved by practice and training. CRT, a reaction to multiple stimuli. Example; reacting to a starting pistol during a 100 m sprint is a simple reaction time task. One example of a choice reaction time is a soccer player who needs to react to the movement of the ball and other players on the field.

Performers receive stimuli from the eyes (position of other players, the balls etc.), the ears (calling from the players, the referees, even spectators), and kinaesthetic sense (the performers position, their options etc.) Skilled players reduce reaction time by selecting the most important information, and by anticipating other player's actions and the path of the ball quickly.

“Reaction time is an individual's ability to quickly respond to a stimulus”

“It is the ability to reach or respond quickly to what you hear, see or feel”

“It is related to mind and body connection”

Tests for measuring reaction time

- SVT reaction test
- Groningen reaction time test
- Batak reaction board test
- Ruler drop test

Exercise for improving reaction time

- Interval drills with sprints
- Juggling with ball

6.Speed

Speed is one of the main fitness components, important for success in many sports. For some athletes such as track and field sprinters, sprint swimmers, cyclist and speed skaters, speed is the most important aspects of fitness. In many other sports, including team field sports, good speed is also very important as part of the overall fitness profile.

“The ability to move quickly or cover a distance in a short period of time”

“Speed refers of an individual ability to perform the movement in the shortest possible time. It is the minimum time taken to complete the tasks”

Speed is not just how someone can run (or cycle or swim etc.), but is dependent on their acceleration (how quickly they can accelerate from a stationary position), Maximal speed of movement, and also speed maintenance. Movement speed requires good strength and power, but also too much body weight and air resistance can act to slow the person down. In addition to a high proportion of fast twitch muscle fibres, it is vital to have efficient mechanics of movement to optimize the power for the most economical movement technique.

Tests for measuring speed

60 m dash

30 m dash

Exercise for improving speed

Ladder drills

Hill sprints

Interval runs

Weight training

FIIT PRINCIPLE

Core of the physical fitness mechanics are the FIIT principles. The FIIT principles dictate how often, how hard and how long you should exercise. The FIIT principle helps to create a proper workout plan that will be more effective in reaching your fitness goals. They are sometimes referred to as an “exercise prescription”

FIIT stands for frequency, intensity, time, and type. It describes the various factors that determine what kind of impact physical activity will have on your body. These four factors do not stand alone but are closely connected and interdependent.

The FIIT principles describes how to safely apply the principles of over load and progression. Over load and progression are two basic principles.

Principle of overload

There should be greater than normal load on the body is required for training adaptation. Training load should be increased for improving the performance. The effectiveness of training diminishes if training load is static. Loading causes fatigue and when loading ends, then recovery starts. If the training load is optimal (just less than maximum which is unknown), the trainee will be more fit after recovery than before the training load was given. For continuous improvement, the training load should be increased after the adaptation of previous training load.

Principle of progression

The overload should not be increased too rapidly. Rapid increase in overload may lead to injury or muscles damage. Progression of training load helps to improve performance and prevent injuries.

A. FREQUENCY

The first thing to set up with your workout plan is frequency. Frequency refers how often you exercise. Frequency depends on a variety of factors including the type of workout you're doing, how hard you're working, your fitness level, and your exercise goals. Following any form of fitness training, the body goes through a process of rebuild and repair to replenish its energy reserves consumed by the exercise. The frequency of exercise is a fine balance between providing just enough stress for the body to adapt to and allowing enough time for healing and adaptation occur.

If you think of a calendar week as your workout period, then your frequency would be the number of times you exercise per week. in the case of strength and resistance training, for

example. It's recommended that you allow at least 48 hours for recovery between sessions. Therefore, your frequency of exercise per week will be lower.

B. INTENSITY

Intensity is probably the most important element of your workout because when you work out at a sufficient intensity, your body grows stronger and you will see changes in your weight, body fat percentage, endurance and strength.

This is an extremely important aspect of the FIIT principle and probably the hardest factor to monitor. Exercise intensity refers to how hard your body is working during physical activity. Health, fitness goals and current level of fitness, will determine ideal exercise intensity. Exercise intensity is usually measured as low, moderate, or vigorous.

Low intensity exercise: walking slowly, certain yoga asana.

Moderate intensity exercise: slow jogging, swimming, fast walking.

Vigorous intensity exercise: 100-meter sprint, plyometric exercises, circuit training, rowing.

You can measure exercise intensity using target heart rates, the talk test, Borg rating of perceived exertion (RPE).

Measuring your heart rate by taking your pulse

Taking your pulse at regular intervals lets you know whether your target heart rate (training heart rate).

Take your pulse before you warm up.

Take pulse again when you have been exercising for about 5-10 minutes.

Continue taking your pulse rate at regular intervals

The radial pulse is located on your inner wrist. To measure you should:

Put the first three fingers of one hand against the inner wrist of other hand just below the thumbs.

Lightly press your fingers into the hollow next to the tendon on the thumb-side-your artery lies just beneath the skin.

Using a watch with a second hand, count your pulse for 15 seconds. Multiply this figure by four to get your beats per minutes.

You can also take your pulse by pressing your fingers lightly against one of your carotid arteries, located on either side of your wind pipe.

C. TIME

It refers to the time you spend exercising or how long you exercising for.

The time you spend exercising is also an important part of the FIIT principle. The time dedicated to exercise usually depends on the type of exercise undertaken. The length of time you spend exercising is directly impacted by the other three components of the FIIT model. Cardio routines, are almost longer than weight lifting routines. Similarly, high-intensity

workouts should be shorter than low-intensity workouts. And lastly you can exercise more frequently by doing shorter sessions, or vice versa.

D. TYPE

It refers to the type of exercise undertaken or what kind of exercise you do.

The type of exercise you will choose will have a big effect on the results you achieve. For example, if you are looking to improve cardio-vascular fitness, then exercise like walking, jogging, swimming, aerobics, Zumba exercise and rowing are very effective. To improve muscular strength, the best exercises include the use of free weight, machine weights and body weight exercise.

APPLYING THE FIIT PRINCIPLE TO THE COMPONENTS OF FITNESS

Application of the FIIT principle to the health related components of fitness.

A. Cardiorespiratory endurance

Frequency: 3-5 days per week

Intensity: target heart rate zone (60-85% of maximum heart rate)

Time: 20-60 minutes

Type: Aerobic activities (cycling, jogging, swimming, aerobics)

B. Muscular endurance

Frequency: 2-4 days per week

Intensity: 3-5 sets of 8-15 repetition (lighter weight with more repetition) (increase/decrease resistance if necessary)

Time: 30-60 minutes

Type: weight/resistance training, resistance band training, Pilates.

C. Muscular strength

Frequency: 2-4 days per week

Intensity: 2-4 sets of 3-8 repetition (heavier weight with few repetition) (use 60%-75% of 1 repetition maximum)

Time: 20-60 minutes

Type: anaerobic activities (weight training).

D. Flexibility

Frequency: daily

Intensity: stretch muscles to a slight discomfort and hold beyond their normal length.

Time: 20-60 minutes

Type: active stretching, passive stretching, yoga, Pilates

E. Body composition

Frequency: daily

Intensity: low intensity

Time: 60 minutes

Type: be active 60 minutes a day, walking, playing, house hold chores etc.

EXERCISES FOR IMPROVING, SPEED, STRENGTH, ENDURANCE, FLEXIBILITY AND CO-ORDINATIVE AILTIES

1.SPEED

It is the or capacity of an individual to perform a movement of some pattern at faster rate.

Speed ability primarily signifies the ability to execute motor movements with high speed. Different sports skills require different type of fast movements and quick reactions. Speed mainly depends on mobility of nervous system and heredity factors especially on types of muscle fibre one has. Reaction ability, movement speed, acceleration ability, loco motor ability and speed endurance are the speed abilities.

Exercise for speed

A. Acceleration runs method

Acceleration runs are usually adopted to develop speed. In this method athlete concentrate on starting and then gaining the maximum speed as fast as possible, but he/she does not maintain the maximum speed. Athlete tries to slow down easily just after gaining maximum speed. For direct improvement of acceleration speed. A sprinter should do 25 to 30-meter sprint 8 to 12 times with the 60 to 120 seconds rest interval. Intensity of acceleration method is maximum or near maximum.

Maximum speed should be achieved within 5 to 6 seconds.

At the end of

1st second-55%

2nd second-76%

3rd second-91%

4th second-95%

5th second-99%

B. Pace runs or races method

Pace runs means running the whole distance with a constant speed. In pace races, an athlete runs the race with uniform speed. An athlete can run a distance of 100 m at full speed but in longer races such as 800 m or above, he must reserve his energy by reducing the speed. Generally, 800 meter and above races are included in pace races. For pace run training an athlete should run at maximum steady speed for a distance. The actual distance and number of repetitions for pace depend upon the activity or nature of the sport. In these races pace has to

be set with another athlete. It involves two athletes with same speed abilities. It is also an effective means for improving speed endurance. For example: in repetition of 800 meter, the pace setter stands 10-15 meter ahead of the other athlete. The pacesetter movement should be properly given otherwise it will slow down the repetition of the good athlete and will have a negative impact on speed and motor co-ordination. Therefore, the pacesetter speed should be equally good for training athlete. In pace races the speed of an athlete requires a high degree of concentration and complete attention towards the race to get best results.

C. Short and long sprints

Short sprints (generally 55 to 200 meters) helps to develop speed and power, while long sprints (200to 400 meters) helps to develop speed.

a) Short sprint exercise

Frequency: 2-3 sessions per week

Intensity: 80-85%

Repetitions: 8-10(100-meter sprint)

Recovery: 45 seconds between reps

b) Long sprint exercise

Frequency: 2-3 sessions per week

Intensity: 75% (300-meter sprint)

Repetitions: 2 series of 3 repetitions.

Recovery: 2-3 minutes between sprints and 3-5 minutes between series

D. Intensive interval exercise

This method is more suitable for the improvement of speed endurance in team games team games, combat sports and racket sports. The exercise is done at maximum or near maximum speed for a short distance or duration after which there is incomplete recovery of short duration.

Intensity: very high to maximum

Distance: 40-60 meter

Repetitions: 3-4 series of 4-5 repetition

Recovery: 20-30 sec, between repetitions, 3-5 minutes between series.

2. STRENGTH

Strength is the ability to overcome resistance.

“Strength is the capacity of the whole body or of any of its part to exert force”

Barrow and McGee

Type of strength

Static strength: It is the ability to act against resistance. It is also called isometric strength. Static strength can be measured by dynamometer.

Dynamic strength: It is the ability to overcome resistance. It is also known by the name of isotonic strength. In pull-ups and push ups we required dynamic strength.

Types of muscle contraction

There are two types of muscle contraction: isotonic and isometric. Isotonic contractions occur when muscles become shorter or longer against resistance, and tension remains the same. Isometric contractions occur when tension increases but the muscle remains at a constant length. Many strength building exercise involves concentric or eccentric movements, which are both isotonic contractions. Concentric movements cause the muscle to shorten, and eccentric movements lengthen the muscle.

Exercise for strength

A. Isometric exercise

Isometric is “iso means same” and “metric means length”

Isometric exercise are those exercises, which are not visible and that involves the contraction of muscles without any movement I the surrounding joint. Most muscle strengthening exercises involves moving the joints, using the muscles to push or pull against resistance. However, isometric exercise involving holding static position for long period of time.

Isometric exercise place tension on particular muscles without moving surrounding joints, by applying constant tension to the muscles, isometric exercise can be useful for improving strength endurance and posture by strengthening and stabilizing the muscles.

Isometric exercise does not involve the muscle shortening or lengthening. During isometric exercises, the joints are still and the muscles do not change shape or size. Some isometric exercise develop tension by holding in a certain position, while others may involve holding weights. Holding the muscle contraction allows the muscle tissue to fill with blood and create metabolic stress on the muscle.

An advantage of isometric exercise is that they are easy to perform, usually do not require any equipment and are easily incorporable in to many weight lifting exercises, These exercises are valuable for rehabilitation purposes and it can be done by a person who is injured. But performing isometric exercises with poor form can also lead to injury. For example, performing a plank without proper form can increase tension in the lower back, potentially leading to an injury.

Examples of isometric exercises: plank, wall sit, Glute Bridge, flexed arm hang, isometric squat.

B. Isotonic exercise

Isotonic movement is a type of muscle contraction. The term “isotonic “comes from ancient Greek. Isotonic is “iso means same” and “tonic “means tension.

Isotonic exercise keeps the muscles at the same tension throughout the movement. Length of muscles can be increased by isotonic exercise. Muscles become flexible. These exercise are much valuable in the field of sports and best for strength development. These exercise can be done with or without technical equipment.

Examples of isotonic exercises: pull ups, push ups, dead lift, bench press etc...

C. Isokinetic exercises

Isokinetic exercise refers to movement at a constant speed regardless of the force applied. Muscle contract and shorten at a constant speed in isokinetic contraction. Isokinetic exercise allows muscles to gain strength consistently all through the range of movement.

Isokinetic exercises are performed on specially designed machines. These exercises were developed by Perrine in 1968. Isokinetic exercises are often used for rehabilitation and recovery since it's a controlled form of exercise. Physical therapists and occupational therapists use isokinetic machine to help people recover from stroke, an injury, or a medical procedure. Isokinetic machines can also be used to treat imbalances in the body that have the potential to cause injury.

3. ENDURANCE

“Endurance is the ability to do sports movements with the desired quality and speed, under the condition of fatigue” Endurance is a very important ability in sports.

Types of endurance

Types of endurance according to the nature of activity

- Basic endurance
- General endurance
- Specific endurance

Types of endurance according to the duration of activity

- Speed endurance
- Short term endurance
- Middle tem endurance
- Long term endurance

Exercise for endurance

A. Continuous method

Continuous training is one of the best methods for improving endurance. In this method of training an exercise is performed for a long duration without any break. In this method, intensity remains low because the exercise is done for a longer period.

a) Slow continuous method

Heart rate -140 to160 BPM

Duration –not less than 30 minutes

b) Fast continuous method

Heart rate -175 to 180 BPM

Duration –not less than 20 minutes.

B. Fartlek method

Fartlek is a Swedish term which means speed play. In such type training, an athlete can adopt any pace as per his wish and ability to complete a specific distance. The main aspect of the training is that he has to cover the distance in fixed time. He can also change his speed or pace according to the various geographical surroundings like hills, rivers, forests, muddy roads and grassy grounds etc. During fartlek training the rate of heart beat should range between 140-180 BPM. It improves the efficiency of the lungs and heart for an activity for duration of not less than 15 minutes.

C. Interval training

Interval method is perhaps the most versatile method for improving endurance of various types. In interval method, the exercise is done at relatively higher intensity with intervals of incomplete recovery. Interval method is based on the following principle:

Work should be done with sufficient speed and duration so that the heart rate goes up to 180BPM. After this there should be a recovery period and when the heart rate comes down to 120-130 BPM, the work should be started again. The training load in interval training can be controlled by repeatedly checking heart rate. Duration of interval training is not less than 20 minutes.

The effect of interval training is determined by speed of work, duration of work, duration of recovery, number of repetitions and nature of recovery.

D. Variable pace method

In this method the exercise is done continuously but with changing pace or speed. The heart rate normally ranges between 140 to 180 BPM. The total duration or volume ranges from about 15 minutes to 1 hour. Because of change of speed, which is pre-planned, this method is very strenuous and can be used by trained sportsman only.

4.FLEXIBILITY

“Flexibility can be defined as the ability to execute movements with greater amplitude or range’

It is the range of movements of joints. Range of movements varies significantly from joint but depends on the structure of the surrounding tendons, ligaments and muscle tissue. Flexibility is related to genetic factors and physical activity programmes.

Type of flexibility

Passive flexibility: The ability to do movements with greater amplitude with external helps is called passive flexibility. e.g. stretching exercise with the help of a partner.

Active flexibility: The ability to movements with greater amplitude without external help is called active flexibility. E.g. stretching a joint by a sportsman himself without any external help. Active flexibility is always less than passive flexibility.

Exercise for flexibility

A. Ballistic method

In ballistic method, the movement is performed with a swing hence the name is ballistic method. In this method a joint is stretched rhythmically to its maximum range. The stretching exercise can be performed rhythmically with a count. At each count joint is stretched to the maximum limit and then it is again flexed.

B. Slow stretch and hold method

In this method the joint is slowly stretched to the maximum limit and is held there for a few seconds before returning to the original position. For best effect the joint must be held in a state of maximum stretch from 3-8 seconds. Longer duration does not increase the effects.

C. Post isometric stretch

In this method a muscle is first contracted iso-metrically for a 6-7 seconds. The isometric contraction should be maximal. After this the muscle is gradually stretched to its maximum limit and is held in this position for 8-10 seconds. This procedure is to be repeated 4-8 times for each muscle group.

5. CO-ORDINATIVE ABILITIES

Blume (1978) a sports scientist has suggested the following seven co-ordinative abilities, which affect performance in sports and games.

It is the ability to control movements of different parts of our body so that they work well together. Co-ordinative abilities are primarily depending on the motor control and regulation of central nervous system.

“The ability to carry out simple or complex movements fast and accurately during constant or changing conditions and the ability to learn new skill fast”

Farfel (1975)

“Co-ordinative ability are relatively stabilized and generalized pattern of motor control and regulation process that enables a sports person to do a group of movements with better quality and effect”

Singh (1991)

“Complex and relatively independent preconditions of movement regulations”

Hirzt

1. Differentiation ability

Ability to achieve high degree of perfection and economy of separate body movements and movement phases in a motor action.

Acquire mastery of the skill for effective application.

Depends upon functional capacity of kinesthetic sense organs.

2. Orientation ability

It is the ability to determine and change the position and movements of the body in time and space in relation to a definite field of action (e.g., playing field, boxing ring, apparatus and/or a moving object (e.g., ball, opponent, partner).

3. Coupling ability

Ability to coordinate body parts movement (e.g. movements of hand, feet, trunk etc).

Coupling ability is especially important in sports I'm which movements with a high degree of difficulty have to be done. eg gymnastics

4. Reaction ability

It is the ability to react quickly and effectively to a signal.

5. Balance ability

It is the ability to maintain balance during whole body movements and to regain balance quickly after the balance disturbing movements.

6. Rhythm ability

To observe or perceive the rhythm of a movement and to do the movement with external rhythm.

Depend upon optic, acoustic and kinesthetic sense organs.

7. Adaptation ability

It is the ability to adjust or completely change the movement programme during the movement on the basis of changes or anticipated changes in the situation.

Exercises for co-ordinative abilities

Co-ordinative abilities are determined by the controlled regulation process. The best method for effective development of these abilities practicing physical exercises. To ensure continuous improvement of co-ordinative abilities the high degree of difficulty of physical exercise should be systematically increased. There are unlimited possibilities of doing this. The important methods of increasing the degree of difficulty commonly used in sports are described below in brief.

A. Variation in movement execution

The variation in movement execution can be achieved by bringing some change in the phases of movement or changing the complete movement to some extent.

Practice with opposite side, hand, foot – Coupling ability

Movement execution with changed rhythm – Rhythm ability

Change in starting or end position – Adaptation ability.

Increasing /decreasing range of movement of one or more body part – Differentiation ability

B. Variation in external condition

Here the possibilities are practically unlimited.

Change in the surface – Adaptation ability

Change in height, weight, size, shape pressure of equipment – Differentiation ability

Change of partner - Adaptation ability

Change in area of supporting surface - Balance

C. Combination of movements

Combination of two or movements is very frequently used to increase the difficulty of co-ordination.

Running and throwing – Coupling ability

Catching and throwing – Coupling ability

Dribbling while pulling the opponent – Coupling ability and adaptation ability

Dribbling with to balls – Coupling ability

D. Change in information uptake

The sportsman receives information about the movement from his different motor sense organs. If these piece of information from the important sense organ /organs are reduced, changed or completely stopped then the degree of difficulty increases manifold. The possibility of using this method in sports training is however, limited.

Practice in front of mirror – Adaptation ability

Dribbling with eyes closed – Differentiation and orientation ability

Catching/receiving without looking – Orientation ability

E. Practice against time

For effective use of this method the sports person should use only those exercises the techniques of which he has already mastery. For effective use of this method the exercises should be done against time. The decrease in the duration to complete the exercise indicate an improvement in coordination.

Reaction exercises – Reaction ability

E.g. Ball or balloon exercise

Agility runs – Complex effect

Exercise on balance beam against time – Balance ability

F. practice under fatigue

In this method exercises should be done after some sort of strenuous exercise.

Balance exercise after several spins – Balance

High accuracy exercise after strength exercise – Differentiation

Any coordinative exercise after hard training – Depends on the nature of exercise

HYPOKINETIC DISEASES

Hypokinetic diseases are also called life style diseases. This are defined as lazy men's diseases linked with the way of people live their life. This is commonly caused by lack of physical activity, unhealthy eating etc. Even though life style diseases are dangerous, they are preventable in nature and can be lowered with alterations in diet and life styles.

MEANING OF HYPOKINETIC DISEASES

Hypokinetic diseases a disease brought on by insufficient movement and exercise.

Hypo means 'under' and the kinetic means 'motion'. These are the diseases caused by the lack of movements.

A. DIABETES MELLITUS

Diabetes is also called diabetes mellitus is a chronic metabolic disease that result in high blood sugar (glucose). our body has a hormone called insulin that lowers the blood sugar level. Diabetes is a condition that results from lack of the hormone insulin in a person blood or when the body has a problem using the insulin it produces (insulin sensitivity).

Type 1 diabetes, an autoimmune disease where the cells of the pancreas destroyed, resulting decreased or no production of insulin, this is one of the most common type of diabetes in people under age 30 but could happen in any age.

Symptoms of type 1 diabetes

- Frequent hunger
- Growing thirst
- Blurry vision
- Tiredness
- Mood changes

Type 2 diabetes in which the body becomes resistant to the action of insulin leading to increased blood sugar levels.in this condition, the pancreas does make insulin but either in adequate amount or the inulin doesn't work effectively. It takes place in much older adults, someone over the age of 40 but it can also occur even in childhood. Type 2 diabetes can be controlled with some life style adjustment like a healthy diet, exercise and weight management.

Symptoms of type 2 diabetes

- Increased hunger
- Frequent urge to urinate
- Tiredness
- Fatigue.
- Sores that take too long to heal.

Causes of diabetes mellitus

Obesity or being overweight	Environmental factors
Smoking	Increase of LDL level
High blood pressure	Intake of medication like, IGF
Family history	Injury
Age	Lack of physical exercise

Sedentary life style	Consumption of alcohol
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Health risks of diabetes

Cardiovascular diseases	Hearing impairment
Nerve damage(neuropathy)	Stroke , heart attack
Kidney damage(nephropathy)	High blood pressure
Eye damage(retinopathy)	Depression
Alzheimer's disease	Dementia

Management of diabetes

Diabetes can't be completely eradicated once it has occurred. However, it can be treated and controlled with beneficial steps taken to prevent it. Here are some life style changes recommended by doctors to manage diabetes;

- Try to maintain your blood glucose level normal, if possible. you can manage it through a balanced diet along with medication and activity.
- Balance your blood pressure, keep it under perfect control.it should never reach beyond the limit of 140/90.
- Maintain normal levels of blood cholesterol and triglycerides(lipids)
- Don't increase your weight, though it can be tough due to frequent hunger caused by diabetes .so to maintain a normal weight. It's recommended to exercise regularly.
- Constantly check your blood glucose and BP levels at home, rather than doctor monthly checkups.it helps to take immediate action.
- Plan what and how much you want to eat t each interval. Following a balanced diet and meal plan is must.
- Don't forget to maintain routine appointments with your health care provider and visit for regular lab tests as prescribed by your doctor.

Exercise and blood sugar level

Exercise has so many benefits, but the most critical one is that it makes it easier to control your blood sugar level. The effect of physical activity has on your blood sugar will vary depending on how long you are active and many other factors, physical activity can lower your blood sugar up to 24 hours or more after your workout by making your body more sensitive to insulin.

There are a few ways that exercise lowers blood sugar'

Insulin sensitivity is increased, so your muscle cells are better able to use any available insulin to take up glucose during and after activity.

When your muscles contract during activity, your cells are able to take up glucose and use it for energy whether insulin is available or not.

B. OBESITY

Obesity is a major public health problem nearly 1 billion individuals worldwide are obese and the numbers are on the rise. Obesity is the term applied to individuals with a high percentage of body fat, generally over 25% of fat for men and above 32%for women. Obesity

is major health problem. Obesity is the main cause for various short term and long term diseases in human life. Obesity increases the risk for at least twenty-six diseases.

Obesity may be defined as an abnormal growth of the adipose tissue (tissue under the skin and around the organs) due to an enlargement of fat cell size (hypertrophic obesity) or an increase in fat cells number (hyperplastic obesity) or a combination of both. Fat is accumulated on a particular part of a body or internal organ.

Causes of obesity

Physical inactivity	Genes and family history
Age and sex	Body type
Diet and nutrition	Health condition
Sedentary life style	Diseases
Use of drugs	Smoking
Cultural habits	Emotional factors

Health risks of obesity

High blood pressure	Ulcers
Diabetes	Back pain
Heart diseases	Gallbladder diseases
High LDL level	Stroke
Cancer	Asthma
Infertility	Bone and joints problem

Management of obesity

Common treatments for obesity include losing unnecessary fat through healthy eating, more physically active and other changes to usual habits. Some people who have unable to lose enough weight and fat to improve their health. In such cases, a doctor may consider adding other treatments, including weight loss medicine, weight loss devices or bariatric surgery.

Role of exercise

People who are overweight or have obesity should also start regular physical activity when they begin their healthy eating plan. Exercise which develops cardio-respiratory endurance such as running, swimming, Zumba exercise, aerobics, cycling and which builds the muscle or which can prevent the loss of muscles such as weight training exercises will be helpful to resist obesity.

Regular physical exercise increases the total energy expenditure in the body. It helps to burn excess fat and thus we can avoid or reduce obesity. Burning extra fat on a regular basis is healthy for our body and causes no side effects on the body.

Regular cardio respiratory exercise training such as swimming, running, cycling, walking will result in an improved ability of skeletal muscles to burn the fat as energy.it helps to burn body fat.

Increased muscle mass due to the weight training schedule will raise the basal metabolic rate of the body which mean more calories is spend and contribute to lose fat.

Role of Diet

Age, gender, body size and level of physical activity dictate how many calories you need to lose weight or to stay at healthy weight.

The ideal diet for prevention of obesity should be:

- Enjoy your food and eat less.
- Low in calories but provide all essential nutrients, avoid high calorie, low nutrient foods such as those high in sugar (ice creams, cookies etc.) instead select low calorie nutrient dense food such as fruits, vegetables, whole grain bread.
- Low in fat (less than 30% of total calories) and high in complex carbohydrate (about 60% of total calories). A diet low in fat is helpful to create fat deficit in body that means daily fat intake is less than the daily fat metabolism.
- Select food that are compatible with your life style and should be obtained easily.
- Make half of your plate fruits and vegetables. Drink water instead of sugary drinks.
- Includes lean meats, poultry fish, beans, eggs and nuts

Weight loss devices

Electrical stimulation system

Gastric balloon system

Gastric emptying system

Weight loss medicines

Stimulants (caffeine, ephedrine)

Bariatric surgery

Bariatric surgery includes several types of operations that help you lose weight by making changes to your digestive system. Bariatric surgery also may be an option at lower levels of obesity if you have serious health problems such as type 2 diabetes, sleep apnea related to obesity.

C. HYPERTENSION

Hypertension or high blood pressure: occurs when your blood pressure increases to unhealthy level.

Types of hypertension

1. Primary hypertension

Primary hypertension is also called essential hypertension. This kind of hypertension develops over time with no identifiable cause. Most people have this type of high blood pressure.

2. Secondary hypertension

Secondary hypertension often occurs quickly and can become severe than primary hypertension.

Causes of hypertension

Kidney diseases	Obesity
Diabetes	Smoking and consumption of alcohol
Intake of too much salt	Mental stress and depression
Hormone problems	Lack of physical activity
Scleroderma	Heart problems
Use of drugs	Adrenal gland problems

Symptoms of hypertension

Head aches	flushing
Nose bleeds	Blood in the urine
Chest pain	Dizziness
Shortens of breath	Visual changes

Health risks of hypertension

Heart diseases	Peripheral arterial diseases
Heart attacks	Aortic aneurysms
Strokes	Kidney diseases
Heart failure	Vascular dementia

Management of hypertension

a) Regular physical activity

Regular physical activity makes your heart stronger. A stronger heart can pump more blood with less effort, as a result, the force on your arteries decreases, lowering your blood pressure. Regular exercise also helps you maintain a healthy weight and helps to control cholesterol level.

Aim to get 150 minutes of moderate physical activity each week. That's about 30 minutes five times per week. Cardiovascular or aerobic exercise can help to reduce blood pressure and make your heart stronger.

b) Developing a healthy diet

A healthy diet is vital for helping to reduce high blood pressure. It's also important for managing hypertension that is under control and reducing the risk of complications. These complications include heart diseases, stroke and heart attack.

c) A heart-healthy diet emphasizes foods that include;

Fruits, vegetables, whole grains. lean protein like fish

d) Reaching healthy weight

If you are obese, losing unnecessary fat through a heart-healthy diet and increased physical activity can help lower your blood pressure.

e) Reduce sodium in your diet

Even a small reduction in the sodium in your diet can improve your heart health and reduce blood pressure by about 5 to 6 mm Hg if you have high blood pressure. In general, limit sodium to 2300 milligrams a day or less. However, a lower sodium intake-1500 mg a day or less –is ideal for most adults.

f) Limit the amount of alcohol you drink

Drinking more than moderate amounts of alcohol can actually raise blood pressure by several points. It can also reduce the effectiveness of blood pressure medications

g) Quit smoking

Each cigarette you smoke increases your blood pressure for many minutes after you finish. The chemicals in tobacco smoke damage the body's tissues and harden blood vessels.

h) Cut back on caffeine

Regular intake of large quantity caffeine increases blood pressure. Caffeine is a stimulant; it increases heart rate.

i) Reduce your stress

Chronic stress may contribute to high blood pressure. Exercise is a great way to manage stress. Other activities can also be helpful. These include;

Meditation, deep breathing, massage, muscle relaxation, yoga

D. CORONARY ARTER DISEASES/CORONARY HEART DISEASES

Heart muscle is responsible for pumping blood throughout your body. Like any other organ or muscle, your heart must receive an adequate, dependable supply of blood in order to carry out its work. Right main coronary artery, left main coronary artery, left circumflex artery and left anterior descending artery. These arteries bring oxygen and nutrient-rich blood to your heart.

Coronary artery diseases are a disease in which a waxy substance called plaque builds up inside the coronary arteries. These arteries supply oxygen rich blood to your heart muscles. These arteries supply oxygen rich blood to your heart muscle. When plaque builds up in the arteries, the condition is called atherosclerosis. The build-up of plaque occurs over many years. Overtime plaque can harden or rupture. Hardened plaque narrows the coronary artery and reduces the flow of oxygen rich blood to the heart. If the plaque ruptures. A blood clot can form on its surface. A large blood clot can mostly or completely block blood flow through a coronary artery. Over time ruptured plaque also hardens and narrows the coronary arteries.

If the flow of oxygen rich blood to your heart muscle is reduced or blocked, angina or heart attack can occur.

Angina-Angina is a chest pain or discomfort. It may feel like pressure or squeezing in your heart. The pain also can occur in your shoulders, arms, neck, jaws or back.

Heart attack – heart attack occurs if the flow of oxygen rich blood to a section of heart muscle is cut off. If blood flow isn't restored quickly, the section of heart muscles begins to die. Without quick treatment, a heart attack can lead to serious health problems or death.

Symptoms of coronary artery diseases

Chest pain	Pain in the arms or shoulders/jaw pain (women)
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Difficulty in breathing/shortness of breath without chest pain (women)	Sweating
Heaviness	Dizziness/nausea
Squeezing	Vomiting

Overtime CAD can weaken the heart muscle and lead to heart failure and arrhythmia, heart failure, sudden cardiac arrest, stroke, ischemic heart diseases and sudden death.

Heart failure: your heart is unable to pump enough blood to the rest of your body.

Arrhythmia: your heart beats abnormally.

Sudden cardiac arrest: your heart suddenly stops working, you stop breathing, and you lose consciousness.

Ischemic heart diseases: your heart does not get enough oxygen.

Causes of heart attack

High blood pressure	High blood cholesterol level
Diabetes mellitus	Lack of physical activity
Unhealthy eating habits	Use of drugs
Over weight/obesity	Use of alcohol/smoking
Psychological problems	Genetic factors
Sedentary life style	Menopause
Obstructive sleep apnea	Age /sex

Management of coronary artery diseases

- Regular physical activity
- Avoid alcohol consumption
- Lower blood pressure if elevated
- Decrease body fat if overweight or obese
- Reduce sugar consumption
- Decrease psychological stress
- Medical treatment drugs {e.g.; cholesterol lowering medications, beta blockers etc.}
- Angioplasty

Diagnosis

- Electrocardiogram (ECG)
- Echocardiogram
- Nuclear stress test
- Cardiac CT scan

EXERCISE PRESCRIPTION

1. DIABETES MELLITUS

Aerobic activity

Frequency – 5 to 7 days

Time – 30 minutes extended (gradually) to 60 minutes

Intensity – 60 to 70% (of MHR)

Type – walking, jogging etc.

Exercise session must involve most major muscles in both lower and upper part of the body

Resistance Exercise

Frequency – 2 days / week

Intensity – moderate (40 to 60% of 1RM)

Repetition – 15 to 20 reps for each major muscle group

Exercise session should include 5-10 minutes of warm up and a 5 minutes of cool down.

Diabetes can be prevented as well as cured if the following asanas are performed regularly

- Bhujangasana
- Paschimottansana
- Pavanamukhthasana
- Ardha mathseyndrasana

2.HYPERTENSION

Aerobic activity

Frequency - on most, preferably all days of week.

Intensity – 55 to 80% of MHR or 40 – 70 % of HRR

Time – 30 to 60 minutes.

Type – walking, jogging etc.

Resistance exercise

Frequency – 2 to 3 days/week

Intensity – 60 to 80% of 1RM

Repetition – 8 to 12 repetition

Type – machine or free weight resistance exercises, 8 to 10 exercises for major muscles.

Exercise session should include 5-10 minutes of warm up and a 5 minutes of cool down.

Hypertension can be prevented as well as cured if the following asanas are practiced regularly

- Tadasana
- Vajrasana
- Pavanamukhthasana
- Ardha chakrasana
- Bhujangasana
- Savasana

3.OBESITY

Aerobic exercise

Frequency – 4 to 5 days/week

Intensity – moderate to vigorous

Time – 45 to 60 minutes

Type – walking, jogging etc.

Exercise session should include 5-10 minutes of warm up and a 5 minutes of cool down.

Diabetes can be prevented as well as cured if the following asanas are performed regularly

- Bhujangasana
- Paschimottanasana
- Pavanamukthasana
- Ardha mathseynndrasana

4.CORONARY HEART DISEASES

Aerobic exercise

Frequency – 3 days/week

Duration – 20 to 60 minutes

Intensity – 70 to 85% of HRR

Type – walking, slow jogging etc.

Resistance exercise

Frequency – 2 to 5days /week

Intensity - 30 to 40% of the 1RM (for upper body), 40 to 50% of the 1RM (for lower body).

Repetition – 12 to 15 Repetition in 1 sets.

Coronary heart diseases can be prevented as well as cured if the following asanas are practiced regularly

- Virabhadrasana
- Bhujangasana
- Sethubandasana
- Dhanurasana
- Uttanasana

Model questions

1.What do you mean by physical fitness?

2.What is health related fitness?

3.What are the components of performance related fitness?

4.What do you mean by hypokinetic diseases?

5.What is obesity?

6.What is diabetes mellitus?

7.What is coordination?

8.What is flexibility?

Short answer type questions

1.Explain hypertension and diabetes.

2.Write a brief note on health related and performance related physical fitness components.

3.Explain management of obesity and coronary heart disease.

Long answer type questions

1.List few hypokinetic diseases. How could they be prevented and managed?

2.Explain health related fitness and performance related fitness?

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