8 Physiology & Sports

Chapter at a Glance

8.1 Gender Differences in Physical and Physiological Parameters
8.2 Physiological Factors Determining Components of the Physical Fitness
8.3 Effects of Exercise on Cardiovascular System
8.4 Effects of Exercise on Respiratory System
8.5 Effects of Exercise on Muscular System
8.6 Physiological Changes Due to Aging
8.7 Role of Physical Activity Maintaining Functional Fitness in Aged Population

INTRODUCTION

Physiology is the branch of science which deals with the functioning of the organs, their relationships with other organs and their effects. Physiology is a scientific study of the normal functions of living organisms. Its aspects in physical education are related to the working of body systems. Exercise has a great effect on all these systems. Physiology of exercise and physical education integrates the basic concepts and relevant scientific informations to provide the foundations for understanding the role of exercise in changing, modifying and improving the function of human body. All organs and systems work together in a close coordinated manner to make the body work efficiently. Basically, we can say if human body is a machine, food is fuel then physical activity is the oil used in a machine to make it work smoothly.

8.1 GENDER DIFFERENCES IN PHYSICAL AND PHYSIOLOGICAL PARAMETERS

Gender differences in lifestyle, daily environment, and health care can all make significant contributions to physical and mental health. These differences are present in all societies but play a particularly substantial role in certain cultures in developing nations.

Gender Differences in Physical Parameters

There are several obvious differences between men and women, including the following:

1. An average man is taller and heavier than an average woman.
2. Men have more bodily hair than women do, especially on the chest and extremities.
3. Women are more sensitive to sound than men.
4. Men are approximately over 30% stronger than women, especially in the upper body. Although many feminists cannot face this fact, females simply do not have the strength or endurance necessary to be.

5. On average, girls begin puberty changing approximately two years before boys.
6. Men have larger hearts and lungs, and their higher levels of testosterone cause them to produce greater amounts of red blood cells.
7. Female fertility decreases after age 35, ending with menopause, but men are capable of making children even when very old.
8. Men's skin has more collagen and sebum, which makes it thicker and oilier than women's skin.
9. Women generally have a greater body fat percentage than men.
10. Men and women have different levels of certain hormones; for example, men have a higher concentration of androgens such as testosterone, while women have a higher concentration of estrogens.
11. An average male brain has approximately 4% more cells and 100 grams more brain tissue than an average female brain. This is not connected with intelligence. However, both sexes have similar brain weight to body weight ratios.
12. In men, the second digit is often shorter than the fourth digit, while in females the second tends to be longer than the fourth.
13. Men have better distance vision and depth perception, and usually better vision in lighted environments. Women have better night vision, see better at the red end of the light spectrum, and have better visual memory.
14. Females have two X-chromosomes, whereas males have a Y-chromosome but only one X-chromosome. There are genes on the Y-chromosome that have no counterpart on X-chromosomes, and, conversely, genes located on the X-chromosome can, in some cases, be expressed at higher levels in females than in males.
15. In women, there are the additional variables of the menstrual cycle, pregnancy, and menopause.

Gender Differences in Physiological Parameters

There are several differences between men and women, including the following:

1. **Cardiovascular Fitness:** Athletes' cardiovascular fitness is measured by their maximum oxygen consumption, which measures their capacity to transport and use oxygen during exercise. Male athletes have a higher oxygen carrying capacity than women, which allows them to reach their maximum training peak earlier. This is probably due to women's lower hemoglobin levels and men's larger body size. Maximum oxygen consumption is directly related to body size.
2. **Bones and Ligaments:** Male athletes have longer and larger bones, which provide a clear mechanical advantage over female athletes. The ligaments of female athletes are generally more lax and fragile than those of their male counterparts. This gives male athletes an advantage in sports that involve throwing, kicking and hitting, and explains the higher incidence of musculoskeletal injuries among female athletes. On the other hand, female athletes have a wider pelvis and a lower centre of gravity, which provides excellent balance.
3. **Strength:** Male athletes have a higher ratio of muscle mass to body weight, which allows for greater speed and acceleration. This explains why female speed records in running and swimming are consistently 10 per cent slower than men's, and why, on average, they have two-thirds of the strength of men.
4. **Endurance:** Endurance is largely determined by a body's efficiency when converting calories into energy. Female athletes are more efficient than male athletes at converting glycogen to energy. This is why female athletes excel in ultra-long-distance sports and rarely hit the wall during long races. It also explains why ultra-running, which includes races longer than a marathon, is one of the few sports where elite female and male athletes regularly compete together, and in which female athletes sometimes win.

8.2 PHYSIOLOGICAL FACTORS DETERMINING COMPONENTS OF THE PHYSICAL FITNESS

Physiology fitness is the ability to carry out tasks without undue fatigue. Physical fitness is considered as a measure of the body's ability to perform the tasks effectively and efficiently. Physical fitness can be determined by strength, speed, endurance and flexibility and therefore considered as the component of physical fitness.

Let's discuss about the physiological factors determining the components of physical fitness.

A. Physiological Factors Determining Strength:

1. **Size of the Muscles:** The strength of the muscles largely depends upon the size of the muscles. It is well-known fact that bigger and larger muscles can produce more force. With the help of different method of strength training such weight-training the size of the muscles can be increased and as a result of that strength is improved. So, the strength is determined by the size of the muscles.
2. **Body Weight:** It is also a well-known fact that the individuals who are heavier are stronger than the individuals who are lighter. There is a positive correlation between the weight of body and strength among international weightlifters. The heavier weightlifiters lift the heavier weight. So, body weight also determines the strength of an individual.
3. **Muscles Composition:** Each muscles consists of basically two types of muscles fibres *i.e.* fast twitch fibres (white fibres) and slow-twitch fibres (red fibres). The fast twitch fibres are capable to contract faster and therefore, they can produce more force. On the contrary, the slow twitch fibres are not capable to contract faster but they are capable to contract for a longer duration. The muscles which have more percentage of fast twitch fibres can produce more strength.
4. **Intensity of Nerve Impulse:** A muscle is composed of a number of motor units. The total force of the muscles depends on the number of contracting motor units. Whenever, a stronger nerve impulse from CNS excites more number of motor units, the muscle will contract more strongly or it can be said that the muscles will produce more force of strength. So the intensity of the nerve impulse also determines the amount of strength.

B. Physiological Factors Determining Speed:

1. **Mobility of the Nervous System:** Our muscles contract and relax at maximum possible speed such as in sprinting events. The rapid contraction and relaxation of muscles is made possible by rapid excitation of the concerned motor centres. This is called the mobility of the nervous system. The nervous system can maintain this rapid excitation and inhibition only for a few seconds after which the excitation spreads to the neighboring centres causing tension in the entire body. This results in decrease in speed. The mobility of the nervous system can be trained but only to a very limited extent. In fact, speed is determined to a great extent by genetic factors.
2. **Muscle Composition:** The muscles which have more percentage of fast twitch fibres contract with more speed in comparison to the muscles which have lower percentage of fast twitch fibres. In fact, the muscles composition is genetically determined and cannot be changed by training. Different muscles of the body have different percentage of fast twitch fibres. So, different parts of body have different speed performances.
3. **Explosive Strength:** For every quick and explosive movement, explosive strength is indispensible. It depends on muscles composition, size, coordination and metabolic process. Except muscles composition, the remaining factors can be improved through training which ultimately improve the speed up to limited extent.
4. **Flexibility:** Up to some extent, flexibility also determines the speed. In fact, good flexibility allows maximum range of movement without much internal resistance. Flexibility also enables complete utilization of explosive strength.

5. **Bio-chemical Reserve and Metabolic Power:** For maximum speed performance the muscles require more amount of energy at a very high rate of consumption. For this purpose, the phosphogen {Adenosine Triphosphate (ATP) and Creation Phosphate (CP)} stores in the muscles should be enough. If ATP and CP store is less in contracting muscles, the muscle contractions due to insufficient energy supply, become slow after a short time. The energy supply also depends on certain enzymes which increase the metabolic power. The amount of ATP, CP and rate of energy supply also depends on certain enzymes which increase metabolic power. The amount of ATP, CP and rate of energy supply can be enhanced by training. Therefore, it can be said that the bio-chemical reserves and metabolic power determine the speed.

C. Physiological Factors Determining Endurance:

1. **Aerobic Capacity:** To perform an activity continuously, energy is required by the muscles which can be supplied in the presence of oxygen. Therefore, the ability of the organism to maintain the adequate supply of oxygen to the working muscles (i.e. aerobic capacity) for energy liberation is important for endurance performance. The aerobic capacity depends on the following factors:
   (a) **Oxygen Intake:** It is the amount of oxygen which can be taken by the lungs from atmosphere. The oxygen intake depends on the vital capacity which further depends on the lung size, number of active alveoli, strength of the respiratory muscles and size of the chest cavity, etc.
   (b) **Oxygen Transport:** The amount of oxygen taken into the blood from lungs has to be transported to the working ability of the circulatory system to carry this quickly to the working muscles. The transportation of oxygenated blood depends on the capacity of the heart. This capacity can be enhanced through training.
   (c) **Oxygen Uptake :** The amount of oxygen which can be absorbed and consumed by the working muscles from the blood is called oxygen uptake. The oxygen uptake depends on the rate of diffusion which is further determined by the speed of blood flow, temperature and partial pressure of oxygen in the blood and of carbon dioxide in the muscles cell. The speed and amount of oxygen consumption also depends on the number, size and metabolic capacity of the mitochondria and fortunately these can be improved up to some extent through training.
   (d) **Energy Reserves:** The aerobic capacity also depends upon the availability of fuel to the muscles for getting energy for the activity. Therefore, the aerobic capacity depends upon the muscles glycogen and sugar level in the blood. If the muscle glycogen level falls below a certain level, the fatigue occurs for long duration activities, the muscle and liver glycogen reserves are important.
2. **Lactic Acid Tolerance:** The ability to tolerate the higher concentration of lactic acid is a significant factor in determining anaerobic capacity. The lactic acid tolerance is important for activities. It can be improved through training. It can help in improving endurance performance.
3. **Movement Economy:** The economical movements are significant for endurance performance. Correct movement is a good technique in endurance sports so, we can save energy.
4. **Muscle Composition:** There are two basic muscle fibres slow and fast. The slow twitch fibres are best used for aerobic or endurance activities. They produce small levels of force for long periods of time and that is why, they are better suited for endurance activities. The percentage of these fibres are regulated genetically.

D. Physiological Factors Determining Flexibility

The range of movement possible at joint *i.e.* flexibility depends upon a number of factors. There are some of the factors which are not trainable but some factors are trainable up to some extent. The various factors which determine the flexibility are described below:

1. **Muscle Strength:** The muscles should have a maximum level to strength to make the movement possible especially against gravity or external forces. Weak muscles can becomes a limiting factor

for achieving the higher range of movement. Muscles strength is high trainable, therefore, it can enhance the flexibility.

2. **Joint Structure :** There are several different types of joints in human body. Some of the joints intrinsically have a greater range of motion than others. For example, the ball and socket joint of the shoulder has the greatest range of motion in comparison to knee joint.
3. **Age and Gender:** It is a well-known fact that flexibility decreases with the advancement of age. However, it is trainable. It can be enhanced with the help of training as strength and endurance are enhanced. Gender also determines the flexibility. Females tend to be more flexible than males.
4. **Stretchability of Muscles:** The stretchability of the muscles is also a factor in limiting the range of movement. For making any movement at joint the muscles must contract to execute the movement. If muscles are not regularly stretched, they tends to get shorter and finally lead to restrict the range of movement possible at a joint. The stretchability of muscles is trainable up to some extent. Therefore, it can be said that stretchability of muscles can determine the flexibility up to some extent.
5. **Internal Environment:** Internal enbvironment of the athlete influences the flexibility for example, 10 minutes of a warm bath increases body temperature and flexibility whereas, 10 minutes stay outside in 10°C reduces body temperature and flexibility.
6. **Previous Injury:** Injuries to connective tissues and muscles can lead to thickening or fibrosing on the affected area. Fibrous tissues are less elastic and can lead to limb shortening and ultimately lead to reduced flexibility.

8.3 EFFECTS OF EXERCISE ON CARDIOVASCULAR SYSTEM

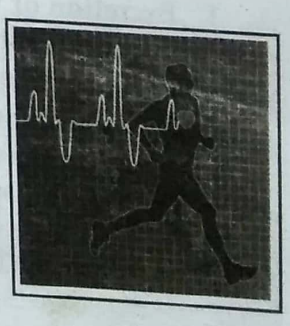
During exercise, the cardiovascular system is called upon to meet the increased needs of the body in many ways. The **cardiovascular system** rushes oxygen to hardworking muscles, returns used blood to the lungs to be re-oxygenated, and delivers fuel to the active tissues of the body.

The cardiovascular system undergoes drastic changes during and immediately after intense exercise. Even more importantly, the cardiovascular system makes long-term and beneficial adaptations to the demands of a regular exercise regimen.

Effects of Exercise on the Cardiovascular System

There are many short and long-term effects of exercises on the cardiovascular system. These are:

Short-term Effects



1. **Increase in the heart rate:** The heart rate will begin to rise before one even starts to exercise. Our brain realises we are going to work out and releases adrenaline to speed up our heart in preparation for the upcoming exertion. This is called "the anticipatory response." Heart rate will continue to rise in direct proportion to the intensity of exercise until maximum heart rate is achieved.
2. **Increase in stroke volume:** The amount of blood pumped out of the left ventricle by each beat increases by up to 80-millilitres per beat.
3. **Increase in cardiac output:** The volume of blood the heart pumps in a period of one minute, *i.e.* cardiac output increases from the typical 5 litres per minute, upto 40 litres per minute, during strenuous exercise.
4. **Changes in blood flow:** At rest, the muscles require only about 15 to 20 per cent of the total amount of blood circulating through the body. During exercise the hardworking muscles demand more oxygen from the cardiovascular system, upto 80 percent. In response, blood is shunted away from the digestive organs, kidney and liver and redirected to the skeletal muscles. Blood flow to the

skin also increases. The blood vessels serving the skin dilate to allow more blood to the surface of the body. This helps cool the body down during exercise.

5. **Decrease in blood pH:** The pH scale is a measurement of the concentration of hydrogen ions within a substance. It ranges from 0 to 14 with 7 as neutral, 0 to 7 as acidic and 7 to 14 as basic. The normal pH or our body is 7.4. When we exercise, we have experienced a drop in body's pH level whether we realise or not. This happens due to production of lactic acid and increase in carbon dioxide level.

Long-term Effects

1. **Decrease in resting heart rate:** Because of regular exercise, it has been noted that an individual may have the heart beat 70-72 beats per minute while highly. The heart eventually becomes more efficient, and no longer needs to beat as quickly to supply the body with blood while at rest. Conditioned athlete can have the heart rate of 35-40 beats per minute.
2. **Stroke volume increases at rest:** Stoke volume is the volume of blood pumped per beat. Resting heart-rate is able to slow down because the heart is now trained to pump a larger quantity of blood with every beat.
3. **Improved circulation:** In response to the need to supply the muscles with more oxygen during exercise, the body increases its number of capillaries (the smallest blood vessels in the body). Existing capillaries also open wider, to improve circulation.
4. **Decrease in blood pressure:** Blood pressure decreases by up to 10 mmHg. An mmHg is a unit used for measuring pressure levels.
5. **Blood volume increases:** The body produces a greater number of red blood cells in order to keep the muscles supplied with oxygen during heavy exercise.

Significance

The cardiovascular system reaps a myriad of benefits from regular exercise helping one to live a healthy life. Any form of aerobic exercise, from swimming and running to dancing or skateboarding, can help strengthen the cardiovascular system.

8.4 EFFECTS OF EXERCISE ON RESPIRATORY SYSTEM

Exercise has a special effect on respiratory system. Exercise increases the speed of respiration because more oxygen is used by muscles. The effects of exercise on the respiration system are as follows:

1. **Excretion of Waste Products:** Movement takes place in the body by doing exercise which causes quick excretion of poisonous products from the body in the form of sweat and urine. This keeps the body disease-free.
2. **Prevention of Diseases:** Exercise provides more flexibility to lungs. Thus, we are saved from being attacked by many diseases. By doing exercise, the speed of inhaling and exhaling of breath increases in our lungs. So, the dirty air and germs inhaled by breath do not stop in the small bags in lungs. As a result person can be saved from many types of diseases.

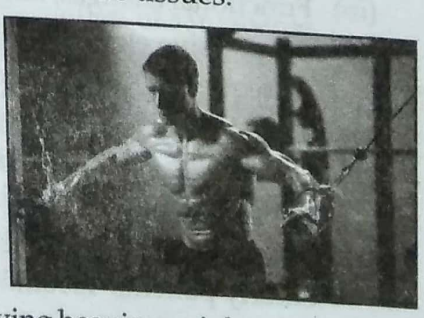
3. **Increase in the Supply of Blood:** More blood gets purified by doing exercise. As a result of this the supply of pure blood increases in the various cells of body by the respiration. Exercise also opens the blockage of nerves which normally remain closed.
4. **Increase in the Working Capacity:** Exercise increases the excretion of waste material from the body which increases the working capacity of body.

5. **Increase in Vital Capacity:** Vital capacity is the greatest volume of air that can be expelled from the longs after taking the deepest possible breath. By doing heavy work through exercise the vital capacity of the body of a person increases. His chest develops with this. This development is although different in different persons. Regular exercising can sustain this development.
6. **Increase in Lung Capacity:** Regular exercise increases the lung capacity of a person. It helps in doing heavy work.
7. **Increase in the Resistance Power of the Body:** Exercise increases the resistance power of the body. By increasing the volume of lungs, the chest skeleton also develops systematically. It improves the respiratory system and hence the resistance power of the body increases.
8. **Increase in the Number of Alveoli:** Regular exercise increases the number of alveoli and thus more blood is purified and the efficiency of the respiratory system improves.
9. **Effects on the Factors of Respiratory Process:** The function of the respiratory system depends upon the factors like composition of blood and its circulation, the alkaline reserves of the body, the size of chest cavity, muscles of chest, the acidity of blood, etc. Regular exercise has a favourable effect on all these factors.
10. **Increase in the Blood Circulation of the Lungs:** By doing exercise the exchange of air in the lungs becomes fast and complete. Due to these fast activities not only the blood gets more quantity of oxygen but also the blood circulation of lungs increases.
11. **Increase in the Endurance of an Individual:** Regular exercise needs a lot of endurance constantly so that he can continue this process for a long time. For example, 3000 m, 5000 m or 10,000 m cross country races, etc. increase the endurance of a person. The persons who do not exercise have very less endurance.
12. **Increase in Tidal Air Capacity:** Regular exercise increases the tidal air capacity, *i.e.* the amount of air that can be breathed in and breathed out.
13. **Increase the Power of Diaphragm and Muscles:** Regular exercise increases the power of diaphragm and muscles of chest. Thus, the efficiency of respiratory system improves.

8.5 EFFECTS OF EXERCISE ON MUSCULAR SYSTEM

Exercise can improve the muscular system by enhancing the physical abilities. Exercise improves the muscular system by enhancing the way muscles work with other body systems, such as cardiovascular and neurological systems. It can also improve the appearance by toning muscles and altering body composition. Following are the effects of exercise on the muscular system:

1. **Blood and Oxygen:** Exercising improves muscular system with repetitive muscle contractions, such as flexing legs while walking on the treadmill or flexing arms while lifting weights. The blood and oxygen flowing into the muscles increases and decreases each time the muscles relax and contract, respectively, during exercise. Exercise improves your muscular system by improving circulation, which enhances energy and capacity for removing waste from your muscle tissues.
2. **Endurance:** Exercise, particularly high-repetition weightlifting, can increase this muscular endurance. Greater muscular endurance can improve quality of life. For example, core muscle endurance helps you maintain a healthy posture, which optimises the flow of nutrients throughout the body.



3. **Strength:** Exercise can improve muscular system by increasing muscle strength. Resistance exercise, such as weightlifting, is the ideal form of exercise for strength training. A stronger muscular system can generate more force against resistance, and allows moving heavier weight over greater distances. The diameter of muscles expands as they get stronger, which protects bones and joints from problems, such as osteoporosis and arthritis.

4. **Coordination:** Athletic training involves exercises that improve coordination. Daily activities such as showering, unloading groceries and household chores all require muscular coordination. Exercise helps maintain and improve coordination by forming neuromuscular pathways which allow muscular system to communicate with nervous and other bodily systems more effectively. Walking and weightlifting with free weights help muscular system coordinate joint movements more effectively.
5. **Increased Heart Rate and Stroke Volume:** Muscles want more oxygen and glucose for fuel as exercise intensity increases. Therefore, brain stimulates to release some hormones into blood, which increases heart rate. Stroke volume is the amount of blood pumped out of the heart. Increase in exercise intensity produces a more powerful contraction, forcing more blood to pump out into the body.
6. **Muscle Glycogen and Protein Synthesis:** As we exercise, glycogen is released into the bloodstream to provide energy. After high-intensity aerobic exercise, body demands more glycogen and protein to rebuild damaged muscle tissues. A combination of protein and carbohydrates should be consumed. This can also suppress the cause of muscle protein to breakdown.
7. **Muscle Soreness:** A strength-training session can leave muscles feeling sore and tender, especially if exercised for a long time. The most likely cause of muscle soreness is the lengthening of muscle tissues while they are under tension. The nervous system increases the pain threshold in muscles to adapt to the exercise stress, which is why one may not feel as sore the next time he/she exercises.
8. **Muscle Fatigue:** The primary symptom of muscle fatigue is defined as a "decline in the maximal force or power capacity of muscle." When energy demand exceeds the energy production rate, muscle fibres reduce their contractile power, which eventually forces to stop exercising. Other factors that can contribute to the degree of muscle fatigue include age, gender, fitness status, presence or absence of disease or injury, body position and exercise intensity.

8.6 PHYSIOLOGICAL CHANGES DUE TO AGING

With age, progressive physiological changes occur that ultimately lead to a decrease in the function of various organ systems. In fact, aging has been defined as "processes in an organism that increase the mortality risk as a function of time."

The following are changes in the body that occur as a part of the aging process:

(*i*) The cardiac output decreases which can lead to decrease in hepatic blood flow, increase in vascular resistance, blood pressure increases and arteriosclerosis develops.

(*ii*) Because most analgesics are metabolised by the liver, decreased blood flow may result in decreased metabolism.

(*iii*) The lungs show impaired gas exchange, a decrease in vital capacity and slower expiratory flow rates.

(*iv*) Functional changes, largely related to altered motility patterns, occur in the gastrointestinal system.

(*v*) Progressive elevation of blood glucose occurs with age on a multifactorial basis and osteoporosis is frequently seen due to a linear decline in bone mass after the fourth decade.

(*vi*) The epidermis of the skin atrophies with age and due to changes in collagen and elastin, the skin loses its tone and elasticity. Lean body mass declines with age and this is primarily due to loss and atrophy of muscle cells.

(*vii*) Degenerative changes occur in many joints and this, combined with the loss of muscle mass, inhibits elderly patients' locomotion.

(*viii*) The heart becomes more dependent on blood volume.

(*ix*) There is a decrease in autonomic nervous system responsiveness, such that following spinal anesthesia there is an increased risk of profound hypotension.

(x) Renal function declines progressively with age. Although primary renal aging occurs, diabetes, hypertension and vascular disease play a significant role in worsening renal function. Decreased renal function can lead to toxic accumulation of drugs and metabolites.

These changes with age have important practical implications for the clinical management of elderly patients: metabolism is altered, changes in response to commonly used drugs make different drug dosages necessary and there is need for rational preventive programmes of diet and exercise is an effort to delay or reverse some of these changes.

8.7 ROLE OF PHYSICAL ACTIVITY FOR MAINTAINING FUNCTIONAL FITNESS IN AGED POPULATION

As much as we would hope the mythical "fountain of youth" existed, there are no proven ways to stop or reverse the aging process. Exercise, on the other hand, has been shown to have significant anti-aging benefits that can slow down the process and provide a better overall quality of life. Five anti-aging benefits of exercise include:

1. Looking younger
2. Improved brain function
3. Maintaining muscle mass
4. Stronger bones
5. Better balance and stability

1. **Looking Younger:** People who participate in regular physical activity have cells that look younger than those of couch potatoes. It has been found that the aging process can be traced to telomeres. Telomeres are the tips at the ends of chromosomes that protect DNA. They are often compared to the little plastic caps at the end of shoelaces, keeping everything intact. Every time a cell divides, the telomeres get shorter. When the telomeres get too short, the cell can no longer divide. It is believed that aging occurs as more and more cells reach the end of their telomeres and die.
2. **Improved Brain Function:** A research in humans indicated that walking for 30 to 50 minutes three or four times a week can increase blood flow to our brain by 15 per cent. Steady blood flow to the brain delivers much needed oxygen, as well as preventing the buildup of proteins in the brain that have been linked to Alzheimer's disease.
3. **Maintaining Muscle Mass:** Starting at the age of 25, people lose up to one per cent of muscle mass per year, leading to frailty, lack of coordination, trembling and weakness later on in life. Sarcopenia, or the loss of muscle mass associated with aging, is caused by a variety of factors including:
   (*i*) Lower levels of hormones
   (*ii*) Poor nutritional status
   (*iii*) Changes to cells due to environmental stress
   (*iv*) Lack of exercise

   Resistance training has been proven to be a powerful tool in the prevention of sarcopenia.
4. **Stronger Bones:** Bone mass (or density) gradually decreases as people age, especially women after menopause, due to the loss of stored calcium and other minerals. As a result, bones become more brittle and may break more easily. Osteoporosis is a disease of the bones. It happens over time when you lose too much calcium; make too little bone or both. As a result, bones become weaker and can break easily. The only way to avoid osteoporosis is to build stronger bones earlier in life and maintain bone density as long as possible by taking calcium-rich diet.

   The two types of exercise that are most effective for building strong bones are:
   1. **Weight-bearing exercise**
   2. **Strength training exercise**

Weight-bearing describes any activity we do on our feet that works our bones and muscles against gravity (*i.e.* walking, jogging/running, jumping rope, playing team sports, etc.). When our feet and legs carry our body weight, more stress is placed on the bones, making them work harder. During training activities for enhancing strength, resistance is added to the movement in order to make muscles work harder and become stronger over time. Although resistance exercises focus on increasing muscle mass, they also put stress on bones which can have a positive effect on bone density.

5. **Better Balance and Stability:** According to the Centres for Disease Control and Prevention (CDC), more than 33% of people over the age of 65 fall each year. Those who fall are 2 to 3 times more likely to fall again. In a recent publication released by the CDC, in an effort to promote fall prevention in older people, several exercise interventions were shown to significantly decrease the incidence of falls.