

Module 2

Scientific basis of physical activity

BENEFITS OF EXERCISE

Exercise is defined as any movement that makes your muscles work and requires your body to burn calories. Exercise involves engaging in physical activity and increasing the heart rate beyond resting levels.

There are many types of physical activity, including swimming, running, jogging, walking and dancing. Exercise offers incredible benefits that can improve nearly every aspect of your health from the inside out. Whether people engage in light exercise, such as going for a walk, or high intensity activities, for example, uphill cycling or weight training. Regular exercise provides a huge range of benefits for the body and mind. Taking part in exercise of any intensity every day is essential for preventing a range of diseases and other health issues.

1. Improves cardiovascular health

Regular exercise is good for heart and lungs health. Possible health includes:

- Lowering blood pressure
- Reducing the risk of heart and heart diseases
- Reducing the risk of stroke
- Reducing the risk of cardiovascular diseases is an important benefit of exercise.

2. Helps with diabetes management

According to American diabetes association (ADA) different type of exercise can benefit people with, or at risk of, type 2 diabetes by:

- Improving control of blood glucose
- Reducing cardiovascular risk problems
- Helping with weight loss
- Helping with general well-being.
- Improving insulin sensitivity
- Delaying or preventing the development of type 2 diseases.

Exercise can also benefit people with type 1 diabetes by:

- Improving cardiovascular fitness
- Strengthening muscles

The ADA say “physical activity and exercise should be recommended and prescribed to all individuals with diabetes as part of management of glycemic control and overall health”

3. Reduces risk of some cancers

The National Cancer Institute say there is strong evidence that higher levels of physical activity are linked to lower risk of the following cancers:

- Colon
- Stomach
- Esophagus
- Breast
- Uterine
- Kidney

4. Improves bone health

Regular exercise can help to prevent the bone density loss that occurs with aging. Moderate or vigorous muscle strengthening and aerobic exercise Improve bone density. Weight bearing exercises, such as walking and dancing, and resistance exercises are particularly good for bone health.

5. Helps with osteoporosis

Regular physical exercise helps to treat or prevent osteoporosis. Regular exercise also helps to prevent falls and Fractures related to muscle weakness and lack of balance, which is particularly important for people osteoporosis.

6. Helps with sleep

Exercise helps people sleep, and some of the benefits can start immediately. Regular exercise can help by:

- Increasing the efficiency of some sleep.
- Improving sleep quality and deep sleep.
- Reducing day time drowsiness.
- Reducing the need for sleep medication.

7. Improves brain function and reduces risk of dementia

Regular exercise can reduce the risk of dementia and Alzheimer's disease in adults Exercise can improve brain function and protect memory and thinking skills.

8. Strengthens immune system

WBC's are body's immune system cells that fight diseases Exercise improves WBC's and increase their movement and potential for fighting diseases.

9. Reduces asthma symptoms

Aerobic exercise can help people with asthma lessen both Frequency and severity and asthma attack.

10. Lowers blood pressure

Regular exercise improves strength of the heart muscles. Strong heart muscles can pump more blood with less effort. As a result, the force on arteries decreases and lowering blood pressure.

11. Helps to regulate Blood sugar level

Regular physical exercise helps to regulate insulin level and regulate blood sugar level.

12. It can reduce pain

Exercise has favorable effect on the pain associated with various condition. It again also increases pain tolerance

13. It helps to increase your energy level

Exercise can be real energy booster for many people including those with the various medical conditions. Regular physical exercise helps to reduce unnecessary fatigue.

14. Helps to build muscles

Exercise place vital role in building and maintaining strong muscles. Activities like weight lifting can stimulate muscle building when paired with a adequate protein intake. Disease because exercise helps to release hormone but promote the ability of your muscles to absorb amino acids. This helps to grow and reduces their breakdown.

As per age, they tend to lose muscle mass and function, which can lead to an increased risk of injury. Regular physical activity is essential for muscle mass and maintaining strength as you age.

15. It can help with the weight loss

Exercise is a crucial to supporting a healthy metabolism and burning more calories per day. It also helps to maintain muscle mass and weight loss.

Body spends energy three ways:

- Digesting food
- Exercising
- Maintaining body functions like your heartbeat and breathing.

While dieting, a reduced calorie intake will lower your metabolic rate, which can delay weight loss. On the contrary, regular exercise has been shown to increase metabolic rate, which can burn more calories to help you lose weight. 16. Increase your chance of living longer

Science shows that exercise can reduce your risk of dying early from the leading causes of death, like heart diseases and some cancers.

17. Improve mental health and mood

Physical activity can help reduce anxiety and this benefit can start after a moderate or vigorous exercise session. Longer term, regular exercise can also help to reduce the risk of depression. Exercise produces changes in the part of the brain that regulate stress and anxiety. It

can also increase brain sensitivity for the hormones serotonin and norepinephrine, which relieve feelings depression. Additionally, exercise can increase the production of endorphins, which are known to help produce positive feelings and reduce the perception of pain.

18. It can promote a better sex life

Engaging in regular exercise can strengthen the heart, improve blood circulation, tone muscles, and enhance flexibility, all of which can improve your sex life. Physical activity can also improve sexual performance and sexual pleasure while increasing the frequency of sexual activity. Additionally, physical exercise helps to improve sex hormones.

HEART RATE

“The number of heart beat per unit of time, usually per minute”. The heart rate is based on the number of contraction of the ventricles (The lower chambers of the heart). usually heart rate is expressed as beat per minute (BPM). The heartbeat to supply oxygenated clean blood from the left ventricle to the blood vessels of the body Via aorta.

Aorta is the large artery that carries oxygen rich blood from the left ventricle of the heart to the other parts of the body.

Heart rate measurement is used by health care professionals to aid in diagnosis follow up of several medical conditions including heart diseases.

Factors affecting heart rate

- Age: The heart rate gets progressively slower as a person moves through childhood toward adolescence.
- Exercise; during physical increases the heart rate as tissue need more oxygen. Highly trained athletes may have resting heart rate below 60BPM, sometimes reaching 40 BPM.
- Use of drugs: many drugs such as nicotine and steroids also have an effect of heart rate
- Smoking; smoking increases heart rate, tightens major arteries and cause an irregular heart rhythm
- Disease condition
- Hormones: E.g.: In general, increased levels of the thyroid hormones increase heart rate.

The following is a table of normal resting heart rate at different ages

Age	Normal heart rate
Up to one month	70 to 190
From 1 to 11 month	80 to 160
From 1 to 2 years	80 to 130
From 3 to 4 years	80 to 120
From 5 to 6 years	75 to 115
From 7 to 9 years	70 to 110
Over 10 years	60 to 100

PULSE

The pulse is the expansion of the arteries. This expansion is caused by an increase in blood pressure pushing against the elastic walls of the arteries each time of heart beats. A healthy pulse is between 60 to 100 beats per minute. These expansion rise and fall in time with the heart as it pumps the blood and then rest as it refills. The pulsation is felt at certain points on the body where larger arteries run closer to the skin.

Some of the pulse sites include

- temporal artery by the side of the forehead
- facial arteries at the angle of the jaws
- carotid artery in the neck
- brachial artery
- radial artery at the wrist
- femoral artery at the groin
- popliteal artery behind the knees
- posterior tibial artery
- dorsalis pedis artery over the foot

How to maintain healthy heart rate

- Regular exercise
- Reducing stress
- Avoiding tobacco
- Losing weight
- Avoiding alcohol and caffeine

RESTING HEART RATE (RHR)

Basal or resting heart rate is a measure of your average heart beats per minute. While your body is in a state of complete rest.

It is a very useful metric for monitoring your fitness level and overall health. Normal resting heart rate is usually between 60 to 100 beat per minute. However, for athletes and people who are active, this number may dip close to 40BPM.

HEART RATE RESERVE

Heart rate reserve (HR reserve) is the difference between a person's measured or predicted maximum heart rate and resting heart rate.

MAXIMUM HEART RATE

Maximum heart rate (MHR) refers to the highest number of beats/minute your heart should register while exercising.

“The maximum number of times your heart can pump in one minute”

Maximum heart rate=220-AGE

TARGET HEART RATE/TRAINING HEART RATE (THR)

Target heart rate is the zone of heart rate is expressed as a percentage of the MHR

Ideal target heart rate zone is 60 to 80 percentage of your MHR

To gain cardiorespiratory health benefits from exercise, your heart rate range should be reach your target heart rate zone.

Examples: For a 15-year-old

MHR= 220-15 =205

THR=

$MHR \times 60\% = 205 \times 60/100 = 123$ (low end of the target HR zone)

$MHR \times 80\% = 205 \times 80/100 = 164$

Conclusion= the target heart range for a 15 years old is between 123 to 164 beat per minute

HEART RATE RECOVERY

Heart rate recovery (HR recovery) is the reduction in heart rate at peak exercise and the rate as measured after a cool-down period of fixed duration. A greater reduction in heart rate after exercise during the reference period is associated with a higher level of cardiac fitness.

To calculate HRR, check your heart rate immediately after you stop exercising. Then check it again 1 minute later and note the difference.

For example; if your heart rate is 170 beats per minute when you finishing physical exercise, and it is drops to 150 BPM 1 minute later, your HRR is 20 BPM.

BRADYCARDIA

It was defined as a heart rate less than 60bpm

TACHYCARDIA

It is defined as resting heart rate more than 100 bpm

ARRHYTHMIA

Arrhythmia are abnormalities of the heart rate and rhythm.

BLOOD PRESSURE

Your heart pumps blood around your body in order to provide to your cells with oxygen. This pumping of blood put pressure on walls of blood vessels (artery) this is known as BP.

“Force exerted by circulating blood on artery walls”

“Blood pressure is the lateral pressure exerted by circulating blood upon the walls of blood vessels”

Blood pressure = Cardiac output \times peripheral vascular resistance. (CO \times PVR)

Cardiac output is the volume of blood heart pumps per minute (5 to 6 litre)

Peripheral vascular resistance (PVR) is the resistance in the circulatory system that is used to create blood pressure, the flow of blood and is also a component of cardiac function. (Vessel diameter, vessels length, blood viscosity)

Blood pressure is usually expressed in terms of the systolic (maximum) pressure and diastolic (minimum) pressure and it is measured in millimetre per mercury (**mmHg**).

1. Systolic blood pressure indicates how much pressure your blood is exerting against your artery walls when heart beat (contraction of heart chamber)

“Systolic pressure refers to the maximum arterial pressure during the contraction of the left ventricle of the heart”

Normal range is 90-120 mm Hg in adults. It is the maximum blood pressure inside the arteries.

2. Diastolic blood pressure indicates how much pressure your blood is exerting against your artery walls while the heart is resting between beats. (Relaxation of heart chamber).

“Diastolic pressure refers to the minimum arterial pressure during the relaxation of the left ventricle of the heart”

Normal range is 60 -80. Minimum blood pressure inside the arteries.

PULSE PRESSURE

The pulse pressure is the difference between the systolic and diastolic blood pressure,

Pulse pressure = systolic BP - diastolic BP

MEAN CARDIAC PRESSURE

The mean arterial pressure (MAP) is the average pressure over a cardiac cycle.

MAP = diastolic BP + 1/3 pulse pressure

“A **cardiac cycle** is defined as the steps involving the conversion of deoxygenated blood to oxygenated blood in the lungs and pumping it by the heart to the body through the aorta”

Factors affecting blood pressure

Viscosity of blood	Use of stimulants
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Elasticity of blood vessels	Use of minerals
Blood volume	Stroke volume
Heart beat	Consumption of alcohol
Stress/anxiety	Smoking
Drugs	Environmental factors

Blood pressure stages

Blood pressure category	Systolic pressure		Diastolic pressure
Low blood pressure	Less than 80	Or	Less than 60
Normal	80-120	and	60-80
prehypertension	120-139	Or	80-89
High blood pressure(hypertension stage 1)	140-159	Or	90-99
High blood pressure (hypertension stage 2)	160 or higher	Or	100 or higher
High blood pressure crisis(seek emergency care)	Higher than 180	Or	Higher than 110

BODY MASS INDEX (BMI)

BMI stands for body mass index. Body mass index has been used for over 100 years to help health professionals decide whether a patient is overweight. BMI was developed by Belgian statistician and Anthropometrist **Adolphe Quetelet** during nineteenth century. BMI is used to check whether we have a healthy body weight according to height. BMI helps to calculate overall health.

Some experts in this field believe that BMI is appropriate for population studies and inappropriate for individual diagnosis. But due to its simplicity, it came to be widely used for individual diagnosis. The purpose of BMI is to be used as a simple means of classifying sedentary (physically inactive) individuals, or rather, populations with an average body composition. BMI is less accurate in people such as bodybuilders and pregnant women.

CALCULATION OF BMI

1. Take your weight in kilograms.
2. Take your height in meter and square the numbers, you will need to multiply your height in meters first by itself first. For example, if you are 1.75 meters tall, then you would multiply 1.75 by 1.75 and get a result of approximately 3.06.
3. Divide your weight in kilograms by meter squared (height)

Next you will need to divide your weight in kilograms by your height in meters squared. For example, if you are weight is 75 KG and your height in meters squared is 3.06 then you would divide 75 by 3.06.you get 24.5 this is your BMI.

Unit=kg/M²

E.g.; height=75KG

Height 175 cm =1.75 m

Square of height = $(1.75 \times 1.75)M^2$

=3.06M²

BMI=weight in KG/height in M²

=75/3.06 =24.5

BMI= weight in pounds

$\frac{\text{weight in pounds}}{(\text{Height in inches}) \times (\text{Height in inches})} \times 703$

BMI NORMS

CATEGORY Kg/m²	BMI range
Severely under weight	Less than 16
Under weight	From 16 to 18.5
Normal (healthy)	18.5 to 25
Over weight	25 to 30
Obese class 1	30 to 35
Obese class 11	From 35 to 40
Obese class 111	Over 40

The WHO regards a BMI of less than 18.5 as underweight and may indicate malnutrition, eating disorder, or other health problems, while a BMI greater than 25 is considered overweight and above 30 is considered obese.

In general, the higher your BMI, the higher the risk of developing a range of conditions linked with excess weight including:

- Diabetes
- Arthritis
- Liver diseases
- Several type of cancer
- High blood pressure
- High cholesterol
- Sleep apnea.

TYPE OF EXERCISE

Anaerobic exercise and aerobic exercise

1. Aerobic exercise

Any activity that you can sustain for more than just a few minutes while your heart lungs and muscles work overtime.

E.g. Jogging/long distance running, swimming, walking, Zumba dance and cycling.

- Aerobic means with oxygen and is often referred to as “**cardio**”.
- Aerobic exercise take place with oxygen.
- Activities performs for longer duration
- It involves moderate intensity workouts. (50% to 70% of maximum heart rate) .
- Activities performed for more than two minutes to an hour.
- Energy is provided by carbohydrates and fats.
- Primarily works Type 1(slow twitch muscle fibres) and requires steady supply of oxygen to the muscles to perform activity.
- Sustain for an extended period of time.
- Tend to bring the heart rate gradually and burns calories during the activity.

The benefits of aerobic exercise

- Aerobic exercise improves the cardiovascular system (stamina) and burns fat.
- Helps to lose weight by expending calories.
- Enlarges the heart muscle and helps with pumping efficiency of blood around the body
- Improves your insulin sensitivity and risk of diabetes.
- Keeping your arteries clear, lowers LDL (bad cholesterol) and increases HDL (good cholesterol) and reduces risk of cardiovascular diseases, stroke, peripheral artery diseases, atherosclerosis and osteoporosis.
- Aerobic exercise can also aid in preventing or reducing the chance of developing some cancers, type 2 diabetes, depression and obesity.
- Boost your immune system
- Greater mitochondrial density and increases in myoglobin.
- Increased fat metabolism enzymes and increase capillary density.
- Produces new blood vessels in the heart and improve brain function.
- Improve sleep quality

Anaerobic exercise

- Anaerobic exercise take place without oxygen
- Anaerobic means without oxygen,
- Intensity: high intensity (80 to 90 % of maximum heart rate).
- Activities performed for short duration.
- Activities performed from some seconds to two minutes.

E.g.: weight lifting, plyometric exercise, sprints, jump squat etc.

- It works the type II muscle fibres (fast twitch) and does not require additional oxygen to be taken in the muscles to move the body.
- Anaerobic exercise is a type of power exercise (speed × strength)
- Energy provided by the adenosine triphosphate (ATP) and creatine phosphate (CP)
- You can't sustain this kind of activity extended time
- Tend to bring heart rate very quickly and burns calories even when the body is at rest.

Benefits of anaerobic exercise

- Helps build strength and lean muscle mass
- Strengthening the bones and ligaments
- Reversing the effects of bone loss and reducing the risk of broken bones and osteoporosis
- Protect your joints
- Increases lactic acid threshold
- Increased level of growth hormone and testosterone
- Improving cardiovascular health
- Helping to improve mood and manage certain mental health problems such as depression and anxiety.
- Boost metabolism – Anaerobic exercise helps to boost metabolism as it builds and maintains lean muscle mass. The more muscle you have, the more calories you will burn more calories.

EFFECT OF EXERCISE ON RESPIRATORY SYSTEM

The respiratory system is the set of organs that allows a person to breathe and exchange oxygen and carbon dioxide throughout the body. The respiratory system consists of the following structures: A) nasal cavity B) pharynx C) larynx D) trachea E) bronchi F) bronchioles G) alveoli (air sacs).

The respiratory system performs two major tasks;

A. External Respiration.

Movement of oxygen from the lungs to the blood

Movement of carbon dioxide from the blood to the lungs

B. Internal respiration

Movement of oxygen from the blood to the tissue cells

Movement of carbon dioxide from tissue cells to blood.

1. **Increases tidal volume:** It is the amount of air that moves in or out of the lungs with each respiratory cycle. A Respiratory cycle is one sequence of inspiration and expiration.

Normal-500ml, during exercise – 3-4 litre

2. **Increase respiratory rate:** Number of breath per minute

Normal-10 to 15 /minute, during exercise- 30/minute

3. **Increase minute volume:** The amount of air taken in to lungs in one minute is known as minute volume. Product of tidal volume and respiratory rate.

Normal – 6 litre. During exercise – 130 to 180 litre

4. **Strengthens diaphragm and muscles:** Regular exercise strengthens the diaphragm and muscles of the chest (intercostal muscles)
5. **Increase in residual air volume:** Residual air is that amount of air which is left in the lungs after exhalation. If an individual performs regular exercise, his /her residual air capacity increases in comparison to an individual who does not perform regular exercise.
6. **Increase vital capacity:** it is defined as the volume of air that can be expelled by a forced expiration after a forced inspiration.
Normal value – 4 litre, with regular exercise a person's capacity may increase 5.5 litre.
7. **Increase number of capillaries:** Regular exercise has the ability to increase the number of capillaries around the alveoli. Moreover, regular exercise can help capillaries dilate more, which in turn facilitates efficient exchange of gases.
8. **Prevention from diseases:** The speed of inhalation and exhalation becomes less in an individual who does not do any exercise. The waste product start sticking to his/her lungs and with the passage of time, his/her lungs gets damaged. On the other hand, if we perform regular exercise, we will have to inhale and exhale more air speedily. By doing so, the waste products never stick to your lungs. These products will come out automatically and the lungs will not be damaged.

EFFECT OF EXERCISE ON CIRCULATORY SYSTEM

The circulatory system is the transport system of the body.

Main functions of circulatory system are;

1. Deliver oxygen and nutrients to the organs and tissues of the body
2. Circulations of hormones and maintained body temperature
3. Fighting disease by transporting WBC throughout the body
4. Remove waste products such as carbon dioxide from the cells.

The main parts of circulatory system are:

Heart: the pump that forces blood throughout your blood vessels.

The heart pumps blood around the blood around the body. It sits inside the chest, in front of the lungs and slightly to the left side. The heart will pump faster during exercise to more quickly bring nutrients and oxygen to the body's muscles so they can continue to make energy. The heart actually double pump made up of four chambers, with the flow of blood going in one direction due to the presence of the heart valves. The contractions of the chambers make the sound of heartbeats.

The right side of the heart

The right upper chamber(atrium) takes in deoxygenated blood that is loaded with carbon dioxide. The blood is squeezed down into the right lower chamber (ventricle) and taken by an artery to the lungs where the carbon dioxide is replaced with oxygen.

The left side of the heart

The oxygenated blood travels back to the heart, this time entering the left chamber(atrium). It is pumped into the left lower chamber(ventricle) and then into the aorta (an artery). The blood starts its journey around the body once more.

Arteries: carry blood away from the heart, deliver nutrients and oxygen to the organs and tissues.

Veins: carry blood back to the heart, removes carbon dioxide and waste products from body tissues by bringing them to appropriate organs to be removed from body

Capillaries: connect arteries and veins. They are tiny tubes that exchange food, oxygen and wastes between blood and body cells.

1. **Increases in heart size:** Regular exercise develop the muscles of the heart. It increases the size of the heart along with the strengthening of heart. The heart becomes efficient in doing its job. (Increases the left ventricle size).

2. **Increases stroke volume:** It is the amount of blood exerted by left ventricle in one beat. Regular exercise helps in increasing the stroke volume at rest. In untrained, individuals the stroke volume at rest remains at 50-70 ml/beat.it increases up to 110-130 ml/beat during intense exercise. The stroke volume of experienced athletes at rest remains at 90-110 ml/beat. It increases up to 150-220 ml/beat during intense exercise.

3. **Reduce viscosity of blood:** viscosity of blood is approximately 2-5 times more than water. When athlete perform physical activity the thickness of blood is reduce and it flows very fast.

4. **Increase cardiac output:** cardiac output is the amount of blood pumped by the heart in one minute. It is measured in litre/minute. cardiac output is a product of stroke volume and heart rate. The cardiac output is about 5litre/minute but during intense exercise it can increase up to 20-40 litre /minute.

5. **Increase blood pressure:** generally, the systolic blood pressure of a healthy individuals ranges from 110 to 130 mm Hg and diastolic BP ranges from 60-90 mmHg during rest position. During exercise the systolic BP can increase over 200 mmHg. Diastolic pressure usually remains unchanged even during intense exercise. If there is an increase of more than 15 mmHg as exercise intensity increases, it indicates the presence of coronary heart diseases.

6. **Increase in blood flow:** The cardiovascular system can redistribute more blood to those tissue which have immediate demand and less blood to those tissues which have less demand for oxygen. Generally, at rest 15-20% of the circulating blood is supplied to skeletal muscles. It increases to 80-85 % of cardiac output during intensive exercise. Blood is moved away from the main organs such as liver, kidneys and intestine.

7. **Reduces stiffness of blood vessels:** Nitric oxide is produced in body to make blood vessels relax. Exercise helps to release more NO₂. Exercise decreases the stiffness of blood vessels and reduces the damage and inflammation that naturally occur.

8. **Increase heart rate:** During exercise heart rate increases normally 72 to 180+ during physical activity.

9. **Decrease resting heart rate:** Regular exercise decreases resting heart rate. After regular exercise, the heart finally more efficient. It does not require to beat so quickly to supply blood to the body at rest. It can be noted that highly conditioned athletes can have their resting heart rates in the 40s.

10. **Increase temperature of blood:** Naturally the temperature of blood is 38 degrees Celsius and during the strenuous exercise it increases 1 degree Celsius to 3 degrees Celsius.

EXERCISE AND IMMUNITY

Immunity

Immunity is the body's ability to fight off harmful micro-organisms (pathogens) that invade it.

The ability of an organism to resist a particular infection or toxin by the action of specific antibodies or sensitized white blood cells.

Meaning

It is the ability of the body to resist infection. The word "immunity" derived from Latin word "immunis" meaning "to exempt".

Immune system

The system in the body responsible for maintaining homeostasis by protecting the body from harmful viruses and organisms (fungus, bacteria, protozoa). Immune system is a complex network of cells, proteins, and tissues that helps protect body from diseases and infections. There are different types of immune responses and different types of immunity. The immune system produces antibodies or cells that can de-activate pathogens

Fungi, protozoa, bacteria, and viruses are all potential pathogens

"Immune system is not simply a system to have around but it is essential to life itself"

Tizard, 2003

TYPE OF IMMUNITY

1. Innate immunity

- Inborn ability to fight various acute infections
- Resistance possessed by an individual by birth.
- Provide first line of defence against infection

- Skin, mucous, gastric juices, salivary juices
- 2. **Acquired immunity** (adaptive immunity)
 - The resistance that an individual acquires during life
 - Acquired by the individual in due course of time
- (A) **Active immunity**: Resistance developed as a result of antigenic stimulus. Active immunity develops in response to an infection or vaccination and it is long lasting.
 - (a) **Natural active immunity**: antibodies developed in response to an infection.
 - (b) **Artificial active immunity**: antibodies developed in response to a vaccination.
- (B) **Passive immunity**: passive immunity develops after you receive antibodies from someone or somewhere else. Passive immunity is short term immunity.
 - (a) **Natural passive immunity**: Antibodies transmitted from mother to baby. (e.g.: Via mother's milk)
 - (b) **Artificial passive immunity**: Antibodies acquired from an immune serum medicine.eg. From a globulin injection of infusion.

White blood cells (WBC) or Leukocytes: are cells of the immune system which defend the body against both infectious diseases and foreign materials.

Effect of exercise on immunity

Physical exercise has numerous effects on the human body, including the immune system. Exercise improve your overall fitness, which can help boost your immune system. Primarily physical activity stimulates the immune system and strengthen the infection defence mechanism. The untrained people who start exercising regularly get a progressively stronger immune system and become susceptible to infections.

When we are stressed the immune system's ability to fight off antigens is reduced. The stress hormone can suppress the effectiveness of the immune system (lowers the number of lymphocytes- the white blood cells that help fight off infections). Exercise reduces levels of the body's stress hormones, such as adrenaline and cortisol. It also stimulates the production of endorphins. (Chemicals in the brain that are the body's natural pain killers and mood elevators)

Exercise improves WBCS and increase their movement and potential for fighting diseases. WBC's are the body's immune system cells that fight diseases. These antibodies or WBC circulate more rapidly, so they could detect illness earlier than they might have before.

Regular short term, moderate intensity exercise is beneficial for immunity. Long duration, high intensity, strenuous exercise can suppress immune function.

Intensive endurance training or competition which last for at least one hour stimulate the immune system sharply in the beginning, but a few hours after exercise/competition, a weakened immune system. This means that the immune system in the hours after hard exercise/competition has a weakened ability to fight against bacteria and susceptibility to infection is temporarily increased. This effect is seen in both untrained and trained individuals. How long this period lasts for is partly dependent of the intensity and duration of the exercise and vary with individual. The "open period" can last from a few hours up to a day. If such a long-term activity session happens

frequently, it can cause prolonged susceptibility to infections and increased risk of complication if an acquired. Planning of training /activity/competition and rest periods is therefore very important and should be done on an individual basis.

Anaerobic exercise helps to produce growth hormone in the body. Growth hormone plays an important role in the development of the immune system. Studies suggest growth hormone may promote growth of thymus (a gland responsible for the production of immune cells called T cells. (T cells are a type of WBC lymphocytes. These cells fight off diseases. The two categories of lymphocytes are T cells and B cells. The T cells respond to viral infections and boost immune function of other cells, while B cells fight bacterial infections.)).

EFFECT OF EXERCISE ON MUSCULAR SYSTEM

Muscles play a part in every function of the body. Muscular system is a complete collection of tissues, each with a different purpose. Understanding the components of the muscular system, including the various types of connective tissues, is a good way to understand how bodies and physical movement work.

There are more than 600 muscles in the human body. A kind of elastic tissue makes up each muscle which consist of thousands of small muscle fibers. Each fiber comprises many tiny strands called fibrils. Impulses from nerve cells control the contraction of each muscle fibers. Muscle's strength depends mainly on how many fibers are present. To fuel a muscle the body makes adenosine Triphosphate (ATP), which muscle cells turn into energy. Humans on the other vertebrates have three types of muscles: skeletal, smooth and cardiac muscles.

Following changes in our muscular system can be seen if exercise is done on regular basis:

- 1.Hypertrophy of the muscles:** Due to resistance training the size of muscle fibres increases. the total amount of protein increases which is essential for muscle growth.
- 2.Formation of capillaries:** When exercises are done, the colour of muscles is change, Because a number of new capillaries form for better and an efficient blood circulation.
- 3.Efficient movement of muscles:** The movement of muscles becomes efficient and smooth. The movements during different activities become attractive.
- 4.Change in the connective tissue:** The connective tissue, which connects fibres, becomes powerful. This tissue can bear stress of strenuous activity and can be extended up to some degree.
- 5.Controls extra fat:** Regular exercise controls the extra fat of the body. exercises burn the extra calories deposited in the form of fat.
- 6.Delays fatigue:** Regular exercise delays fatigue. Fatigue is mainly due to formation of carbon dioxide, lactic acid and acid phosphate. the accumulation of both carbon dioxide, Acid phosphate and lactic acid becomes less in an individual exercise regularly. Hence, fatigue can be delayed if exercises are performed daily.

7. **Toned muscles:** Regular exercises helps in keeping the muscles intoned position. Muscles become firm and maintain a slight, a steady pull on the attachment.

8. **Correct body posture:** Regular exercise keeps the Correct Posture of the body by strengthening the muscles. The postural deformities do not occur. If there is any physical deformity, then it is removed.

9. **Increases food storage:** The food store capacity is increased When regular exercises are done. this stored food can be utilized immediately wherever it is needed.

10. **Exercise and its health benefits:** Our body remains Fit and healthy with Increased blood circulation and oxygen intake. regular exercise gives a healthy glowing look and is a natural Anti-ageing technique. It improves digestion, in helps to Strengthen Body muscles and thus an attain Good posture. Exercises help us to get good sleep and look good when we wake up.

11. **Non- functioning fibers become Active:** When we do not do any strenuous Work, all the muscle fibers of our body are at rest. But when we perform exercise regularly, they non-functioning fibers also begin to get active. Consequently, the strength of the body increases, because The total contraction Power of the muscle fibers increases.

12. **Improves reaction time:** As a result of regular exercise, the speed of nerves Impulses Increases Which ultimately improves the reaction time. These nerve impulses move very quickly through motor nerve from nervous system to muscles fiber. Owing to this, the reaction time improves.

13. **Increased blood flow:** During exercise increased volume of blood that is pumped to muscle tissues.

14. **Muscle exhaustion:** When exercise continues through muscle fatigue Without proper rest After time it can lead to muscle exhaustion.

BODY TYPES

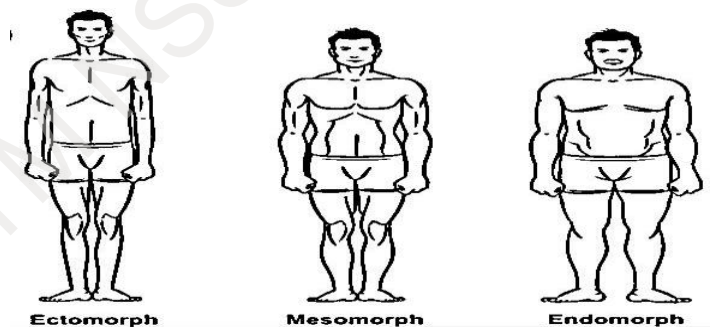
All individuals have different physical characteristics because of different biological, psychological, sociological, geographical, culture and racial backgrounds. The concept that an individual body type is related to his health, immunity from diseases, physical performance and personality characteristics has developed from ancient times. **William Herbert Sheldon** (1898-1977) was an American psychologist and physician. He introduced the concept and ‘somatotype’ in ‘the varieties of human physique’ 1940. The three main somatotypes are ectomorph, mesomorph, and endomorph. Dr William Sheldon introduced them in his text on constitutional psychology back in the 1940s. Since then the theory has been useful in determining individual’s fitness routine and nutrition.

Body type is also known as somatotype

ECTOMORPH	MESOMORPH	ENDOMORPH
Small frame, naturally lean, thin, delicate body structure, small shoulders	Medium frame, hard and rectangular body shape, athletic, wide shoulders	soft and round body shape

Not gain weight easily, lean muscle mass, not gain fat	Gain muscle easily, gain fat easier than ectomorph	Gain muscle easily, gain fat very easily, find it hard to lose fat
Fast metabolism, poor digestive system	Normal metabolism	Slow metabolism, better digestive system
Abdomen is flat with hollow above navel	Abdomen is large with low waist	Abdomen is large, full above the navel
They have thin buttocks and long thin legs	They have heavy buttocks with heavy forelegs	They have heavy buttocks and heavy legs
Their skin is soft with more hairy growth	Their skin is rough	They have thick and hairy type of skin
Their face is small, forehead and chin is pointed and nose is sharp	Their face bones are prominent and long and has the shape of a long oval	Their face is large round head with broad face, square jaw and small ears
Their hands are small but fingers and toes are long		Their palms are broad with short fingers, their feet are also broad with low arch
Sensitive, quite, non-assertive, self-conscious	Active, assertive, combative, fearless, aggressiveness	Relaxed, social, peaceful, fun-loving
Thyroid dominant	Testosterone and growth hormone dominant	Insulin dominant, slow metabolic rate
Long distance runners	Sprinters, cyclist, weight lifters	Powerlifters

Most people have a mixture of mesomorphic, endomorphic and ectomorphic characteristics.



Model questions

Very short answer type 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?