



## IMMUNITY AND EXERCISE

**Dr. Augustine George, Assistant Professor of Physical Education  
Directorate of Collegiate Education  
Kerala**



### ABSTRACT

Immunity is very essential to ward off many diseases and to live a quality life. Lot of research is going on to find more about immunity and how to improve it. There are many ways to boost our immune system. Exercise is considered as one of the way to improve human immunity. Research has come out with some conclusions on the role of exercise in boosting immunity. A systematic review of literature connected with immunity and exercise is being done to understand the connection between exercise and immunity. It is seen that moderate intensity exercise improves immunity whereas high intensity exercise decreases immunity for a short period of time. The duration of exercise is also as important as the intensity of exercise.

**Key words** – Immunity, Exercise, Moderate Intensity Exercise, High Intensity Exercise.

### INTRODUCTION

The function of immune system is to defend our body from harmful substances like pathogens or toxic non living objects like certain gases, metals etc. If immune system doesn't work then we get hold of infections and transmissible diseases. There are various established ways to boost up our immunity. Exercise is one among them. But not all exercise or physical activity claim to boost up immunity. Moderate intensity exercise done for a moderate period of time boost up immunity

whereas low intensity exercise doesn't seems to affect immunity. High intensity exercise affects human immune system negatively for a shorter duration immediately after exercise.

Our body has three layers of defense which protect our body from pathogens and foreign non living objects. The first one is barrier immunity followed by innate immunity and acquired immunity. Our largest organ skin and the surface lining of respiratory system, digestive system, and excretory system protect our body by physical barrier as well as chemical and biological barriers. Skin secretes antimicrobial proteins that kill microorganisms, it also contains immune cells which stop harmful microbes from entering the body, skin shedding also helps to get rid of harmful microbes. In respiratory system we have respiratory cilia, mucus etc which stops the micro organisms, stomach releases acids which kill microorganisms which enter through food. Tears in our eyes contain antimicrobial proteins like lysozyme that kills microorganisms. Next layer of immune system is called innate immunity which is present right from our birth. Cells of innate immunity are white blood cells or leukocytes. Different types of WBC are

- a) Neutrophils - 60 to 70 % of WBC – they detect and eat the pathogens. They are found in blood streams. They are the first cells to respond to any infections. They get signals from the chemicals released by pathogens.
- b) Mast cells – it resides in the mucus membrane like the lining of respiratory and



- gastro intestinal system and connective tissues. It helps in wound healing and defence against pathogens
- c) Basophils – 0.5 to 1 % - fights parasitic infections, helps in blood clotting also
  - d) Dendritic cells – present in those system which is connected to outside environment such as skin, inner lining of nose, stomach and intestines.
  - e) Eosinophils – 1 to 3 % of WBC – fights parasites and bacterial infections. If unchecked these cells can cause tissue damage and inflammation in many diseases like asthma.
  - f) Monocytes – it circulates in blood
  - g) Macrophage – they are large eaters and can migrate out of blood vessels to kill pathogens
  - h) Natural killer cells or NK cells – it doesn't directly attacks pathogens it kills our own cell which are defective, like tumor cells or virus infected cells.
- Next layer of immune system is adapted or acquired immune system – it is not present from birth and is created with exposure to an infection. The cells responsible for this is called lymphocytes and are part of WBC which constitutes around 20 to 40 % of WBC. Around 2 % circulates in blood and rest moves in tissue spaces and in lymphatic system.
- a) B lymphocytes – humoral immunity – it produces antibodies – it capture antigens present in the surface of bacteria and captures them. They do not destroy the bacteria but activates other WBCs. Antibodies also coat the pathogens by several other antibodies which gives a signal to other WBCs like neutrophils which engulfs them. There are 5 different types of antibodies.

- b) T lymphocytes – cellular immunity – it is produced in thymus.
  - o Helper T cells –
  - o Killer T cells – it kills the pathogens by directly invading it

#### Ways to boost immune system

We have understood that our immune system is not a single entity and consist of many organs and cells. Harmony and balance with all this entities is vital for our immune system to work. Research is still finding out ways to improve immunity but it is found that positive life style plays a vital role in giving immunity an upper hand. Some of the healthy living strategies are

- o Avoid smoking and drinking alcohol
- o Eating a balanced diet.
- o Exercising regularly.
- o Maintaining a healthy weight.
- o Getting adequate quality sleep.
- o Maintaining personal and environmental Hygiene
- o Minimizing stress

#### Effects of Exercise on Immunity

Research has found that highly conditioned athletes have higher levels of NK cells and T-lymphocyte which finds pathogens and wipe them out.

It promotes better circulation of blood and lymph which allows the cells and substances of the immune system to move through the body in higher rate and higher numbers and thus do their job efficiently. It is seen that after a 45 minutes workout immune cells float around the body for up to 3 hours. When you do exercise next day it again happens and has an summation effect.



Exercise reduces inflammation. In reduced inflammation immune cells function better.

Recent studies indicate that exercise and physical fitness diversifies the gut microbiota, thus stimulating immunity and fastening digestion.

It gives you quality sleep – Exercise depletes your energy and helps you go for a quality sleep. Release of endorphins also helps in better sleep.

It is a stress buster – exercise produces endorphins the happy hormones which reduce stress and anxiety. A wide variety of maladies, including stomach upset, hives, and even heart disease, are linked to the effects of emotional stress. Sudden stress may not bring problem but chronic stress do, such as that caused by strained relationships with family, friends, and co-workers, or continued challenges to perform well at one's job. Glucocorticoids such as cortisol are elevated during periods of isolation and confinement and can inhibit many critical functions of our immune system. When we are stressed, the ability of our T-cells to multiply in response to infectious agents is markedly reduced, as is the ability of certain effector lymphocytes (e.g., NK-cells and CD8+ T-cells) to recognize and kill cells in our body that have become cancerous or have been infected with viruses.

Exercise helps to have a healthy weight – Moderate intensity exercise increases our metabolism. It also elevates our calorie expenditure. Both of these factors help to burn off excess fat.

It promotes ways to inculcate good habits and shun the bad ones like smoking and heavy drinking. Research studies have shown that people who exercise have more positivity in life and have lesser bad habits.

Categories of exercise/Physical Activity

Based on the intensity of exercise to elevate heart rate exercises are divided into three categories

- Low intensity exercise – 40 to 50% of your maximum heart rate.
- Moderate intensity – 50 to 70 % of your maximum heart rate.
- High intensity – 70 to 85% of your maximum heart rate.

Assessing Exercise Intensity

- Step 1: Calculate HR max – it is a measure of how fast your heart can beat in a minute or the maximum level of load your cardiovascular system can handle. It can be calculated by subtracting one's age from 220.
- Step 2: Calculate resting heart rate – Measure it in the morning when you get out of bed. The time when you are fully relaxed. To measure this place your three fingers from index finger on your carotid artery (on your neck by the side of wind pipe) and count the beats for 15 seconds and multiply it by 4 to get heart rate in a minute.
- Step 3: Calculate heart rate reserve (HRR) – it can be calculated by subtracting your HR max with your resting heart rate.
- Step 4: Calculate Exercise zone –
  - Low Intensity - Multiply your HRR by 0.4 (40 %) and add your resting heart rate to this number to get the lower reading of target heart rate zone of 40 % of HRmax. Multiply your HRR by 0.5 (50 %) and add your resting heart rate to this number to get the higher reading of target heart rate zone of 50 % of HRmax.
  - Moderate Intensity - Multiply your HRR by 0.5 (50 %) and add your resting heart rate to this number to get the lower reading of target heart rate zone of 50 %



of HRmax. Multiply your HRR by 0.7 (70 %) and add your resting heart rate to this number to get the higher reading of target heart zone of 70 % of HRmax.

- High Intensity - Multiply your HRR by 0.7 (70 %) and add your resting heart rate to this number to get the lower reading of target heart rate zone of 70 % of HRmax. Multiply your HRR by 0.85 (85 %) and add your resting heart rate to this number to get the higher reading of target heart zone of 85 % of HRmax.

#### Exercise Duration

It is found through studies that to improve immunity duration of exercise is also as important as the intensity of exercise. Moderate intensity exercise up to 90 minutes is preferable to boost up immunity. Moderate intensity exercise done for more than 90 minutes reduces immunity temporarily whereas chronic overtraining can lower immunity for longer time.

#### **CONCLUSION**

Human immune system responds positively to exercise and physical activity. However high intensity exercise with higher duration dampens the immune system for a longer time. People should be educated about the importance of exercise in daily life. They should also be taught

about the intensity and duration of exercise and the necessity and purpose of exercise for different outcomes.

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