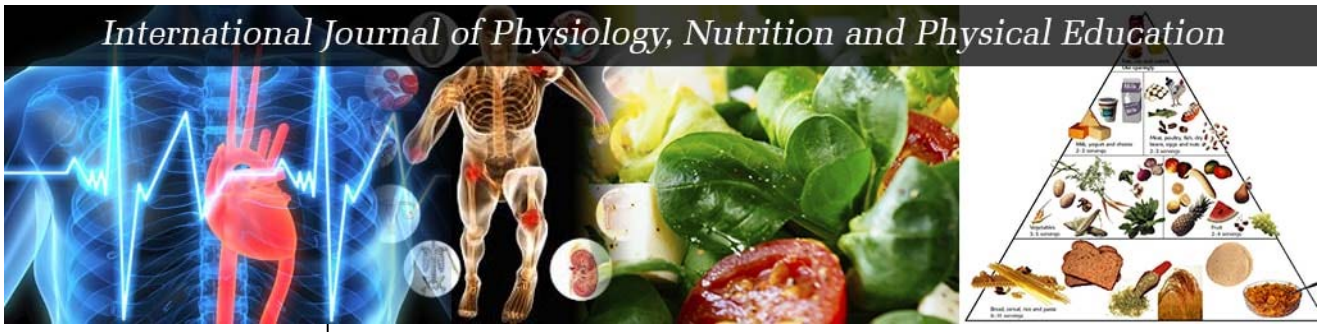


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# General physiological concepts in physical education and sports

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**Abstract**
There are numerous Physiological terms being used in the field of Physical Education and Sports. For all the trainers, coaches and Physical Education teachers, the clarity and well understanding of all these terms is very important to make the players or the students understand fully, so that better methods of training or teaching may be facilitated. This paper will review the general Physiological concepts that already used in the field of Sports and Physical Education.

**Keywords:** Physiological concepts, physiology, exercise physiology, sports, physical education

## 1. Introduction
Physical exercise is any bodily activity that improves or maintains physical fitness and overall health and wellness. Regular exercise makes the heart stronger and the lungs fitter, enabling the cardiovascular system to deliver more oxygen to the body with every heartbeat and the pulmonary system to increase the maximum amount of oxygen that the lungs can take in. A sports physiologist examines the acute responses and chronic adaptations to athletic performance in a variety of environments [1]. Physiology is the branch of biology dealing with the functions and activities of living organisms and their parts, including all physical and chemical processes. Exercise Physiology is the study of how exercise changes the function and structure of the body. Exercise Physiology is what happens to the body as it exercises a single time, how these changes are brought about, what changes in function occur after repeated sessions of exercise and how these changes come to pass, and finally, what can be done to improve the body's response to exercise and its adaptation to training. It is the identification of physiological mechanisms underlying physical activity, the comprehensive delivery of treatment services concerned with the analysis, improvement, and maintenance of health and fitness, rehabilitation of heart disease and other chronic diseases and/or disabilities, and the professional guidance and counsel of athletes and others interested in athletics, sports training and human adaptability to acute and chronic exercise [2].

## 2. General Physiological Concepts [3, 4, 5]
The below terms and concepts are very essential to all the sports, Physical education teachers and coaches. In order to improve the way of teaching, coaching and training.

### 2.1 Vital Capacity (VC)
The total volume of air that can be voluntarily moved in one breath, from full inspiration to maximum expiration, or vice versa, is termed as the vital capacity (VC). This consists of the tidal volume plus the inspiratory and expiratory reserve volumes. VC=TV+IRV=ERV. Average volume of vital capacity is about 4-5 liters in healthy young man. The values of 7.6 and 9.1 liters have been reported for a professional footballer.

### 2.2 Tidal Volume (TV)
It is the volume of air moved during either inspiratory or expiratory phase of each breath. Average tidal volume of normal individual at resting condition is about 500 ml of air per breath.

**2.3 Inspiratory Reserve Volume (IRV)**
The amount of air inspired as deeply as possible in one breath is called inspiratory reserve volume (IRV). This additional volume is about 2.5 to 3.5 liters above the inspired tidal air.

**2.4 Expiratory Reserve Volume (ERV)**
It is the maximum amount of air expired in one breath. It is ranged between 1.0 to 1.5 liters for an average sized man.

**2.5 Function Residual Volume (FRV)**
It includes the known expiratory reserve volume (ERV) and the unknown residual volume.

**2.6 Residual Lung Volume (RLV)**
When one exhales as deeply as possible, there is still a volume of air that remains in the lungs. This volume which cannot be exhaled is the residual lung volume. It averages between 1.0 and 1.2 liters.

**2.7 Total Lung Volume (TLV)**
The residual lung volume plus vital capacity constitute the total lung volume (TLV). TLV=RV+VC

**2.8 Minute Ventilation (MV)**
Amount of air, which we can inspire or expire in one minute, is called minute ventilation. MV=TV+BF = 500ml × 12= 6L/min at rest.

**3. Second Wind**
In the field of sports particularly in running a race the term second wind is commonly used by coaches or trainers and also experienced by athletes. But this state of feeling is unexplained by athletes because of poor understanding. A second wind is a sensation characterized by a sudden change of condition or state from an unknown feeling of distress or fatigue during the early part of prolonged exercise as compared to less stressful feeling later in the exercise. At the early portion of workout the athlete feels himself in an uncomfortable state or feel fatigue but suddenly the athlete feels sense of freedom as the distress or feeling of uncomfortable is gone. He/ She has experienced second wind. The feeling of second wind is related to more comfortable pattern of breathing.

**3.1. Causes of Second Wind**
The possible causes of second wind may be:
1. Relief from breathlessness caused by slow ventilator adjustment early in exercise.
2. Oxidation or removal of lactic acid accumulated early in the exercise as a result of delayed blood flow changes in the working muscles.
3. Inadequate warming up.
4. Because of local muscle fatigue, particularly of the diaphragm.
5. Due to psychological factors.

**4. Oxygen Debt**
We know that after exercise our body does not immediately return to resting level. In lighter exercise recovery is fast. But if the exercise is heavy or stressful such as swimming 200 meters or running 800 meters as fast as possible, comparatively the body needs more time to return to rest. The amount of oxygen consumed during the recovery period following exercise that is in excess of the volume, which is normally consumed while at rest, is called oxygen debt. The definition of oxygen debt is the amount of oxygen consumed during recovery from exercise above that ordinarily consumed at rest in the same time period.

**5. Fatigue**
We usually use the term fatigue when we feel tired at the end of doing work or hard physical activity. Term fatigue describes general feeling of tiredness and decrease in muscular performance. In fact fatigue is experienced by everyone. It is a temporary in ability of muscular system to perform efficiently. We can also define Fatigue as a state discomfort or decreased efficiency resulting from prolonged exertion.

**5.1 Types of Fatigue**
A- Physical Fatigue
B- Mental Fatigue

**5.1.1 Physical Fatigue** is the one that a person experiences after a hard work, or after tiring muscular work, like playing tennis match or after cross-country running.

**5.1.2 Mental Fatigue** is the one that a person experiences after cramming long hours for an examination. Mental Fatigue is also caused from having nothing to do or boredom.

**5.2 Local Muscle Fatigue**
In local muscle Fatigue the muscle is unable to continue contracting at the same rate of energy expenditure over a given period of time.

**6. Muscular Contractions**
Muscular contractions can mainly be categorized into four types of contractions such as Isotonic Contraction, Isometric Contraction, Eccentric Contraction and Isokinetic Contraction. All of these contractions are used during various sports training programs, although the degree of use may vary from activity to activity. These contractions are key factors in sports training and sports performance.

**7. Blood Pressure**
Blood pressure is the pressure that blood exerts against the wall of the arteries. The amount of pressure depends upon the strength and rate of the hearts contraction, the volume of blood in the circulatory system, and the elasticity of the arteries. Blood pressure is measured with an instrument called a sphygmomanometer. There are two types of blood pressure on is systolic pressure which represents the blood pressure when the heart is contracting. The other one is diastolic pressure which represents the blood pressure while the heart is relaxing. Blood pressure usually rises with age because of the decreased elasticity in the arteries and slow down the flow of blood. High blood pressure may cause heart failure, a stroke or kidney failure.

**8. Pulse Pressure**
Pulse pressure is the difference between the systolic and diastolic pressure readings. It is measured in millimeters of mercury (mmHg). It represents the force that the heart generates each time it contracts. If resting blood pressure is (systolic-diastolic) 120-80 millimeters of mercury (mmHg), pulse pressure is 40.

**9. Blood Volume**
Physical training or exercise particularly endurance results increase in blood volume which is mainly due to increase in blood plasma volume (Liquid portion of the blood). Number

of blood cell also will increase. Increased blood plasma volume decreased blood thickness that can improve circulation of the blood and oxygen availability. Highly trained male athlete may have more than 7 liters of total blood volume as compared to untrained individual having less than 5.6 liters of total blood volume.

**10. Blood Flow**

Physical training changes the function and the structure of the heart. It is well known fact that active muscle require more oxygen and nutrients. To fulfill these requirements, more blood must be supplied to these muscles during exercise. As the muscles become better trained, the circulatory system adopts to increase blood flow to them [6].

**11. Heart rate**

It is the speed of the heartbeat measured by the number of contractions of the heart per minute (bpm). The heart rate may be too fast (tachycardia) or too slow (bradycardia). The pulse is a bulge of an artery from waves of blood that course through the blood vessels each time the heart beats. The pulse is often taken at the wrist to estimate the heart rate [7].

**12. Cardiac output**

The amount of blood the heart pumps through the circulatory system in a minute. The amount of blood put out by the left ventricle of the heart in one contraction is called the stroke volume. The stroke volume and the heart rate determine the cardiac output.

Cardiac output = Stroke Volume × Heart Rate [8].

**13. Stitch in the Side**

This happening is also very familiar to most athletes or sports persons. The stitch in the side is usually felt as a sharp, severe pain in the side or rib cage. It takes place at an early stage of exercise generally during running and swimming. This pain gradually subside as the activity continues.

**14. Stroke Volume**

The amount of blood pumped by the left ventricle of the heart in one contraction. The stroke volume is not all the blood contained in the left ventricle; normally, only about two-thirds of the blood in the ventricle is expelled with each beat. Together with the heart rate, the stroke volume determines the output of blood by the heart per minute (cardiac output) [9].

**15. Lactic Acid Removal from Muscle and blood**

Our bodies create lactic acid regularly in small amounts to assist with various biological functions. However, when acid is produced at a rate faster than your body can naturally remove it, the condition is called lactic acidosis. During exercise, this occurs if your exercise intensity is such that your muscles need more fuel than is readily available. Once you decrease the intensity of your exercise or stop exercising completely, your body begins to naturally remove the lactic acid. This is because the need for the glucose fuel substitute has diminished, and in turn, the acid byproduct begins to dissipate. The muscle discomfort associated with the acidosis also dissipates as your exercise pace decreases. Since this acid elimination happens naturally, no additional steps are needed to remove the lactic acid. The natural elimination of lactic acid generally happens within an hour.

**16. Restoration of muscle Glycogen**

Muscle glycogen recovery is the process through which the muscles of the body are replenished with carbohydrate sources that have been depleted through the energy expended in exercise. The muscles that are the target of this recovery to an optimal glycogen level are the skeletal muscles, those structures that are actually engaged in the movement of the body; the other muscle groups, the smooth muscles of the internal organs and the cardiac muscles do not possess a capacity for glycogen storage or conversion to fuel in the muscle.

**17. Carbohydrate Loading**

A carbohydrate-loading diet, also called a carb-loading diet, is a strategy to increase the amount of fuel stored in your muscles to improve your athletic performance for endurance events. Any physical activity requires carbohydrates for fuel. For most recreational activity, your body uses its existing energy stores for fuel. But when you engage in long, intense athletic events, your body needs extra energy to keep going. The purpose of carbohydrate loading is to give you the energy to complete an endurance event with less fatigue and to improve your athletic performance [10].

**18. Proprioception**

It is the internal regulatory system of the body that governs, the ability to generate and maintain an effective upright posture and physical balance. An internal sensory feedback system, proprioception is the complex series of communications that signal a variation in muscle contraction made in response to any external factors. The important proprioceptors located within the body are the vestibular system (the organs and nerves of the inner ear) and the stretch receptors, nervous system components that are located in the muscles of the joints. These receptors assist in permitting the body to know where the joints are positioned at any time.

**19. Muscle tone**

Muscle tone, also known as muscle tonus or residual muscle tension, is an unconscious low level contraction of your muscles while they are at rest. Essentially, muscle tone is what makes your muscles still feel somewhat firm while you are resting and not intentionally tensing them.

**20. Posture**

Posture is the position in which you hold your body upright against gravity while standing, sitting or lying down. Good posture involves training your body to stand, walk, sit and lie in positions where the least strain is placed on supporting muscles and ligaments during movement or weight-bearing activities.

**21. Equilibrium**

A state in which opposing forces or influences are balanced. State of stable conditions in which all significant factors remain more or less constant over a period, and there is little or no inherent tendency for change [11].

**22. Conclusion**

Based on the above physiological concepts and terms and their meaning, it can be concluded that it is very important to any one related to Sports, Physical Activity and Physical Education as a Coach, Trainer or Teacher to be aware about all the physiological concepts in Sports and Physical Education.

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