Chapter-I

Introduction

A sport in the present world has become extremely competitive. It is not the mere participation or practice that brings victory to an individual. Therefore, sports life is affected by various factors like Physiology, Biomechanics, Sports Training, Sports Medicine, Sociology, and Psychology etcetera. Coaches, trainers, physical education personnel and doctors are doing their best to improve the performance of the players of their country. Athletes/players of all countries are also trying hard to win laurels/medals for their countries at International competitions (Ghuman and Dhillon, 2000).

Many years or centuries ago, we as a race, worked very hard much every day. Most people did some sort of physical labor during job or for just basic survival. There were no preservatives not artificial sweeteners not diet pills and since food was not nearly as abundant most were not usually overweight. So people were not dying from obesity related illness or disease, they were just dying from other natural causes like rotten teeth!
“Health is Wealth”. Those who have understood its importance will try to keep them fit. Apart from a balanced diet, sports are necessary to maintain our health. If we do not play regularly, our body does not develop; it becomes weak. We may become a target for many of the diseases. Sports are necessary for maintaining our health and physical fitness.

Healthy living and physical fitness are closely connected. Being physically fit not only helps people live healthy lives; but also helps people to live longer. People who do physical activity and exercise as part of their daily life, when they are young likely to continue the same in their life as they grow older and get benefited throughout their lifespan. Physical activity is defined as any movement that spends energy. Exercise is a subset of physical activity, but it is an activity that is structured and planned. The best way to keep physical activity and exercise a permanent part of one’s life is to make it fun and enjoyable. If people are given different options of what they can do and have easy access to those options, they are more likely to participate in physical activity and exercise. This allows people to have a positive attitude toward physical fitness. It is also helpful if people are knowledgeable about the rewards of physical activity and exercise.
Sports also inculcate good qualities in us. Involving oneself in competitive sports will encourage healthy competition. Taking up captainship in team games will inculcate leadership qualities. Playing as a team will encourage co-operation among the players.

Sport is a worldwide phenomenon today. The unprecedented popularity and better organization of sports activities and competitions would have been impossible without the recognition of the importance of sports and sports competitions by the world. The world has realized the importance of sports for the development of modern civilization. The main objectives of physical education are to promote physical fitness, which in turn promotes health and happiness.

Sports in the present day have become extremely competitive; previous records are being broken whenever there is competition. It is not mere participation or a few days’ practice that brings an individual victory, but the continuous hard work and training right from childhood and strong anthropometry variables play their part and contribute to success.
Training

The term training refers to the acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies.

Training is much like constructing a multi storied building. One needs for the building things such as aerobic, anaerobic running, comprehensive conditioning, flexibility, etc. Several kinds of materials like training intensities and modalities should be utilized in an ongoing process to active the goal of raising strong structures or competitively fit athlete. Depending on the progress in the construction plan, the relative mix of all these materials will vary. As a training season develops, compressive conditioning work for strength of endurance will gradually form a transition into an emphasis on power with a substitution of intensity of volume in determining the total load.

Singh(1984) opines that sports performance is achieved not only by training but also by means like theoretical instructions, tasks of observation, physiotherapeutic measures for recovery from fatigue, psycho regulative procedures and so on. Hence, for him a sport training is “a process of preparation of sportsman, based on scientific and pedagogical principles for higher performance”.

The word “training” has been a part of human language since ancient times. It denotes the process of preparation for some task. These processes invariably extend to a number of days and even months and years. The term ‘Training’ is widely used in sports. There is however, some disagreement among sports coaches and also among sports scientists regarding the exact meaning of this word. Some experts, exceptionally belonging to sports medicine, understand sports training as “basically doing physical exercises”. Several terms are used in training. Example Strength training, Interval Training, Technical and tactical training reflect this line of thinking (Singh, 1991).

The term training refers to the acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies.

Training induces physiological changes in almost every system of the body, particularly within the skeletal muscles and the cardio respiratory system. The changes resulting from training are influenced by the frequency, direction and particularly, by the intensity of the training programme, and the heredity. The effects of training are specific to the type of exercises performed, the muscles groups involved and to the type of training programme used. The specificity of training and exercise has two broad
physiological bases – metabolic and neuromuscular. Training effects can be maintained with programmes consisting of one or two days of exercise per week. Previous training does not significantly influence the magnitude or rate of gain of training effects induced by subsequent training programme.

**Sport Training**

Sport training is a systematic process extending over a long period. For best results the system of training has to be based and conducted on scientific facts and lines; where it is not possible to do that, the training has to be based on the results of successful practice which has withstood the test of time in sport.

Sport training is a physical, technical, moral, and intellectual participation with the help of physical exercises. It is a planned process for the participation of athletes and players to achieve top-level performance.

Sport training aims at improving the sports performance. The sports performance, as any other type of human performance is not the product of one single system or aspect of human personality. On the contrary, it is the product of the total personality of the sports person (Singh, 1991). Therefore the nature and structure of sports performance determine to a great extent the means and methods of training as well as the total planning, organization, implementation and assessment of
training. The knowledge about the nature and structure of sports performance must be considered as the first and perhaps the most important step towards the successful preparation of sportsmen for higher performance. The process of identification and development of sports talent also has to be based on this knowledge.

**Types of Sports Training**

Numerous types of fitness training exercises improve performance in specific sports. Together, the correct combination of activities must build the fitness components that are key to high performance in each specific sport. Think of the fitness components such as speed, strength, and agility, as general qualities that are developed through skills like running, bounding, and jumping.

**Weight or Resistance Training**

Weight or resistance training focuses on building up strength, power or local muscular endurance by exercising muscle against a resistance. The muscles contract to lift a weight such as a barbell, a dumbbell or an item that offers resistance.


**Circuits Training**

Circuits Training is a great way to build a variety of fitness components and skills, particularly for larger groups of athletes. It features multiple stations where athletes perform assigned activities for specific periods of time or until they have completed a set number of repetitions, and then they rotate.

**Interval Training**

Interval Training involves short bursts of intense activity interspersed with lighter activity or rest periods. For example, athletes may repeat 200 meter sprints with full recovery or specific rest intervals. Intervals are excellent for building speed endurance for sports, where intense activity is separated by brief recovery periods, such as soccer, basketball, and rugby.

Interval training is used to improve both aerobic and anaerobic fitness. It refers to having periods of intense physical activity between periods of recovery, to allow longer periods of training time at your peak performance levels. Doing ten 80-metre sprints in ten seconds with a 60 second recovery is an example. In training for sprints, for example, the exercise intensity or maximum effort should remain unchanged and the recovery period should be at least three times longer than the training interval.
**Strength Training**

Strength Training requires athletes to use resistances to build strength, endurance, and size. Barbells, resistance bands, machines, and other types of equipment that offer resistance can be used to build strength—even the athlete's own body weight.

**Plyometric Training**

Plyometrics, or bounding exercises, are excellent for building power, coordination, and explosiveness. Boxes are sometimes used to capitalize on the effect of gravity for additional resistances.

**Endurance Training**

Endurance fitness can involve a variety of sustained activities that improve cardio respiratory function, or the heart and lungs. Jogging, swimming, and cycling are examples of activities that build aerobic capabilities while improving muscular endurance.

**Continuous Training**

Continuous training refers to aerobic activity performed at 60 to 90% VO$_{2\text{max}}$ for at least half an hour with a minimum of three training sessions per week. This training improves aerobic capacity. Examples of this are aerobics, gym circuit classes,
cycling and swimming and running and jogging. When done at the lower end of this range, it is often referred to as long, slow distance (LSD) training. This level of training is ideal for those starting off an exercise programme, those wishing to maximize burning calories for weight loss and as an option for an active "rest" day in a weekly aerobic training programme.

**Hill Training**

Hill running has a strengthening effect as well as boosting one’s athletic power and is ideal for those athletes who depend on high running speeds - football, rugby, basketball, cricket players and even runners. To reduce the possibility of injury hill training should be conducted once the athlete has a good solid base of strength and endurance.

**Training and Sports Performance**

The word training means different things in different fields. In sports, the word training means doing physical exercises. In a narrow sense, training is doing physical exercises for the improvement of performance. The concept is reflected in short terms, which are given to separate components of training or to separate methods or procedures of doing physical exercises.

Coaches and exercises physiologists also understand training to be doing physical exercises for the improvement of performance or separate performance factors. Training and sports
performance are a process of preparation of sportsmen and principles for higher performance.

The main aim of training in sports is to achieve high level of performance. This aim relates to different factors. The sports performance depends largely on physical fitness. Sports activity is a physical activity, which is not possible without motor abilities. Therefore, the improvement of physical fitness or motor abilities is the principal aim of sports training.

Now a day’s people are aware of physical fitness and they know the importance of physical education. The Physical education is one part of the education process. Physical fitness is very important for the youth. People know the slogan a “sport for all”. It develops ones physical, mental, emotional, social and spiritual aspects through the medium of physical activities.

**Continuous Training**

In this method an exercise is done for a long time without any break or pause. Because of the long duration of work the intensity is low. The continuous method has four variations which are slow continuous method, fast continuous method, variable pace method, and fartlek method.
Continuous training is a type of physical training that involves activity without rest. This type of training may be of high intensity, of moderate intensity with an extended duration, or fartlek training.

Continuous training means the person training uses 60-80% of their maximum heart rate for at least 30-60 minutes at least four or five times a week. This method suits long distance runners as well as tennis players etc, because it means that their endurance levels will increase, and it is the way which they would normally compete. Continuous training is a good way for an athlete to build up their cardio-vascular endurance levels. Continuous training forms the basis for all other training methods both anaerobic and aerobic.

**Methods of Continuous Training**

**Slow Continuous Method:**

In this method the speed or pace of exercises is determined according to heart rate. For trained sportsperson the heart rate during the exercise should be from 140 – 160 beats per minute.

The volume in terms of total duration should not be less than 30 minutes, and endurance athletes can go up to 2 hours or even more.
Fast Continuous Method: -

In this variation the work is done fast with/at unchanging pace for durations without any break. Heart rate is normally between 160-180 beats/minute. Total volume or duration should not be less than 20 minutes for trained sports persons.

Variable Pace Method:-

In this method the exercise is done continuously by changing pace or speed. The heart rate normally ranges between 140-180 beats/minute. The total duration or volume ranges by about 15 minutes to 1 hour. It can be used by trained sportsman only.

Fartlek Method: -

It is a variation of variable pace method. In fartlek change of pace or speed is not pre – planned. The sportsman changes the speed on his own during the activity, according to the terrain, surrounding and his feeling. The heart rate fluctuates in the range 140-180 beats / minute.

It is said to be continuous training when low to mid intensity exercises are performed for more than 20 minutes without resting intervals. Generally, this type of training is used to prepare the body for sustained workouts such as marathons and triathlons, but can also be effective for more casual athletes. It allows the body to work from its aerobic energy
stores to improve the overall fitness and endurance. Chief benefits of continuous training include fat burning, muscle building, and increasing maximum aerobic potential.

**Benefits of Continuous Training**

The benefits of continuous training include loss of body fat, stronger heart muscles, and higher energy levels. Athletes take advantage of this form of training to prepare for sports, competitions and other events, but ordinary individuals can often experience health benefits as well. For example, the loss of body fat can help individuals shed unwanted pounds. Muscle building and toning also helps to maintain a desired body weight and metabolizes fat. While there are many benefits, it is often noted that this exercise method can lead to mental exhaustion, muscle spasms and chronic headaches.

To gain the benefits of stronger heart muscles, an individual would have to work out continuously at a certain percent of his maximum heart rate and for a specified duration based on that percentage. For example, a jogger could run for 60 minutes at 60% of his maximum heart rate or up to five minutes at 95% his maximum heart rate. This forces the heart muscle to work hard and it often results in a stronger one. The same is true for the other muscles in the body. Swimming more laps, for example, will
help to build and strengthen muscles by pushing those muscles to work harder for a longer period.

An increase in energy level is one of the outcomes of continuous training. The reason is that it provides aerobic benefits, which lead to endurance. Individuals experience more energy to complete tasks when they are not working out and often find that they are more productive as well (www.wisegeek.org).

**Fitness Benefits of Continuous Training**

One of the biggest benefits of a continuous exercise plan is slow but steady improvement most athletes see over time. Someone who may only be able to jog for eight minutes at the start may find, after enough weeks or months have passed, jogging for 12 minutes is achievable. Before long, 20 or even 30 minutes may become normal. Usually at least three or four workouts per week are required to see improvement.

Continuous training can also help establish what is called a "fitness base," a foundation of exercise that athletes can depend on for further training. A person who knows he or she can comfortably jog for 45 minutes will be able to use that amount of time as a window for speed intervals or more intensive workouts later on. When the body is conditioned to keep moving for certain durations, it can adapt to fill those periods with different, more strenuous activities.
**Intermittent Training**

Intermittent exercise is a term used to describe a variety of different physical training types. The term "intermittent," which means to stop and start at intervals, and the term "interval," as in interval training, is used somewhat interchangeably. In most circumstances, interval training will be conducted as a high intensity exercise activity.

By its nature, exercise is not aimless; it involves physical exertion that is directed towards the development, increase, or maintenance of physical fitness. Intermittent exercise is a description of the intensity of the activity as well as its nature.

Intermittent exercises of various types are best known where they have been employed as components to endurance sports. Disciplines such as distance running, road cycling racing, and mountain biking require the body to produce the energy necessary for physical performance through the aerobic energy system, which primarily utilizes stores of carbohydrate products, in the form of glycogen reduced, as energy is required, to the sugar glucose. To generate energy, the body—through the cardiovascular system—transports oxygen and other nutrients essential to muscle function. The greater the ability of the heart to pump blood volume to the muscles, the likely more efficient the
production of energy and the removal of wastes such as carbon dioxide will be.

Intermittent exercise programs will tend to increase the oxygen transporting capacity of the body, often referred to as by the shorthand VO$_{2\text{max}}$. As a further general rule, the more the intense of the intermittent period of training, the greater will be the VO$_{2\text{max}}$. By illustration, suppose two equally athletically talented and physically fit cyclists are monitored over a training period of six months. One cyclist maintains a set exercise program of 60 minutes per day. The other cyclist rides the same distances at the same speed as the first for four days per week; his or her remaining three workouts are higher intensity, intermittent workouts of four 15-minute segments—each separated by rest intervals of five minutes from the intermittent training the cyclist would expect to obtain an increase in measured VO$_{2\text{max}}$ levels in the range of 5-15%.

The maximum oxygen uptake of an endurance sport athlete is not a guarantee of competitive success. Physical techniques, tactics, the strength of the musculoskeletal system generally, and other fitness factors will all play a role. What is virtually certain in these sports is that all other factors being equal, the athlete with the best ability to pump blood through the cardiovascular system and process oxygen has the best chance for competitive success.
As a further general proposition, the more intense the work performed in the intermittent period, and the shorter the rest interval, the greater the impact upon the \( \text{VO}_2\text{max} \). Intermittent training also tends to produce a heightened ability in the body to rid itself of lactic acid, a byproduct of aerobic energy production and a performance inhibitor. There have been a number of high level scientific studies conducted in an effort to resolve the question as to whether an intermittent exercise tends to reduce the fat stores in the body more efficiently than regular single duration exercises. It is believed that during the post-exercise recovery period the body does not utilize fat stores any more readily than it would after regular forms of exercise; it is likely that the noted fat losses in many of these studies are actually a confirmation of the fact that the appetite of an athlete involved in intermittent exercise programmes will be more readily suppressed, resulting in a reduction in fatty foods being consumed.

Sports that are powered by the anaerobic energy systems also benefit from intermittent exercise programmes with an aerobic emphasis. In a sport such as rugby, all of the body's energy will be produced by the anaerobic alactic system, where the ATP is available in the muscle for short bursts of activity up to
approximately ten seconds, and it is stored in a fashion that requires the ATP to be replenished very frequently. In the anaerobic lactic energy system, the body must sustain an energy level in segments of play greater than approximately 10 seconds and less than 90 seconds. Intermittent exercise training will assist the athlete in increasing the anaerobic threshold, which is the speed at which the athlete may function without drawing unduly upon lactic system. The aerobic system is the measure of the athlete's ability to recover from intense activity through the increased transport of oxygen.

The best specific measure of the recovery powers of an athlete in intermittent exercise is the ability of the athlete to attain a resting heart rate after the interval is completed. The biathlon, the traditional winter Olympic event involving intense cross-country skiing and the calm precision of target shooting, is an example of a discipline where the heart rate of the competitor may be pushed to levels very close to the maximum rate during the skiing portion of the event, followed by a required settling of the athlete's physiology to shoot at a target from a prone position. If the athlete is unable to reduce the heart rate for the shooting component, the ability to deliver the shots will be compromised.
Interval running enables the athlete to improve the workload by interspersing heavy bouts of fast running with recovery periods of slower jogging. The athlete runs hard over any distance up to 1k and then has a period of easy jogging. During the run, lactic acid is produced and a state of oxygen debt is reached. During the interval (recovery), the heart and lungs are still stimulated as they try to pay back the debt by supplying oxygen to help break down the lactates. The stresses put upon the body cause an adaptation including capillarisation, strengthening of the heart muscles, improved oxygen uptake and improved buffers to lactates. All this leads to improved performance.

Interval training has been the basis for athletic training for several years. The first form of interval training, called "Fartlek" involved alternating short, fast bursts of intensive exercise with slow, easy activity. Fartlek was casual, unstructured training that perfectly fitted its English translation: "speed play."

The interval programmes of today have become highly sophisticated methods of structured training for athletic performance enhancement. Physiologists and trainers have designed interval programmes that are specifically suited to individual athletes. These sessions include precisely measured intervals that match the athlete's sport, event and current level of
conditioning. Often the appropriate intensity and duration of the intervals is determined by the results of anaerobic threshold testing (AT) that includes measuring the blood-lactate of an athlete during intense exercise.

Interval training works both the aerobic and the anaerobic system. During the high intensity effort, the anaerobic system uses the energy stored in the muscles (glycogen) for short bursts of activity. Anaerobic metabolism works without oxygen. The by-product is lactic acid, which is related to the burning sensation felt in the muscles during high intensity efforts. During the high intensity interval, lactic acid builds up and the athlete enters oxygen debt. During the recovery phase the heart and the lungs work together to "pay back" this oxygen debt and break down the lactic acid. It is in this phase that the aerobic system is in control, using oxygen to convert stored carbohydrates into energy.

This repetitive form of training leads to the adaptation response. The body begins to buildup new capillaries, and is better able to take in and deliver oxygen to the working muscles. Muscles develop a higher tolerance to the build-up of lactate, and the heart muscle is strengthened. These changes result in improved performance particularly within the cardiovascular system.
Interval training also helps to prevent the injuries often associated with repetitive endurance exercise, and they allow you to increase your training intensity without overtraining or burn-out. In this way, adding intervals to your work-out routine is a good way to cross-train.

Interval training involves periods of intense training, interspaced with rest periods. During the rest period, the chemical fatigue produced of exercises can be paid off and new sources of energy are provided to the muscle. The intensity of training on the cardiovascular system is much greater than in distance running. The interval training stresses the glycogen system, which results in the production of high levels of discomfort associated with all intensive exercises. As a result, interval-trained athletes are subject to high levels of physiological stress and thus are familiar with this stress and know how to adjust to it when it confronts them during competitions.

Interval training method is mainly used for endurance enhancement. These types of conditioning programmes are quite flexible and permit adaptation. Interval training programmes have been very successful because they require less time and precautionary guidelines. They adapt to any physical place or
exercise regimen and they permit rapid progress. Interval training can be designed for all people regardless of age, sex, state of fitness, and mode of activity.

The idea of interval training was adopted by American coaches and through much experimentation. The variables of interval training have been designed, tested, and proved to produce greater gains in cardiovascular endurance.

The major point of interval training is that if the work rate or intensity is increased while work duration is held constant, the athlete will increase his work capacity to higher levels (Sreedher, 2007).

Interval training is a form of progressive conditioning in which the intensity of the activity, the duration of each bout, the number of bouts, the time or kind of rest periods between bouts or the order of the bouts are varied.

The variables associated with interval training include the number of repetitions, the duration of effort, work intensity, and duration of recovery.
The four significant factors of interval training are as follows:

1. A specified distance that is repeated a given number of times.
2. A recovery period during which the athlete jogs slowly and relaxes.
3. A pre-determined pace carefully timed at which the athlete covers the set distance.
4. A pre-determined number of repetitions in running the distance (Dhayanithi, 1991).

Interval training method is mainly used to develop endurance in movement.

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

The Interval method is based on the principle that work should be done with sufficient speed and duration so that the heart beat rate goes up to 180 beats per minute. After this there should be a recovery period and when the heart rate comes down to 120-130 beats per minute the work should be started again. The training load can be controlled by repeatedly checking the heart beat rate.
The effect of the interval method is determined by various methods keeping in mind the following factors:

- Speed of work
- Duration of work
- Duration of recovery
- Number of repetitions
- Nature of recovery

In simple terms, Interval Training involves a series of high intensity training which is bout followed by periods of rest. This type of training helps improve the delivery of oxygen to the muscles. Because of this, Interval Training is often used by long distance runners to build up their endurance.

The training effect of an exercise depends upon the amount of stress imposed upon the relevant parts of the body. There are variations, in the resting heart rate of different individuals. The percentage of heart rate reserve that is used in the exercise gives a better indication of intensity.

**Variables Chosen for this study:**

Almost all physical activities incorporate elements of force, quickness, duration, and range of motion. Exercises to overcome resistance are strength exercises. Speed exercises maximize
quickness and high frequency. Exercises of long distance or duration, or many repetitions are endurance exercises. Maximum range of motion results in a flexibility movement. Exercises with complex movements are known as coordination exercises.

Any physical activity may lead to physical, anatomical, physiological, biochemical, and psychological changes. The efficiency of a physical activity results from its duration and repetitions (volume); load and velocity (intensity); and the frequency of performance (density). When planning the dynamics of training, these aspects, referred to as the variables of training, should be considered. Throughout the training phases preceding a competition, the component emphasizing to achieve the planned performance objective should be defined. As a rule, the intensity for sports of speed and power and volume for endurance sports may be emphasized. Finally, for sports requiring intricate skills, training complexity is primary. In this study the following motor, Bio-chemical, and athletic performance factors have been selected as dependent variables.

**Bio-motor Factors**

- Speed
- Agility
- Cardio respiratory endurance
Bio-Chemical Factors

High Density Lipoproteins Cholesterol (HDL)

Low Density Lipoproteins Cholesterol (LDL)

Very Low Density Lipoproteins (VLDL)

Athletic Performance

100 Meters Run

800 Meters Run

1500 Meters Run

Importance of Bio-motor Factors

Speed is the ability to move the body or a part of the body as rapidly as possible from one point to another. Speed is the rate of movement, or the amount of time it takes for a body or object to travel between two points. Speed usually refers to running speed, as in the sprints in track or in football. However, speed can be performed as leg speed in soccer kicking, arm speed in throwing a basketball, and body speed (acceleration) necessary in fast break. Speed is related to strength and power. In fact, all skill-related components contribute to speed. Speed requires the expenditure of a large amount of energy in a short period. Age is a factor in attaining speed. Speed is the amount of distance covered in a given amount of time. Acceleration is how quickly you get to top speed.
Agility is the ability to change body positions quickly and accurately to the indicated response or situation. Some experts contend that strength is the most important factor in agility since a stronger body moves with more ease and efficiency.

Agility is a recognized and accepted factor of motor fitness. It is a unique compound factor, which includes acceleration, control, speed, reaction time, movement time, balance and explosive strength. It is total body movement, usually of short duration and or distance. Agility is total body movement, involving change of direction at a high rate of speed, quick acceleration and dodging. When the movement is performed well, it is controlled, accurate and efficient. Agility is the rapidity with which, accuracy of the total body movement is in response to the perceived stimulus. Injury and body weight affect agility performance.

Agility is the ability to explosively stop, change direction, and accelerate again. The primary goal of agility is to enhance body control and increase the athlete’s ability to accelerate and decelerate in multiple directions.

Cardio respiratory endurance refers to one’s body’s ability to gather process and deliver oxygen to the working muscles. Along with other physical skills such as speed, strength, power and agility, cardio respiratory endurance plays a significant role in the overall success of a basketball player. By improving cardio
respiratory endurance, you can improve your basketball performance by training, practising and playing at a higher intensity for a longer period of time.

Cardio respiratory endurance also plays a role in muscular endurance -- the ability to perform repeated muscle contractions for an extended period of time (www.livestrong.com).

Cardiovascular fitness is best improved by activities, which employ large muscle groups working dynamically. Such activities include walking, jogging, running, swimming, skating, cycling, stair climbing, and cross-country skiing.

Developing maximum power and strength are the two most important fitness goals for most volleyball players. This is because the game is comprised of fast plays require powerful bursts of movement. Due to this, training sessions that involve quick, intense movements are the best for most volleyball players.

The endurance needed to sustain general total physical effort for long periods of time is called cardiovascular endurance. A look at the basic physiological nature of the cardiovascular system will make clear how this system affects the player.
**Importance of Bio-Chemical Factors**

Bio-chemical factors include neutral fat, known as triglycerides, the phospholipids, cholesterol and a few others of lesser importance. Chemically, the basic lipid moiety of the triglycerides and the phospholipids is fatty acid, which is simply long chain hydrocarbon organic acid (Guyton, 1991). An odourless, tasteless, white fatty, alcohol cholesterol is found in all cell membranes. It is vital to cell survival and growth. Cholesterol is also a key precursor or intermediate compound in the production of numerous biologically important substances collectively called steroids. These include various essential hormones and bile acids, the major excretory product of cholesterol metabolism, which is also important in the digestion and absorption of dietary lipids (Leon, 1987).

The triglycerides are used in the body mainly to provide energy for the different metabolic processes and this function they share almost equally with carbohydrates. However some lipids, especially cholesterol, the phospholipids and derivatives of these are used throughout the body to perform other cellular functions (Guyton, 1991).

As lipids are insoluble, they are chemical in the plasma lipoprotein complex. There are four types of lipoproteins. Based
on their density they are named as high-density lipoprotein (HDL), low-density lipoprotein (LDL), very low-density lipoprotein (VLDL) and chylomicrons.

The epidemiological studies indicate a higher level of lipid circulation, than the desired level in a person’s blood circulation and this may be a strong cause for the incidence of Cardio Vascular Disease (CVD) among such people. The circulating lipids in the blood may be categorized into five types of lipoproteins according to their density, composition, and size, Very Low Density Lipoproteins (VLDL), Low Density Lipoproteins (LDL), Intermediate Density Lipoproteins (IDL), High Low Density Lipoproteins (HLDL), and Chylomicrons. Again there are subfractions in HDL like HDL-1, HDL-2, and HDL-3. Total cholesterol is carried by VLDL, LDL, HDL and Chylomicrons.

The percentage of LDL is the most significant risk factor in the development of Coronary Heart Disease (CHD). LDL cholesterol is the main component in atherosclerotic plaque formed in the term of blood arteries, causing blockage of blood stream. Incidentally, the HDL cholesterol acts as reverse cholesterol transfer stem that resists the development of atherosclerosis.
Importance of Athletic Performance Factors

The 100 metres, or 100-metre dash, is a sprint race in track and field competitions. The shortest common outdoor running distance, it is one of the most popular and prestigious events in the sport of athletics.

The 800 and 1500 meters are exciting races. They require a combination of speed and stamina unique in the world of track and field, and this makes them amazing to watch for both participants and spectators. Even if athletes are in peak physical condition, they will often have to work their guts out to win at the end. Racers learn how to kick after sprinting either 600 meters or 1200 meters.

These two races are fast, yet unlike the 100 meters, there is time to make up for minor mistakes. Just when you may think the winner is clear, a racer can "tie up" or another racer can surge and run past. The two races are long sprints, as they are fast for 2 or 4 laps, depending on the race. Although the world's top racers make it look easy, those who have attempted to run these distances know how demanding the race pace can be.

The first key to success in the 800 mts and 1500 mts, of course, includes the basics: biomechanics, being in good physical condition, completing appropriate workouts throughout the season, and staying injury-free. An additional step that can add to
all of the physical hard work is to be mentally prepared. This article will focus on specific mental skills to prepare for the 800 and 1500 meters. Specifically, key mental preparation components will be discussed. Strategies for applying the techniques to a training routine will also be addressed. Finally, some common racing errors will be identified, along with some potential solutions (Bessel, 2014).

In this context, the investigator has made an attempt to find out the acute effects of Continuous running and Intermittent training programmes on selected Bio-motor, Bio-chemical and athletic performance factors of professional college men athletes, such as Speed, Agility, Cardio Respiratory Endurance, High Density Lipoproteins Cholesterol (HDL), Low Density Lipoproteins Cholesterol (LDL), Very Low Density Lipoproteins Cholesterol (VLDL), 100 Meters Run, 800 Meters Run, and 1500 Meters Run.

**STATEMENT OF THE PROBLEM**

The present study was designed to find out the acute effects of Continuous running and Intermittent training programmes on selected Bio-motor, Bio-chemical, and athletic performance factors of professional college men athletes.
HYPOTHESES

It has been scientifically accepted that any systematic training over a continuous period of time would lead to produce changes in human beings. Based on this concept, the following hypotheses were drawn.

1) There would be significant improvement on selected Bio-motor related factors due to the effect of continuous running and intermittent training programmes.

2) There would be significant improvement on selected Bio-chemical related factors due to the effect of continuous running and intermittent training programmes.

3) There would be significant improvement on selected athletic performance related factors due to the effect of continuous running and intermittent training programmes.

4) There would be significant differences on the selected Bio-motor, Bio-chemical and athletic performance factors of professional college men athletes among the experimental groups.
DELIMITATIONS

1) To achieve the purpose of the study, forty five (N=45) men students who were studying in various affiliated Colleges of Anna University Zone-XIII and who were participating in inter collegiate athletic meets during the year 2012-2013 were randomly selected as subjects.

2) The age of the subjects ranged from 18 to 21 years.

3) The subjects were divided at random into three groups of fifteen each (n=15). Group-I underwent Continuous Running, Group-II underwent Intermittent Training, and Group III acted as Control.

4) The duration of the training period was restricted to twelve weeks and the number of sessions per week was confined to three.

5) The study was delimited to the following variables:

**Independent Variables**

- Continuous Running
- Intermittent Training

**Dependent Variables**

**Bio-Motor Factors**

- Speed
- Agility
- Cardio respiratory endurance
Bio-Chemical Factors
- High Density Lipoproteins Cholesterol (HDL)
- Low Density Lipoproteins Cholesterol (LDL)
- Very Low Density Lipoproteins (VLDL)

Athletic Performance
- 100 Meters Run
- 800 Meters Run
- 1500 Meters Run

6) The selected criterion variables for the study were assessed by the following standardized test items: Speed was assessed by 50 meters run test, Agility was assessed by shuttle run test, Cardio respiratory endurance was assessed by Cooper’s 12 minutes run/walk test, High Density Lipoproteins Cholesterol (HDL), Low Density Lipoproteins Cholesterol (LDL) and Very Low Density Lipoproteins Cholesterol (VLDL) were assessed by Blood samples test, and 100 meters run, 800 meters run and 1500 meters run were assessed in the 400 meters standard track.

7) The data were collected on selected criterion variables at prior and immediately after the experimental period as pre and post tests respectively.
LIMITATIONS

The following limitations were considered for this study:

1) Psychological factors, food habits, and daily schedules could not be controlled.
2) No special motivation could be given for the subject during testing and training.
3) Participation in routine work and other physical activities by the subject could not be controlled.
4) The previous experience of the subjects in the training was not considered in this study.
5) Changes in climate conditions during the training period could not be controlled.
6) Heredity and endogenous factors could not be controlled which might have influenced the results of the study especially the HDL Cholesterol and LDL Cholesterol levels.

DEFINITION OF THE OPERATIONAL TERMS

Training

Training has been defined as a programme of exercise designed to improve the skills and increase the energy capacities of an athlete for a particular event (Fox, 1984).
Sports training is a pedagogical process, based on scientific principles, aiming at preparing sportsmen for higher performances in sports competition.

**Continuous Running**

Continuous running means running in an unbroken series or pattern of running with oxygen.

**Intermittent Training**

Intermittent training is defined as a method of conditioning runners, which involves variables factors including the distance of the training run, number of repetitions of the training distance, speed of the training runs, and the type of activity (walking or jogging) during the recovery period after each training run. Briefly it involves repeatedly running a specific distance at predetermined speed, resting a specific period of times following each fast run.

**Speed**

Speed is defined as the capacity for moving a limb or part of the body’s lower system or the whole body with the greatest possible velocity (Dick, 1980).

Speed of movement is a prized quality in athletics. Speed of movement shall be defined as the rate at which a person can propel his body or parts of his body through space (Johnson and Nelson, 1988).
**Agility**

It is the ability of the human body to change direction quickly and effectively (Uppal, 1992).

**Cardio Respiratory Endurance**

Cardio-respiratory endurance is the ability to do movements involving large number of muscles, at a slow pace for prolonged period e.g., jogging, walking at moderate speed (Singh, 1991).

It is defined as the ability of the heart and lungs to work at optimal efficiency during continuous exercise (Seaton, 1983).

**High-Density Lipoprotein Cholesterol (HDL)**

A cholesterol carrier regarded as a scavenger that removes cholesterol from the arterial wall and transports it to the liver to be metabolized (Wilmore and Costill, 1994).

**Low-Density Lipoprotein Cholesterol (LDL)**

A cholesterol carrier theorized to be responsible for depositing cholesterol in the arterial wall (Wilmore and Costill, 1994).

**Very Low Density Lipoproteins Cholesterol (VLDL)**

VLDL- Cholesterol is specific kind of lipoprotein when found in excess in the blood to increase the risk of sclerosis by carrying cholesterol to the tissue. The VLDL contains the greatest
percentage of lipid (95%) of which about 60% is in the form
triglyceride. These lipoproteins transport to muscle and adipose
tissue the triglycerides formed in the liver from lipids,
carbohydrates, alcohol and cholesterol. VLDL is TG/5 and
expressed as mg/dl.

**100, 800 and 1500 Meters Run**

A run of a total distance of 100, 800 and 1500 meters
continuously in the standard track and judged by the least time
taken to cover the distance.

**SIGNIFICANCE OF THE STUDY**

1) The finding of the study may help the Coaches,
athletes, and Physical Education teachers to select
and utilize well planned effective training methods for
peak performance.

2) This study would be of immense significance because
it would provide an opportunity to the Physical
Education teachers, Coaches and athletes to
scientifically understand and assess the changes in
the fitness variables due to continuous running and
intermittent training.
3) The results of this study would help the professional college students to know the depth concept in the area of continuous running and intermittent training.

4) The findings would contribute to the existing fund of knowledge in the field of training, by shedding new knowledge.

5) This study may be useful to the budding researchers who may get motivated by the findings of the present study, to explore new horizons in the chosen area of investigation.