CHAPTER I

INTRODUCTION

Improving skill means that the performance of any motor task becomes more efficient thereby reducing the time taken to complete the task and the level of effort required. This increased level of skillfulness could also mean more enjoyment and satisfaction for the performer by increasing the ease with which the task can be completed or by allowing new, more complex skills to be attempted. If by understanding the processes that govern the control of movement we can show the way for all individuals to improve their ability to perform the myriad of motor tasks that they confront, then we can claim to have made a real contribution to improving the quality of life within our society (Kerr, R. 1982).

Sports in the present world has become extremely competitive. It is not the mere participation or practice that brings out victory to an individual. Therefore, sports life is affected by various factors like physiology, biomechanics, sports training, sports medicine, sociology and psychology etcetera. All the coaches, trainers, physical educational personals and doctors are doing their best to improve the performance of the players of their country. Athlete players of all the countries are also trying hard to bring laurels, medals for their countries in International competitions.

Athletic performance has dramatically progressed over the past few years. Performance levels unimaginable before are now commonplace, and the number of athletes capable of outstanding results is increasing. One factor is that athletics is a challenging field, and intense motivation has encouraged long, hard hours of work. Also, coaching has become more sophisticated, partially from the assistance of sport specialists and scientists. A broader base of knowledge about athletes now exists, which is reflected in training methodology (Bompa, 1999).

Most scientific knowledge, whether from experience or research, aims to understand and improve the effects of exercise on the body. Exercise is now the focus of sport science. Research from several sciences enriches the theory and methodology of training, which has become a branch of science. The athlete is the subject of the science of training. . The athlete represents a vast source of information for the coach and sport scientist.

Training is not a recent discovery. In ancient times, people systematically trained for military and Olympic endeavors. Today athletes prepare themselves for a goal through training.

Training represents a long term endeavour. Athletes are not developed overnight and a coach cannot create miracles by cutting corners through overlooking scientific and methodical training.

1.1 SPORTS TRAINING

Training is a programme of exercise designed to improve the skills and to increase the energy capacity of an athlete particular event, therefore training is essential for the development of physical fitness components (William and Sperryn, 1976).

Sports training is the process of sports protection based on scientific and pedagogical principles for higher performance (Hardayal Singh, 1991).

The word training has been a part of human language since ancient times. It denotes the process of preparation for some task. This process invariably extends to a number of days and even months and year. The term “training” is widely used in sports. There is however some disagreements among sports coaches and also sports scientists regarding the exact meaning of the word. Some experts, especially belonging to sports medicine understood sports training as basically doing physical exercise, Several terms used in training for example, strength training, interval training, bench step training, technical training and tacticall training reflect the line of thinking.

The Basic training procedures will serve better when utilized with modification suited to individuals or a group dealt with. The training programme should look into improving the performance of the athletes and at the same time should prevent injury from taking place (Fox, 1984).

Training means a systematic scientific programme of conditioning exercise and physical activities designed to improve the physical fitness and skills of the players or athletes participated. Training means preparing for something for an event or reason of athletic competition, a nursing carrier or operative performance of military combat. Much growth and change occur during training.

Training involves periodic assessment of the athlete's status and progress. Training usually varies regular increase in the difficulty of task performance. Training suggest some form of gradual increase in performance output over an extended period of time. Most kind of training needs regular repeated and collective repetition of some of the original movement. Any invariable training implies hard work. Training should result in a level of personal fitness and should be associated with good health.

1.2 METHODS OF TRAINING

There are different methods of specific training programmes available for the development of speed, muscular strength level, endurance and cardio respiratory endurance to their maximum. Methods of training include weight training, interval training, fartlek training, circuit training, isotonic training, isometric training, isokinetic training. But before giving training the coaches or physical education teachers should have clear understanding of the method of training to be given to the sports men concerning. the basic principles and guide lines for constructing an effective conditioning programme. Since there are specific principles and guidelines

for optimal training adaptation to take place, training programme should be designed to suit the specific energy sources needed for athletics, specific event or contest. Moreover it is generally agreed among coaches and exercise physiologist that every body does not respond to training in the same manner. There are certain anatomical (trunk, shoulder, pelvis, chest, abdomen, upper and lower extremities) and physiological (blood volume, blood pressure, heart rate, cardiac output and vital capacity), sex difference which favour both male and female for specific activities. Coaches and physical education teacher should also have an idea of factors influencing in the pre adolescent and adolescent period during the training period.

Physical activity causes beneficial changes in the functioning of all internal organs, particularly, the heart, lungs and circulatory system. Studies have proved that exercise is the cheapest preventive medicine and after a period of training there is a slow but consistent reduction in resting heart rate along with an increase in stroke volume. It is a known fact that the slower heart rate and increased stroke volume provide a greater rest for the heart between beats.

1.3 EFFECTS OF TRAINING

Vigorous training, the blood circulation quickness, blood and lymph stream through the muscle, supply the cells with oxygen and nutrition removing waste products. The heart activity is accelerated exercise and strengthening its own fibers. Exercise also stimulates growth, and strengthens the bones, muscles, ligaments and tendons (Hardayal Singh, 1984).

The training process acts as a means of improvement of sports performance. In order to ensure fast development in every individual the physical education teachers, the coaches and the instructors must possess a thorough knowledge of the improvement aspect of sports training (Walter, 1969).

Training demands correct understanding and realization of the sportsman's strength, capacity and weakness, so planned and formulated that the strong points are further encouraged and developed and his weakness are discriminated and eliminated. Training improves the functions of the circulatory, the respiratory and the muscle system while practice is largely aimed at improving the control of muscle activity by the nervous system. Different training methods have been commonly used to improve physical fitness and its related standards of performance of the players.

Training increases the overall efficiency of the heart contraction and becomes more forceful. The diastolic phase increase and the reservoir capacities are enlarged.

1.4 INTENSITY

The term intensity refers to how hard one is working during his workout. Intensity is one of the most important components of the workout programme. When one does workout at a sufficient intensity, his body grows stronger and he'll see changes in his weight, body fat percentage, endurance and strength.

Intensity in training can be described as giving 100 percent of one's mind, body, and soul to every repetition, every set, every exercise, and every workout. Intensity means pounding the weights so hard that every set throughout the entire workout ends in absolute failure. In other words, one have absolutely nothing left in reserve when the set is completed. Intensity is just as much a mental feat as it is a physical one.

Intensity can also be defined as consistently striving for a higher level of excellence with every exercise, set, and rep one perform—regardless of what one has achieved in the past. The person must constantly strive to raise the standards for what one expect of oneself during every session. Intensity is never being satisfied with the current level of performance or development because, deep inside the soul, one knows that he is capable of at least one more repetition, five more pounds, or a slight improvement in his form or execution.

Intensity has been called the most important of the prescriptive components. It is also the most difficult phase because of the necessity of bringing in control of the intensity of training. That is, intensity is expressed in terms that they are stable such as heart rate, so attention must be made to conditions that create stability and the methods of monitoring change.

Most exercise physiologists agree that the physiological and biochemical changes associated with training occur at about two percent of the individuals maximal aerobic capacity where as intensity less than 60 percent are not nearly

sufficient. The same experts have also warned adults exceeding 90 percent of their maximal aerobic capacity even during peak exercise effort. They recommend 60 percent and 80 percent of their maximal capacity for state effective training. These levels can be estimated by using heart rate as guidelines.

Different activities can be carried out with different intensities which may have different effect in organism. According to noble exercise intensity is determined by adding 4 seconds to the average race pace speed. This is maximal times manipulation of exercise and rest time has a sufficient effect on the intensity of the training stimulus.

The proper intensity of training can be determined by trial and error. If an exercise bout results in a heart rate that is below the training heart rate increase the speed or intensity of the next bout and if the heart rate is above the training heart rate decrease the intensity of the next bout. One of the great advantages of this type of program is that it allows exercise in many varied and different conditions with minimal changes. The heart rate will accurately reflect the stress level on the body and allow an adult to exercise safely in the heat or at altitude. The speed of the activity may decrease but the training effect will be same. The principle works on the other way too. As the cardio vascular system becomes more efficient, work will become easier and the tempo of the activity will necessarily increase to maintain the training heart rate.

1.5 EXERCISE INTENSITY

Exercise intensity should be checked frequently during and beginning of exercise programme. This requires some practice in taking one's pulse usually in the radial or carotid artery locations, since it is rather difficult to calculate the pulse during exercise. The pulse should be taken for a period of ten seconds immediately after stopping, beginning the count with zero. If the rate is below the prescribed training range, the intensity should be increased and if the rate is above the range, the intensity should be reduced.

For cardiovascular conditioning to take place the intensity should exceed approximately 50 percent at 60 percent of functional capacity (VO_2) and for safety and comfort and may exceed to 75 percent to 80 percent. This usually translates to a heart rate training range of 70 percent to 80 percent of maximal heart rate.

Maximal heart rate can be estimated to be 220 beats per minute for healthy individuals under age 20. Under age 45 with no coronary risk factors, endurance – training also tends to show somewhere around 185 to 190 beats per minute. It tends to lower the resting heart rate. In highly trained athletes, it may be as low as or lower than 40 to 45 beats per minute, on the other hand, in healthy but untrained subjects, resting heart rates may be as high as 90 to 100 beats per minute. Thus the trained subject is generally characterized as having a lower resting heart rate and the untrained as a high resting heart rate. The highest attainable heart rate during

performance of strenuous work not only depends upon the state of conditioning but also upon age.

For cardiovascular conditioning to take place the intensity should exceed approximately 50 percent of functional capacity (VO_2) and for safety and comfort not to exceed 75 percent to percent. This usually translates to a heart rate training range of 70 percent to 80 percent of maximal heart rate.

The intensity and length of the work interval should be based upon the primary energy system being used in the activity. Short distance runners should have short high intensity intervals whereas marathon runners may run intervals of 3 miles at race pace or slower. It should be pointed out that the rest interval is really not a time to stop all activity but only a jog or walk period which allows the body to recover somewhat before the next interval begin.

At the age of 20 the maximal heart rate is about 200 which is reduced to approximately 155 at the age of 70. The exact mechanism involved in this age reduced maximal heart rate is not fully understood. It is also pointed out that the type of exercise also definitely influences the increase in heart rate. For example the greatest acceleration of the heart occurs in exercises of speed such as sprint running where as the smallest increase takes place in exercise of strength such as weight lifting and throwing in exercise that are classified as endurance such as distance running. The heart rate is some where between those of speed and strength exercise

at the same time, however heart rate recovery take longer following cessation of the endurance exercise.

There are several factors that affect the resting heart rate besides exercise and training. Although the extent of variation differs with each individual body position has a definite effect upon the heart rate. Generally the rate is lowest in the recumbent followed by the sitting and standing. It appears that the typical response from the recumbent to the standing position is an increase around 10 to 12 beats per minute. This is done to the influence of the gravity which lowers the volume of blood returning to the heart. One goes from a reclining position to a sitting or standing position individuals who are physically fit show a similar increase between lying and standing than sedentary individuals.

1.6 THE SELECTION OF EXERCISE INTENSITIES

The following principles are used for establishing the structure of the exercise test.

1. The test duration should exceed 6 minutes but not longer than approximately 15 minutes.

2. The test protocol should incorporate a warm up period.

3. The initial exercise intensity should be at a level below the estimated point of impairment in the case of a patient and below the estimated maximal capacity in other cases.

4. The test should involve variable loads instead of single continous protocol. The technique allows observation of an individual within a variety of exercise intensities, representing the possible daily range of physical activities.

5. The tests protocol should be arranged in stages with each stage progressively increasing in intensity until the termination criteria is reached. The staged duration should ensure attainment of steady state conditions for heart rate and oxygen consumption duration between 3 minutes to 6 minutes meet this requirement.

1.7 INTENSITIES OF TRAININGAND ITS EFFECTS

Intensity is defined as the percentage of maximum load that was being used. For example a 75% load (e.g. if one can use 100 lbs maximum and are lifting 75 pounds), is a lower intensity than a 95% load (when one is using 95 pounds of his 100 pound maximum).

Physiological changes ranging from training are generally related to the intensity of the exercise. Intensity is expressed in terms of efforts relative to the subject control capacity. The enhancement of capacity is greater when load of 90 to

100% of the individual capacity are imposed. Maximal loads are potentially injures and painful and reutilized mainly by athletes in their final training for championship performance.

The training effect of exercise depends upon the amount of stress imposed upon the relevant part of the body. There are variation in the resting heart rate response that is used in the exercise gives a better indication of intensity.

Significant training changes occur at levels of intensity as low as 25% of maximal cardiovascular function of middle aged men improved identically at the intensity of the individuals. Maximum heart rate equals to 70 to 87% of his maximal – oxygen uptake (Anthony, 1972).

1.8 EFFECTS OF TRAINING

The training process acts as a means of improvement of sports performance. In order to ensure fast development of sports performance in every individual the physical education teacher, the coaches and the instructors must possess a thorough knowledge of the improvement aspects of sports training.

Training demands correct understanding and realization of the sportsman's strength, capacity and weakness, so planned and formulated that the strong points are further encouraged and developed and his weakness are discriminated and eliminated.

Training improves the functions of the circulatory, the respiratory and the muscle system while practice is largely aimed at improving the control of muscle activity by the nervous system. Different training methods have been commonly used to improve physical fitness and its related standards of performance of the players.

Training increases the overall efficiency of the heart Contraction becomes more forceful. The diastolic phase increases and the reservoir capacities are enlarged.

1.9 FREQUENCIES OF TRAINING

A substantial amount of evidence has been found to indicate that in order to develop one's cardio respiratory endurance capacity, daily exercise and train11ing are not necessary. In fact studies show that three to five days per week is an optimal number of work outs of developing cardio respiratory fitness. Once a regular exercise routine has been established and the workouts have been enjoyable then the frequency of workouts may be extended to more than three to five days per week . One of the major goals of an exercise program is to make it not only intense enough to see some positive results (in terms of cardio respiratory endurance) but also to make it enjoyable enough to where it becomes a part of an individuals regular routine, any person should look forward to workout session and not dread it. It is better to start gradually and take more time reaching your objectives than to start at a high level drop out because of injury caused by either the intensity or frequency of

the programme. Any sports activity whether it is running, calisthenics can be done in accordance with the interval principal. As a matter of fact man should do all physical work in intervals rather than continuously more work and less fatigue will be the reward (Morehouse and Gross, 1975).

According to Doherty (1976) resistance to many effects of fatigue can be obtained by a gradual increase in the accomplished work in proportion to the increase in muscle efficiency. To find out how far the resistance training in the form of weight training with varied intensities and frequencies influences selected motor fitness and physiological variables the investigator was interested to study the effect of varied intensities and frequencies of weight training on selected motor ability components and the physiological variables.

110 WEIGHT TRAINING

Better performances can be the product of a number of factors. This product is primarily the outcome of efficient technique. The progression of speed and the maturing competitive attitude on a sound basis of general endurance, all round strength and general mobility. The development of all round strength is best achieved in the weight training and then progressing this through weight training in the form of varied frequencies and intensities.

Weight training is a common type of strength training for developing the strength and size of the skeletal muscle. It uses the force of gravity (in the form of

weighted bars, dumbbells or weight sticks) to oppose the force, the force generated by muscle through concentric or eccentric muscles contraction. Weight training uses a variety of specialized equipment to target specific muscle groups and types of movements. (Wikipedia, 2007)

Development of strength with the use of weight training is based on the overload principle. Weight training can be most effective training programme for development of the strength and size of skeletal muscles. It provides functional benefits and may improve overall health and well being.

Weight training differs from body building, weight lifting, power lifting and strong men, which are sports rather than forms of exercise. Weight training however is often parts of the athletes' training programme.

Sports movements strength does not appear in isolated form but in combination with other abilities and techniques or skill. The strength required for executing a specific movement for doing a specific activity is called as specific strength. The specific strength has to be improved in combination with factors with which it appears. Therefore, the selection and executing of exercise has to be done in accordance with the nature of the competitive movements. Structure and load structure of the exercise should closely resemble competition movements (Hardayal Singh, 1984).

1.10.1 WEIGHT TRAINING EXERCISES

The exercise must be specific to the type of strength required and is therefore related to the particular demands of the events (specificity). The coach should have knowledge of the predominant types of muscular activity associated with the particular event, the movement pattern involved and the type of strength required. Exercises should be identified that will produce the desired development.

Although specificity is important, it is necessary in every schedule to include exercises of a general nature, e.g. power clean, power snatch, bench press, back squats, sit ups, deadlift, shoulder press, chest press, cat pull downs, lower back extensions, tricep press, calf raise, leg curls, leg extension, leg press etc. These general exercises given a balanced development and provide a strong use upon which highly specific exercise can be built.

1.10.2 MUSCLE FIBRE HYPERTROPHY

Resistance training will increase the muscle size (hypertrophy). Muscle growth depends on the muscle fibre type activated and the pattern of requirement. Muscle growth is due to one or more of the following adaptations. (a) Increased contractile proteins (action and myosin). (b) Increased number of size of myofibrils per muscle fibre. (c) Increased amounts of connective, tendinous and ligamentous tissues and (d) Increased enzymes and stored nutrients.

1.10.3 BENEFITS OF WEIGHT TRAINING

The variation and degree of benefits from weight training is influenced primarily by the effort put into the training programme. Normally better performance is the product primarily of efficient techniques, the progression of speed, the maturing competitive attitude, a sound general endurance, all round strength and general mobility. The development of all round strength is best achieved with circuit training with further programme through the weight training. Weight training is the most widely used and popular method for increasing strength.

The principle refers to continually increasing the demands on the muscle skeletal system in order to continually make gains in muscle size, strength and endurance, in simplest terms. In order to get bigger and stronger, one must continually lift more and more and make the muscles work under them they are used to. If not, the muscle will not become any stronger or bigger than they are.

The progressive overload principle does not just apply to resistance training and increasing muscle growth and strength. It can also be applied to increasing bone and connective tissue strength (strength resistance training) as well as cardiovascular fitness and associated physiological changes that take place through a progressive weight training.

1.11 MOTOR ABILITY COMPONENTS

The neuromuscular components of fitness, which enable a person to perform successfully at a particular motor skill, game, or activity is defined as motor ability components. Specific motor fitness components include agility, balance, coordination, power, reaction time, and speed. Motor fitness is sometimes referred to as skill-related fitness.

It is a term refers to the total dynamic physiological state of an individual. The components of motor abilities are strength cardio vascular endurance, speed, agility, power, flexibilities, balance and co-ordination.

Motor skills are a learned combination of movements that allow a person to be efficient when performing a task. Throughout the day, people use thousands of movements that involve their various motor skills. There are different motor skills as detailed below.

1.11.1 Gross Motor skills

Gross motor skills are movements that utilize the large muscles of the body. These skills allow children to sit, walk, crawl, throw and catch a ball and to stay balanced while riding a bike. Gross motor skills typically develop before fine motor skills and can include rolling over and lifting one's head. Over time, a child's coordination with his gross motor skills improves and it will continue to give a healthy lifestyle through adulthood.

1.11.2 Fine Motor Skills

Fine motor skills involve the movement of smaller muscles like the eyes, hands, feet, toes, tongue and lips. These skills can involve the manipulating of play activities such as, the tearing of paper into small strips, cutting with scissors, finger painting, and hand and foot eye coordination. Fine motor skills also involve the sensation of touch and how the brain perceives the objects touched. A term often used to describe fine motor skills is dexterity.

1.11.3 Graphomotor Skills

Some consider graphomotor skills a subset of fine motor skills, but others believe that the ability to hold and manipulate a writing utensil falls into another category. The development of strong graphomotor skills requires a connection between the brain and the fingers, developed finger and hand muscles, and the muscle memory of where the fingers should hold the writing utensil. A student who is strong at drawing and weak at writing may have developed fine motor skills without having yet developed graphomotor skills.

1.11.4 Perceptual Motor Skills

Perceptual motor skills can refer to any motor skills whether it is gross motor skills, fine motor skills or graphomotor skills. For a child to fully develop any motor skills, they must become perceptual motor skills. This means that the child has internalized skills and a connection now exists between the particular action and the

brain. A child who has played tennis may play badminton well because they are similar motor skills and that skill has already developed a connection to the brain.

1.12 MOTOR FITNESS

Motor Fitness refers to the ability of an athlete to perform successfully at their sport. The components of motor fitness are (Davis 2000) Agility, Balance, Co-ordination, Power (speed & strength) and Reaction Time

Fitness has been defined as how well a person is adapted to and capable of living a certain lifestyle. The athlete obviously has greater fitness than the non-athlete because of the training for a chosen event or events. But what is fitness made up from? The law of specificity states that there is a specific response to the specific nature of a training load. This specific response will tend to emphasise one or more of the abilities that make up fitness. These abilities are basic and respond well to training. Since these abilities affect how the body moves they are given the name "biomotor abilities".(IAAF, 2002)

1.13 THE COMPONENTS OF MOTOR FITNESS

There are five basic motor abilities which are considered as biomotor abilities and these are strength, endurance, speed, flexibility and coordination.

Each exercise in training tends to develop a particular biomotor ability. For example, when the load of an exercise is maximal it is a strength exercise. Quickness

and frequency of movement give a speed exercise. If distance or duration is maximal the exercise becomes endurance based.

Exercises that have relatively complex movements are called coordination exercises. This is a simplified view and practice exercises usually develop two or more biomotor abilities.

Different events have different demands on fitness. The fitness of the marathon runner is obviously very different to the fitness of the shot putter. To develop the specific fitness required for an event it is necessary for the coach to understand the characteristics of the five biomotor abilities and how to develop them.

1.13.1 STRENGTH

Muscular strength is the ability of the body to exert force. Strength is important to every event for both men and women. Muscle fibres within the muscles respond when subjected to weight or resistance training. This response makes the muscle more efficient and able to respond better to the central nervous system. Strength may be broken down into three types:

- Maximum strength
- Elastic strength
- Strength endurance

1.13.1.1 MAXIMUM STRENGTH

This is the greatest force that a contracting muscle can produce. Maximum strength does not determine how fast a movement is made or how long the movement can be continued. It is important in events where a large resistance needs to be overcome or controlled.

1.13.1.2 ELASTIC STRENGTH

Elastic strength is the type of strength required so that a muscle can move quickly against a resistance. This combination of speed of contraction and speed of movement is sometimes referred to as "power". This special type of strength is of great importance to the "explosive" events in running, jumping and throwing.

1.13.1.3 STRENGTH ENDURANCE

This is the ability of the muscles to continue to exert force in the face of increasing fatigue. Strength endurance is simply the combination of strength and duration of movement. Performing an exercise, such as sit-ups, to exhaustion would be a test of strength endurance. This strength characteristic determines an athlete's performance where a movement is repeated over a fairly long period of time. Runs between 60 seconds and 8 minutes, for example, require a lot of strength endurance.

1.13.1.4 DEVELOPMENT OF STRENGTH

Weight training and resistance training develop strength. If there is an increase in muscle mass as a result of training this is called hypertrophy. Muscle hypertrophy is associated more as a result of training for maximal and elastic strength rather than strength endurance. When strength training stops the law of reversibility indicates that some strength will be lost and the muscle mass may reduce. Reduction in the muscle mass is known as atrophy. Muscle atrophy is a direct result of low, or no, activity and may be a factor in injury rehabilitation.

Maximum strength is best developed by exercises which involve a low number of repetitions and a large resistance or loading. Elastic strength is developed through fast repetitions using a medium loading and strength endurance is developed using a high number of repetitions with a low resistance.

1.13.2 ENDURANCE

Endurance refers to the ability to perform work of a given intensity over a time period, and is sometimes called stamina. The main factor which limits and at the same time affects performance is fatigue. An athlete is considered to have good endurance when the athlete does not easily fatigue, or can continue to perform in a state of fatigue. Endurance, of all the biomotor abilities, should be developed first. Without endurance it is difficult to repeat other types of training enough to develop the other components of fitness. There are two basic types of endurance:

- Aerobic endurance
- Aerobic endurance

1.13.2.1 AEROBIC ENDURANCE

Aerobic means "with oxygen" and aerobic endurance means muscular work and movement done using oxygen to release energy from the muscle fuels. The absorption and transport of the oxygen to the muscles is carried out by the cardio-respiratory system. Aerobic training leads to both a strong cardio-respiratory system and an increased ability to use oxygen in the muscles. Aerobic endurance can be developed by continuous or interval running. The longer the duration of an event the more important is aerobic endurance. Aerobic endurance should be developed before anaerobic endurance. (IAAF, 2002)

1.13.2.2 ANAEROBIC ENDURANCE

Anaerobic means "without oxygen" and anaerobic endurance refers to the energy systems which allow muscles to operate using energy they already have in store. Anaerobic training allows the athlete to tolerate the build up of lactic acid. There are two important types of anaerobic endurance, speed endurance and strength endurance. Developing speed endurance helps an athlete to run at speed despite the build up of lactic acid. Strength endurance allows the athlete to continue to express force despite the lactic acid build up.

1.13.2.3 DEVELOPMENT OF ENDURANCE

Both aerobic and anaerobic endurance can be developed using interval training. The variables in interval training are:

Intensity Speed or velocity of the repetitions. This may be expressed as a percentage of maximal speed or effort.

Duration Length of time or distance of one repetition.

Recovery Time of intervals between repetitions and sets.

Recovery activity Normally a low intensity movement such as a walk or jog.

Repetitions The total number of repetitions in a session. These may be divided into sets.

1.13.3 SPEED

Speed is the capacity to travel or move very quickly. Like all biomotor abilities speed can be broken down into different types. It may mean the whole body moving at maximal running speed, as in the sprinter. It may involve optimal speed, such as the controlled speed in the approach run of the jumping events. or, it may include the speed of a limb, such as the throwing arm in the shot or discus, or the take-off leg in the jumps.(IAAF, 2002)

1.13.3.1 DEVELOPMENT OF SPEED

Speed training involves development of a skill so that the technique is performed at a faster rate. To develop speed the skill must be practised on a regular basis at a maximum or close to maximum rate of movement. Maximal running speed, for example, is developed by runs over short distances at maximum effort. The skill of moving at speed should, like all skills, be practiced before the athlete becomes fatigued. For this reason recovery times between repetitions and sets should be long enough to recover from any fatigue.

When considering speed it is important to include reaction time. Reaction time is the time between a stimulus and the first movement by the athlete, such as the firing of the starter's pistol and the athlete's movement from the blocks. There are many factors both physiological and psychological which influence reaction time and the initiation of movement. Reaction time can be improved with practice, provided the practice situation is realistic

1.13.4 FLEXIBILITY

Flexibility is a pre requisite for maximal development of movement force and speed. Greater range of movement enables the muscles to develop more force and speed and also allows movements with minimum of muscle tension and internal resistance help in achieving higher movement economy (Singh, 1991)

Movement about a joint creates changes pressure in the joint capsule that derive nutrients from the synovial fluid towards the articulation cartilage of the joint (Baechle, 1994) . The motor learning requires adequate level of flexibility of the concerned joints. Flexibility is joint specific, in other words, a high degree of flexibility in one joint differs in other joints. For example, back stroke in swimming needs more shoulder flexibility; wrist flexibility of shot putter and discuss thrower is greater and there is above average flexibility of gymnasts in the hip (Edward and Mathews, 1981).

Flexibility is significant in performing sports skills and also in physical medicine such as rehabilitation, general health and fitness, example, flexibility exercises for relief of dysmenerrhea, general neuromuscular tensions and low back pains (Baechle, 1994). Inadequate flexibility leads to errors in movement execution. Because of its effect on technique it assumes importance for tactical skills. Optimum level elasticity, stretchability and suppleness of muscles and ligaments help in absorbing the shocks and external forces tending to cause an injury. (Singh, 1991)

1.13.5 CO-ORDINATION

The motor co-ordination process form the basis of co-ordinative ability. Co-ordination is a complex interaction between muscles and nerves. The proprioceptors that are located in the muscles tendon, joints, and labyrinth of the inner ear provide the athletes a knowledge of a the part of body is doing when executing a skill (Kumar and Panda, 2002)

The movement quality depends to a great extent on rhythm, flow, accuracy, constancy and amplitude are expression of motor co-ordination. In technical sports the graceful movements, maximal utilization of conditional abilities, technical skills and success of releasing are well developed co-ordinative abilities. The speed of learning of skill and its stability is directly dependent on the level of various co-ordinative abilities. Assessment and possibilities of their further development form an important part of the process of talent identification in sports (Singh 1991)

Balance tasks are often used by motor learning researchers because significant improvement is noted in a relatively short time. (Baumgartner and Jackson, 1987).

1.14 PHYSIOLOGY

Physiology is the science of functioning of all the organs and systems of an organism. For the physiological system of the body to be fit, they must function well enough to support to specific activity that the individual is performing. More over different activity make different demands upon the organism with respect to circulatory, respiratory, metabolic and neurologic process which are specific to the activity.

In physiology, one learn how the organs, systems, tissues, cells and molecules within cells work and how their functions are put together to maintain the internal environment. Physiology is the science dealing with the study of human

body functions. Exercise physiology is the study of how body's structures and functions are changed as a result of exercise. It applies the concept of exercise physiology to training the athlete and enhancing the athlete's sports performance. (Ajmer Singh, 2005)

Exercise physiology is the scientific study of physiological changes in athletes body with the effects of exercise, whether long term or short term. Different environmental changes, namely, altitude, climate, temperature, humidity, nutritional status etcetera have some close associations with the optimal performance of an athlete. (Shyamal Kaloy, 2007)

For the physiological system of the body to be fit they must function well enough to support the specific activity in which individual is performing. Moreover different activities make different demands upon the organism with respect to circulatory, respiratory, metabolic and neurological process which are specific to the activity**.**(Frost 2001)

The lungs, heart and blood perform a vital function on the body's supply system. They supply to the muscle with necessary fuels, oxygen and carry wastes such as carbon dioxide and lactic acid. Consequently the cardio respiratory system in the athletes needs to be developed**.**

The various physiological variables are resting pulse rate, blood pressure, breath holding time, vital capacity, anaerobic power, aerobic power etcetera. The

resting pulse rate, VO_2 max, anaerobic capacity and breath holding time are selected for this study.

1.14.1 IMPORTANCE OF PHYSIOLOGY

Understanding the importance of physiology in physical education is to study the training effects. To study the ways and means by which the athletes can improve their performance and the principle of training methods. Sports consist about 99% of preparation and 1% of performance we need to make the most effective use of our preparation time so that our athletes can achieve high level performance for that the physiological systems should be taken care very much for the adoption to their particular activities. as because " Function decides structure". The system will change or adopt according to the nature of the activity. Therefore, to know this among the players are very important for the improvement of performance. In this present research, the investigator selected physiological variables VO_2 max, Vital capacity and anaerobic power to study the effect of varied intensities and frequencies of weight training among athletes.

1.14.2 RESTING PULSE RATE

Pulse rate is the number of beats felt exactly in one minute. The average rate of the pulse in a healthy adult is 72 beats in each minute. There may be variation of upto five beats per minute in the normal range. The number of beats of a pulse per minute or the number of beats of the heart.

The pulse rate or heart rate varies greatly among different people and in the same person under different situations. The American Heart Rate Association accepts as normal range from 50 to 100 beats per minute. The average rate is 72 beats per minute but the rate can accelerate to 220 per minute. The lesser pulse rate gives good performance for all the sports and games.

The total number of beats of heart per minute is called heart rate. The automatic nervous system which supplies para sympathetic or vagus nerves and the sympathetic or acceleratory nerves to the Sino-vial artery node play a prime role in regulating the heart rate (Larry, 1982).

1.14.3 VO_2 MAX

VO_2 max (also maximal oxygen consumption, maximal oxygen uptake or aerobic capacity) is the maximum capacity of an individual's body to transport and utilize oxygen during incremental exercise, which reflects the physical fitness of the individual. The name is derived from V - volume per time, O_2 - oxygen, max - maximum.

VO_2 max is expressed either as an absolute rate in liters of oxygen per minute (l/min) or as a relative rate in millilitres of oxygen per kilogram of bodyweight per minute (ml/kg/min), the latter expression is often used to compare the performance of endurance sports athletes

"Maximal oxygen uptake (VO_2max) is widely accepted as the single best measure of cardiovascular fitness and maximal aerobic power. Absolute values of VO_2max are typically 40-60% higher in men than in women."[1] Clearly, then, VO_2max varies considerably in the population, with sex being a primary determining factor in this variability.

1.14.4 ANAEROBIC POWER

Most of the anaerobic activities are related to the leg power. Greater the leg power, better the Anaerobic performance in the field of sports and games. Leg power is essential with muscular strength. Muscular strength can be developed through maximal load of weight training. Muscle strength and explosive power are increased, due to the increase in the size of the muscle fiber which are present in the leg muscle. The muscle fibers are developed as a result of the increase in Actin, Myosin and other myofibrular proteins present in the muscle fibre.

The leg explosive power is also associated with the fast twitch muscle fibre. Greater the percentage of fast twitch muscle fibre, better the leg explosive power and speed. Hence the Leg explosive power plays the vital role in most of the Anaerobic activities.

Anaerobic exercise is typically used by athletes in non-endurance sports to build power and by body builders to build muscle mass. Muscles that are trained under anaerobic conditions develop biologically differently giving them greater performance in short duration-high intensity activities.

1.14.5 BREATH HOLDING TIME

Breath holding time is defined as the duration of time through which one can hold his / her breath without inhaling and exhaling after a deep inhalation.

There are two types of breath holding time:

Positive Breath holding time

Negative Breath holding time

Endurance type of training will improve the breath holding time. Breath holding time also plays a vital role in the sports performance (P.J.Strukic, 1981).

1.15 REASON FOR THE SELECTION OF THE TOPIC

Understanding the importance of motor fitness and physiology in physical education is to study the training effects, to study the ways and means by which the athletes can improve their performance and the principle of training methods. Sports consist of preparation and performance about 99% preparation and 1% performance. We need to make the most, effective use of our preparation time so that our athletes can achieve high level performance. For that the motor fitness and physiological systems should be taken care very much for the adaptation to their particular activities because these functions decide structure as very important for the improvement of performance. Because the level of motor fitness of physiological

system may vary from players to player and according to conditional status of the proper training system is needed to achieve in sports.

Weight training can provide significant functional benefits and improvement in overall health and well-being, including increased bone, muscle, tendon and ligament strength and toughness, improved joint function, reduced potential for injury, increased bone density, a temporary increase in metabolism, improved cardiac function, and elevated HDL (good) cholesterol. Training commonly uses the technique of progressively increasing the force output of the muscle through incremental increases of weight, elastic tension or other resistance, and uses a variety of exercises and types of equipment to target specific muscle groups. Weight training is primarily an anaerobic activity; there is every possibility of reaping the benefits of aerobic exercises through manipulation of intensities and frequencies of weight training. In this study, the researcher was interested to find out whether weight training of different intensities and frequencies can alter selected motor fitness such as variables, speed, explosive power, endurance and arm strength and physiological variables, such as resting pulse rate, VO_2 max, naerobic power, and breath holding time.

1.16 STATEMENT OF THE PROBLEM

The purpose of the study was to find out the effects of varied intensities and frequencies of weight training on selected motor fitness and physiological variables among athletes.

1.17 HYPOTHESES

In light of the preceding discussion and for the purpose of the present investigation, the following were hypothesized.

1. It was hypothesized that varied intensities and frequencies of weight training would significantly improve in selected motor fitness variable, such as speed among athletes compared to control group.

2. It was hypothesized that varied intensities and frequencies of weight training would significantly improve in selected motor fitness variable, such as explosive power among athletes compared to control group.

3. It was hypothesized that varied intensities and frequencies of weight training would significantly improve in selected motor fitness variable, such as endurance among athletes compared to control group.

4. It was hypothesized that varied intensities and frequencies of weight training would significantly improve in selected motor fitness variable, such as arm strength among athletes compared to control group.

5. It was hypothesized that varied intensities and frequencies of weight training would significantly improve in selected physiological variable, such as resting pulse rate among athletes compared to control group.

6. It was hypothesized that varied intensities and frequencies of weight training would significantly improve in selected physiological variable, such as VO_2 max among athletes compared to control group.

7. It was hypothesized that varied intensities and frequencies of weight training would significantly improve in selected physiological variable, such as anaerobic power among athletes compared to control group.

8. It was hypothesized that varied intensities and frequencies of weight training would significantly improve in selected physiological variable, such as breath holding time among athletes compared to control group.

9. It was hypothesized that there would be no significant differences among treatment groups involved in varied intensities and frequencies of weight training on selected physical and physiological variables.

1.18 SIGNIFICANCE OF THE STUDY

Better performances would be the product of a number of factors. This product may be primarily the outcome of efficient technique, the progression of speed and the maturing competitive attitude on a sound basis of general endurance, all round strength and general mobility. The development of all round strength may be best achieved through improving of motor fitness and physiological variables by progressing through weight training. In the light of these theoretical foundations made by previous researches, the following were the significance of this research.

1. This study may help in developing a weight training schedule with different intensities and frequencies for the benefit of athletes.

2. Through manipulation of weight training by varied intensities and frequencies, the study may be unique in making the weight training exercises, which was anaerobic in nature into an aerobic one which may be more beneficial for athletes.

3. The findings of this study would help the coaches, physical educationists and players to apply the training schedule suggested in this study for improving selected motor fitness and physiological variables of athletes.

4. The findings would lay theoretical foundations on the importance of varied intensities and frequencies in weight training for the better development of athletes' motor fitness and physiological variables.

5. The finding of the study may be helpful for the coaches and instructors to apply proper frequency for better performance.

6. Finding of the study may be helpful for the coaches and players to opt the intensity and frequency level for participation and coaching in future.

7. The result of the study may be helpful to physical education teacher, coach in designing the training programs to improve athletics performance according to the individual concerned.

1.19 DELIMITATION

The study was delimited in the following aspects and while interpreting the results. It should be taken into consideration.

1. The study was delimited to school boys who participated in different athletic events at district level athletic meets.

2. The athletes were randomly selected from the contingent participated at Thiruvannamalai District sports meets.

3. The athletes were in the age group of 16 to 17 years.

4. In this study, the following variables were selected for the study.

Dependent Variables

Motor Fitness Components

1. Speed
2. Explosive power
3. Endurance
4. Arm Strength

Physiological Variables

1. Resting Pulse Rate
2. VO_2 max
3. Anaerobic Power

4. Breath Holding Time

Independent Variables

1. 12 weeks High Intensity and Low Frequency of weight training
2. 12 weeks Low Intensity with High Frequency of weight training

1.20 LIMITATIONS

1. The investigator could not control the life style, psychological stress and factors that affect metabolic function.
2. Psychological and sociological aspects of their day-to-day life interactions to their environment could not be controlled.
3. The daily routine, climatic conditions, nutritional factors, motivational factors and socio-economic factors, were not taken into consideration.
4. The time of training and time of testing were the working days, in mostly morning and evening hours.

1.21 DEFINITION OF TERMS

1.21.1 Training

Training has been explained as programme of exercise designed to improve the skills and increase the capacities as resting heart rate (Hardayal Singh, 1991).

1.21.2 Weight Training

Weight training is a common type of strength training for developing the strength and size of skeletal muscles. It uses the weight force of gravity (in the form of weighted bars, dumbbells or weight stacks) to oppose the force generated by muscle through concentric or eccentric contraction. Weight training uses a variety of specialized equipment to target specific muscle groups and types of movement.(Frederic 2001)

1.21.3 Intensity

Intensity is the rate of doing work. In other words it is the pace of which a physical activity is done.

Intensity is the impact of the load at every movement of the exercise with a degree of concentration of the volume of training work in time.(Hardayal Singh, 1984)

1.21.4 Frequency

The number of times per week that the athlete trains is the measure of frequency. A training programme with a frequency of three or five times per week over period of 5 to 6 weeks may be sufficient to produce significant training effects (Hardayal Singh, 1984).

1.21.5 Speed

The capacity of moving a limb or part of the body's lower system or the whole body with the greatest possible velocity (Frank Dick, 1992).

The maximal rate at which an individual is able to move hi entire body over a specific distance is considered to be his speed movement (Eckert, 1974).

1.21.6 Explosive Power

Explosive power is the ability to release maximum muscular force in the shortest time as in executing a standing broad jump. (Baumgartner, 1987). For operational purposes, the standing broad jump test was conducted.

1.21.7 Endurance

Endurance is defined as the ability to do sports movements with the desired quality and speed under conditions of fatigue. (Hardayal Singh, 1984).

1.21.8 Arm Strength

The force that the muscle group of arm can exert against resistance in one's maximum effort is arm strength. For the purpose of this study, the push ups ability is considered as arm strength.

1.21.9 Resting Heart Rate

Measurement of heart rate when an organism is under physical and mental rest can be termed as resting heart rate (Moorhouse and Miller, 1976).

1.21.10 VO_2 Max

VO_2 max is the maximal oxygen uptake or the maximum volume of oxygen that can be utilized in one minute during maximal or exhaustive exercise. It is measured as milliliters of oxygen used in one minute per kilogram of body weight.

1.21.11 Anaerobic Power

The capacity to carry out work without the presence of oxygen and fatigue outcome is called as anaerobic power.

1.21.12 Breath Holding Time

Breath holding time is defined as the duration of time through which one can hold his breath. (Laurence E. Morehouse and Augustus T.Miller, 1967).