CHAPTER – I
INTRODUCTION

Modernization and urbanization have reduced the physical fitness of human being. Woman depends on machines for all her works. Manual labor has been considerably reduced. Physical activity is considered to be the low in dignity and hence avoided. Therefore, the general physical fitness has come down, and to restore it human beings will have to revert to the age and old habits. Physical education is a body oriented discipline based on scientific facts and principles. It provides knowledge about the physiological effects of activity, mechanical efficiency of motor skills, psychological effects of participation, sociological implications, aesthetic aspect of movement and therapeutic value of exercise. These characters are all equated with the healthy functioning of the body. Another important component of physical fitness and the skill are interested. It is only through physical activity; physical fitness is built and maintained. Some researchers attribute the beneficial effects of exercise on stress, reduced electrical activity in the muscles and an increased feeling of fitness. Few other benefits of physical activity that leads to physical fitness are the delay in aging process, reduction of lower weight reduction in the rate of heart diseases and the reliance of drugs that induce sleep.

Sports and games in the modern era occupy a very prominent and important place in the life of people and also in every sphere of life. Sport consists of physical activity carried out with a purpose for competition, for self-enjoyment, to attain excellence, for the development of a skill, or more often, some combination of these. Sports differ in their dependence upon a set of individuals or team skills, as well as in
the ways in which they have their participants compete. As fitness and sports go hand in
glove there is a need to develop the ability in an individual to play the game with good
skill and perform consistently well. Being involved in sports has been proven to help
people learn valuable skills for dealing with life's ups and downs. They teach people
how to interact with others and work as a team. This helps in daily life when working on
a class project or a school plays with others. Sports also help people become more
independent and feel better about them. The result is positive self-esteem and self-
confidence, which are extremely important to a person's happiness and success.

Sport form an inspirable part of the system of physical education. Physical
education offers opportunity in competitive situation for physical, social, emotional and
moral development. Sports and games are the best ways to earn social recognition and
acquire a status in the modern society. The term motor ability is used synonymously
with general athletic ability. There are many factors that contribute to successful
performance in athletic skill. In most of the advanced and developed countries, the
awareness for motor learning and skill developed among children is very much
scientific and prolonged which perhaps helped them to level of general fitness with
motor abilities like power, speed, agility, balance, reaction time etc. are essential
qualities required to be develops in the players (Clarke, 1976).

1.1 SPORTS

A sport is an activity that is governed by a set of rules or customs and often
engaged competitively. Sports commonly refers to activities where, the physical
capability of the competitor are the sole or primary determinant of the outcome
(winning or losing), but the term is also used to include activities such as mind sports
Sports are commonly defined as an organized, competitive and skilful physical activity requiring commitment fair play. Some view sports as differing from games based on the fact that there are usually higher levels of organization and profit (not always monetary) involved in sports. Accurate records are kept and update for most sports at the highest levels, while failures and accomplishments are widely announced in sport news. The term sports are sometimes extended to encompass all competitive activities in which offense and defense are played, regardless of the level of physical activity. Both games of skill and motor sport exhibit many of the characteristics of physical sports, such as skill, sportsmanship, and at the highest levels, even professional sponsorship associated with physical sports (Oxendine, 1984). Sport is all forms of physical activity which, through casual or organized participation, aim to use, maintain or improve physical fitness and provide entertainment to participants. Sport may be competitive, where a winner or winners can be identified by objective means, and may require a degree of skill, especially at higher levels. Hundreds of sports exist, including those for a single participant, through to those with hundreds of simultaneous participants, either in teams or competing as individuals. Some non-physical activities, such as board games and card games are sometimes referred to as sports, but a sport is generally recognized as being based in physical athleticism (Wuest, 1987).

1.2 SPORTS TRAINING

Improve physical fitness and provide entertainment to participants. Sport may be competitive, where a winner or winners can be identified by objective means, and may require a degree of skill, especially at higher levels. Hundreds of sports exist, including
those for a single participant, through to those with hundreds of simultaneous participants, either in teams or competing as individuals. Some non-physical activities, such as board games and card games are sometimes referred to as sports, but a sport is generally recognized as being based in physical athleticism maintenance and recovery of performance capacity and performance readiness. Physical exercises are the physical means of training. The other means are used in addition to physical exercises or separately as per requirement. Each training means has its own specific effect on the performance capacity. This effect may be direct or indirect. Physical exercises have a direct effect on performance capacity. Means like physiotherapy, autogenously training has indirect effect.

Physical training refers to the processes used in order to develop the components of physical fitness, as for example, how to improve aerobic endurance, to strength and relax muscles, to increase arm and shoulder strength, to relate exercises and programmers to the specific requirements or individual sports. On the other hand, sports training aims at achieving high performance in sports competition. In order to achieve high performance, sports training is done in a planned and systematic manner. Sports training is based on systematic facts and principles. A system most suitable for achieving high performance has to be first made on the basis of the sports training which is planned. It is always assessed, planned, organized and implemented by a coach or a sports teacher or some other person. The sports training aim sat finding out hidden reserves and makes the sportsperson aware of it. It also aims at further development of these reserves. The sportspersons control their day to day routine in such a manner that they are able to do training once or twice a day with high effect. Sports training is basically an educational process. So, it strives to develop all the
aspects of personality. It is a continuous process of perfection, improvement and creation of means and methods of improving sports performance and factors of performance.

Research on the effect of weight training on health and fitness determinants revealed that weight training, like other types of exercise, positively affects physical performance and body composition and a number of health parameters. Almost every study revealed an increase in muscular strength, whereas the effect on aerobic power is inconsistent and dependent on the type of weight training compared with running and cycling, the weight training induced changes in body composition consist of a larger increase in fat free mass, whereas the decrease in fat mass seems to be somewhat smaller. The modest effect on fat mass might be attributed to the lower energy costs of a single weight-training workout. The latter finding seems to make this kind of exercise less effective in programs of weight control and weight reduction.

Muscle strength is related to the cross sectional area of the muscle. However, this strong relationship diminishes when explosive athletes and endurance athletes are compared. What most studies suggest is that strength is highly related to muscle size. However, people who have a disproportionate amount of fast-twitch fibers will gain strength faster than those who do not. Fast-twitch fibers tend to be stronger than other fiber types, so people who have more of them will tend to be stronger and have greater potential for strength gains.

1.3 PRINCIPLES OF TRAINING

Principles of training are the guide-lines for coaches, teachers and sports persons for the formulation and control of sports training. These principles are valid for all
aspects and elements of training. These are formed successful practice. The principles of training can be general or specific. General principles are valid for the process of sports training as a whole. The specific principles are applicable to a limited part or aspect of training only. The training should be a continuous and regular process. Continuous and regular training leads to the improvement of performance capacity. The sportsman must be educated about the importance of continuity of training by convincing him about the negative effects of training breaks and irregular training on his performance capacity. The training load is the principal stimulus for starting the psychophysical processes of adaptation which eventually leads to the increase in performance capacity. A quantum of training load forces the organism to adapt to a certain level of psychic and physical demands. If the same load is repeated, it gradually loses its value as a stimulus for adaptation. Higher performance will be achieved when the organism adapts to a higher level of functioning and this is possible only by increasing the load. The training programme should be formulated uniformly but allowing for individual differences. Uniformity means that training for all should be based on the same principles and system which have been worked out to achieve the prognostic sports performance In stages. According to Singh (1984) training aims at improving the fitness of a person and promoting the acquisition of basic movement skills. To achieve this, training should have some basic principles and the most important basic principle of training is overload. Most Physiological systems can adapt to functional demands that exceed these loads encountered in normal daily life. Training often systematically exposes selected physiological systems to Intensities of work or function that exceed those to which the system is already adapted. Excessive overload has to be avoided because physiological system cannot adapt to extreme consistency as most physiological systems require
exposure to overloading activities three times a week or more. The required frequency of training however depends on the season, the athlete, the activity and the specific components of fitness. There is no substitute for consistency in a training programme. The athlete might participate in training that is highly specific to the participation of physiological system overload, to the particular muscle group used and to the particular muscle fibers performing the work progression in the successful training programme plan for a steady rate of progression over a load period. The athlete has to improve over several years of participation; the training programme must progress so that the appropriate physiological systems continue to be overloaded. However, too rapid increase of the training stress may lead to exhaustion and impaired performance. Apart from these principles one has to give due attention to the individuality. Factors such as age, sex, maturity, current fitness level, and years of training, body size, somatic type and psychological characteristics should be considered by the coach in designing each athlete’s training regimen (Thomas and Roger, 2008).

1.4 COMPONENTS OF TRAINING

1.4.1 Progressive Loading (Overload)

Biological systems can adapt to loads that are higher than the demands of normal daily activities. Training loads must be increased gradually, however, to allow the body to adapt and to avoid injury (system failure due to overloading). Varying the type, volume, and intensity of the training load allows the body an opportunity to recover, and to over-compensate.
1.4.2 Adaptation

Adaptations to the demands of training occur gradually, over long periods of time. Efforts to accelerate the process may lead to injury, illness, or “overtraining”. Many adaptive changes reverse when training ceases conversely, an inadequate training load.

1.4.3 Specificity

Energy pathways, enzyme systems, muscle fiber types, and neuromuscular responses adapt specifically to the type of training to which they are subjected. For example, strength training has little effect on endurance. Conversely, endurance training activates aerobic pathways, with little effect on speed or strength. Even so, a well-rounded training programme should contain a variety of elements (aerobic, anaerobic, speed, strength, flexibility) and involve all of the major muscle groups in order to prevent imbalances and avoid injuries.

1.4.4 Reversibility

A regular training stimulus is required in order for adaptation to occur and to be maintained. Without suitable, repeated bouts of training, fitness levels remain low or regress to the pre-training levels.

1.4.5 Variation and Recovery

Muscle groups adapt to a specific training stimulus in about three weeks and then plateau. Variations in training and periods of recovery are needed to continue progressive loading, without the risks of injury and/or overtraining. Training sessions should alternate between heavy, light, and moderate in order to permit recovery. The
content of training programmers must also vary in order to prevent boredom and “staleness”.

1.4.6 Individual Response

Each athlete will respond differently to the same training stimulus. There are many factors that alter the training response: genetics, maturity, nutrition, prior training, environment, sleep, rest, stress, illness or injury and motivation, to name a few.

1.4.7 Periodization of the Training Cycle

The training programme must consist of a variety of elements, including cardiorespiratory (aerobic) fitness, general strength, anaerobic fitness (power), speed, neuromuscular skills development, flexibility and mental preparation. The emphasis placed upon each of these elements must vary during the training year; Skills acquisition should not be emphasized during a high-intensity training cycle, but should be reserved for periods of lower volume and intensity.

1.4.8 Maintenance

Gains achieved during high-intensity training periods can be maintained with a moderate level of work. Thus, by means of periodization, some elements can be maintained with less work, while other elements are stressed.

1.5 COMPONENTS OF LOAD

The components of load the various aspects of load determine the degree of load. The effect and direction of load depends upon the load components. One cannot predict the effect of physical activity done for 20 minutes unless and until one knows
some others aspects of load such as intensity, density, etc. Only by properly controlling the load components we can achieve the desired effect through physical activity (Harre, 1979).

1.5.1 Intensity

Intensity is the pace at which physical activity is done or it is the rate of doing work. An activity can be carried out with different intensity which will have different effect on the organism. Hence, in practice, the total range of intensity is divided into various zones. This is important for planning, implementation and evaluation of the training. The highest intensity which can be achieved by the sportsman is taken as 100% and this is used as a reference point for the various intensity zones. In endurance training the intensity zones are made according to the heart rate.

1.5.2 Density

If the training activity is done with pauses in between, then the intensity is affected to a large extent by the density. The density characterizes the temporal relationship between load and recovery phases in a training session. Most commonly, it is referred to as the rest period between two motor stimuli. If more stimuli are given in a certain time period, then the training is denser, i.e., the density is high. The density is determined by the aim and objective of the training activity. The role of density is two-fold.

1.5.3 Volume

It is the total amount of work done in a training session. When the activity is done according to the continuous method, the total distance covered, or total number of
repetitions or the total duration of the activity is the volume. Like intensity, volume should also be the optimum in order to have some effect on the organism, e.g., for the development of basic endurance, one should run continuously for at least 30 minutes. In training activity, which done with a pause in between, the volume is usually the product of duration of stimulus and frequency of stimulus (Harre, 1979).

1.5.4 Duration

It is the time period for which a single motor stimulus acts on the organism. Optimum of stimulus is important to start the desired adaptation process, e.g. for the development of acceleration ability, the duration of each repetition should be at least 6 second. In some activities, the duration of stimulus can be so short that it may not carry any significance for the calculation of load, e.g., in jumps and throws.

1.5.5 Frequency

It is the number of time a motor stimulus (repetition) is given. In cyclic activities like swimming, running etc, there is no frequency of stimulus as there is only one long duration stimulus. In interval and repetition method, it is the number of repetition. In weight training it is the number of repetitions of an exercise. Same is the case in jumps, throws and free-hand exercises (Singh, 1984).

1.6 PHYSICAL EDUCATION

Physical Education may be defined as education through the physical activities where many of the educational objectives are achieved by means of big muscle play activities. It is a vital phase of education and an integral part of the total education process. The vital phase of education that is physical education, aims at all round
development of an individual where the medium of achieving the goal is physical activity. Hence it is through the big muscle activity an individual can enlighten the personality traits such as physical fitness, emotional balance and social behavior etcetera besides intellectual development. The physical education programme provides each student with an opportunity to assess the fitness and to develop skill and understanding that will enable one to enjoy a productive stay in school, college and a more meaningful existence after school and college. Right from the origin of physical education the major objectives of physical education was physical fitness. The aim of physical education in the early years attained physical fitness, which was a main requisite of the citizens. As days changed, the need, importance, scope and objectives have also changed because the demand of environment to preserve to withstand stress, to resist fatigue and to possess the energy for vigorous and well rounded life has increased (Barrow & McGee, 1979).

1.7 PHYSICAL EDUCATION AND SPORTS

Every human being has a fundamental right of access to physical education and sport, which are essential for the full development of his or her personality. The freedom to develop physical, intellectual and moral powers through physical education and sport must be guaranteed both within the educational system and in other aspects of social life. Everyone must have full opportunities, in accordance with his or her national tradition of sport, for practicing physical education and sport, developing physical fitness and attaining a level of achievement in sport which corresponds to his or her gifts. Physical education performs an essential element of lifelong education in the overall education system. Physical education and sport, as an essential dimension of education and culture, must develop the abilities, will-power and self-discipline of every
human being as a fully integrated member of society. The continuity of physical activity and the practice of sports must be ensured throughout life by means of a global lifelong and democratized education. At the individual level, physical education and sport contribute to the maintenance and improvement of health, provide a wholesome leisure-time occupation and enable man to overcome the drawbacks of modern living. At the community level, they enrich social relations and develop fair play, which is essential not only to sport itself but also to life in society. Physical education and sport programs must meet individual and social needs to suit requirements and personal characteristics of those practicing them as well as the institutional, cultural, socioeconomic and climatic conditions of each country. They must give priority to the requirements of disadvantaged groups in society (March and Bucher, 2010).

This goes on to the building of society by way of healthy sporting activities. Physical education and sports are important for nurturing physically and mentally healthy citizens, apart from fostering friendship and camaraderie among those who participate in sports. At the personal level, sports enhance the individual’s abilities, general health and self knowledge. At the national level, Physical education and sports can contribute to socio economic Development, improve public health and encourage national identity and community spirit. This perspective is compatible with the International Charter of Physical Education and Sport, adopted by the General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO) at its 20th Session in Paris in 1978. Physical Education and fitness have traditionally been emphasized to help the physical growth and development of students within the context of liberal education. Presently in Asia, the purpose is more focused on active living, fitness and healthy lifestyles. There is, now, a better integration of
Physical Education lessons and lifestyles, making the connection clearer for the students. Traditionally, Physical Education consisted mainly of practical exercises, with learning through doing or moving. Spurred by the active living concept, current physical education pedagogies are also trying to transmit more knowledge-based lessons to students. While European, American and Olympic sports are taught extensively in Asian schools, calls have been made for Asian physical activities and games to be included in the curriculum. This will help students identify with their own cultures and strengthen the development of a healthy image and self confidence. Some efforts have being given to implement local Asian indigenous activities, especially Asian martial arts and physical health, into the curriculum (Haddad, 2008).

1.8 PHYSICAL EDUCATION AND HEALTH

Health, recreation, and dance are frequently referred to as allied fields of physical education, exercise science and sport. These fields share many purposes with physical education exercise science and sport, namely the development of the total individual and concern for quality of life. Health education concerns itself with total well-being of the individual, encompassing physical, mental, social, emotional and spiritual health. Three areas within health education are health instruction, the provision of health services and environmental health. Health instruction is targeted at individuals of all ages, ranging from preschoolers to the elderly, and is delivered through a diversity of agencies-including educational instruction at all levels, public health services and private programmers. Health instruction can encompass many areas, including disease prevention, mental health, nutrition, physical fitness, stresses management and dealing with abuse of drugs and alcohol. Delivery of health services is the second area of health education. These services are concerned with developing and maintaining a satisfactory
level of health for all people. Americans are becoming increasingly conscious of the instrumental role physical activity plays in one’s health related quality of life. Data supporting the health benefits of participation in appropriate physical activity on a regular basis continue to mount. Accrued benefits of regular physical activity include the prevention of coronary heart disease, hypertension, noninsulin independent diabetes mellitus, osteoporosis, obesity and mental health problems. Other benefits include the reduction of the incidence of stroke and the maintenance of the functional independence of the elderly. The strong role regular and appropriate physical activity plays in the health and well-being of individuals further confirms the allied nature of health and physical education, exercise science and sport (Deboraha, 2010).

1.9 PHYSICAL EDUCATION AND FITNESS

Physical fitness is the body ability to function efficiently and effectively. It is a state of being that consists of at least five health-related and six skill-related, physical fitness components, each of which contributes to the total quality of life. Physical fitness is associated with a person’s ability to work effectively, enjoy leisure time, be healthy, resist hypo kinetic diseases and meet emergency situations. It is related to, but different from, health and wellness. Although the development of physical fitness is the result of many things, optimal physical fitness is not possible without regular physical activity. The five components of health-related physical fitness are body composition, cardiovascular fitness, flexibility, muscular endurance and strength. Each health related fitness characteristic has direct relationship to good health and reduced risk of hypo-kinetic disease (Corbin, 2000).
1.10 ROLE OF PHYSICAL EDUCATION AND SPORTS IN SOCIETY

Societal trends influence the role of physical education, exercise science, and sport in our society. One significant trend is the changing demographics of our population. Our society is more culturally diverse than at any other time in its history. This diversity will become even greater as we move farther. As professionals are committed to enrich the lives of all people, we must, increase our consciousness and appreciation of differences associated with heritage, characteristics, and values of people. The wellness movement emphasizes the individual’s responsibility to make informed choices that will lead to an optimal state of health. Disease prevention and health promotion are the cornerstones of this movement. Participation in physical activity by people of all ages should be encouraged. There is substantial evidence to support the values of leading a physically active lifestyle across the lifespan (Deboraha, 2010).

Physical education has a special significance, unique role and has made unlimited contribution in the modern age as it caters to the biological, sociological, and psychological necessities of the man. Swami Vivekananda has stressed that “what India need today is not the Bhagwat Geeta but the football ground”. Physical education is of great value for the man not only for his present but also for his future. Emphasizing the need and importance of physical education, Rousseau said, “It is the sound contribution of the body that makes the operation of mind easy and certain”. The Secondary Education Commission was aware of the need and importance of physical education when it stated, “The physical welfare of youth of the country should be one of the main concerns of the state and any departure from the normal standards of physical well-being at this period of life may have serious consequences” (Singh, 2003).
1.11 AIMS AND OBJECTIVES OF PHYSICAL EDUCATION

The aim of physical education is the wholesome development of human personality or complete living. Physical education should aim to provide skilled leadership, adequate facilities and ample time for the individual and the groups to participate in activities that are physically wholesome, mentally stimulating and socially sound. The important contribution of physical education is the general developments through physical activities, when these activities are properly directed it leads to the total education of the individual. Thus physical education are physical activities are tools of education for the development of the individual as a whole. Physical education should be an important part of that requirement and does more than provide some minutes of moderate-vigorous activity. It also teaches students how to integrate exercise into their lives in order to establish a lifetime of healthy living. A growing body of evidence demonstrates the benefits of physical education beyond fitness. Several large scale studies found improvements in students’ academic performance and cognitive ability with increased time spent in physical education. Children who spent time in physical education in place of a classroom activity performed no worse academically than students not enrolled in physical education. Physical activity also has a positive impact on tobacco use, insomnia, depression and anxiety. The quality of the physical education program, not just the time spent on the class, is the foremost concern.

Physical activity enhances a person's life both socially and psychologically. Studies have shown that physical activity may modify anxiety and depression. Physical education may help prevent degenerative disease, improve overall physical condition, maintain emotional balance, promote a sense of social effectiveness, contribute to academic performance and establish positive recreation habits. Therefore, physical
education must not be considered a curricular frill; rather, it must be supported as an integral part of comprehensive education. (Clarke & Harrison, 1976).

1.12 AEROBIC TRAINING

Both the term and the specific exercise method were developed by Kenneth H. Cooper M.D., an exercise physiologist and Col. Pauline Potts, a physical therapist, both in the United States Air Force. Dr. Cooper, an avowed exercise enthusiast, was personally and professionally puzzled about why some people with excellent muscular strength were still prone to poor performance at tasks such as long distance running, swimming and bicycling. He began measuring systematic human performance using a bicycle ergometer and began measuring sustained performance in terms of a person's ability to use oxygen. His groundbreaking book, Aerobics, was published in 1968, and included scientific exercise programs using running, walking, swimming and bicycling. The book came at a fortuitous historical moment, when increasing weakness and inactivity in the general population was causing a perceived need for increased exercise. It became a bestseller. Cooper's data provided the scientific baseline for almost all modern aerobics programs, most of which are based on oxygen consumption equivalency (Stoll & Jennifer, 1989).

Aerobics is a form of physical activity that combines rhythmic aerobic exercise with stretching and strength training routines with the goal of improving all elements of fitness, flexibility, muscular strength and cardiovascular fitness. It is usually performed to music and may be practiced in a group although it can be done solo and without musical equipment. With the goal of preventing illness and promoting physical fitness practitioners perform various routines comprising a number of different dance like
exercise. Aerobics is a vigorous physical activity that can provide an inexpensive and practical workout for most people. Aerobic fitness helps to promote the cardio-respiratory system from disease and it promotes physical, mental, emotional and spiritual development. Aerobic program can be started at any age and the intensity of the program can also be suited to meet the larger needs of the individual (Cooper, 1985).

Aerobic exercise means the exercise where all body parts/muscles are supplied with enough oxygen with the increased heart rate. Aerobic exercises include brisk walking, jogging, swimming, cross country, skiing, hopping and skipping. By doing aerobics, the whole body is used and major muscle groups including legs, trunk and arms get involved. In aerobic exercise the heart rate increases substantially, but never reaches its maximum level. The heart is always able to deliver sufficient oxygen-rich blood to muscles so that they can derive energy from fat and glycogen aerobically. Aerobic exercises builds stamina for sports and it also is the most important form of exercise for health, since it increases the efficiency of heart, circulation and muscles. Aerobic exercise is the keystone of fitness by doing aerobics it increases the capillary network in the body. Aerobics is a good way to decrease our percentage of body fat and to attain the other metabolic benefits of fitness. Aerobics is also a very good way to develop muscular skeletal fitness while building strength, flexibility and coordination.

Aerobics is a progressive physical conditioning programme that stimulates cardio respiratory activity for a time period sufficiently long to produce beneficial changes in the body. To do any work we need energy and even while at rest some physiological functions have to be carried within our body and for that purpose some calories of energy will be burnt. As the intensity and duration of work increases the
demand for the fuel in the working muscles also increases. The organs which supply the
needful should cope with the demand. Aerobics and calisthenics are performed to the
rhythmic pulse of disco music and strength together in what amounts to a modern dance
form, so as to make the exercise more enjoyable and encouraging without extra effort.
By doing exercise, the whole system of our body carries oxygen rich air enters the
organs and tissues of the muscles has been called “the aerobic system” and for this
reason training the system for stamina is called aerobic training (Cooper, 1985).

Aerobics blood circulation. Training to improve aerobic endurance capacity
involves four basic elements. Mode, intensity, duration, and frequency of exercise, a
training program which does not contain all four to an adequate degree is not likely to
be effective. A typical aerobic exercise work out consists of 8 to 10 minutes of
stretching, calisthenics and low intensity exercise. This is followed by 15 to 45 minutes
of either high or low impact aerobic dancing according to the target training intensity.
The heart rate should be monitored at least 6 times during the exercise to ensure that the
heart rate stays within the target zone. The 10 minutes cool down period usually
includes more stretching and callisthenic type exercise.

Aerobic exercise is the exercise that involves or improves oxygen consumption
by the body. Aerobic means "with oxygen", and refers to the use of oxygen in the body's
metabolic or energy generating process. They are several kinds of aerobic exercise
which are carried out at moderate levels of greatness for extensive periods of time. To
obtain the best results, an aerobic exercise gathering involves a balmy up period,
followed by at least 20 minutes of moderate to intense exercise, involving large muscle
cluster and a cooling down period at the end. Aerobics is a form of physical exercise
that combine musical aerobic exercise with stretch and strength training routine with the
goal of getting better all element of fitness (flexibility, muscular strength and cardio-vascular Endurance). It is frequently performed to music and may be practiced in a group setting led by a lecturer, although it can be done solo and without musical accompaniment. With the goal of prevent illness and promoting physical fitness, practitioners perform various routine comprise a number of different dance like exercises. Formal aerobics classes are divided into different levels of intensity and complexity. Aerobics classes may allow participants to select their level of participation according to their fitness level. Many gym offer a wide selection of aerobic classes for participants. Each class is designed for a certain level of experience and trained by a certified instructor with a specialty area related to their particular class (Cooper, 1985).

Regular aerobic exercises will improve cardiovascular and cardio respiratory function (heart and lungs), an increased maximal oxygen consumption (VO2max), maximal cardiac output (amount of blood pumped every minute), maximal stroke volume (amount of blood pumped with each beat) and blood volume and ability to carry oxygen. Reduced workload on the heart (myocardial oxygen consumption) for any given sub maximal exercise intensity, increased blood supply to muscles and ability to use oxygen. Lower heart rate and blood pressure at any level of sub maximal exercise, threshold for lactic acid accumulation. Lower resting systolic and diastolic blood pressure in people with high blood pressure, increased HDL Cholesterol (the good cholesterol), decreased blood triglycerides reduced body fat and improved weight control. Improved glucose tolerance and reduced insulin resistance.

For every moment, the body uses energy. The body can procure this energy in two different ways: Without oxygen (anaerobic) – when there is not enough oxygen, waste products will pile up in the muscles with oxygen (aerobic) – this means that the
exercise is performed under circumstances where there is enough oxygen in the muscles. To improve endurance the practitioner should train aerobic system and move to lactate threshold. Aerobic training can be divided into three overlapping training intensity areas: low, moderate and high intensity training. The overall purpose of aerobic training is to: improve the oxygen transport in the circulation improve the muscle’s ability to use the available oxygen improve the ability to recuperate after hard exercise.

Aerobic exercise is a moderate intensity workout that extends over a certain period of time and uses oxygen in this process. Aerobics has become the most happening workout trend among the youth. Not only is performing aerobic exercise interesting, but also is very beneficial for health. There are different types of aerobics like fitness walking, jogging, swimming, kickboxing, inline skating, bicycling etcetera. In line skating or rollerblading is one of the most popular sports that are luring millions of people into trying it. It helps to strengthen lower back and works a great deal in enhancing cardiovascular development. Kickboxing is extremely useful for quick weight loss, as it helps in burning about 350-450 calories during a 50 minute workout session. At the initial level, kickboxing consists of some basic stretches and cardio warm up.

Aerobic exercise and fitness can be contrast with anaerobic exercise, of which strength training and weight training are the most important examples. The two types of exercise differ by the duration and intensity of muscular contractions involved, as well as by how energy is generated within the muscle. Initially during aerobic exercise, glycogen is broken down to produce glucose, but in its absence, fat metabolism is initiated instead. The latter is a slow process, and is accompanied by a decline in
performance level. The switch to fat as fuel is a major cause of what marathon runner’s call "hitting the wall". Anaerobic exercise, in contrast, refers to the initial phase of exercise, or any short burst of intense exertion, in which the glycogen or sugar is consumed without oxygen and is a far less efficient process. Operating anaerobically, an untrained 400 meter sprinter may "hit the wall" short of the full distance (Stoll & Jennifer, 1989).

Aerobic capacity describes the functional status of the cardio respiratory system, (the heart, lungs and blood vessels). Aerobic capacity is defined as the maximum volume of oxygen that can be consumed by one's muscles during exercise. It is a function both of one's cardio respiratory performance and of the ability of the muscles to extract the oxygen and fuel delivered to them. To measure maximal aerobic capacity, an exercise physiologist or physician will perform a VO\textsubscript{2} max test, in which a subject will undergo progressively more strenuous exercise on a treadmill, from an easy walk through to exhaustion. The individual is typically hooked up to a spirometer to measure oxygen and the speed is increased incrementally over a fixed duration of time. The higher a cardio respiratory endurance level, the more oxygen transported to exercising muscles, the longer exercise can be maintained without exhaustion and accordingly the faster they are able to run. The higher aerobic capacity, the higher the level of aerobic fitness. The Cooper and multi-stage fitness tests can also be used to functionally assess aerobic capacity. Aerobic capacity can be improved through a variety of means, including Fartlek training. About Aerobic June (2014).
1.13 CIRCUIT TRAINING

Circuit training is an efficient and challenging form of conditioning. It works well for developing strength, endurance (both aerobic and anaerobic), flexibility and coordination. Its versatility has made it popular with the general public right through to elite athletes. For sports men and women, it can be used during the closed season and early pre-season to help develop a solid base of fitness and prepare the body for more stressful subsequent training. Circuit training is an effective organizational form of doing physical exercises for improving all physical fitness components. Before and after training, the initial and final tests were conducted for the variables such as speed, agility, power, coordination, static balance and dynamic balance for the experimental and control groups. Circuit training is an exercise program that develops overall fitness. Performed regularly, circuit training will simultaneously improve muscular strength, endurance, cardiovascular fitness and flexibility. Circuit training was invented in 1953 as an efficient way for coaches to train many athletes in a limited amount of time with limited equipment. The exerciser moved through a series of training or calisthenics arranged consecutively. It was a fast-paced workout of 15 to 45 seconds per station with little (15 to 30 seconds) or no rest between stations. Today, this is known as “circuit training”. Research has shown that it can increase muscular strength and endurance. There is a mild improvement in aerobic stamina but only if the rest periods are kept very short (Alpert et al., 1990).

Circuit training is a practical method entailing some preliminary planning, but beyond that, it needs co-ordination. Athletes find it motivating since it makes conditioning fun and challenging through competition against team mates. Circuit training is a continuous series of exercises attempting to improve as many components
of physical fitness as possible especially endurance. Generally, six to twelve stations are up. Selection and sequence of the activities within a lap of circuit is made with consideration given to the continuous nature of the performance.

The circuit training format utilizes a group of 6 to 10 strength exercises that are completed one exercise after another. Each exercise is performed for a specified number of repetitions or for a prescribed time period before moving on to the next exercise. The exercises within each circuit are separated by brief, timed rest intervals, and each circuit is separated by a longer rest period. The total number of circuits performed during a training session may vary from two to six depending on training level (beginner, intermediate, or advanced), period of training (preparation or competition) and training objective. Circuit training aims at developing general or basic fitness which is a pre-requisite to every sport. It is designed to assist the development of the muscular as well as the circulatory and respiratory systems of the body. Its principle is based on the system of progressive loading. Circuit training can be used for general fitness purposes; can be adapted as a conditioning medium for various strenuous sports. A circuit may consist of a number of different exercises with or without apparatus. It aims at all round development. The dosages of each exercise are arranged in station around the gymnasium or track. In each circuit try to ensure that no two consecutive exercises to the same muscle group. A circuit should be set up so that you work each body part as follows: total body, upper body, lower body, core and trunk, etcetera (Paoli et al., 2013).

One must aim to improve the time per exercise first, then as fitness improves, the repetition may be increased and later load per station as increased. A large number of persons can be accommodated at the same time. Individual works at his own rate
within his own capacity the goals are both immediately attainable and easily evaluated and “Target Time”, the attempt to complete the circuit in a certain maximum time provides a strong motivational factor. Appropriate form of training for most sports can be adjusted to suit age, fitness and health of the athlete. Exercises are simple enough to make each athlete feel a sense of achievement in completing them. A wide range of exercises will select from which will maintain the athlete’s enthusiasm. Circuit training is a workout routine that combines cardiovascular fitness and resistance training.

Circuit training stations are generally sequenced in a way to alternate between muscle groups, which allows for adequate recovery. The rest interval between stations should be between 30-90 seconds and 1-3 minutes between circuits. A typical gym has several strength training machines and workstations, which enables the creation of several circuits. This benefit of variability challenges the skills of the participant and keeps them interested from session to session. Circuit training plays an integral role in the off-season workouts of many professional athletes. It serves as a way to maintain general fitness while avoiding the high physical demands of in-season sport. A participant should always consult with a physician before beginning a fitness program. Circuit training is an efficient and challenging form of conditioning. It works well for developing strength, endurance (both aerobic and anaerobic), flexibility and coordination. Its versatility has made it popular with the general public right through to elite athletes. For sports men and women, it can be used during the closed season and early pre-season to help develop a solid base of fitness and prepare the body for more stressful subsequent training. A well designed circuit can help to correct the imbalances that occur in any sport played to a high level. It can also be one of the best types of
training for improving strength. A great time saver, it can be a refreshing and fun change from the more monotonous types of exercise.

Circuit training is also a convenient way to exercise. It maximizes the total exercise volume (number of sets, repetitions, and amount of weight) completed in a period of time. Exercises are completed in a row, and therefore, the time spent exercising is condensed. Separate cardiovascular training is not necessary. All body parts are trained in one session, and therefore, exercisers do not need to work out every day. Circuit training is a type of exercise program where one does a series of timed exercises at a fairly rapid pace, with a brief period of rest in between each exercise. Circuit training workouts may target the entire body or just one specific area, such as the arms, legs, or chest. In addition, circuit training workouts may focus on strength training, aerobics, or a combination of the two; the possibilities are virtually limitless. In general, there are four types of circuit training workouts and these include a timed circuit, a competition circuit, a repetition circuit, and a sport specific/running circuit (Paul, 2013).

1.14 HEALTH RELATED PHYSICAL FITNESS

Health related physical fitness is important to everyone and should be stressed by physical educators and medical people alike. Health related fitness is defined as the ability to perform strenuous activity without excessive fatigue showing evidence of traits that limit the risks of developing diseases and disorders which affect a person’s functional capacity. Components of health related physical fitness are identified as muscular strength, muscular endurance, flexibility, cardio respiratory endurance and body composition (Beverly Nichols, 1986).
To enjoy an optimum state of health and physical fitness, exercises are quite necessary. Exercises are helpful in maintaining the sound body throughout life. Health and fitness afford the people an opportunity to live longer and they add to the quality of everyday life (Greenberg and Pargnam, 1986).

1.15 KINANTHROPOMETRIC

Kinanthropometric has a rich tradition in sports sciences and sports medicine. Though, in different times, different terms were used like dynamic kinanthropometry, sports kinanthropometry, biometry, physiological anthropometry, anthropometrical, kinanthropometry scientists to establish some relationships between the body structure and the specialized functions required for various tasks. In fact, it is well established that each individual is unique. The extent of human variability is so enormous that no two individuals can ever be exactly the same. There are two fundamental causes for this variation. One is the genes inherited from parents and the other is the infinity of environment which acts upon individuals from cradle to grave. Therefore, scientists have always been fascinated by the phenomenon of human variation. In the populations, the law of chance operates as a whole and people in general tend to fall along a curve of normal distribution on all traits (Koley & Sandhu, 2012). With the innumerable variety of human physique, it has become a generalized consideration that become sports events are more suitable to individuals with specific physique than other. (Reco-Sanz, 1998; Keogh, 1999). It has been well established that specific physical characteristics or anthropometric profiles indicate whether the player would be suitable for the competition at the morphological parameters are the sensitive indicators of physical growth and nutritional status of the athletes for their maximal performances (Wilmore & Costilla, 1999).
Kinanthropometric measurements relevant to human movement gained formal recognition as a discipline with the inauguration of the International Society for Advancement of kinanthropometry in 1986. Anthropometrics of all continents have participated in several major multi-disciplinary studies that are being or have been conducted to assess the physical characteristics of people. Kinanthropometry has been defined as the quantitative interface human structure and function. (Ross, Drinkwater, Baily, Marshall, Leahy, 1980). This interface is examined through the measurement and analysis of age, body size, shape, proportion, composition and maturation as they relate to gross body function. Previous reports have shown that body structure and morphological characteristics are important determinants of performance in many sports and certain physical impressions such as body composition (body fat, body mass, muscle mass) and physique (somatotype) can significantly influence athletic performance (Carter, 1970 and Duquet & Carter, 2001).

1.16 PSYCHOLOGY

Sports psychology has emerged as a legitimate field of scientific inquiry. As with all scientific endeavors, sports psychology shares the same basic goals of science, the observation of events, the description of phenomena, the explanation of the factors that influences events in systematic manner, the prediction of events or outcomes based upon systematic and reliable explanations and ultimately, the control of events or contingencies that result in expected outcomes. Sports psychology in many ways is a fortunate scientific field of inquiry. Researchers are afforded ample opportunity to observe, describe and explain the various psychological factors that influence diverse aspects of sport and physical activity (John, 1999).
Sports psychology when viewed as a sub discipline within the larger field of psychology would be defined as an applied psychology or as a field of study in which the principles of psychology are applied. Although sports psychology has not been recognized traditionally as a sub disciplinary area of study within the field of academic psychology. Scientists recently suggested that sports psychology is read to be embraced by mainstream of psychology. The view of sports psychology as a sub discipline within the field of sports and exercise science comes mostly from scientists in physical education. They argued that the academic discipline of physical education consist of the study of certain aspects of such field as psychology, physiology and anatomy (Thelma, 1996).

1.17 KABADDI

Kabaddi is a game of 2 teams of 12 players each, where one team becomes the raiders and the other team anti raiders. Seven players shall take the ground at a time and the remaining five players shall be reserved. The raider has to go to the opposing court with the continuous clear sound recitation aloud of the word 'Kabaddi' without stopping to take a breath and should try to touch an anti raider and make him out. The duration of a match for men shall be 2 halves of 20 minutes each. For women and juniors there will be 2 halves of the duration of 15 minutes each. There shall be an interval of 5 minutes between both the halves. The side that wins the toss shall have the choice of the court or the raid. In the second half, the court shall be changed and the side which had not sent their raider first shall send their raider first. The game in the second half shall continue with the same number of players as it was at the end of the first half. Over the years, the game's pattern changed along with the rules and the size of the playfield. The concept of Kabaddi as an Indigenous Game of India first came up during the year 1921 in
Maharashtra, when a certain framework of rules was prepared and the game was played on the pattern of Sanjeevani & Gemini in a combined form. A special committee was constituted in 1923 which amended the rules. These rules were applied in an All India Kabaddi Tournament organized during the same year.

In Maharashtra, the pioneering state to regularize the game and bring it to the National platform, Kabaddi, which was known as "Hu-Tu-Tu", was played according to the rules framed by the Deccan Gymkhana from 1928 to 1938. It was the Hanuman Vyayam Prasarak Mandal, Amaravati, Maharashtra, which took up the task of organizing and developing Kabaddi in a more systematic & scientific manner. This Institution believes in the maxim “A healthy mind in a healthy body”, and has been doing yeoman's service to sports in general and indigenous games in particular, over the years. During the years 1927 to 1952, Kabaddi was played in different parts of the country based on rules framed by the various clubs and organizing committees, which mushroomed and gained in prominence. There were frequent disputes over the rules during tournaments owing to lack of uniformity in the rules and regulations followed in various parts of the country.

The introduction of the game to the Inter-national arena as a demonstration game in the 1936 Berlin Olympics led to the inclusion of Kabaddi in the list of priority games of the Indian Olympic Committee, in the year 1940. Thereafter, Inter-provincial Kabaddi tournaments were organized bi-annually. The matches at the district and provincial level were played as per the rules framed by the Akhil Maharashtra Sharirik Shikshan Mandal, while the Inter-Provincial Championships were based on Buck's Rules of Games and Sports, published by Mr. H.C Buck, Founder and Principal of YMCA College of Physical Education, Madras. The game's pattern also changed over
the years, along with the standardization of rules and regulations. Some of the major changes in the game's pattern include the introduction of the Unproductive Raid Rule, Time Out system, Bonus Line Game, etc that did not change the basic structure of the game but all the same had a lot of impact. Some of the major changes that had an impact on the game are being elaborated in this chapter for the benefit of the readers.

In 1979, a return test between Bangladesh and India was held at different places of India including Mumbai, Hyderabad, and Punjab. The Asian Kabaddi Championship was arranged in 1980 and India emerged as champion and Bangladesh runner-up. Bangladesh became runner-up again in 1985 in the Asian Kabaddi Championship held in Jaipur, India. The other teams in the tournament were Nepal, Malaysia and Japan. The game was included for the first time in the Asian Games in Beijing in 1990. India, China, Japan, Malaysia, Sri Lanka, Pakistan and Bangladesh took part and India won the gold medal and India also won gold at the following three Asian Games in Hiroshima in 1994, Bangkok in 1998 and Busan in 2002. India won the gold medal in the 2006 Asian Games at Doha. The game of Kabaddi got a major boost when it was included for the first time in Asian Games held in Beijing in 1990.

Attempts to popularize kabaddi in Great Britain saw British TV network Channel 4 commission a programme dedicated to the sport. The show, Kabaddi, on Channel 4 in the early 1990s, failed to capture viewers despite fixtures such as West Bengal Police versus the Punjab. Kabaddi was axed in 1992, but not before its presenter Krishnan Guru-Murthy suffered a collapsed lung while participating in the sport. The First World Kabaddi Championship was in Hamilton, Ontario, Canada, when 14,000 at the Cops Coliseum watched top players from India, Pakistan, Canada, England and the United States. The next edition was in Surrey, British Columbia, which hosted the first
all-kabaddi stadium. India has remained world champion since it was included in Asian Games and South Asian Federation games. In 2008 Sukhbir Singh Badal mooted a professional world kabaddi league with sponsorship to attract the best players; this league will be based in India with tournaments in Canada as well. The current Kabaddi Championship team consists of several local Indian players.

The sport has a long history dating back to pre-historic times. It was probably invented to ward off croup attacks by individuals and vice-versa. The game was very popular in the southern part of Asia played in its different forms under different names. A dramatized version of the great Indian epic, the "Mahabharata" has made an analogy of the game to a tight situation faced by Abhimaneu, the heir of the Pandava kings when he is surrounded on all sides by the enemy. Buddhist literature speaks of the Gautam Buddha played Kabaddi for recreation. History also reveals that princes of yore played Kabaddi to display their strength and win their brides. The origin of kabaddi can be traced to the pre-historic times when the game was devised as a way to develop the physical strength and speed in young men. The game is essentially an Indian one, and commands huge popularity in the Indian hinterland.

1.18 FORMS OF KABADDI

1.18.1 AMAR

Amar literally means invincible. This is a form of Kabaddi, which is played based - on points scored by both sides. The play field has no specific measurements and nine to eleven players constitute each of the teams. In this form of Kabaddi, there is no 'out' and revival' system or 'Iona' but time is the deciding factor. The main advantage of
this form of the game is that tile players remain in the court throughout the match and are able to give their best performance.

1.18.2 GEMINI

This form of Kabaddi is played with nine players on either side, in a play-field of no specific measurements. The principle characteristic of this form of Kabaddi is that a player who is put out has to remain out until all his team members are put out. The team that is successful in putting out all the players of the opponent's side secures a point. This is akin to the present system of 'Iona'. After all the players are put out, the team is revived and the game continues. The game continues until five or seven 'Iona' is secured. The game has no fixed time. The main disadvantage of this form of Kabaddi is that the player is not in position to give his best performance since he is likely to remain out for the better part of the match until a loner is scored.

1.18.3 SANJEEVANI

This form of Kabaddi is the closest to the present game. In this form of Kabaddi, players are put out and revived and the game lasts for 40 minutes with a 5-minute break in between. The team consists of nine players on each side. The team that puts out all the players on the opponent's side scores four extra points for a 'Iona'. The winning team is the one that scores the maximum number of points at the end of 40 minutes. The play field is bigger in this form of Kabaddi and the 'cant' was different in various regions. Modern Kabaddi resembles this form of Kabaddi a great deal especially with regard to 'out & revival system' and 'Iona'. The present form of Kabaddi is a synthesis of all these forms of Kabaddi with a good number of changes in the rules and regulations.
The game, known as Hu-Tu-Tu in Western India, Ha-Do-Do in Eastern India & Bangladesh, Chedugudu in Southern India and Kaunbada in Northern India, has undergone a sea This study would help to assess the health related chance through the ages. Modern Kabaddi is a synthesis of the game played in its various forms under different names. Kabaddi is said to have originated in the Indian state of Tamil Nadu and is called Sadugudu in Tamil and Chedugudu in Telugu. Kabaddi is also very famous and popular in Punjab and Bangladesh, where it is the national sport, known as Hadudu. In India, kabaddi is played in different names (Chedugudu or Hu-Tu-Tu in southern parts of India, Hadudu (Men) and Chu-Kit-Kit (women) in eastern India and Kabaddi in northern India) and forms (Amar, Gemini and Sanjeevani).

The Kabaddi Federation of India came into existence in 1950 and took upon the task of standardizing the rules of the game. After the formation of the Federation, the first men's Nationals were held in Chennai, while the women's Nationals were held in Calcutta in the year 1955. The Amateur Kabaddi Federation of India (AKFI) was founded in 1973.

1.19 STATEMENT OF THE PROBLEM

The purpose of the study was to find out the effect of aerobic training and circuit training on selected health related physical fitness, kinanthropometric and psychological variables such as muscular strength, muscular endurance, flexibility, cardio respiratory endurance, body composition, cognitive anxiety, somatic anxiety, self confidence, hip girth and calf girth among adolescent kabaddi players.
1.20 SIGNIFICANCE OF THE STUDY

Physical fitness, psychological and kinanthropometric variables among adolescence kabaddi players.

1. The results of the study would help to introduce the training packages for adolescent kabaddi players.

2. The results of the study would motivate the players to practice the game kabaddi.

1.21 HYPOTHESES

On the basis of available literature and scholar own understanding of the problem, the following hypotheses were formulated:

1. It was hypothesized that there would be a significant improvement in selected health related physical fitness, psychological and kinanthropometric variables separately.

2. It was hypothesized that there would be a significant improvement in selected health related physical fitness, psychological and kinanthropometric variables among due to the effect of aerobic training and circuit training.

3. The findings of the study showed that the aerobic training group showed significant improvement only on cardio respiratory endurance than the circuit training and control groups. Hence the third research hypothesis was partially accepted.
1.22 DELIMITATIONS

This study was delimited to the following aspects.

1. The study was delimited to forty five adolescence women kabaddi players from Namakkal district, Tamilnadu.

2. The study was confined to adolescence women kabaddi players between the age group of 18 and 25 years.

3. This study was delimited to only aerobic training and circuit training.

1.23 LIMITATIONS

This study was delimited to the following aspects.

1. The regular activities of the subjects were not controlled

2. The food habits and life styles were not controlled.

3. The atmospheric temperature and meteorological factors during training and testing period were not considered. Though the subjects were motivated verbally, no attempt was made to differentiate the motivation levels during the period of training and testing.

4. The growth and development of the subjects, if any during the training and could not be controlled.

5. The emotional status of the subjects was not controlled.
6. The previous experience and knowledge of the subjects in training which might influence the results of the study would be considered as one of the limitation of the study.

1.24 DEFINITION OF TERMS

1.24.1 Muscular Strength

It is defined as the ability of a muscle group to develop maximal contractile force against a resistance in a single contraction (Baumgartner et al., 2003).

1.24.2 Muscular Endurance

Muscular endurance is the ability of a muscle to lift weight repeatedly over time (Baumgartner et al., 2003).

1.24.3 Flexibility

It is most frequently given as “the range of movement about a joint”. (Baumgartner et al., 2003).

1.24.4 Cardio-Respiratory Endurance

It is the ability to perform dynamic exercise involving large muscle groups at moderate to high intensity for prolonged periods (Baumgartner et al., 2003).

1.24.5 Body Composition

It is the physical makeup of the body including weight, lean weight, and percent fat (Baumgartner, et al. 2003).
1.24.6 Cognitive Anxiety

It is commonly contrasted with cognitive anxiety which is that provoked by mental concerns or worry (Sandhu, 2002).

1.24.7 Somatic Anxiety

Somatic anxiety is anxiety provoked by bodily symptoms of tension such as butterflies in the stomach (Sandhu, 2002).

1.24.8 Self Confidence

The self confidence derives from knowing that you have the right type of skills and interesting goals to achieve the self confidence (Weinberg, 2003).

1.24.9 Hip Girth

The circumference of the buttocks at the level of their greatest posterior protuberance, perpendicular to the long axis of the trunk (Marfell, 2006).

1.24.10 Calf Girth

The circumference of the leg at the level of the medial calf skinfold site, perpendicular to its long axis (Ross et al., 2003).