Chapter I

INTRODUCTION

Training methods and procedures to select athletes for sports and training them have been markedly revolutionized. The rapid progress made in the understanding of the mechanism involved in the adaptation of athletes to different training procedures has significantly contributed to the development of various training methods. Variations in these training methods have been introduced to make them appropriate and to achieve specific performance objectives. Therefore, training methods and techniques are generally used according to the degree of the involvement of different element of fitness in any sports performance. High sports performance is not merely the product of physical, psychic and physiological prerequisites possessed by an individual sportsman. High performances are achieved only after prolonged periods of training (Singh, 1991).

High level of performance is the result of many years of well-planned, methodical and hard training. During this time the athlete tries to adapt his organs and functions to the specific requirements of the chosen sport. The adaptation level is reflected by performance capabilities. The greater the degree of adaptation, better the performance. Training adaptation is the sum of transformations brought about by systematically repeated exercises. These structural and physiological changes result from a specific demand that athletes place on their bodies by the activity they pursue depending on the volume,

intensity and frequency of training. Physical training is beneficial only as long as it forces the body to adapt to the stress of the effort (Bompa, 1999).

1.1: Sports Training

Sports training is a programme of exercise designed to improve the skills and increase the energy capacities of an athlete for a particular event. Sports activities consist of motor movement and action and their success depends to a great extent on how correctly they are performed. Techniques of training and improvement of tactical efficiency play a vital role in a training process (Fox, 1984). Bompa (1999) suggested that the physiological goal of training is to improve body function and optimize athletic performance. Training is primarily a systematic athletic activity of long duration, which is progressively and individually graded. Human physiological functions are modelled to meet demanding tasks.

Sports training aim at achieving higher performance in sports competition for which training should be based on facts and principles, and executed in a planned and systematic manner. A system most suitable for achieving higher performance has to be first made on the basis for which sports training is planned. It is always assessed, planned, organized and improved by a coach or a sports teacher or the athlete himself. The sport training aim at finding hidden reserves and makes the sports person aware of it. It also aims at grater development of the reserves. The sports person controls their day to day routine in such a manner that they are able to do training once or twice a day with high effect. It is a continuous process of perfection, improvement and

criterion of means and methods of improving sports performance and factors of performance.

Sports training aims at 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 (Singh, 1991).

1.2: Swissball Training

The physical object known as a "Swiss Ball" was developed in 1963 by Aquilino Cosani, an Italian plastics manufacturer. He perfected a process for molding large puncture-resistant plastic balls (Flett, 2003). Those balls, then known as "Pezzi balls", were first used in treatment programs for newborns and infants by Mary Quinton, a British physiotherapist working in Switzerland. Later, Dr. Susanne Klein-Vogelbach, the director at the Physical Therapy School in Basel, Switzerland, integrated the use of ball exercise as physical therapy for neuro-developmental treatment. Based on the concept of "functional kinetics", Klein-Vogelbach (1990) advocated the use of ball techniques to treat adults with orthopedic or medical problems. The term "Swiss Ball" was used when American physical therapists began to use those techniques in North America after witnessing their benefits in Switzerland

(Carriere, 1998). From their development as physical therapy in a clinical setting, those exercises are now used in athletic training, (Hillman, 2005) as part of a general fitness routine (Milligan, 2005) and incorporation in alternative exercises such as yoga and Pilates (Mitchell, 2003).

Exercises are mostly designed with the part or the whole of the body to make physically fit. Different authors have made researches on all aspects of exercise training and their significance and effect on the physical fitness. Any specific conditioning for a particular activity will bring a definite change in physical fitness level and having this in mind, a new set of exercises called physioball exercises were developed especially to improve fitness (Author's Guide, 1993). The ball, while often referred to as a Swiss ball, is also known by a number of different names, including balance ball, birth ball, body ball, ball, fitness ball, gym ball, gymnastic ball, physioball, pilates ball, Pezzi ball, sports ball, stability ball, Swedish ball, therapy ball, or yoga ball.

Training on swissball is being discovered by people of all ages for therapeutic rehabilitation and overall fitness. Rather than joining a club buying costly equipment, one can get a total body workout with minimal time and less expense right in one's own living room. This represents a major leap forward in exercise technology and balance training. They are simple products that can be used to improve strength, endurance, flexibility and core stability.

The Swiss Ball or Exercise Ball has become a common site in good health and fitness clubs around the world, earning it's place due to the many benefits it offers in improving our posture, balance, reaction speed and

core strength. This is because a Swiss Ball provides an enriched and challenging environment in which to train. Also Swiss Ball exercises are fun and achievable for most people, as they can be easily adapted to suit all levels of ability. Swiss ball training is classed under the category of 'functional stability training' - along with other balance tools such as Bosu Balls, stability discs, single leg training and power plates. It is most often used in physical therapy, athletic training and exercise. It can also be used for weight training.

As of today, countless fitness professionals are promoting the use of ball exercises and athletes from every sport imaginable and from every level are incorporating them into their training regimen. Exercise balls now come in a variety of different sizes and are often used alongside other fitness equipment. For example, in order to reduce the range of motions allowed by the exercise ball, one can use what is known as a stability cushion that would position underneath the ball in order to cradle it in place. Furthermore, new ball exercises as constantly being developed that incorporate the use of dumbbells or cable systems.

While a variety of methods are encouraged, perhaps the one area in which a swiss ball can be used on a consistent basis is abdominal training. Swiss balls allow a full range of motion; the exerciser can easily roll forward during crunches to take any strain off the lower back, and they allow for numerous variations of abdominal exercises. A routine of weighted crunches (crunches with a plate held across the chest for resistance), reverse crunches

and russian twists performed on the ball will lead to an impressively chiselled and strong midsection.

The whole concept of the Swiss ball is to create an unstable environment. In doing this, more demand is placed on the body as it tries to achieve stability, forcing it to use smaller stabilizing muscles. In a nutshell, instability provides an increased challenge for the body, which results in increased benefits.

1.3: Benefits of Ball Exercises

The biggest benefit to training using ball exercises is that they are very effective at targeting core muscles, those muscles that are essential for stability and good posture but are often overlooked when exercising with fixed position equipment such as those found in gyms. With the body responding to the instability of the ball to remain balanced, it engages more muscles and individual muscle fibres. The long term benefits of training include delaying the age-related degeneration of our nervous system and reducing the risk of neuromuscular-related conditions like Parkinsons disease. Using a Swiss ball adds variation within our regular exercise plan, especially when we are an experienced / advanced exerciser who requires greater challenge to still achieve overload and progression.

Swiss balls are effective as a regular tool for core training to optimise core stability and abdominal strength**.** Incorporating a balance demand takes the intensity and muscle activation of floor-based sit-ups to a new level. Effective improvements can be difficult to sustain for a variety of reasons such

as lifestyle stress, boredom from the same routine, time pressures etc. Swiss ball training is consistently challenging and can serve as a real driving force to achieve mastery over the hundreds of different exercises available. Swiss ball training is a phenomenal tool to have in our training tool box, so get fitness professional to further our exercise knowledge and get more from how we train.

Swiss ball or exercise ball stimulates all those essential muscles that help maintain a healthy posture. This is because they are constantly working to maintain our centre of gravity, so that we don't fall off the ball. Using a Swiss Ball requires the consistent recruitment of the core musculature and as all movement is initiated and supported by the core, a stronger core leads to stronger extremities (*arms & legs*). During regular daily activities our body is challenged by many forces in all dimensions. Since most machines are anchored to the floor they do not require recruiting our stabiliser muscles, dumping down our systems ability to control our body's movement. Swiss Ball training requires recruiting our core muscles to manage these forces improving balance, co-ordination and stability. Swiss Balls provide an enriched training environment which challenges the nervous system and improves our ability to react to a changing base of support. Swiss balls are naturally unstable, sitting; exercising or balancing on it activates a myriad of motor recruitment patterns, increasing muscle function and awareness. This is particularly beneficial when rehabilitating because often muscles are inhibited as a result of injury.

The gym-ball store products firm and tone buttocks, thighs and abdominals strengthen lower back, chest and arms, increases aerobic endurance and core stability, perfect for any age or fitness level used by professional athletes, also recommended by doctors. Nothing works as efficient as the swissball in isolating the abdominals, back and thighs for maximal results. After a long day of sitting, bending, twisting or lifting the swissball revitalizes tired achy and stiff muscles while supporting the entire spine.

1.4: Flexibility Training

Flexibility training involves exercises, which aim to stretch muscles and their connective tissues. It is muscle and the tissues which surround and attach muscle to bone that limit the range of movement of the various joint actions which facilitate the running and hurdling actions. The activities which stretch these muscles are often referred to as stretching, flexibility or suppleness excises, the aim of each exercise being to stretch to the limit of the range of movement, often referred to as the position, and to seek to improve the range by stretching at and beyond this point.

There are a number of techniques used in performing flexibility exercises to increase the range of movement. The simplest and safest is the active or slow stretch method. This position should then be held for about 10-15 seconds. The stretch is then released and repeats the exercise a number of times. When holding the stretched position other parts of the body should be as relaxed as possible. It also helps to concentrate on relaxing the muscles, which are being stretched. Greater flexibility can be achieved in warm rather than

cold conditions. It is therefore important that the runner increases the heat in his muscles through light running or jogging before stretching. In cold conditions it will be necessary to wear warm clothing whilst stretching. But care must be taken to ensure that tight clothing does not restrict movement. Flexibility training is best undertaken in a warm environment, which usually means indoors in our climate (Brook, 1992).

Training to develop flexibility must also obey the laws of specificity, overload and reversibility. Specificity: Training must focus on a particular joint action and the active, passive or kinetic nature of the flexibility required in that joint action. 'Specific', here, refers to athlete, joint action and technical demand. Overload: Range of movement will not be maintained unless the existing limit is reached regularly, nor will it be improved unless that limit is exceeded. Active flexibility exercise is acceptable for maintaining a range of movement, provided strength of the protagonists is not lost. It has only limited value for developing flexibility and implies increased strength of the protagonists and work in the end position, i.e., at the existing limit of the range of movement. Passive flexibility exercise, given appropriate external force will maintain or increase the range of movement. Kinetic flexibility exercise makes its greatest contribution by relating flexibility achieved through active or passive exercise, to the dynamics of a sport technique. However, as a carefully supervised type of exercise, it may also improve flexibility. Reversibility: Mobility status is lost more slowly on cessation of regular specific training than

other characteristics. Nevertheless it is gradually lost so the athlete should include mobility training (Dick, 1988).

Flexibility can be improved in an immediate or a long - range basis. For immediate improvement, flexibility can be increased to a limited amount of preparatory stretching exercises. Prior to warm up antagonistic muscles relax slowly and incompletely when against contract, and thus retard free movement and accurate coordination. Warm - up exercises causes the antagonists to relax more completely, and the movements become smoother and better coordinated. Slow stretch exercise during which the antagonistic muscles are stretched and consciously relaxed for several seconds are the most effective for immediate improvement in flexibility.

1.5: Importance of Flexibility

Flexibility may be an important health-related fitness component, proper flexibility may be helpful in the prevention of low back pain, the improvement of posture and physical appearance, and the prevention of minor injuries associated with everyday life and planned aerobic exercise programs. The soft tissues of the body, such as muscles, tendons, ligaments, and connective tissue, contain elastic fibres that can be stretched in order to improve flexibility. Although both static stretching and ballistic stretching techniques may improve flexibility, the static is recommended because the slow movement is less likely to cause an injury. In order to improve flexibility, the muscle must be overloaded (*stretched beyond its normal range of motion*) and held in position for about 15 to 60 seconds three times a day. The key to flexibility exercises

for the low back area is to flatten out the forward curve in the lumber area-as it would appear if curled our self up into a ball. Joggers and runners may benefit from flexibility exercises for several body areas- the low back region, the hamstrings, the calf muscles or Achilles tendon, and the groin muscles. We can develop a flexibility program for almost any joint or muscle group in the body simply by stretching that muscle group and using the basic guidelines relative to overload and progression (Williams, 1990).

The benefits of adequate joint mobility (or flexibility) for athletes should already be evident. When an athlete is strong as well as flexible, more force is required to produce muscle or connective tissue tearing, and more stretch is required before occurs the greater these limits of strength or stretch. When athlete remains un-injured for long periods, they can continue to make progress in their training, which permits them to more closely approach their performance.

1.6: Volleyball

Volleyball is played by million of people around the world. In many countries, it has been ranked as top-level competitive sports. It is a fascinating game, which everybody will accept. It is a well-knows fact that volleyball is a thrilling game. It is one of the recreational games with in a small area. It is a game where not only the hands are engaged in receiving and spiking the ball, but the whole body and mind are engaged in this game. Volleyball is probably the leading ball game in the world as far as action and accuracy are concerned. Regarding the result of this game anything many happen at any time.

Volleyball is a team game where six players in the court will play as a unit and not like machine.

Versatility and speediness are the trend of development in modern volleyball sport. “Versatility” means that the athletes should not only be well-prepared for their specific position, but also posses’ high levels of all-round skills in serving, setting, spiking, blocking and defence. “Speediness” requires the athletes to be able to move quickly to the optimal place on the court. Speediness and agility in tactics, as the key factors, work together to make suddenness the feature of modern volleyball sport (Huang, 1992).

Though volleyball was originally invented to be a recreational game; it has now developed into a high competitive sport, requiring a high degree of fitness. The requisite level of fitness will vary depending upon the level of competition. Participation in top-notch competitive volleyball requires that a person should be in a state of optimum fitness.

On emphasizing the requirements of a volleyball player, once Japan's national team coach Matsudaira said, 'I would like to be able to select a team who have the individual skill of Czechoslovakian team, power of the Soviet team, the ability and team play of a Japanese team, and the jumping ability of Cuban team and the competitive and fighting spirit of a Korean team. (Matsudaira, 1997)

From the above statement, it is evident that these components of performance are essential for volleyball players. Nicholls recommends power, speed, agility, coordination, flexibility, muscular and cardio-respiratory

endurance and concentration as well as quick thinking and reaction time are the factors basic to performance in volleyball (Nicholls, 1919). The ingredients of success volleyball players are power, speed, and judgement of the distance and space concentration training, agility, flexibility, peripheral vision and ability to remain high up for a sufficiently long period. Quickness is the prime necessity in the modem volleyball both in attack and in defence (Smith, 1982).

Among all the physical performance indicators, speed and power (*eg. in jumping & spiking*) are of the most important ones. Particularly, jumping height is decisive for the execution of techniques and tactics (Jin *et al*., 2007). The research by Japan Volleyball Association demonstrated the significant correlation between the vertical jumping index and the competitive ability of the volleyball players. It was found that the jumping ability had a positive correlation with the number of spiking, and the total success rates of spiking, blocking and serving in a game (Tian, 2006)**.**

Although flexibility is generally considered one of the five components of physical fitness, its exact contribution to general health is even less clearly defined the importance to athletic performance. Within the realm of sport there are many activities where high degrees of flexibility in specific joints are desirable for enhanced performance in both quantitative and qualitative athletic activities (Foster, 1995). Flexibility training will improve all-round strength and flexibility, especially in vital areas such as the abdominal oblique's, and also shoulder girdle.

1.7: Physical Fitness Components

Fitness is a condition in which an individual has sufficient energy to avoid fatigue and enjoy life. Physical fitness is divided into four health and six skill-related components. Health-related fitness involves skills that enable one to become and stay physically healthy. Skill- or performance-related fitness involves skills that will enhance one's performance in athletic or sports events.

The performance of a sportsman in any game or event depends on performance-related physical fitness. The physical fitness or condition is the sum total of five motor abilities namely muscular strength, agility, power, speed and cardiovascular endurance. Therefore, the sports performance in all sports depends to great extent on these abilities. Improvement and maintenance of physical fitness is the most important aim of sports training (Uppal, 1980).

Maximal strength and power are not distinct entities; they have a hierarchical relationship with one another. Maximum strength is the basic quality that influences power performance. Power performance is affected by the interaction between agonist, antagonist, and synergic muscles involved in joint movements. Muscular power, often referred to as explosive power, is a combination of speed and strength which is important in vigorous performance since it determines how hard a person can hit, jump and push etc. Power is an essential quality of many sports, for it represents the effective combination of strength and speed. Increase in strength or speed will improve power.

In the short distance running there is a purpose to overcome the gifted distance in the shortest possible time. The decisive factors of the sports

performance structure are maximal running speed and the ability to keep it as longer as possible (*speed endurance*). Even in many different sports and events the maximal running speed participates either directly or not on the level of sports performance and sportsman's successfulness. That is why the development of speed abilities is very topical problem of the sports theory and practice. Sprinting speed is determined by the length of stride and stride frequency. Leg speed is innate, but stride length can be improved by increasing muscular strength, leg power and mobility.

The strength of the muscle depends upon the size of the muscle. Rigorous training, particularly, when done against heavy resistance (weights) usually results in muscle fibre thickening. There is also an increase in the number of capillaries surrounding and nourishing the muscle, and a thickening of connective tissue. Similarly with the muscle tendons that connect muscles and ligaments that connect muscle to bone. These kinds of changes are likely to result in a gain in body weight. However in order to achieve this exercise must be done regularly over a fairly long period of time and at significant level of intensity (James, 1985).

Explosive power is defined as the rate of expenditure of energy. It is the ability of the muscles or group of muscles to overcome resistance with maximum speed and effort. Explosive power mainly depends on strong muscle. The abdominal and leg strength play a vital role on the performance of jumpers. In order to develop the abdominal and leg strength, jumping exercise play a major role. Explosive power represents one of the most important

features of track and field. Only the energetic aspect of substrate utilization represents the biological basis as many. Indeed, the most peculiar factors for explosive power development must be formed in neuromuscular properties.

Most sports require the explosive application of force to accelerate the body or limb, whereas 1 RM strength tests do not require rapid acceleration to produce the necessary force. In fact, 1 RM type of strength is maximized during slow muscle actions and minimized as the velocity of movement increases. Conversely vertical jump performance requires great power; that is, the ability to exert force rapidly through a vertical distance based on the level of flexibility.

The ability to move each joint through a full range of motion without undue strain is essential for the efficient execution of many everyday tasks. With limited flexibility we may experience “tightness” or stiffens” at joint and have difficulty in performing some movements. Increased flexibility allows more efficient movement with less resistance. Range of motion is highly specific to the joint and depends on the structure. Flexibility is related to age, sex and physical activity. Flexibility progressively decreases with age due to changes in the elasticity of the soft tissues and a decrease in the physical activity level. Thus, older person should be encouraged to perform flexibility exercises daily to counter at the loss of elasticity (Dintimen, 1997).

During day-to-day activities, sedentary people typically do not move their joints through their maximum range of motion, except perhaps during a nice relaxing accompanied by a stretch of the upper limb. Only by more

vigorous activities-calisthenics, sports, or a sudden burst of energy; for example, to bound up a flight of stairs-do people greatly increase the extent of joint movement. Muscular lightening or shortening permits this to occur. If they are not periodically stretch the connective tissues and less stretchable over time, increasing the difficulty of achieving what earlier was considered the full range of joint motion.

Minimum information about joint structure and the role of muscles is necessary for a basic understanding of flexibility a joint is simply a junction of two or more bones where movement takes place. The joints structure is important, because it will determine what movement can take place at the joint as in some cases will limit the range of motion. For example the elbow and knee joints are allow movement in only one direction. The only movements possible are flexion and extension. When the forearm and lower leg are fully extended, the bones “Lock” into position and the structure of these joints permits no further movement in that direction.

1.8: Biochemical Variables

Cholesterol and triglycerides are two forms of lipid, or fat. Both cholesterol and triglycerides are necessary for life. Cholesterol is necessary, among other things, for building cell membranes and for making several essential hormones. Triglycerides, which are chains of high-energy fatty acids, provide much of the energy needed for cells to function.

There are two sources for this lipid: diet and "endogenous" sources (*that is, those manufactured within the body*). Dietary cholesterol and triglycerides

mainly come from eating meats and dairy products. These dietary lipids are absorbed through the gut, and then are delivered through the bloodstream to the liver, where they are processed. One of the main jobs of the liver is to make sure all the tissues of the body receive the cholesterol and triglycerides they need to function. Whenever possible (*that is, for about 8 hours after a meal*), the liver takes up dietary cholesterol and triglycerides from bloodstream.

The LDL stands for "low density lipoprotein," and HDL for "high density lipoprotein." In the bloodstream, "bad" cholesterol is carried in LDL, and "good" cholesterol is carried in HDL. Most cholesterol in the blood is packaged as LDL. Only a relatively small proportion is from HDL cholesterol. Thus, the total cholesterol level in the blood usually reflects mainly the amount of LDL cholesterol that is present.

Elevated levels of LDL cholesterol have been strongly associated with an increased risk of heart attack and stroke. It appears that when LDL cholesterol levels are too high, the LDL lipoprotein tends to stick the lining of the blood vessels, which helps to stimulate atherosclerosis. So, an elevated LDL cholesterol level is a major risk factor for heart disease and stroke. This is why LDL cholesterol has been called "bad" cholesterol.

Much evidence now suggests that higher HDL cholesterol levels are associated with a lower risk of heart disease, and that low HDL cholesterol levels are associated with an increased risk of heart disease. Thus, HDL cholesterol appears to be "good."

While the association between triglycerides and the risk of heart disease has not been as clear as it is for cholesterol, in recent years, several studies have been established that people with elevated levels of triglycerides are indeed at increased risk. Also, elevated triglyceride levels are very often strongly associated with other important risk factors, including low levels of HDH cholesterol, obesity, insulin resistance, diabetes, and a tendency toward excessive blood clotting.

Most of these risk factors associated with high triglyceride levels are part of condition called metabolic syndrome, a condition caused by excess weight and lack of exercise in people who are prone to develop insulin resistance. So, treating high triglyceride levels is most often not done in isolation, but requires treating the constellation of risk factors associated with metabolic syndrome.

The relationship between triglyceride-rich lipoproteins and HDL, noting the inverse relationship between HDL and CVD risk, which is more pronounced in women than in men, and the inverse relationship between triglyceride and HDL cholesterol levels. A potential explanation is the transfer of triglyceride from apoB- to apoA1-containing particles via CETP, leading to small, triglyceride-rich, cholesterol ester–depleted HDL particles. Chylomicrons and VLDL are the main triglyceride carriers in human plasma, chylomicrons containing apoB-48, produced in the intestine, while VLDLs contain apoB-100, produced in the liver.

1.9: Need of the Study

Though the volleyball game seems to be simple game but the recent trend indicates that it is not so simple but it has very complex skills and fast game. Volleyball game requires comprehensive ability including physical, technical, mental and tactical abilities. Among them physical abilities of players exert marked effects on the skills of the players themselves and the tactics of the team. The skills like higher attack, powerful jumping-serve, attack from the back row and aggressive blocking are now widely used by volleyball players. All these bring forward greater demand for specific physical fitness and physique of volleyball players. In volleyball, technical and tactical skills, anthropometric characteristics and individual physical performance capacities are most important factors that contribute to the success of a team in competitions (Hakkinen, 1993).

Physiologically, a volleyball game is an intermittent exercise that requires the players to perform frequently short bouts of high-intensity activities such as jump and spike, followed by periods of low-intensity activities (Kuenstlinger *et al.,* 1987; Viitasalo *et al.,* 1987). Therefore, the players should possess both aerobic and anaerobic power. The instant and explosive spiking and blocking over the net are intense enough to trigger anaerobic metabolism which means lactic acid may accumulate in the blood. Moreover, since the match time is not restricted, a match sometimes may last for more than two hours. Therefore, it also requires a high level of aerobic fitness (Chen, 2005, Tian, 2006). Volleyball players require well-developed

muscular strength, power, endurance, speed, agility, flexibility, high level of jumping ability, fast reaction time and swift movements (She, 1999). Considerable demand is also placed on the neuromuscular system during sprints, jumps (*blocking & spiking*), and high-intensity court movements that occur repeatedly during competition (Hakkinen, 1993).

Hence, like any athlete, volleyball players also need to follow conditioning program that aims towards them peaking at certain stages of the year. By concentrating on systematic training workouts throughout the off season will enable the volleyball players to perform with greater ability and reduce risk of injury during the competitive season. Swiss balls are commonly employed in athletic conditioning, setting to enhance core stability.

Swissball training is purported to enhance neuromuscular and cardiovascular function. Furthermore Swissball training is reported to be superior to conventional abdominal training for the development of a stable midsection, reportedly vital for optimal function. However, empirical data to support the claims made by clinicians, trainers and users of Swissball are lacking. Data from Swissball studies conducted thus far indicate greater activation of the abdominal musculature, when compared to other forms of abdominal training. Moreover, of the published and unpublished training studies conducted to date, it appears Swiss Ball training may lead to greater core stability; however this is not reflected by superior athletic performance. Unlike other physical parameters, there appears to be no 'Gold Standard' for quantification of core stability. This, coupled with the lack of sensitivity of

athletic performance measures employed in studies to date, has likely led to the lack of significant findings. Thus, until a measure of core stability is defined, and performance outcome measures are rigorously controlled, the prescription of Swissball exercises should be viewed with caution.

In volleyball, strength and speed are physical qualities that are undoubtedly important for successful performance and, therefore, are greatly emphasized in conditioning training. On the other hand, flexibility is not viewed as a considerable contributor to success on the court and is frequently ignored or not given proper attention by coaches and athletes. A reluctant attitude toward flexibility training is generally caused by a lack of evidence that flexibility improves the overall performance of a volleyball player. Most volleyball players would benefit from flexibility training that are designed to improve the range of motion of the joints used in volleyball skills. For instance, an increased range of motion in the shoulder joint could potentially improve hitting, whereas increased flexibility of the lower extremities could make it easier for an athlete to assume a technically correct low dig position. There is no research to support the notion that a regular flexibility program produces a decrease in muscular strength of volleyball players.

The concept of swissball and flexibility training has been the focus of controversy among sports scientists and trainers in recent years. The research literature does not provide all the answers, and practitioners report different levels of success using a variety of modes and techniques. The challenge of human muscle power enhancement for sports performance is based on the use

of a variety of training approaches and it is generally agreed in the literature that some form of exercise involving near maximal efforts will improve power output.

Several studies have demonstrated that physical fitness components could be improved through systematic training, however no study have been conducted to compare the effect of isolated and combined swissball and flexibility training on physical fitness, biochemical and skill performance variables among school volleyball players. Through the study of science and various sports training, researchers have developed a greater understanding on how the human body reacts to exercise, training, different environments and many other stimuli. The present scientific study is one of the efforts to explore and suggest the advantage of these three training concepts such as swissball and flexibility exercises and its combination for the volleyball players.

1.10: STATEMENT OF THE PROBLEM

The purpose of the study was to find out the effect of isolated and combined swiss ball and flexibility training on selected physical fitness, biochemical and skill performance variables among school volleyball players.

1.11: OBJECTIVES OF THE STUDY

The primary research objectives are the following:

1. To analyze the changes on selected physical fitness, biochemical and skill performance variables of volleyball players due to the effect of

swiss ball training, flexibility training and combined swiss ball and flexibility training.

2. To compare the effects of swiss ball training, flexibility training and combined swiss ball and flexibility training on selected physical fitness, biochemical and skill performance variables of volleyball players.

1.12: HYPOTHESES

Based on the objectives of the study and reviewing the related literature available in the area, the investigator framed the following hypotheses.

1. It was hypothesized that there would be significant improvement on selected physical fitness, biochemical and volleyball skill performance variables due to the impact of swiss ball training.
2. It was hypothesized that there would be significant improvement on selected physical fitness, biochemical and volleyball skill performance variables due to the impact of flexibility training.
3. It was hypothesized that there would be significant improvement on selected physical fitness, biochemical and volleyball skill performance variables due to the impact of combined swiss ball and flexibility training.
4. It was hypothesized that the combined swiss ball and flexibility training would be better in improving the selected physical fitness, biochemical and volleyball skill performance of volleyball players than isolated swiss ball and flexibility training.
5. The control group may not improve in any of the chosen physical fitness, biochemical and volleyball skill performance variables.

1.13: SIGNIFICANCE OF THE STUDY

Acquiring physical fitness and skill performance for the optimum performance in volleyball is the serious concern of volleyball players and coaches today. The ideal competition purpose is still to be explored. This study can contribute to the training methods in the following ways.

1. This study will help the coaches to identify the appropriate methods of training among the three types namely Swiss ball training, flexibility training and combined training to improve the physical fitness, biochemical and skill performance of volleyball players.
2. This endeavour may provide better idea in fixing the training load to obtain the desired effect through isolated and combined Swiss ball training and flexibility training.
3. Changes in physical fitness components and biochemical parameters after training would help us to compare the impact of isolated and combined Swiss ball and flexibility training among volleyball players.
4. Skill performance alterations following isolated and combined Swiss ball and flexibility training in the experimental groups would help in framing a scientific training programme for the volleyball players.
5. This study provides practical implications for sedentary individuals, physiotherapists, strength and conditioning specialists who can benefit from core strength training with Swiss balls.
6. The outcome of the study may add a little more to the ocean of knowledge in the area of sports training.

7. The result of this study would help the volleyball players to know about the importance of Swiss ball training and flexibility training and how much they influence on physical, biochemical and skill performances.

1.14: DELIMITATIONS

The study was delimited to the following factors.

1. Forty volleyball players studying various schools in Vellore district, of Tamil Nadu, India, during the academic year 2012-2013 were selected as subjects, they were boys and their age ranged from 16 to 18 years.
2. The subjects selected for this study was forty (N=40) and were divided into four equal groups of ten each (N=10) at random.
3. Group-I confined to swiss ball training, group-II performed flexibility training, group-III was assigned combined training of swiss ball and flexibility training, and group-IV acted as control.
4. The physical fitness variables taken up for this study were speed, muscular strength, flexibility and explosive power.
5. The biochemical variables considered were triglycerides, HDL-cholesterol, LDL-cholesterol, hemoglobin.
6. The skill performances chosen for this study were under arm pass, over hand pass and serving ability in volleyball.
7. The duration of the training period was restricted to twelve weeks and the number of sessions per week was confined to three.
8. The selected dependent variables were assessed prior to and immediately after the training period.

1.15: LIMITATIONS

The following uncontrollable factors associated with the study were considered as limitations of the study.

1. The environmental factors such as, climatic condition, atmospheric pressure, temperature and humidity during the twelve weeks of training period and collection of the data were not taken into consideration.
2. The previous experience of the subjects in the training was not considered in this study.
3. The emotional status of the subjects during the training and testing period were not given importance.
4. Though the total work load of these three programmes was equal, the intensity of the load which varies from individual to individual was not taken into consideration.
5. Heredity and socio-economic conditions and its influence on the subjects were not considered in this study.
6. During training and testing periods, the factors like personal habits, life style and other domestic involvements of the subjects, which may influence the results of the study were not taken into consideration.

1.16: DEFINITION AND EXPLANATION OF THE TERMS

1.16.1: Training

Training is a pedagogical process, based on scientific principles, aiming at preparing sportsmen for higher performance in sports competitions (Singh, 1991).

Training has been explained as a program of exercise designed to improve the skill and increase the energy capacities of the athlete for the particular event.

1.16.2: Sports Training

Sports training is a process of preparation of sportsman, based on scientific and pedagogical principles, for higher performance (Singh, 1984).

1.16.3: Swiss ball Training

An air-filled very large inflatable ball constructed of elastic PVC which measure 35 to 85 cm (14 to 34 inches) which is used in physical therapy, athletic training, and exercise and as an assistive device for weight training.

1.16.4: Flexibility Training

Flexibility is the capacity to perform joint actions through a wide range of movements (Brook, 1997)

The capacity to perform movement over a broad range is known as flexibility (Bompa, 1999).

1.16.5: Combined Training

Combined training is one of the most advanced forms of sports training integrates various training modalities.

1.16.6: Physical Fitness

Physical fitness is the ability to perform occupational, recreational and daily activities without becoming unduly fatigued.

1.16.7: Speed

The capacity of moving a limb or part of the body's lever system or the whole body with the greatest possible velocity is called speed (Rogers, 2000).

Speed is the ability to perform rapidly successive movements over a short period of time in a single direction (Barrow & McGee, 1979).

1.16.8: Muscular Strength

Muscular strength is the amount of tension a muscle or group of muscles can exert in one maximum contraction (Fukushima, 1978).

1.16.9: Flexibility

Flexibility is the condition of suppleness characterized by the ability to move joints through their intended normal range of motion. The dictionary definition of flexibility is "a capacity of being bent without breaking." In the body, breaking corresponds to a tearing of connective or muscle tissue.

It is the functional capacity of a joint to move through a normal range of motion. It is specific to a given joint and is actually more upon the musculature surrounding a joint than on the actual body structure of the joint.

1.16.10: Explosive Power

Explosive power is defined as the ability of the muscle or group of muscles release maximum force in the shortest possible time, in an explosive manner, projecting the body or object (Clark, 1976).

1.16.11: Triglycerides

Triglycerides is referred to as the largest lipo-protein particles with the lowest density.

1.16.12: High Density Lipoprotein Cholesterol

High density lipoproteins cholesterol comprise the smallest portion of lipoproteins and the largest quantity of protein. These high density lipoproteins may be associated with a lower risk of heart disease (Stoll & Beller, 1989).

1.16.13: Low Density Lipoprotein Cholesterol

Low density lipoprotein cholesterol (LDL-C) is the major cholesterol carrying lipoprotein. Elevated low density lipoprotein levels herald a strong predisposition to coronary heart diseases, stroke and peripheral vascular diseases.

1.16.14: Hemoglobin

Haemoglobin means a complex compound found in red blood cells that contains 6% iron (heme) and 94% protein (globin) and it combines with oxygen to transport oxygen throughout the body.

1.16.15: Volleyball

A player on one of the teams begins a 'rally' by serving the ball from behind the back boundary line of the court, over the net, and into the receiving team's court. The receiving team must not let the ball be grounded within their court. They may touch the ball as many as three times. Typically, the first two touches are used to set up for an attack, an attempt to direct the ball back over the net in such a way that the serving team is unable to prevent it from being grounded in their court.

The rally continues, with each team allowed as many as three consecutive touches, until either a team makes a kill, grounding the ball on the

opponent's court and winning the rally or a team commits a fault and loses the rally. The team that wins the rally is awarded a point, and serves the ball to start the next rally.

1.16.16: Skill

Skill denotes the level of effectiveness with which a movement or motor action can be done. Technical skills in sports represent automatisation of motor procedures.

1.16.17: Underarm and Overhand Pass

The skill of passing involves fundamentally two specific techniques: underarm pass, where the ball touches the inside part of the joined forearms or platform, at waist line; and overhand pass, where it is handled with the fingertips, like a set, above the head. The pass is the attempt by a team to properly handle the opponent's serve, or any form of attack. Proper handling includes not only preventing the ball from touching the court, but also making it reaches the position where the setter is standing quickly and precisely.

1.16.18: Serving Ability

A player stands behind the inline and serves the ball, in an attempt to drive it into the opponent's court. His or her main objective is to make it land inside the court; it is also desirable to set the ball's direction, speed and acceleration so that it becomes difficult for the receiver to handle it properly. A serve is called an "ace" when the ball lands directly onto the court or travels outside the court after being touched by an opponent.