Chapter - I

Introduction
Chapter I

INTRODUCTION

In the last few decades' sports have gained tremendous popularity all over the globe. The popularity of sports is still increasing at a fast pace and this happy trend is likely to continue in the future also. With the enhanced status in society the provision of sports training has gained importance although the need for competent training has been a felt factor without any effective sports training. Sportspersons' potential will never be fulfilled. Comprehensive sports training programme are the key factors in the production of the skillful high performance of a sports person.

In the modern world, promotion of physical education and sports is no long not a matter of dispute. Today physical education and sports is considered as an International discipline for they develop international understanding and universal brotherhood. Hence, the promotion of physical education and sports is accepted as moral and social responsibilities.

The competitive nature of human being is as old as his origin. Competitive sports has developed very rapidly through out the world in recent years. All sportsmen look for ways of making themselves better in their chosen sports. Every year new record is being made in every sports activity which are previously considered as impossible factors.
This is mainly due to recent changes in the training methods which are based on advanced scientific research.

The Television and the Press are giving much more coverage to sports and have become effective medium to carry sports to millions of people around the world. Sports has become an important social and cultural activity of the modern world enjoying the rightful and relevant place it deserves by the societies of the world.

Sport is as old as human society itself. It is an institution, which has its own traditions and values. Being an institutionalized and competitive activity, it involves vigorous physical exertion and the use of relatively complex physical skills by individuals whose participation is motivated by a combination of intrinsic satisfaction associated with the activity itself and external rewards earned through participation. With the enhanced status of sports in society the provision of sports training has become very important although the need for competent training has long been recognized. Over 3000 years ago the Greeks saw the need to provide effective and efficient training for the athletes taking part in the Olympic games. Since 1950s many countries have recognized the relevance of an effective sports training programme in a wide range of activities not only for the success in major international competitions but also for the development of healthy participants. Earlier one has only to look on towards the 'Eastern Block' countries for value on success in sports.
Good amount of money has been expended on facilities and the preparation of sports persons. But, without any effective sports training, the sportsperson's potential will never be fulfilled. Comprehensive sports training programmes are the key factors in the preparation of sports persons.

Today's world is a world of competition. This is aptly true in the case of sports and games. As a matter of fact those sports have become a prestigious matter to various countries and they consider winning medals at the international level something equal to winning other nations. Thereby quantum of medals won by a country denotes the efficiency of such nations power of establishing their victories or other nations loss in the battle of sports or games. That is why many countries evolve strategies in various training methods and leave no stone unturned to achieve the goal of victory.

In this context, the word “Training” has gained meaningful significance from the language of sports from ancient times. It denotes the process of preparation for achieving a given task. This process invariably extends to a number of days, even months and years. Thus training is a programs of exercises designed improve various capacities of an athlete to accelerate his / her performance for a particular event.

In another sense training can be compared to the construction of multi stored building. To complete a fashionable building one needs
various kinds of building materials and accessories. Depending upon
the progress in the construction plan the relative mix of the various
material cost will be varied on fixed to complete the target of finishing
the building with perfect beauty of architectural splendour. Similarly
in the sports training we require materials input, like aerobic,
apneumatic running, comprehensive conditioning, flexibility etc., The
training programme envisages the relative mix of the above material in
order to achieve the perfect blend of comprehensive strength and
endurance of an individual that is required for achieving the slated
object. Hence, utilizing this perfect mixed potential to achieve the
avowed goal of victory. In this sense the perfect blend of material for a
perfect strong building and the same such material mentioned above
for a perfect fit of the individual sportsman is to be a signal factor to
be taken in to account.

Training induces physiological changes in almost every system
of the body, particularly within the skeletal muscles and the cardio
respiratory system. The changes resulting from training are influenced
by the frequency, duration and, particularly, by the intensity of the
training program, and by heredity. The effects of training are specific
to the type of exercise performed, the muscle groups involved, and to
the type of training program used. The specificity of training and
exercise has two broad physiological bases-metabolic and
neuromuscular. The effects of training are lost after several weeks of
detraining. Training effects can be maintained with maintenance programs consisting of one or two days of exercise per week. Previous training does not significantly influence the magnitude or rate of gain of training effects induced by subsequent training program [Edward, (1984)].

According to Hardayal Singh (1993), sports training is a pedagogical process based on scientific principles aiming at preparing sportsmen for higher performance in sports competition. Training is a systematic process of repetitive and progressive exercise (or) work involving and learning process and acclimation.

Harre (1986) said, “Sports training, based on scientific knowledge is a pedagogical process of sports perfection which through systematic effect on psycho-physical performance ability and performance readiness at leading the sportsman to high and the highest performance. Through active and conscious interaction with the given demands in sports training, the sportsman’s personality develops according to the norms and standards of socialist society.

Sports training is always performance oriented as it targeted at achieving high performance in a given sports competition. Each and every aspect or process of sports training leads to improving sports performance whether it is a physical or psychological preparation or skill/technique development or tactical and mental training.
Sports training is always a planned and systematic for achieving the highest performance in a given competition. Desired results in any sports/events or game cannot be achieved without proper planning i.e. long term, intermediate and short term planning and also without systematic process. One cannot have mastery over tactical aspect of any sport/event or game without developing skills or technique first. So sports training are a planned and scientific process to achieve excellent performance.

One of the main tasks of sports training is to develop the capacities and capabilities of sportsperson besides exploitation of his potentials. Some time sportspersons are unaware about their performance limits. Hidden potentials are tapped through training and sportspersons are educated about these reserves. Through sports training sportsperson scales new heights of his own performance and sets the higher target.

This is one of the unique characteristics of sports training that each and every element of training is fully controlled. In sports training athlete/player has to be very disciplined, dutiful and committed to all aspects of training to realize the maximum benefit for better performance. His/her training is fully managed through daily training session to micro, meso and macro training cycles.

The contribution of sports towards the overall welfare the human society may be consolidated in the following points.
1. Sports help in the all round developed of human personality.

2. Provide ample and healthy means for recreation and relaxation of human mind and body

3. Are effective for rehabilitation and social adjustment of the injured, sick and handicapped

4. Provide opportunities for social interaction

The importance of training program is to produce metabolic physiological adaptation’s that allow sports person to perform better.

Training increases the demand of aerobic energy the number of size of muscles mitochondria will increase so that in the chemical factories when aerobic metabolism takes place they become larger and so numerous. This will enable athletes to get more energy from aerobic metabolism.

Thus training improves the functioning stages of circulatory, respiratory and muscle system while practice is largely aimed at improving the control of muscular activity by the nervous system. Systematic nature of the training process is reflected adequately by the fact that various means and methods load dynamics training tasks etc are all planned in order to achieve short (or) long term goals, keeping in view the interrelation of various training elements cyclic nature of performance development and long term goal of sports
training. A beginning has been made in this direction and after some years perhaps, we would be in a position to determine satisfactory the structure of performance in varies sports. This would have positive effort on better and systematic formulation of the training process.

There are three steps in the adaptation process:

1. The first step involves creating the need for more aerobic energy training must be sufficient in both duration and intensity to accomplish this.

2. The second steps are to provide proper nutrients to build and repair mitochondria tissues.

3. The third step is that, the athlete must be given enough rest to build and repair those tissues.

Finally it will be necessary to increase the duration and intensity of training to create further adaptation once plateaus occur. This brings ensures that continuous over load take place. A three principles concern with the nature of adaptations. (Constellate, 1992)

Sports performance is a result of various factors, may differ from person to person. Thus, sports training to great extent an individual matter. But, it does not mean that sports training should not be given in-group. Rather sports training in groups are essential for mobilizing performance potentials by providing necessary emotional basis. Group training is economical and important factor – in-group education. It is essential to give the weight age to individual
factors while planning load and frequency management in sports training.

Sports training are always a planned and systematic for achieving the highest performance in a given competition. Desired results in any sports/events or game cannot be achieved without proper planning i.e. long term, intermediate and short term planning and also without systematic process. One cannot have mastery over tactical aspect of any sport/event or game without developing skills or technique first. So sports training are a planned and scientific process to achieve excellent performance.

Power is an essential quality in many sports and games for, it represents the effective combination of strength and speed. Increase in strength or speed will increase power, and when power increases, more work can be done in less time [Sharkey (1975)]. Muscular power is related to muscular strength. One may possess adequate strength, but may not be able to deliver the generated force judiciously on time, and at the particular point of action to advantage. Power is the application of force, per unit time or per unit area of surface. The nature of power application determines the effectiveness of the execution of the skill [Sundararajan (1979)].

Power refers to the explosiveness of body movement or the rate at which force is produced. As such, it involves two elements: strength to produce the force and speed to increase the rate at which
it is applied. Thus, power can be increased either by improving strength or speed of movement or by both [Frank Vitale, (1973)].

Most sports require power, muscular endurance or both. The level of maximum strength effects both power and muscular endurance. Power cannot reach high standards without a high level of maximum strength because power is the product of speed and maximum strength [Tudor O. Bompa, (1999)].

Strength and power are the most critical for many sports. All team sports and speed-power dominant sports rely on solid strength and power development. Understanding the mechanics and physics of strength training and incorporating those principles into our training program will give our athletes a competitive edge.

The quest for optimal power training has led to the development of various training methods. Traditionally, heavy resistance training techniques have been used to improve strength and subsequently, performance. These techniques have typically used weights of 60 to 90 percent of one-repetition maximum for repetitions four to six in number. More current thought combines a variety of training modalities, including plyometrics, dynamic weightlifting and combinations of these, to enhance power components.

The main characteristic of a maximum power training programme is involving exercise of all or at least most of the neuromuscular units. Everyone aiming to develop maximum strength
must, therefore, frequently employ maximum and super maximum stimuli.

Maximal power training exercises must be employed to activate the motor units more quickly to encourage better nervous system adaptation. Training practice and research has shown that muscle adaptation requires considerable time and progresses from year to year. Adaptation, especially in well trained athletes, shows itself in the form of higher and better synchronization of motor units and their fixing pattern. Another physiological adaptation phenomenon, so critical in the display of power is, that muscles discharge a greater number of muscle fibers in a very short time.

Neuromuscular adaptation to maximal power training also results in improved infra muscular coordination, better linkages between the excitatory and inhibitory reactions of a muscle to many stimuli. As a result of such adaptation the CNS “learns” when and when not to send a nerve impulse that signals the muscle to contract and perform a movement. [Tudor O. Bompa, (1999)]

A further indication of adaptation to maximal power training is realized by better inter muscular co-ordination or the ability of the agonistic and antagonistic muscles co-operate to perform a movement effectively. Improved intermuscular co-ordination enhances the ability to contract some muscles and relax others, namely to relax the
antagonistic muscles which results in improved speed of contraction of the prime movers and the relaxation of agonistic muscles.

The main difference between traditional heavy weight training and power training lies in the load and speed of the exercises. Loads of 75-95% of 1RM will result in increased maximum strength, while loads of 50-60% of 1RM, performed ballistically, will result in increased maximum power. Once an athlete has reached high strength levels, maximum power training may be more conducive to peak athletic performance than further increases in max strength.

The human body has the capacity to adapt to any environment and therefore any type of training. If an athlete is trained with body building methods which are often the case, the neuromuscular system adapts to them. As a result, the athlete should not be expected to display fast the explosive power because the neuromuscular system was not trained for it. [Tudor O. Bompa, (1999)]

It has been my experience that “plyometric” training is one of the most requested forms of training by athletes. All have heard the stories of great power development accredited to this method of training. To add to the mystery, plyometrics originated as a training method in the secretive eastern block countries where it was referred to as “jump training”. As the eastern block countries rose to become powerhouses in sports, plyometric training was credited for much of their success. In the 1920s, the sport of track and field was the first
to employ a systematic method of using plyometric-training methods. By the 1970s this methods of power development was being used by other sports that required explosive power for successful competition.

Plyometrics is the term now applied to exercises that have their roots in Europe, where they were first known simply as jump training. Interest in this jump training increased during the early 1970s as East European athletes emerged as power-horses on the world sport scene. As the Eastern block countries began to produce superior athletes in such sports as track and field, gymnastics and weight lifting, the mystique of their success began to centre on their training methods.

The actual term plyometrics was first coined in 1975 by Fred Wilt, the American Track and Field coach. The elements ply and metric come from Latin roots for “increase” and “measure” respectively, the combination thus means ‘measurable increase” [Thomas R. Baechle (1994)].

Plyometrics became known to coaches and athletes as exercises or drills aimed at linking strength with Speed movement to produce power. Presently many coaches and athletes have successfully used plyometric type exercises chiefly as a method of training to enhance performance though it has potential benefits in improving strength and overall conditioning of the athletes also.
Plyometric training can take many forms, including jump training for the lower extremities and medicine ball exercises for the upper extremities. Jump training exercises were classified according to the relative demands they placed on the athlete. All the exercises are progressive in nature, with a range of low to high intensity in each type of exercise. The classification of exercises are jumps in place; standing jumps; multiple hops and jumps, bounding, box drills and depth jumps.

Plyometrics exercises utilize the force of gravity (e.g. you step off a box) to store energy in the muscles (potential energy). This energy is then utilized immediately in an opposite direction (e.g. immediately you jump up upon landing), so the natural elastic properties of the muscle will produce kinetic energy. Elastic strength is the ability of the muscles and connective tissues (muscle sheath and tendon tissues) to exert a force rapidly in order to produce maximal power in linear, vertical, lateral or combination movements.

The ability to apply force rapidly (reactive force) is the major goal of plyometric training. Plyometrics are used to apply an overload to the muscles with speed - strength as a goal. The speed-strength ability is known as power. Plyometrics should not be considered an end in itself, but as part of an overall program (stretching, running, strength training nutrition, etc). After an athlete has begun a proper
strength and conditioning program, plyometrics are used to develop speed – strength [Thirumalaikumar (2002)].

Speed and strength are integral components of fitness found in varying degrees in virtually all athletic movements. Simply put the combination of speed and strength is power. For many years coaches and athletes have sought to improve power in order to enhance performance. Throughout this century and no doubt long before, jumping, bounding and hopping exercises have been used in various ways to enhance athletic performance. In recent years this distinct method of training for power or explosiveness has been termed plyometrics. Whatever the origins of the word the term is used to describe the method of training which seeks to enhance the explosive reaction of the individual through powerful muscular contractions as a result of rapid eccentric contractions.

The maximum force that a muscle can develop is attained during a rapid eccentric contraction. However, it should be realized that muscles seldom perform one type of contraction in isolation during athletic movements. When a concentric contraction occurs (muscle shortens) immediately following an eccentric contraction (muscle lengthens) then the force generated can be dramatically increased. If a muscle is stretched, much of the energy required to stretch it is lost as heat, but some of this energy can be stored by the elastic components of the muscle. This stored energy is available to
the muscle only during a subsequent contraction. It is important to realize that this energy boost is lost if the eccentric contraction is not followed immediately by a concentric contraction. To express this greater force the muscle must contract within the shortest time possible. This whole process is frequently called the stretch shortening cycle and is the underlying mechanism of plyometric training.

The golden rule of any conditioning program is specificity. This means that the movement you perform in training should match, as closely as possible, the movements encountered during competition. If you are rugby player practising for the line-out or a volleyball player interested in increasing vertical jump height, then drop jumping or box jumping may be the right exercise. However if you are a javelin thrower aiming for a more explosive launch, then upper body plyometrics is far more appropriate.

Plyometric type exercises have been used successfully by many athletes as a method of training to enhance power. In order to realise the potential benefits of plyometric training the stretch-shortening cycle must be invoked. This requires careful attention to the technique used during the drill or exercise. The rate of stretch rather than the magnitude of stretch is of primary importance in plyometric training. In addition, the coupling time or ground contact time must be as short as possible. The challenge to you as coach or athlete is to select or create an exercise that is specific to the event and involves the correct
muscular action. As long as you remember specificity and to ensure there is a pre stretch first then the only limit is your imagination. Plyometric exercise and weight training can be combined in complex training sessions to further develop explosive power.

Plyometric exercise has been advocated for sports that require power and the ability to jump vertically; plyometrics train muscles to switch rapidly from eccentric to concentric movements. This shortens the amortization phase, which is the delay between eccentric and concentric movements and allows more work to be done in less time.

Plyometric exercises develop fast muscle fibre. It is based on the understanding that a concentric (shortening) muscular contraction is much stronger if it follows an eccentric (lengthening) contraction of the same muscle immediately. It's a bit like stretching out a coiled spring to its fullest extent and then letting it go: immense levels of energy are released in a split second as the spring recoils. Plyometric exercises develop this recoil. Muscle fibres store more elastic energy and transfer it more quickly and powerfully from the eccentric to the concentric phase.

Many athletes have used Plyometric type exercises successfully as a method of training to enhance power. In order to realize the potential benefits of plyometric training the stretch – shortening cycle must be invoked. This requires careful
attention to the technique used during the drill or exercise. The rate of stretch rather than the magnitude of stretch is of primary importance in plyometric training. In addition, the coupling time or ground contact time must be as short as possible.

A separate quality quite distinct from strength, which can be developed with training, is power. In simple terms, power is the ability to generate force quickly; it is defined mathematically as force x velocity. If you look at the force-velocity curve once again, you will see that high levels of power will occur in the mid-range of either force or velocity. If an athlete develops greater power, this, in turn, enhances his ability to generate both force (strength) and velocity (speed). This amalgam of speed and strength may be more useful for athletic performance than strength alone.

Maximal power training and plyometric training have become very popular in developing explosive power. Explosive power is seen in quick movement when body weight is propelled either upward or forward, it is characterized by one short burst of energy and is seen in such tests as the standing long jump and vertical jump. It has been known for a long time that the amount of energy transformed in muscular exercise is proportional to the oxygen consumption.

Plyometrics can best be described as "explosive-reactive" power training. This type of training involves powerful muscular contractions in response to a rapid stretching of the involved
musculature. These powerful contractions are not a pure muscular event; they have an extremely high degree of central nervous system involvement. The event is a neuromuscular event! It is a combination of an involuntary reflex (i.e. a neural event), which is then followed by a fast muscular contraction (i.e. voluntary muscular event).

The old adage that 'what goes up must come down' applies just as much to fitness as to gravity. But although athletes have come to accept detraining as a depressing but inevitable consequence of an injury or illness, few are aware of just how profound and rapid these changes are. And according to Richard Godfrey, new evidence suggests that the magnitude of these changes means that elite athletes need to plan their return to full fitness after a lay-off very carefully indeed.

Detraining (often referred to as 'reversibility') reflects the fact that if a training stimulus is insufficient, or removed entirely, then the aspect of physiological conditioning to which it relates begins to decline. In other words, the individual begins to lose 'fitness'. However, 'fitness' is a difficult term to define because we often find ourselves asking 'fit for what?' Better terms are 'conditioning', 'level of conditioning' or 'conditioned state' and so here these terms will be used interchangeably with 'fitness'.

In general, the removal of a training stimulus produces a significant loss in conditioning after two to six weeks. In addition, it
is simply not possible to train all aspects of physiology simultaneously, hence the concept of periodisation, first introduced by the Russian, Matveyev, in the 1960s.

To date, the vast majority of detraining research has focused on club level athletes – hardly surprising as it's very difficult to convince elite athletes to stop training just to allow scientists to get a feel for the consequences. For the first time, however, this article will present findings from an elite athlete – the author's own research data on the detraining and retraining of an Olympic gold medal list rower.

The strength of a muscle or a group of muscle is dependent on its size and quality. Muscles grow in size and quality in relation to general growth, nutrition and amount of exercise. Varying degrees of strength needed in muscles is depending upon the type of work or activity, which is to be done beyond the ordinary daily needs. Physiologically the muscle will increase in strength only if it is called upon to increase its workload beyond what is ordinarily required of it. This is called the principle of overload. Muscle strength is just maintained or not increased, if no additional effort or intensity is added to exercise or activities. Further, the development of strength is specific to the muscle or muscles involved in a particular activity.
Strength is a basic need in all sports and games to reach success. All sports and games need not require the same amount of strength for successful performance. Various sports differ markedly in their requirements of strength for successful performance.

Strength is essential to a variety of everyday physical activities. Even though strength is a relative factor related to the demands of the activity, all individuals need a minimum level of strength. Strength development should be the prime concern of anyone who attempts to improve an athlete’s performance. Strength plays an essential role in determining the sports and games performances. Strength is the maximal amount of force a muscle or muscle group can generate in a specified movement pattern at a specified velocity of movement.

Strength endurance is the capacity of the whole organism to withstand fatigue under a long lasting expenditure of strength. Consequently it is characterized by a relatively long duration expression of strength together with a faculty to persevere.

Muscle power is the product of strength and speed. Power is the rate of performing work. Power represents as the one of the components of athletic fitness that may be the most essential to indicate the success in sports requiring extreme and rapid force
production. Explosive power can be increased either by increasing the amount of work or by decreasing the amount of time.

Power can be defined as a combination of strength and speed. In other words, power involves the application of force in the shortest amount of time possible, or work performed during a specific period of time.

Power is the ability of the muscles of product high levels of force in a short period of time. Power can be increased by strength training, and is basic to a number of competitive sports [Gary T. Moran (1994)].

Power is a combination of physical and mental factors and basically consists of two main forces; strength and speed. Skill motivation, etc., also play an important role, but speed and strength are the basic components. Both strength and power are the best developed by exercising against resistance which can be progressively increased by small denominations, quite often by one pound or less, also special machines for a specific movement range have been designed to develop mainly strength and muscle for selected parts of the body [Murray, (1986)].

Power is the ability of the body to release maximum force muscle contraction in the shortest possible time. Power indicates or stands for explosive movements, a release of maximum force, in the
shortest possible time at a maximum speed. It is understood that, power is highly dependent upon the elements of speed and strength. Power is one of the most important factors to succeed in performance of jumping, kicking for distance, throwing for distance, charging an object or opponent, sprint starts or sudden bursts of speed, the dunk in basketball, the knock-out punch in boxing, etc. It can be improved through gain of muscular strength.

In a specialized training, which aims at the optimum mastery of expected skills, a number of other related and intervening variables contribute for the outcome of the training. And one cannot presume those outcomes by relying upon the guessing or predictions. Hence the selected criterion variables may be measured in an investigation by sticking to the research norms and guidelines from various sources by undertaking an experiment.

**STATEMENT OF THE PROBLEM**

The purpose of the study was to find out the effects of maximal power and plyometric trainings on selected strength and power parameters such as leg strength, back strength, strength endurance, elastic power, explosive power in terms of vertical distance and explosive power in terms of horizontal distance and their status after four cessations of training (detraining programme) and after four weeks of retraining programme at different stages.
DELIMITATIONS

The study was delimited in the following aspects,

1. Only forty five sports hostel boys in Tiruchirapalli, Tamil Nadu, India were randomly selected as subjects from a total of 103 students.

2. The selected subjects were randomly divided into three equal groups of fifteen each (n = 15). Group I underwent maximal power training, group II underwent plyometric training and group III acted as control.

3. The experimental groups namely maximal power training group (group I) and plyometric training group (group II) underwent their respective training programmes for three sessions (days) per week for twelve weeks. The control group (group III) did not participate in any of the special training programme.

4. The experimental and control groups underwent detraining programme for forty days with four cessations with an interval of ten days.

5. After the forty days of detraining period, the experimental groups underwent a four weeks of retraining programme.
6. The following strength and power parameters namely leg strength, back strength, strength endurance, elastic power, explosive power in terms of vertical distance and explosive power in terms of horizontal distance were only selected as criterion variables.

7. Leg strength and back strength were assessed by using leg dynamometer. Strength endurance was tested by conducting bend knee sit-ups. Elastic power was measured by conducting bunny hops test. Explosive power in terms of vertical distance and explosive power in terms of horizontal distance were tested by using sargent jump and standing broad jump respectively.

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

9. During the detraining period, the data were collected on selected criterion variables at the end of every ten days for forty days (four cessations).

10. In the retraining period, the subjects were tested on selected criterion variables at the end of four weeks of retraining period.
LIMITATIONS

The following limitations were drawn to consider, while interpreting the results of the study.

1. No effort was made to find out the differences in environmental conditions during tests and training periods.

2. Though, all the subjects were residing in the hostel, no effort was made either to control or assess the quality and quantum of food ingested, and also their life styles were considered as limitations.

3. Since, the subjects were motivated verbally during testing and training periods no attempt was put to differentiate their level of motivation.

4. The previous experience and knowledge of the subjects in training, which might influence the results of the study, were considered as limitations.

5. The psychological stresses and other factors, which affect the metabolic function were not taken into consideration.
HYPOTHESES

The following were drawn as hypotheses of this study.

1. It was hypothesised that there may be significant improvement on selected strength and power parameters due to maximal power training and plyometric training after twelve weeks of training period.

2. It was hypothesised that there may be a significant difference among maximal power training, plyometric training and control groups on selected strength and power parameters after twelve weeks of training period.

3. It was hypothesised that there may not be significant reduction of performance on selected strength and power parameters for maximal power training and plyometric training groups after first and second cessations of detraining period.

4. It was hypothesised that there may be significant reduction of performance on selected strength and power parameters for maximal power training and plyometric training groups after the third and fourth cessations of detraining period.
5. It was also hypothesised that there may be significant improvement on selected strength and power parameters due to maximal power training and plyometric training after four weeks of retraining period.

6. It was further hypothesised that there may be significant difference among maximal power training, plyometric training and control groups on selected strength and power parameters after four weeks of retraining period.

OPERATIONAL DEFINITION AND EXPLANATION OF THE TERMS

Training

Training may be defined as “a programme of exercise designed to improve skills and increase energy capacities, for an athlete, the preparation for a particular event” [Ardy Friedberg (2001)].

Sports Training

Sports training is a long, continuous and systematic process of physical and mental hard work, to attain high level performance in competitions of various levels by making the best use of the principles derived from other sports sciences.
Maximal Power Training

Maximal Power training is a systematic programme of exercises against some resistance with maximum speed for the development of muscular system.

Plyometric Training

Exercises that link sheer strength and scope of movement to produce an explosive-reactive type of movement; often refers to jumping drills and depth jumping, but can include any drill or exercise that uses the stretch reflex to produce an explosive reaction [Tudor O. Bompa (1999)].

Detraining

The loss of training effects following the cessation of training [Jack H. Wilmore (1988)].

Retraining

The training which is given after a period of cessation of training.

Strength

Strength is the ability of a muscle to produce a maximum amount of force [Gary T. Moran (1988)].
Leg Strength

The capacity of the lower limb to exert muscular force. Leg strength measures the limit of lifting resistance in lowering and arising from sitting position [Barry L. Johnson, (1982)].

Back Strength

Back strength may be defined as “the capacity of a person to exert muscular force of the lower back muscles” [Clarke and Clarke, (1987)].

Strength Endurance

It may be defined as the ability of a muscle or muscle group to perform repeated contractions against a resistance to sustain contraction for an extended period of time with less discomfort and more rapid recovery [Ajmer Singh, (2002)].

Power

Power is the ability of the body to release maximum force of muscular contraction in the shortest possible time.

Elastic Power

Elastic power is ability of the muscle or a group of muscles to release maximum force in the shortest possible time.
Explosive Power

Explosive power is the ability of the muscle or a group of muscles to release maximum force in the shortest possible, in an explosive manner, projecting the body or an object. [Clarke and Clarke, (1987)]

SIGNIFICANCE OF THE STUDY

The present investigation has the following significant contribution.

1. The results of the study would reveal

(i) The effects of maximal power training and plyometric trainings on strength and power parameters after twelve weeks of training period.

(ii) The effects of maximal power training and plyometric training on strength and power parameters after four cessation of detraining period.

(iii) The effects of maximal power and plyometric training on strength and power parameters after four weeks of retraining period.

2. The results of the study would provide an additional knowledge in the area of research.