CHAPTER

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1.1 Introduction

"To live is to choose. And the life is choices, then Jessie Owen's life is an extra ordinary example of what it is all about. Jesse's childhood was marred by chest disease, but he chooses to run".

KOFI ANNAN

Ancient Greece engaged in intense fighting and competitive activities. The introduction of physical education during that time fulfilled the need to train up soldiers and athletes. Training began at age of seven and remained intense for the remainder of the young soldier's life. Athletes trained for activities such as foot races, boxing, chariot races, and javelin throwing. Field and Track events trained soldiers for strength and endurance. There was just only one winner, who was crowned with an olive circlet and received a crater as a prize. But it was not important; the best prize for them was the glory, and being honored almost like a god, it was deserving to be like a god, a salute and a hymn relating the winner's achievements and preserving them parsing his native city in which he became a role model to be imitated by his fellow citizen. The Greek were not worried about the records. Obviously, they could not calculate the exact time of the race or establish precise measurements, and therefore they could not make comparisons with earlier results but if we look at the etymology of the world record, from the Latin recorders meaning "preserve in the memory"
The history of physical education goes back to ancient times, if we think of it in the simple terms of fitness. As with all body of knowledge what we have learned, valued, and taught has evolved over time. The same is true for our concept of physical education.

Physical education is the oldest and fundamental education. The first physical educator was the parent who taught his son to throw a spear, to climb a tree, to leap a brook, to do all those things that were important for a youth to learn in the tribal life of uncivilized man. Over the centuries, through civilization normal social scene has changed tremendously, ways of living have profoundly altered, and new stresses have pressed upon the old biological pattern of man. However, the need to learn fundamental skills such as throwing, climbing, leaping etc., is not yet fulfilled.

Physical education that way, is not a newly developed concept in this modern world, but it is as old as the existence of the human race. In the ancient period, the nature of Physical education used to be very simple and informal; and it was normally given to younger ones by the senior persons in the family. Its main aim, then, was just to provide some basic knowledge and experiences, and develop various skills in their childhood, and prepare them to combat against various life situations and make them capable to feed and protect themselves and their families. In due course of time, because of the accumulation of variety of experiences and growth in the knowledge, various sciences were developed, and advancement in technology was achieved. This advancement created a storm of civilisation, which blew over the world and thereby
almost every field was civilised. Under such changing circumstances, the old concept of Physical education also underwent drastic changes and modifications from time to time and finally it has evolved into a large and formal system with many sub-systems as its integral components.

Physical education is generally a life long and continuous process, which is carried out formally and informally, either in the school or outside, with or without the help of books, notes, literature material equipment etc, in the presence or in the absence of a trainer, coaches and teacher irrespective of caste, creed, religion, age, sex.

The beginning of formal physical education began in England in an effort to encourage beauty and posture for English women. Colleges in the United States soon followed and offered a variety of courses in physical education. As education in the United States progressed, the need to educate students about caring for their bodies as well as their minds became more important. Schools in the United States began offering classes in gymnastics, exercise, and dance. More states soon followed as schools continued to recognize that healthier bodies contributed to more effective learning experiences.

Since ancient times, people in India believed that the human body is indeed an instrument of dharma (shareeramevādyā hi khalu dharmasādhanam). Hence the body is to be properly nourished, and maintained. In medieval period people gave as much importance to physical exercise as to literary education. The principle of “a sound mind in a sound body” was not only accepted but also faithfully
practiced. The system of yoga was the first step in spiritual training. Yoga comprises full-fledged toning of the body and mind. It includes the use of various body postures to control breathing and muscle movements, and to help gain control over human passions as well. It was the general belief that this balancing of the body and mind led to intellectual strength.

In ancient India, the peoples' existence was very religious in nature. The person desiring to be holy was ignoring the physical needs of the body and making his concentration solely on spiritual needs. Even then, the religious caste, called as Brahmins were used to learn many combating skills, horse riding, sword fighting, swimming, etc., to protect themselves and their families. Another group of people, specifically known as Kshatriyas or military caste were involving themselves in different physical activities to develop their physical fitness and motor skills according to their vocational needs. Thus various physical activities, which today we call as physical education existed long before the schools and schoolbooks were not in vogue.

Village schools were usually situated in the temple premises or in the courtyard of mathas, where children played after daytime lessons. Besides this, every village had one or two playgrounds, where sporting events and games were held during the annual fair of the village deity. These involved wrestling, boxing, mallakhambha (pillar acrobatics), the shooting of arrows, and demonstrations of strength such as weight lifting. The bigger grounds were reserved for ram-fights, buffalo fights, fencing and dueling. Various ball games, and the indigenous sports of Kho-kho and Kabaddi were common.
There was this tradition in every village. Most children sports in medieval India ensured body-development. The economy and variation of indigenous games were greatly admired by visiting foreign travelers.

Today, we actually think of physical education more in terms of health, Sports science, Sports Management, Sports Psychology, and etc. Indeed, probably most schools and Colleges in world today even separate health and physical education classes. As we move forward in the realm of physical education we should look at the history of physical education as well as look at what we currently identify, so a well-developed education covering health and fitness can be applied in the society. The history of physical education verifies that in many of the ancient cultures sports, and fitness, were a way of life. Sports were often a way for young men to develop the skills and strength necessary to be a warrior. For most people life was physical and difficult but for the wealthy sedentary life began as agriculture became more technically advanced and sophisticated.

Young women were generally not involved in these sports because the sports were associated with military training. The ancient Persians, Assyrians, Greeks, and Romans all had fitness training regimens and young men expected to serve in the military. The education was essentially around those skills.

Physical Education was very much centered on these “warrior” sports and activities or simply was developed as part of the work involved in life. The knowledge and understanding
of health was primitive and thus the education regarding that aspect was virtually non-existent.

The history of physical education for centuries was about athletics and physical activity. Health education was very often closely linked to the spiritual practices of the culture and the spiritual laws that were passed down. For example, the ancient Jews had laws and customs around food and leprosy. The Ayurvedic traditions of India also had important health teachings that were tied into their spiritual beliefs and practices.

The first modern physical education movement, which was centered on physical fitness, came in the form of gymnastics programs becoming especially prevalent in Germany, Denmark, Sweden, and Great Britain.

Plato supported the study of physical training as part of a balanced education, pointing to the wisdom of Greek and Roman cultures. One of the first men to recognize the importance of physical activity in school curriculum was Johann Bernard Basedow in Germany. He included gymnastics as part of the daily curriculum devoting up to three hours per day to educating through the physical. Johann Bernard Basedow required a specific uniform for his students so they could have unrestricted movement. He also offered a camp for two months during the summer for his students.

In 1810 Friedrich Jahn, began working outdoors with his students using simple exercises and games sometimes taking long hikes. The thing that motivated Jahn to develop a system
of physical training was his deep sense of patriotism. Germany had been soundly defeated in the Napoleonic wars. So, he developed his system with the hopes of creating strong, sturdy and fearless youth who would help secure Germany's freedom and could defend the Motherland from outside forces. The growth of gymnastics in Germany can be primarily attributed to the work of two physical educators: Johann Guts Muths and Friedrich Jahn. Friedrich Jahn received the title of "Father of German Gymnastics" for his long-lived work.

Charles Beck who was a student, friend and follower of Friedrich Jahn teamed up with a friend and they made their way to Switzerland, France and eventually America. George Bancroft who had opened the Round Hill School in America had been looking at and studying the German system and immediately hired Beck to teach Latin and Physical Education in the form of German gymnastics. Beck turn out to be the first official Physical Education teacher in America in 1825.

Per Henrik Ling developed and introduced his own gymnastics program to Sweden, which consisted of three different areas: Educational gymnastics, Military gymnastics, and Medical gymnastics. Ling understood that exercise was necessary for everyone. He believed that exercise programs should be created based on the needs and uniqueness of the individual. Ling also thought physical educators must possess knowledge of the effects of exercise on the human body. Ling used science and physiology to better understand the importance of fitness.

Frank Nachtegall played an important role in the history of physical education by introducing and helping to popularize
gymnastic programs throughout Denmark. He was especially concerned with development of gymnastic programs in schools. He taught in a private facility, which was devoted entirely to physical training. He eventually became director of a school called Training Teachers of Gymnastics.

Americans deep cultural connection with Great Britain explains why the history of physical education in America was influenced by Great Britain. Within Great Britain, Archibald Maclaren promoted the importance of fitness and regular exercise. Maclaren was also fascinated with the scientific components of fitness. Maclaren made several observations based on his research.

Maclaren believed the cure for weariness and stress was physical action. Secondly, he noted recreational exercise found in games and sport was not sufficient for attaining adequate fitness levels. Finally, Maclaren realized both growing boys and girls required regular physical exercise. Maclaren, like Ling, recognized the need for individualizing fitness training programs. Another significant contribution was that he documented the importance of progression of exercise. As you look at the history of physical education in Europe from the 18th and 19th centuries and you can see its impact on American schools. As Europeans moved to the United States they brought with them aspects of their culture, including views on education. Within Europe, schools had been an important institution used for spreading the idea of the importance of physical education to society. Physical education was merged into their educational systems.
It is now universally agreed that physical education should be an integral part of general education. In India education as a whole is going through radical changes to serve the needs of the individual and the society; and this trend is reflected in physical education also, and it is being reorganized with definite aims and objectives of education. Hence, now-a-days the emphasis is not merely on teaching physical activities, but on achieving the goals of education through these activities.

In a democratic country like India, it is a fundamental right of every citizen to have a good quality of education. Hence it becomes a prime duty of every Government to see that, the benefit of education must reach each and every child. Since mass education for different age-groups has become an accepted responsibility of our democracy, the schools have to shoulder this responsibility in the most comprehensive manner. Now, the physical education is a subject of greater vitality for the pupil, it is concerned with their own progress and development, their ultimate well-being and being useful to the community. Therefore, it deserves a higher position in the present educational pattern. Hence in this situation, every school is required to accept physical education on par with other curricular commitments.

Participation by the students in a physical education programme under the guidance of a well-qualified teacher contributes significantly to total health through development of physical, mental, emotional, social aspects. Physical education also provides experiences in developing a spirit of democratic citizenship. Our National Plan of physical
education even aims the same outcomes. Thus it is clear that, organised physical education programmes enable an individual to reach the highest level of development in his life.

According to the World Health Organisation (WHO), "Health" is "not merely the absence of any disease or deformity or disorder, but it is a complete state of physical, mental, emotional, social and spiritual wellbeing of an individual".

Normally every individual whether he or she, is working or not, they need a good health. A person from any profession or field demands a good health, physique and stamina to perform both mental and physical labours. Every job requires a greater amount of physical and mental energy for further professional growth. A person, who suffers from any organic defects or does not have sound health, cannot bear the strain and stress of the jobs or any life situations. This clearly indicates that, efficiency and physical fitness are the prerequisites to perform any task. Both of these i.e. efficiency and fitness are the indications of good health.

Physical Education is a modern concept, which helps us to develop and maintain good health and vigour. This includes threefold programme, viz. health instructions (knowledge), health examination or service and health practices.

To attain a good physical fitness, many things are required such as—regular practice of physical activities, appropriate diet and nutrition, proper rest, good habits, a lifestyle free from stress, a complete knowledge about the body and its systems, signs and symptoms of various diseases, hygiene and cleanliness, recreation and fun, etc. The
knowledge of all these things is made available to pupils through the theoretical and practical work we perform in the first part of physical fitness education.

In emphasizing the importance of both play and work in the life, a famous English poet William Wordsworth mentions in his poem “work is worship”, that -

"Work while you work, Play while you play, that is the way to be happy and gay”.

Here the poet has rightly said that, to gain happiness or joy in the life, both work and play are equally important, but they need to be performed at appropriate times. In case, both these things are mixed or reversely performed then it will lead to sad situations in the life.

According to Ravindranath Tagore, there is a deep connection and a harmony between our body and mind and the discord between the two leads to breaking of the rhythm of life. Also in his opinion, education, art, music, and games are the important means to achieve a well co-ordinated development of physical, mental and spiritual aspects of personality.

Various games and sports are the modified forms of play and socially organised activities. In this modern and civilized world, the needs of every individual are increasing day by day. So to meet these requirements extra money is required and to earn that every individual has to work more and more. This extra burden of work or worries in the life creates tension in the life of people and gradually it results in to many psychosomatic diseases. In this situation, to earn the fun of life and
to overcome the psycho-somatic diseases, some or other form of plays, games or sports are necessary.

Now, in the present trend of rapid industrialisation and urbanisation, people are migrating in large numbers into cities and factory centers where hours of work are strictly controlled and ample leisure will be available to them. Many a times such leisure creates problems both for individual and community, because it tends to be misused in anti-social ways or in ways greatly detrimental to the health and happiness of an individual or his family. In this situation participation in games and sports brings in many types of satisfaction - emotional, physical and mental.

Many researches carried out concerning the outcomes of participation in various games and sports have proved that,

a. a regular participation in games and sports improves general health and physical fitness, develops mental abilities, inculcates sociability, and brings-in emotional stability;

b. it provides recreation, fun and leisure time activity;

c. it also helps the development of will power, moral values and aesthetic sense and leadership qualities.

On realising the outcomes of games and sports, from the past few decades many foreign countries have introduced physical education and sports as one of the important and compulsory subjects in the curriculum of their educational systems and they are promoting sports elsewhere in their countries. As a result we see that, in recent years many small countries like Korea, Japan, Indonesia, Thailand, etc., are
securing large number of medals in international sports and also they have made rapid progress in all walks of life.

From the facts mentioned above, it can be concluded that, there is a great need to give top priority to Physical Education and Sports and include them as a compulsory subject in every curriculum in all the sub-systems of education.

According to Charles Bucher, a fit citizen is that person, who is physically fit, mentally alert, emotionally stable, socially well-accepted. A person to become a fit citizen he also needs to be honest, intellectual, spiritual and patriotic in nature. This means, to become a fit citizen, a person should have a well-balanced and fully developed personality. But, in reality it is noticed that, the fit citizens as such are not born, but they have to be made fit through various processes.

The history of mankind reveals that, during the past few centuries the man has gained new knowledge, developed various sciences and achieved tremendous and unbelievable progress in all fields in general and science and technology in particular; and through it he has succeeded in building up a glorious and cheerful world around him. With such a great background, as we enter into the 21st century, one can realise that, in spite of such superb conditions around us, today's generation is yet trying to make many more additions and modifications in the world day by day through new inventions and researches. It is therefore, natural that our future world will be much more civilised, advanced and sophisticated inspite of tough challenges and hard competitions. Under such circumstances, it becomes very necessary for a man to
get himself built-up by gaining perfect knowledge of all the events of life and be prepared to face cutthroat challenges of new centuries to come.

Russia & eastern union countries used new & unique training techniques on their Olympic athletes of plyometrics years back to the sixties. As we look at records of those athletes, they dominated certain sports during that time. Their training consisted of different styles of jumps, foot speed drills, training equipment, stretching, and weight training exercises that when combined properly, resulted in speed development.

Yuri Verkhoshansky started his career in the late 1950's as a track, field and physical education coach at the Moscow Institute of Aeronautic Engineers. In just two years he achieved incredible results, transforming 12 non-athlete university students into high-level track & field jumpers. In addition, he became famous as the first Soviet coach to introduce the barbell squat into the training of jumpers and sprinters. To add to his long list of contributions, he created the shock method/depth jump exercise. Soon he became the head coach of the Moscow United Team in the sprint and jump events and coach of the European record holding sprinter Boris.

It was a typical Russian winter - snow, bitterly cold temperatures etc. Yuri Verkhoshansky, was determined to put together a training program for his jumpers to use during the winter months, as they had no indoor facilities at the time. In the past, the best they could manage was participation in winter sports such as ice skating and skiing to maintain condition, as well as a small amount of jumping in the snow.
Obviously this was not ideal for athletes who were competing against the very best the world had to offer.

On one particularly horrendous day it was not possible for any type of training to take place outside. However Yuri was determined for his athletes to get some sort of training done that day, so he located a barbell, found a small area in which the athletes could train (actually under a set of stairs) and set the athletes a few of the exercises that were being used in strength conditioning programs at the time. As they winter continued, Coach Verkhoshansky modified the exercises being performed to make them more specific to the jumpers needs.

When spring rolled around it was discovered that the training done with the barbell had actually been of great benefit to the athletes and it was this that planted the seed in Yuri's head about the possibilities of strength training for jumpers.

At the time Yuri was also conducting some research on the various phases of the triple jump, and in particular the force placed on the body during the second and third phase. It was discovered that the pressure placed reaches up to 300kg! Having seen the good results achieved with the adhoc training program implemented over winter, a more methodical approach was taken from here on in.

Yuri realized that it would not be possible to simulate a 300kg force by doing squats - it was much too heavy a weight for the jumpers to be attempting. Even with partial squats, it was soon found that athletes were experiencing back injuries as a result.
The next idea was to attempt a form of what we know now as the leg press, with two spotters assisting. However even with the two spotters, the weights being used were too heavy, and the exercise ended up being too dangerous. The second idea was where he struck gold. After attempting to simulate the forces by using heavy weights, he realized that it may also be possible to simulate the forces by using the body's own energy. Movements that closely resembled those of the athletic event would reproduce in the body the same need to overcome the forces that are at work during the event itself.

So, using what space he had - narrow tall areas underneath stairways at the Institute - he gradually developed a training methodology that he would term the Shock Method. This method of training would be crucial to the success of many Russian jumpers and sprinters of the time. To discover the methods of training being used, and in the end develop what we know as plyometrics today.

The plyometrics today is not the same as the training method that was created by Yuri Verkhoshansky. An American coach by the name of Fred Wilt is believed to be the first person to use the term plyometrics to describe the jump training that some U.S coaches were implementing with their athletes. It is under this term that we now group the many different types of exercise that are performed with the aim of increasing the power output of the muscular contraction by utilizing and maximizing the stored energy that is created by the preceding extension of the muscle.

Today, the goal of plyometrics is to enhance the explosive reaction of the individual through powerful muscular
contractions as a result of rapid eccentric contractions. This is accomplished through various techniques. The first is to develop the hip flexure muscles, its physiological function is to lift the leg. This maximizes the frequency of the turn over of the leg during the running stride, the balance, and the alignment of the body during movement. The result is a stronger and faster athlete with increased explosive power, vertical leap, reaction speed, lateral speed, coordination, foot speed, balance, development of the stabilizer muscles in the ankle, knee and hip joint, and more energy transferred to the movement.

One of the first coaches in the United States to utilize this knowledge of plyometrics and incorporate this into his training regimen was Tom Landry, the head coach of the Dallas Cowboys in the 70's & 80's. The Dallas Cowboys dominated the NFL during that time. Since then, other professional sport organizations, Olympic teams, and major universities added this training system to their program. Plyometrics is an ever evolving science as we continue to see athletes reach new heights & set new records.

Plyometrics has become so important that if an athlete is not involved in this type of training, he will fall behind his peers. Athletes are now being chosen by colleges because of their speed, agility, and strength due to their exposure to this unique style of training. As stated in the Sports this is "The Future of the Next Generation of Athletic Training.

Plyometric exercise is a popular form of training commonly used to improve athletic performance. The stretch-shortening cycle, which involves stretch of the muscle-tendon
unit immediately followed by shortening, is integral to plyometric exercise. The stretch-shortening cycle enhances the ability of the muscle-tendon unit to produce maximal force in the shortest amount of time, prompting the use of plyometric exercise as a bridge between pure strength and sports-related speed. Maximal-effort plyometric training, or "shock training," to aid the development of explosive "speed-strength." Research on the shock method of training examined drop jump heights of over 3 m, which possibly pushed the limits of safety, but also demonstrated the high-intensity of early plyometric techniques.

The Plyometric is the ability of muscles to exert maximal force output in a minimal amount of time (also known as rate of force production) enhances performance during functional activities. All else being equal, success in most functional activities depends on the speed at which muscular force is generated. Power output and reactive neuromuscular control represents a component of function. Power and reactive neuromuscular control are perhaps the best measures of success in activities that require rapid force production. Plyometric training, also called reactive training, makes use of the stretch shortening cycle to produce maximum force in the shortest amount of time and to enhance neuromuscular control efficiency, rate of force production, and reduce neuromuscular inhibition.

The focus and application of plyometric training has evolved in recent years. Now plyometric exercises in athletic conditioning programs are often performed at a submaximal level and are directed at the achievement of proper
biomechanical technique. Training in this manner has been effective in reducing lower-extremity injuries as well as improving performance.

Plyometric training has also crossed over into the rehabilitation field. Recently published rehabilitation protocols include plyometric exercise as a means to improve function and facilitate a return to sport. Although plyometric exercises have been recommended for use in rehabilitation, the body of supporting evidence is surprisingly small relative to the performance enhancement literature. There are evidence about plyometric training in the performance literature to the current trends in rehabilitation application, develop a framework for describing plyometric exercise that may be used to generate more agreement between clinical and scientific communities, and promote future research related to the use of plyometric exercise in rehabilitation.

Plyometric training is known to improve vertical jump performances (Foure A, 1996). During a plyometric exercise, the mechanical properties of the Achilles tendon, such as stiffness and dissipative properties underlie the elastic energy storage-recoil process and the transmission of muscular tension (Bosco C, 1982). These mechanical properties may also play a role in debilitating injuries, including Achilles tendon rupture or tendinopathy (Ying M, 2003).

It has been shown that strength and stretch training induce changes in the stiffness and dissipative properties of the Achilles tendon. The results of previous studies on the effects of plyometric training on Achilles tendon stiffness remain conflicting. (Burgess, Connick,, Graham-Smith, &
Pearson, 2007). and Wu et al. found an increase in Achilles tendon stiffness after 6 and 8 week of plyometric training, respectively, whereas Kubo et al. found no significant change in Achilles tendon stiffness after 12 week of plyometric training.

Success in many sports depends heavily upon the athlete's explosive leg power. In many of the games as track and field events and other activities the athlete must be able to use strength as quickly and forcefully as possible. This display comes in the form of speed-strength or power. Power represents the amount of work a muscle can produce per unit of time. An increase in power gives the athlete the possibility of improved performance in sports in which the improvement of the speed-strength relationship is sought.

Endurance performance, as in long distance running imposes great demands on both the cardiovascular system and the muscle system. Although Coyle(1999) defines performance in endurance events as: The power or velocity that can be maintained for durations of 30 minutes to four hours, long distance running races are commonly regarded as races over distances from 3000 m to 41 km. This gives racing times ranging from approximately 7.30 minutes to approximately 2.30 hours at high performance, Mcdbo and Tabata (1989) have demonstrated a 50-50% aerobic & anaerobic energy release already after one minute of maximal bicycle ergometer work. As the duration of a work increases, the higher the energy release from aerobic processes, reaching approximately 99% for marathon race (42.2 km) (Astrand and kodahl 1986). In short time trials, professional road cyclists
work at mean heart rates between 80% and 90% of maximum heart rate (Padilla et al. 2000), which is slightly above the cyclists lactate thresholds LT). In longer road races, the mean intensity seems to be slightly below lactate thresholds LT (Vogt et al. 2006).

In distance running and cycling, anaerobic capacity is thus of minor importance compared to the aerobic energy production. An efficient oxygen transport system is thus vital. Endurance sports are apparently demanding in terms of aerobic capacity, but performance over more than a few minutes is also influenced by somatic factors (e.g. gender, age and body dimensions) psychological factors (e.g. attitude, motivation), environment (altitude, heat) and probably most of all training adaptations (Maughan et al. 1969; Astrand and Rodahl 1986).

Strength is defined as the maximal force a muscle or muscle group can generate (Komi 1992). Power is work (which is the product of force and work distance) divided by time. Power is thus the rate of doing work, and is measured in watts (Astrand and Rodahl 1986). RFD is closely related to power. It is defined as the rate at which force is developed (Kent 1994). If the force itself and the time to teach this force, or the time in which this force is acting is measured.

The importance of strength and power in long distance running or cycling would intuitively seem small. Each step would in average only account for a small percentage of the maximum force production possible in the involved muscle groups. In the final sprint toward the finish line, high power production may be of some importance, as is shown in shorter

The long Distance running is done all over the world. There are many races organized on the local level. Most the runner uses the traditional type of training they also known as back-to-basics, conventional training or customary training, refers to long-established customs found in schools that society has traditionally deemed appropriate. The traditional training promote the adoption of the old elite athletes experience sharing training schedule. In the eyes of Research Scholars, traditional Training methods focused on routine training. However, many athletes and Coaches are concerned with the maintenance of objective new standards based on testing, they favors a more traditional approach. Runners only run on the roads and do practice of same kind of running. Nowadays the Runners are using the different methods of training. The performance level has been increased. Plyometric exercise slowly inaugurated the way to a number of fitness regimens all over the world. Plyometric exercises are primarily designed to develop strong and intense body movement. It also enhances the performance of the nervous system which plays a vital role in any sports and physical activity. It increases the body's strength and speed, and further boosts the body's coordination and agility.

Plyometric exercises come from the Greek word plyometric which means "more length." This length refers to the body's muscle for enhanced performance and powerful
movements. Plyometrics exercises include the movements which aim to strengthen tissues by loading up the muscle and thereafter contracting it in rapid progression. It makes use of strength, flexibility and innervations of the muscles and tissues which will allow the practitioner to run faster, jump higher, hit harder or throw farther among many others. Plyometric exercises help in achieving the increase in the contraction rate or strength of muscles which leads to a successful and enhanced performance in sports activities.

The neuromuscular mechanism of the plyometric action is a myotatic (stretch) reflex. Plyometric training is an awareness of the physiological response known as the myotatic stretch reflex. This is a protective mechanism built into the human body and designed to prevent us from stretching or elongating a muscle too quickly. When a muscle is stretched too quickly, sensing bodies within the tendons of that muscle react to this 'too fast stretch' and cause the affected muscle to contract. This is a self-protective reaction. This reflex is also commonly referred to as the stretch-shortening cycle. Plyometric activities are created by an intense plyometric contraction of a muscle followed immediately by a rapid myometric contraction; this action produces a forceful, explosive movement. Plyometric suggests the elastic properties of the muscle fiber and connective tissue, which allow the muscle to store energy during the deceleration phase and release that energy during the acceleration phase. This results in muscles being trained under tensions greater than those achieved by Traditional slow-speed resistance training.
The stretch reflex is one of the fastest reflexes in the body due to its direct connection between receptors in the muscle and the cells in the spinal cord. Plyometric training does not enhance the time of the stretch reflex action; however it changes the strength of the reflex's muscle contraction. The key concept to know is that a faster stretched muscle results in greater force development.

Lundin and Berg (1991) described the process of plyometrics as: A muscle forcibly stretched before a contraction uses the stretch reflex to activate the muscle to shorten vigorously, and the elastic nature of the muscle fibers allows the muscle to store energy during negative work, that will be released during the shortening contraction.

Plyometric training is an effective mode of training as it enhances motor learning and neuromuscular efficiency promoting the excitability, sensitivity, and reactivity of the neuromuscular system to increase the rate of force production (power), motor-unit recruitment, fine frequency (rate coding), and synchronization.

Muscles produce the necessary force to change the direction of an object’s center of mass. All movement patterns that occur during functional activities involve a series of repetitive stretch shortening cycles. The neuromuscular system must react quickly and efficiently following an eccentric muscle action to produce a concentric contraction and impart the necessary force (or acceleration) in the appropriate direction. Therefore, specific functional exercises that emphasize a rapid change in direction must be utilized to
prepare each athlete for the functional demands of a specific activity.

Plyometric training provides the opportunity to train specific movement patterns in a bio-mechanically correct manner at a more functionally appropriate speed. This provides functional strengthening of the muscle, tendon, and ligaments specific to the demands of everyday activities and sports. The ultimate goal of plyometric training is to improve the reaction time of the muscle action spectrum (eccentric deceleration, isometric stabilization, and concentric acceleration).

The speed of muscular exertion is limited by neuromuscular coordination. This means that the body will move most effectively and efficiently within a range of speed that the nervous system has been programmed to allow. Plyometric training improves both neuromuscular efficiency and the range of speeds set by the central nervous system. Optimum reactive performance of any activity depends on the speed at which muscular forces can be generated.

Thomas also agreed with the concept of the stretch-shortening cycle by stating that "muscles that contract immediately after being stretched produce greater force than a muscle, which contracts without pre-stretch". The quickness in the ability to convert from a plyometric contraction to a mio metric contraction is the key to exploiting the muscle's elastic compositions. Therefore, it is implied that plyometric training improves the velocity of the stretch-shortening cycle. The potential for the muscle to store elastic energy is due to the muscle's series elastic components (tendons and cross
bridge characteristics of actin and myosin) and sensors in the muscle spindle that play a role in presetting the muscle tension. The storage of elastic energy caused by plyometric enables the muscles to generate greater force and power. For this reason, plyometric training plays an essential role in strength and conditioning programs in long distance running.

Discovering what contributes to running success helps coaches and athletes to improve and change competition. One area of running research is the biomechanical differences in form between sprinters, middle, and distance runners at various speeds. Research has found running forms and body positions that aid in runners' top speed in several different running events. However, little research exists to show if differences in running forms exist among sprinters, middle, and distance runners while running at the same speed. Discovery of possible differences can aid athletes in greater running performance. Researchers have focused on finding what contributes to top running form of elite sprinters, middle, and distance runners. They have studied if differences in stride length and stride frequency contribute to the success of a runner (Cavanagh, 1987; Nummela et al., 2007). When a runner increases speed, stride length and stride frequency increase but each runner has a self-selected optimal stride length and no set standard can be applied to all runners (Nummela et al., 2007). This self-selected stride causes natural variations in form to occur between runners. Despite natural differences in form due to stride length, similarities exist with the changing of runners' form when running at lower speeds compared to higher speeds.
An increase in speed also changes knee movements and ground contact time (Nummela, 2007; Vaughan, 1984; Williams & Cavanagh, 1987). In the knee, changes in the angle of flexion and extension occur. The maximum knee flexion increases from running to sprinting in the swing phase of the gait cycle and the absorption period of the knee decreases from running to sprinting (Novacheck, 1998). With known changes that occur in knee angles, research can be furthered to determine if changes occur at the same rates between sprinters, middle, and distance runners with increases in speed.

“Successful running requires a good training program. No single programme is the perfect way to train. You can use many different routes for the same goal. However, every successful training program follows certain basic principles and shares common characteristics with the other successful training programs.” states 1964 Olympic 5000m bronze medalist and head track coach at the University of Oregon, Bill Dellinger.

The ability of muscles and tendons to store and release elastic energy have been considered to be more important factors than previously thought to achieve a higher level of performance during distance running. However, few training studies have directly evaluated the effect of plyometric training on improving running performance.

The concept of plyometrics is based on the three-component model of muscle. Muscle is modeled with a contractile element and two elastic elements that are named according to their relationship to the contractile element one
in line with (the series elastic element) and one in parallel (the parallel elastic element). When a muscle contracts, tension is not directly transmitted to the ends of the tendon and the load is not overcome, leading to movement. This would only happen if the connection between the contractile element and its insertion were rigid and inelastic. In reality, the contractile element develops tension, stretching the series elastic element; the degree of stretch is dependent on the load to be moved. After sufficient tension has been generated the tension at the ends of the muscle is sufficient to overcome the load and the load is moved. When a load is applied to a joint (eccentric phase), the elastic elements stretch and store potential energy (amortization phase) prior to the contractile element contracting (concentric phase).

An eccentric contraction immediately preceding a concentric contraction significantly increases the force generated concentrically as a result of the storage of elastic potential energy. During the loading of the muscle, the load is transferred to the series elastic components and stored as elastic potential energy. The elastic elements then contribute to the overall force production by converting the stored elastic potential energy to kinetic energy, which enhances the contraction. The muscle's ability to use the stored elastic potential energy is affected by the variables of time, magnitude of stretch, and velocity of stretch. Increased force generation during the concentric contraction is most effective when the preceding eccentric contraction is of short range and is performed without delay.
A simple example of the use of the energy stored in the elastic element is the basic vertical, or countermovement, jump. The initial squat (the countermovement) is the eccentric phase that stretches the elastic elements and stores elastic energy (amortization phase). When the jump is performed (the concentric phase), the stored energy is "added" to the tension produced leading to a higher jump. The amount of stored energy used is inversely proportional to the time spent in the amortization phase. When doing a vertical jump, the longer one waits at the end of the countermovement before performing the jump, the lower the eventual jump height due to the inability to recover the stored elastic energy.

The improved muscular performance that occurs with the pre-stretch in a muscle is the result of the combined effects of both the storage of elastic potential energy and the proprioceptive properties of the muscle. The percentage that each component contributes is unknown at this time, but the degree of muscular performance, as stated earlier, is dependent upon the time in transition from the eccentric to the concentric contraction. Training that enhances neuromuscular efficiency decreases the time between the eccentric and concentric contraction, thereby, improving performance. This can be accomplished through integrated training.

The body has proprioceptors, or receptors that are sensitive to tension and stretch. The muscle spindle is one of these proprioceptors and plays an active role in the stretch reflex. The stretch reflex is an involuntary response (contraction) to external stimuli that stretch the muscle (i.e.
In essence, when the spindle is stretched it sends out a signal to the spinal cord, which in turn sends a signal back to the muscle causing it to contract. The strength of the response of the muscle spindle is determined by the rate of stretch. Practically speaking this means the greater and more quickly a load is applied to the muscle, the more forceful the muscular contraction will be. The Golgi Tendon Organ (GTO) is another proprioceptor located near the muscle-tendon junction and actually inhibits muscle contraction. The Golgi Tendon Organ (GTO) protects against overloading and when it is stimulated it signals the muscle to relax. It may be that plyometric exercise can manipulate the threshold of Golgi Tendon Organ (GTO) activation to maximize the elastic property of the muscle. Each muscle fiber is innervated by a nerve, called a motor neuron, and the point where the nerve innervates the muscle fiber is called the neuromuscular junction (motor end plate). A motor neuron can innervate multiple muscle fibers, and the motor neuron and all the fibers it innervates are collectively called a motor unit. There are basically two ways to increase a muscle's force production: 1. Increase the rate at which a motor unit is stimulated, and/or 2. Increase the number of motor units that are activated.

Plyometric training influences these two factors affecting force production and speed of that force production. Basically it is plyometric exercise that trains the neuromuscular system to respond more efficiently.

In addition to other indices like muscle endurance and power, muscle strength plays a cardinal role in achieving
athletic excellence. The final common denominator in athletic events is what the muscles can do for you - what strength they can give when it is needed, what power they can achieve in the performance of work and how long they can continue in their activity.

The rate of oxygen consumption (VO2max) is typically regarded as a good predictor of distance running performance, but new research suggests that running economy may be a more accurate predictor. While running economy is usually improved by long slow distance training, there is evidence that plyometric training may also produce the desired changes in running economy. Plyometric training may result in increased musculotendinous stiffness, which may improve the ability of the runner to store and use the energy experienced during running. There is currently a conceptual link between stiffness and running economy. Plyometric exercises have been used successfully over the years to elicit training responses from athletes. Plyometrics training is almost exclusively applied to extensor Muscle of the legs, and consists of a vigorous lengthening of the active extensor muscles (eccentric contraction) immediately followed by a maximal concentric contraction. They are most frequently used as a means of increasing speed and anaerobic power output in sprinters and jumpers, but the techniques may also be of value to other types of sportsmen (Watson, 1993; Wausen, 1990). Sharkey (1986) described plyometric exercises as explosive callisthenic-like exercises which involve the conditioning of the neuromuscular system to permit faster and more powerful changes of direction such as moving from up and down in jumping or switching leg positions as in running. The training
modes adopted for this study were based on the principle of plyometrics training.

In athletics, diverse efforts have been made to try and enhance records through active studies and the development of training methods. With increasing interest in athletics, the importance of athletics identification has been recognized. Desired records in athletics cannot be achieved only with natural movements and efforts, but also require more reasonable and scientific training content and methods. The physical strength elements required for athletic Long distance running events include endurance, strength, swiftness, agility, speed, flexibility, and physical balance. Although plyometric training and weight training are implemented as representative training methods for improving swiftness and agility, most studies of it have been conducted with players of other sports. Majority of research literature prove it to be effective and accepted globally, but very few have talked about their on long Distance running.

Therefore, the purpose of this study is to examine whether there is the effect of plyometric training on distance running performance.

1.2 Statement of the problem

The main purpose of the study was to find out the effect of plyometric and traditional training on performance of long distance athletes.

1.3 Delimitations

1. The study will be delimitated to the Sangli and Satara District.
2. The study is delimitated to middle distance and sprints performance.
3. The training period will be restricted 6 weeks only in each plyometric and Traditional training.
4. The study will be restrained to selected motor components i.e. Speed, strength and power, which are essential for improving the performance.

1.4 Limitations
1. The study is limited to the college student of Shivaji University only.
2. The study is limited to the Long distance athletes.
3. The study is limited to the athletes.
4. Non-availability of sophisticated equipment will be considered another limitation to the study.

1.5 Major objectives
The main objective of the study where to establish if a plyometric training program will improve the performance of long distance running

1.6 Minor objective
1. To determine if plyometric training improves the speed, explosive power, muscular endurance, resting pulse rate, and Vo2 Max of long distance running.
2. To determine if plyometric training improves the endurance of long distance athlete during a 5000 meter run time trial.
3. To determine if Traditional training improves the endurance of long distance athlete during a 5000 meter run time trial.
1.7 Hypothesis

On the basis of literature reviewed, research findings discussions with senior colleagues in the field and scholar own understandings of the problem it was hypothesized that:

H₀: There would be no significant difference in the performance of long distance running due to the effect of Plyometric training.

H₀: There would be no significant difference in the performance of long distance athlete due to the effect of Traditional training.

H₀: There would be no significant difference in the performance of long distance athlete due to the effect of Plyometric training and Traditional training.

Alternative Hypothesis: There would be significant difference in the performance of long distance athlete due to the effect of Plyometric training and Traditional training.

1.8 Definitions of the terms used

Plyometric Training

Conceptual Definition

Eccentric contraction followed immediately by a concentric contraction i.e., the exercise is based on the rapid lengthening of a muscle (forced stretch) just prior to a contraction. The voluntary impulse must be timed to coincide with involuntary impulse to achieve most powerful contraction to gain maximum height of jumps.
Operational definition

For the present study the Plyometric training means the ability of muscles and tendons to store and release elastic energy have been considered to be more important factors than previously thought to achieve a higher level of performance.

Traditional Training

Conceptual Definition

Traditional Training varies greatly with geography and by historical period. Traditional Training is to transmit to a next generation those skills, facts, and standards of Sports that athlete deem to be necessary for the next generation's sports success. As beneficiaries of this, which educational reformists John Dewey described as being "imposed from above and from outside", the students are expected to docilely and obediently receive and believe these fixed answers. (wikepida.com)

Operational definition

For the present study the Traditional Training means the senior athletes passes skills to his junior fellow.

Sport performance

Conceptual Definition

Sport performance is the unity of execution and result of a sports action or a complex sequence of actions measured or evaluated according to socially determined and agreed norms.
Operational definition

For the present study the Sport performance means the result of the skill it may be Distance or time.

Long Distance Running

Conceptual Definition

Long-distance running, or endurance running, is a form of continuous running over distances of at least five kilometers. Physiologically, it is largely aerobic in nature and requires stamina.

Operational definition

For the present study the Long distance is the running that covers the 5 kilometer, 10 kilometer, half marathon and marathon events.

Endurance

Conceptual Definition

The ability of the heart, blood, blood vessels and lungs (delivery system) to take in and transport an adequate of oxygen to the working muscles, and the ability of slow twitch muscle tissue to sustain rhythmic movement for an extended period of time.

Operational definition

For the present study the Cardiovascular Endurance the ability of an individual to run for longer period.
1.9 **Scope of the study**

No study of this nature has been done in this geographical area. Over the past four decades, there has been an increase in the awareness of prevalence of overweight and physical fitness in Society across all genders, ages and racial/ethnic groups the negative effects of degraded physical fitness on both the individual and society are serious and multi-dimensional. My study will help them to improve their physical fitness of all the sports personals as well as the society members.

1.10 **Need of the study:**

In Shivaji University most of the students won the medal at national level are long distance runner. The Runners from this area do practice with the traditional method in different area if they come to know about which method is fine then they will adopt the best method to improve their performance in Long Distance Running.

Physical educationists, coaches and sports scientists have been working over a significant period of time to develop efficient means of training so as to facilitate sports persons to attain high performance in various games and sports. Numerous research works have been done in the field of sports having different training means to find out the effectiveness of training methods to improve the performance in Long Distance Running. The investigator felt that the study may prove to be significant in the following ways:

1. The results of the study will be immense help for the sports persons in Long Distance Running.
2. The findings of the study shall add a new dimension to the existing knowledge of sports training with special reference to different forms of plyometric & Traditional Training.

3. The outcomes of the study might highlight the different effects produced by the two types of selected training methods to develop running economy.

4. The physical education personnel and coaches will be able to decide what type of training will be best suitable for their athletes

1.11 Significance of the study

In the normal course, the responsibility of creating and nurturing of sports talent rests over educational institutions and district level to national level federations of concerned games and sports. Presently, though India being the second largest country in terms of population i.e. human resources and a greatest democratic nation; and inspite of spending a huge amount and implementation of various schemes by the government authorities, our sports achievement at the international level is extremely poor and performance standards are very pitiable.

Strength is the basis of high-level performance in most of the sports. Improvement of speed strength, referred to as explosive strength or explosive power, is an important objective of plyometric training that could benefit distance running players greatly.

The standard of sports and sportsmen in India are of great concern to many because of the poor performances in the National and International arena. The reasons may be the lack of scientific knowledge, the use of available knowledge,
financial conditions, training methods, lack of sophisticated equipment and facilities, proper guidance and many others. Now, comparison of the past and present contributions of Shivaji University towards national sports shows a decline in terms of both quality and quantity. Apart from the above mentioned factors there are certain underlying causes with in the individuals, the physical, physiological, and psychological factors which are not taken care of. Hence in this study an effort will been made by the investigator on regarding basic factors called Endurance and Running Economy of an athlete and its contribution to the achievement or performance of an athlete or to see the extent of the role played by these factors on Long distance events. Under such circumstances this study will be significant in following ways

1. The outcome of this study will provide the knowledge about the Endurance and Running Economy and their role in aiding the athlete to run faster by cutting precious fraction of seconds in Long distance events races.

2. The study will high lights the important effects of Plyometric exercise in increasing Endurance and Running Economy of an athlete which ultimate improve Performance.

3. The study will further help the physical education teachers and coaches by pointing out the selection of different training menus for the Performance of Long distance running.

4. The study will further assist the authorities of the Shivaji University raise the general fitness level of its students in general and enhance their sports performance in Long distance running.