Chapter-1

INTRODUCTION

Changes and challenges are the twin laws of nature and they affect every aspect of human life. Changes are taking place all around, and because of these changes, new challenges present themselves. Man is constantly trying to meet these challenges and excel his previous performance every time.

It is because of the growing change in competitive philosophy of sports that a close liaison has developed among sports scientists, team physicians, athletic trainers, coaches and athletes to investigate modern scientific techniques in terms of selection of athletes best suited to the activity and to device new tactics and training methods. The author has also attempted to identify the fitness factors that help in achieving a level of skill and fitness, which a player can attain. thought proper training and evaluation in various games.¹

The player’s performance dependents on their effectiveness of training programmes, quality of surface, constructional characteristics,

and weather conditions. The playing characteristics are thought to be also determined by player movement, and player-surface interaction. Several tests have been designed to quantify these characteristics and some have been adopted as a measurement standard. The surface interaction of players is affects the performance and movement. Player-surface interaction is evaluated from measuring the peak deceleration of a sphere dropped onto the surface, and by measuring the ground reaction force during a simulated running action using a constant man model. \(^2\)

Regular exercise benefits players of all ages & sexes. Regular physical activity and exercise offer great benefits to players is a good reason to make exercise routine. There are many types of activities that improve a player's physical fitness. It is well known that regular physical exercise is an important determinant of healthy life style, and, to the contrary, According to the principles of sports physiology, exercising for few weeks is insufficient to develop a high level of physical fitness of players. Some recreational activities is better than doing nothing. The study by L. Ángyán suggest that even limited level of exercise helps to maintain physical fitness. All the averages of the

fitness measures were within the normal ranges or somewhat better as compared to non-athletes. It is generally accepted that the resting heart rate, resting blood pressure of a well-trained, athlete tends to be lower than for a sedentary person. Trained the vital capacity is slightly longer than that of the sedentary subjects. 3

Every game required a considerable amount of physical fitness and mastery of skills. Now the question that arises in the mind of every individual is “What does the term 'physical fitness' deal with? Fitness is very specific to the sports or activity, which a person does. For example, the fitness required to be a 100 mts sprinter is entirely different from that needed to be a marathon runner. Similarly, the fitness required to play soccer is different from that needed by rugby, hockey or squash. Soccer players must have good endurance, good lower and upper body strength, good flexibility, agility and speed. 4

Better performance and physical fitness are closely interconnected. Being physically fit not only helps player’s better performance, it also helps players live longer physical fit. Physical activity is defined as any movement that spends energy. Exercise is a

3 M.D. Fillman, P. Fiolkowski, Department of Exercise and Sports Sciences (University of Florida, FL, USA, 2002), 121-128,

subset of physical activity, but it is an activity that is structured and planned. According to the Centers for Disease Control and Prevention (CDC), doing some kind of physical activity or exercise on a regular basis helps to increase strength and flexibility, improve pressure endurance, control weight, increase bone mass, and improve self-esteem, as well as reduce stress, anxiety, depression, and the risk of developing high blood.

It is a known fact that adding regular physical activity to one's daily routine will improve health and well-being. Regular physical activity maintained body's physiological and physical fitness. Being physically active has also been proven to help build healthy bones, joints, and muscles and helps to perform better performance in competitions.5

As a result there is a constantly increasing demand for more knowledge and better training means to coach the game. Sports scientist coaches and physical education teachers are charged with the responsibility of training and teaching their player's soccer and sponsors and shopping for gifts for favorable officials back home, have

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5 M. H. Murphy, J Young and W.F. Wallace, “Department of Sports and Exercise Sciences” (University of Ireland, U.K. 11 Jan. 2005).
snapped the physical, mental and financial energies of our players. At present the crisis between political interference in participation.⁶

Five decades of Independent India has not achieved much as to the participation of women with the rising of odds stacked against them. Indian sports have something to build upon, but for that more needs to be done. The Human Resources Development Minister will stand at the pulpit and repeat the slogan of making sports compulsory in Schools. Very little chance of that happening when 95% of the schools don't even have their own playgrounds. What is needed is a “Sports for All” campaign.

Only if there is an increase in participation per household in sports will women's sports get the right impetus, because the more mothers play sports, the more their children will follow. It will take time, but we have an entire millennium ahead of us. For too long players have suffered due to late clearances, running around for kits training and knowledge of its changing nature to uplift the total performance.⁷

Once you decided to exercise regularly, consider a few factors to choose an exercise program. You will improve your skill and endurance more rapidly, and it will be easier for you to chart your progress. One of the most important factors in beginning an exercise program is to select the most convenient time for you to exercise. It is also important to follow a regular schedule so exercise becomes a habit. Each exercise session should include a warm-up, the dynamic exercise, and a cool-down period. The warm-up of five minutes should consist of moderate activity that will gradually increase your heart and breathing rate. These prepare the body for vigorous activity by increasing respiration, circulation and body temperature. A warm-up will reduce the risk of injury during the exercise period.

Whether you are soccer player, basketball player, fat or skinny, a long distance runner or a sprinter you can probably benefit from aerobic training. The increase in lean muscle mass that results from aerobic training is the key to overall strength and to your body's ability to burn calories.8

The performance of Players in competition highly depends on their function of heart. Your heart, like any other muscle in your body,

gets stronger with regular exercise. The right kind of exercise increases cardiovascular fitness by improving blood circulation throughout your body. Cardiovascular fitness allows you to exercise vigorously for long periods of time with less tiring.

Overall fitness requires more than just cardiovascular fitness. A balance of endurance, strength, and flexibility must be achieved. The most often recognized components of fitness include: Muscular Fitness, Muscular Strength, Muscular Endurance, Flexibility, and Cardiovascular Endurance.\(^9\)

Research has shown that aerobic and resisting training are both safe and effective for women players, including those who are not in perfect health. Resistance training, particularly in conjunction with regular aerobic exercise, can also have a profound impact on a person's mental and emotional health. There are numerous benefits to resistance and aerobic training regularly, particularly for young age players. It can be very powerful in reducing the signs and symptoms of numerous unfitness.\(^10\)


Strength, power, agility and speed are just as important for female as for male players, yet many females are uncomfortable in the traditional strength-training environment. The answer, according to James Marshall, could be skill-based fitness training. Female games players in sports such as soccer, rugby, tennis, netball, hockey and lacrosse, who wish to perform at a high standard, need high levels of fitness. Aerobic capacity, power, speed, agility and strength are all required in varying degrees to enable players to excel at these sports.

Coaches having limited time to access their players, and with a host of things to work on, combining trainings with fitness training seems an ideal way to maximise contact time with the players. This is commonplace practice. However, female games players are slightly different for two reasons; firstly, many female athletes are uncomfortable in the strength-training environment, because they regard it as more of a 'male' mode of training; secondly, the female body is obviously different from the male specifically the biomechanics of the lower limb can make females more susceptible to lower limb injuries.
In order to provide a positive environment that encourages female players to improve their fitness and also reduce their risk of injury, integrating skills and fitness sessions could be beneficial.\textsuperscript{11}

The modern games demanding of the physical fitness levels needed to play at the highest levels. The games require high levels of speed, agility, Strength, power and endurance in order to be effective at the top levels. This combination of requirements is rare in the sporting arena, and offers a considerable challenge to those who wish to play the game to the best of their ability.

You may be the best technical scrmagged in a game, but you will not be effective if are not able to perform after the first few minutes due to fatigue. Research undertaken in 1992 (McLean, 1992, Journal of sports sciences) indicated that there were between 24 and 45 scrums in a 5-Nations match, so endurance is essential (and the game physical demands of the game have advanced since this research, due to professionalism and law changes making the game quicker!). Similarly, a scrum-half who cannot be at every breakdown to begin the next phase of play after every rock and maul will never reach the top,

and if he is not powerful or fast enough to exploit space around the base of the scrum, his game will lack a dimension.\(^{12}\)

Training may help contribute to the other areas of fitness. Aerobic training can also improve performance for a variety of sports. While its impact may, in some cases, be limited for long distance runner, it certainly can help the performance of a triathlete, and many other athletes who participate in a variety of sports. There are benefits to participating in aerobic training for the long distance runner. Those sore shoulders and tired arms at the end of long run, and those achy backs might become less troublesome. The long distance runner may find a bit more power for the sprint to the finish line and may find that improved arm strength allows for an easier crank up a hill and better balance on trails.

The existing literature in the field of games shows that endurance, speed, agility, maximum leg strength, upper body strength, leg power, muscular endurance, flexibility, coordination and reaction

time are important pre-requisites for efficient performance in the games, whereas excess body fat proves to be a hindrance.\textsuperscript{13}

All game requires a high level of strength, endurance, speed, agility, flexibility, and co-ordination ability for players to play their game successfully. The demands for rebounding, jumping, shooting, playing defense, to change direction, to reach from one place to another place, and to play the game for long duration of time without undue of fatigue, require a high level of physical fitness. In order to claim that a basketball player is in great condition, the players should have the endurance to run tirelessly on the court and possess the strength to engage in the physical battles underneath the basket. There is no doubt that training plays an important part in building up the specific demands on the court (Fulton, 1992). College basketball has emphasized strength training with differed modes to a great degree because it increases overall strength, power, lean body mass, and flexibility (Fulton, 1992). The objective of implementing training to enhance overall sport-performance appears well founded.\textsuperscript{14}

\textsuperscript{13} A.K. Uppal and P. Roy, “Assessment of Motor Fitness Components as Predictors of Soccer Playing Abilities” \textit{SNIPES Journal} 9:3.

Strength deserves considerable attention for players of various games. It required in every game and sports, e.g. players need to produce power when kicking a ball in soccer, throwing the ball for a long distance in Basketball and taking a powerful shoot in badminton etc. While accelerating quickly or jumping, players can and must work for improving their strength and power to play more effectively.

There is the demand of regular physical activity to build muscular strength. "Strength is the ability to resist force", muscles constantly resist force. The more strength a person has, the easier it is for his or her muscles to resist greater force. Just as regular physical activity builds strength, it also builds muscular endurance. Similar to cardiovascular endurance, muscle endurance means that muscles are able to work for longer periods of time.

Muscles grow through physical activity just as they can become more well-defined (in terms of appearance). Typically, however, more strenuous activity and exercise is required for this to occur. Muscle growth comes with activities and exercises that require strength, while
muscle definition stems from exercises that require muscle endurance.\textsuperscript{15}

Endurance is the essential ability of the players; it refers to a person's ability to continue doing a stressful activity for an extended period of time. This is sometimes called stamina. What this means is that a person with good endurance or stamina can, jog, play, or run for a long time without getting tired. Having a healthy endurance level means that a person has a healthy level of cardiovascular fitness. Technically speaking, cardiovascular fitness refers to how efficiently the heart and lungs can pump blood (which holds oxygen) to muscles that are being worked.

In games, it is vital that the players should have high level of endurance. It is useless to dominate a match in the beginning because the players with superior skill may lose it as in the long run they become exhausted and can no longer perform well. A lack of endurance results in fatigue which diminishes several elements of good performances such as timing coordination, reaction time, general alertness and concentration. Since increased endurance delays the onset

of fatigue, it is therefore improves the overall performance during the match.\textsuperscript{16}

Speed is important ability which highly affects the performance of players, it is necessary to improve it before to take part in any competition; it is the ability to move the body, or a portion of the body, quickly. (Power, a concept much discussed in relation to the modern game, is the ability to exert a large force quickly, and is therefore a product of speed and strength). When undertaking training to improve the speed of players, the Fitness Advisor (or coach) should consider the training to improve the elements of reaction time, acceleration, and sprinting technique, all of which should be incorporated into the training programmed.

Speed is the ability to cover the distance between 2 points in the shortest possible time. This is the product of reaction time (time taken to detect and respond to a stimulus) & movement time (time from beginning of a movement to its completion). Movement time can be

seen as the product of acceleration and top speed (maximum possible meters per second that a player can run).\footnote{Paradisis G.P. & Cooke, "Effect of Training on Sand Versus Hard Surface in Speed" \textit{Medicine and Science in Sports and Exercise} (1999) p. 785.}

Scientifically constructed training programmed improves the factors which determined the speed. Speed depends on two factors: stride length and stride frequency. Stride frequency is generally considered to be largely dependent on the type of muscle fiber the athlete has. Faster fibers give an athlete an advantage in the quality and speed of muscle contraction. Slower fibers provide an advantage in maintaining work over prolonged periods.

If an athlete can’t make significant improvements in stride frequency by pushing harder and faster off the ground, he or she looks toward improving stride length. This is usually the case because it is so difficult to improve stride frequency. (It has been estimated that although you can increase a muscle’s strength by 300 percent, you can only increase its speed by approximately 10 percent!) Increasing stride length allows athletes to cover the same distance as athletes with greater stride frequency in the same amount of time, thereby offsetting their competitors’ advantage.
How do you go about increasing the ability to push off the ground with more power? To get to this point, you have to take a course slightly different from the norm: The workouts may be shorter but of higher intensity.

Speed is important for the players during play their game. Speed is the quickness of movement of a limb, whether this is the legs of a runner or the arm of the shot putter. Speed is an integral part of every sport and can be expressed as any one of, or combination of, the following: maximum speed, elastic strength (power) and speed endurance. Speed is influenced by the athlete's mobility, special strength, strength endurance and technique. Flexibility and a correct warm up will affect stride length and frequency (strike rate). A well constructed training programme develops the factors which determined the speed.

Length can be improved by developing muscular strength, power, strength endurance and running technique. It is important to remember that the improvement of running speed is a complex process that is controlled by the brain and nervous system. If you maintain some form of speed training throughout the year, your muscles and

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18 Stepto N.K., Hawley J. P. & Hopkins, W.G. “Effect of Different Training Programmes on Speed”
nervous system do not lose the feel of moving fast and the brain will
not have to re-learn the proper control patterns at a later date.
Functional strength and explosive movements against medium to
heavy resistance will improve the speed. Sprinting form and speed
endurance to develop sprinting technique and improving the length of
time you are able to maintain your speed.¹⁹

Agility is frequently demanded ability at the time of the
competitions. Agility can be considered as the ability to precisely and
quickly change direction or body position. In a rugby match, all players
will be required to undertake directional change after many, and
varied, distances, although the majority of directional changes revolve
around the 5-10m mark. Therefore, acceleration is an important part of
all agility drills. As well as enhancing your performance, good agility
training will also aid injury prevention, because your body will be used
to quick changes of direction.

Agility plays a vital role in players to play the game because
when a player participates in the game, he has to change directions and
movement of various parts of the body while dribbling the ball, to

¹⁹ Reilly T. & Williams, “Aerobic Training on Aerobic Fitness and Speed in Soccer Players”
Science and Soccer, USA, Rutledge, 2003)
change the direction quickly according to situation and in the case of the goalkeeper to save the goal in soccer and hockey.  

Aerobic Training helps the player to maintain their fitness of the body because players performance is highly depend on their effective physical fitness level such as, fat free body mass, height because in most of the game players benefit from their good height, leg strength etc.

Aerobic training is crucial to weight control, because individuals who have more muscle mass have a higher metabolic rate. Muscle is active tissue that consumes calories while stored fat uses very little energy. Strength training can provide up to a 15% increase in metabolic rate, which is enormously helpful for weight loss and long-term weight control and, heart performs better when the body is leaner. Being overweight can become hindrance in player’s performance, and moderate weight (muscles and bone weight) can help players in their performance.  

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Lean body mass is effective for the players to play their game effectively, aerobic exercises are the best Weight maintain exercises. Cardio exercises are the real secret to lose body fat and gain lean body mass. Cardio Exercises are the only ones proven to burn calories at a sustained rate and hence qualify to be the best Weight Loss Exercises ever.” Aerobic Exercises are the best Weight Loss Exercises there is”. Aerobic Exercise is the ultimate secret to loss extra body fat and gain lean body mass.

Exercise also helps to control their body weight. Your normal daily activities burn up a large number of extra calories. Exercise burns up calories, so, you participate in a regular exercise program and, you can lose extra pounds or stay at your ideal weight which is essential for the players.22

Changes that occur within the muscle because of training are classified as: Myogenic Changes, long duration training results in muscle hypertrophy, an increase in the cross-sectional size of existing fibers. This is achieved by increasing: number of myofibrils, sarcoplasmic volume, protein, supporting. Connective tissue (ligaments

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and tendons), Strength training programs increase the intramuscular stores such as adenosine triphosphate (ATP), creatine phosphate (CP) and glycogen. In women, the potential for hypertrophy is not as great as men due mainly to the lower levels of testosterone in women.

Training cause biomechanical changes that occur within muscle and serve to increase the oxidative capacity of the muscle. The affects of strength training are an increase in ATP, CP and glycogen concentration, a decrease in oxidative enzyme activity, a decrease in mitocarbohydratendrial density. These changes vary slightly according to the training intensity. By repeatedly stimulating muscle, you increase the rate of response of the central nervous system. The recruitment patterns become more refined and as a result, gross movement patterns become more efficient and effective.23

Physiological changes in the human body may be brought about by different types of conditioning programmers such as jogging, calisthenics, circuit training etc. These activities bring about changes in certain physiological parameters if they are carried out for certain duration to time.

Players required a good physiological systems such as resting heart rate, blood pressure, vital capacity, respiratory rate to perform better in competition play a vital role in player's performance, scientific research has shown that exercises can slow the physiological aging clock. While aerobic exercise, such as walking, jogging, or swimming, has many excellent health benefits—it maintains the heart and lungs and increases cardiovascular fitness and endurance—it does not make your muscles strong but training does. Studies have shown that resistance exercise two or three times a week increases strength by building muscle mass and bone density.

Exercise that promotes cardiovascular fitness improves your body’s circulation to help your heart, lungs and other organs work together more efficiently.24

As you continue to exercise regularly, you will find that it takes more effort to reach your target heart rate. This is a good sign and means that your heart and lungs are getting stronger and that your aerobic capacity is improving.

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Regular activity and exercise make for a healthier heart. A healthy heart is a strong heart that works efficiently and is able to easily supply the body with blood. The heart pumps blood, which carries oxygen to muscles and carries away waste.\textsuperscript{25}

A very noticeable change effected with training is the reduction in resting heart rate. This body-cardiac may result in resting values for the athlete as much as 20-30 beats per minute slower than for an untrained person. Moreover, and perhaps more importantly, the endurance-trained athlete enjoys a lower heart rate for any given workload when compared with his untrained counterpart.\textsuperscript{26}

Regular physical activity help players to feel better, look good, and can improve your overall fitness. It can increase your physical strength and stamina. Proper exercise also can improve your circulation and the performance of your heart and lungs. The Running gives the quickest results in the area of cardiovascular fitness, but besides strengthening a few specific muscles and rapidly burning a lot of calories do not greatly contribute to the other criterion of fitness.


Being physically active is related to moderate blood pressure, and physical activity can help to lower blood pressure. The Surgeon General recommends that players should engage in moderate–level physical activities for at least 45 minutes continuous for a year maintain moderate blood pressure or lower blood pressure which give advantage to them to play game for long duration of game.27

Cardiovascular fitness is improved by aerobic exercise. The word aerobic refers to something that occurs in the presence of oxygen. Aerobic exercise improves cardiovascular health as it typically uses the body's largest groups of muscles (the legs) continually which makes a person need more oxygen. The more oxygen a person needs, the more efficiently his or her cardiovascular system must be. Cardiovascular activity and aerobic activities actually increase lung capacity. So while regular aerobic activity will continue to improve lung capacity.28

Aerobic exercise strengthens the heart and lungs and tones the body. There are two types of aerobics: high-impact and low-impact. Both involve moving the body for at least twenty minutes in order to increase the heart rate to a point where the body is burning fat. High-


impact aerobics involves dance combinations and jumping movements, while low-impact aerobics uses similar movements without the jumping.

Changes in respiratory responses to exercise take place during training. As a result, for a standard amount of exercise the pulmonary ventilation is reduced and the amount of breathing decreases in the trained subject even at rest the depth of breathing is greater and the respiratory rate may fall from about twenty to eight breaths per minute.\(^{39}\)

The quality of the ground has an effect on the training programmes. A smooth ground is particularly suitable for easy running. But if it is uneven, it is difficult to run easily. Grassy grounds have different effects on the training programmed. It bounces high on a hard surface. A moderately loose ground helps the players in working the ball by observing its pace. A completely loose, in most cases sandy ground always creates difficulties, and the players tire quickly, since they use up their strength in running over the loose ground.\(^{30}\)


Environmental factors and field conditions affect the various games to a large degree and the team that best adapts to them will increase its chance of winning. Snow, ice, rain and wind can bring parity to teams of different abilities. Teams can use adverse conditions to their advantage if they know how to deal with them and how their opponents perform in a particular situation.

Rain can make a fundamental transformation in ground conditions within a relatively short time. The conditions of the field vary according to the quantity of rain. A wet and slippery ground may also cause the ball to bounce in the same deceptive manner as on a very grassy field. If the ball is sent in front of a running colleague in the same manner as when passing on a hard ground, it is likely to go too far ahead because of the treacherous conditions. On a wet pitch, the ball must be sent directly to the foot of the teammate. A muddy or snow covered field of play is usually more favorable for strong players.

Special care is required if the ball is in goal area and the ground is heavy. The ball is liable to stick in a pool, and both the attackers and defenders should reckon with this possibility. Since the ball becomes
greasy on a muddy or slippery ground, the goalkeeper is bound to have difficulties in clutching and holding.\textsuperscript{31}

In India, due to geographical and climatic conditions, development and maintenance of good ground is not always possible. Scarcity of water and funds also act as limitations in developing and maintaining good grounds. That is why in India condition of the ground varies according to the region, climate conditions of the region, popularity of the game and other factors.\textsuperscript{32}

It has been found that the training affected by the variety and quality of surfaces which also effects the physical fitness level of the trainee. In general, natural surfaces tended to be more consistent in their playing quality, required less force to overcome the surface. This finding has been endorsed by the FIFA and UEFA and all international coaches that there are use of various means & methods, and the quality of surface used during training session affects the performance of players.

Attempts have been made to quantify the effects of specific characteristics of sand surfaces. It has been reported that the impact


absorption characteristics of sand surface had significantly highly compared to a natural surface, and wooden surface (Bowers & Martin 1975). The coefficient of friction was found to be a function of the normal force applied, and as the normal force increased, the coefficient of friction decreased. The friction force increased.\textsuperscript{33}

Numerous injuries have been attributed to playing on uneven or hard surfaces. Recently, Field Turf was conducted a study on the characteristics or effectiveness of surfaces. No long-term study has been conducted comparing game-related, high school football injuries between the 2 running has a strengthening effect as well as boosting your athlete's power and is ideal for those athletes who depend on high running speeds - football, rugby, basketball, cricket players and even runners. To reduce the possibility of injury training on sand should be conducted once the athlete has a good solid base of strength and endurance. In sand running, the athlete is using their body weight as a resistance to push against, so the driving muscles from which their leg power is derived have to work harder. This stretches the calf muscles upwards and downwards as much as possible and applies resistance which overtime will improve their power and elasticity. Many experts

\textsuperscript{33} K.E. Fallon, \textit{British Journal of Sports Medicine} 34 (June 2001), 170-173.
believe that the "bouncy" action is more important than the speed at which the athlete runs. Sand work results in the calf muscles learning to contract more quickly and there by generating work at a higher rate, they become more powerful. The calf muscle achieves this by recruiting more muscle fibers, around two or three times as many when compared to running on the grassy or natural surface. The "bouncy" action also improves the power of the quads in the front of the thigh as they provide the high knee lift that is required. For the athlete, when competing in their sport/event, it can mean higher running speeds and shorter foot strike times. Sand training on sand surface offers the following benefits like it gives the effects of strength training helps develop power and muscle elasticity, improves stride frequency and length, promotes strength endurance, develops maximum speed and strength.\textsuperscript{34}

Grass courts surface is firm and less slippery than the hard courts and wooden court, little disadvantage of this surface than wooden surface, due to high maintenance costs however, grass courts are now rare as they must be watered and mowed often, and take a longer time to dry after rain than hard courts, and it is difficult to run.

For a more extensive to conduct the training most advantageous on grass court.

There are many advantages of soft surfaces like sand surface than hard going e.g. the sand is soft, the athlete has to work a lot harder, and increase their leg speed to keep themselves going. At the same time, there is a reduced risk of damaging their legs through impact injuries. In general, it has the same effect as hill running, but the distances can be reduced because of the difficulty. Other methods of building leg strength are running in boots, running through snow or running with a pack on your back. As the coach remember, the tougher he session the more carefully it must be integrated into the overall training plan.\textsuperscript{35}

In respect of physical fitness, the Indian players are lagging far behind in comparison to western players. It is not denying the fact that they are naturally gifted with the climatic condition and normal physique. But the Asian countries like Japan and Korea have proved that through continuous and scientific training, those barriers can be

tackled and considerable physical fitness necessary for playing soccer may be achieved.

Due to lack of high modern technology and sophisticated instruments in India high level of training programmers are still far behind that of the development western countries.

Thus, a query had interested the scholar regarding the effect of different compact surfaces and their varied resistance to speed, strength, endurance, agility and the physiological changes which result from training like heart rate, blood pressure, respiratory rate and vital capacity and the anthropometric changes from training on different surfaces on weight, height, calf girth, thigh girth before such study was undertaken.

**Statement of the problem**

The purpose of the study was to compare the effects of training on different playing surfaces on physical, physiological and anthropometric variables of female players and also to find out which surface brings maximum changes in selected physical, physiological and anthropometric variables.
Delimitations

1. The study was delimited to female players taking part in the school competition in the campus of BHEL, Haridwar between the age group of 14 to 16 years.

2. The study was restricted to 10 weeks of training on grassy, non-grassy, wooden and sand surface.

3. The study was further delimited to the following physical, physiological and anthropometric variables.

Physical Variables

(i) Strength (Explosive Strength)

(ii) Speed

(iii) Agility

(iv) Endurance (Cardio Vascular Endurance)

Physiological Variables

(i) Resting Heart Rate

(ii) Blood Pressure

(iii) Vital Capacity

(iv) Respiratory Rate
**Anthropometric Variables**

(i) Weight
(ii) Height
(iii) Calf Girth
(iv) Thigh Girth

**Limitations**

The subjects selected for the study were within the different schools of BHEL, Haridwar. But they were not within a residential campus. The factors like diet, life style, daily routine, habits etc. which might affect the result of the study, should be considered as a limitation of research.

**Hypothesis**

It was hypothesized that there will be significant differences between different playing surfaces and their effect on physical and physiological variables after training but their will be no significant difference on anthropometric variables after training on different playing surfaces.
Definition and Explanations of Terms

Training

Sport training is a process of preparation of a sportsman, based on scientific and pedagogical principles, for higher performances.  

Surface

Surface means the outside of a material body on the upper boundary of the soil i.e. outward aspects of the training field.

Grassy Surface

Grassy surface means the outward aspect of the surface full of grasses.

Sand Surface

Sand surface means the surface full of sand, in the river bed away from the portions of water flow.

Wooden Surface

Wooden surface means the outward aspect of the surface covered with wooden.

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Non-Grassy Surface

Non-Grassy surface means the outward of the surface consists predominantly without grasses.

Speed

Speed is the ability to execute motor actions, under given conditions in minimum possible time.\(^{37}\)

Strength

The force that a muscle or a group of muscles can exert against resistance in one maximal effort.

Explosive Strength

It is the capacity of the individual to release maximum force against resistance in the shortest period of time.\(^{38}\)

Endurance (Cardio-Vascular Endurance)

Cardio-vascular endurance is the moderate contractions of large muscle group for relatively longer periods of time, during which maximum adjustment of the cardio-respiratory system are necessary.\(^{39}\)

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Agility

Agility can be defined as speed in changing position or in changing directions.\textsuperscript{40}

Resting Heart Rate

Best and Taylor\textsuperscript{41} have stated that the resting heart rate is pressure change transmitted as a wave through the arterial wall and blood column to the periphery while the person is at rest.

The number of ventricular beats per minute is heart rate. Heart rate is usually determined from pulse rate which is the number of pressure waves per minute along the carotid artery at the neck or the radial artery at the wrist.

Blood Pressure

Blood pressure is the pressure exerted on the walls of the arteries as the heart pumps the blood through the body.\textsuperscript{42}


Systolic Blood Pressure

When the left ventricle contracts and pushes the blood into the aorta the highest pressure produced is known as the systolic blood pressure.

Diastolic Blood Pressure

When complete cardiac diastolic occurs and the heart is resting following the ejection of blood, the least pressure within the arteries is termed as the diastolic blood pressure.\(^{43}\)

Vital Capacity

Vital Capacity is the maximum volume of air that can be forcefully exhaled from the lungs following a maximal inspiration.\(^{44}\)

Respiratory Rate

The number of inspiration or expiration in one minute is known as respiratory rate.

Body Weight

Weight of the nude human body with empty bowels.

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**Height**

(i) **Standing Height** - It is the maximum height of the individual when standing erect on a horizontal surface with her head and face in F.H. plane.

(ii) **Sitting Height** - It is the height of point vertex from the horizontal table top of which the subject sits with her legs hanging down while the thighs rest completely on the table top.

**Thigh Girth**

It is the maximum circumference of the thigh at a mid point of femur length.

**Calf Girth**

It is the maximum circumference of the lower leg over the calf muscles.

**Significance of the Study**

The present study will be significant in the following ways:

The study will critically examine the physical, physiological and anthropometric profiles which are essential for developing female player's ability for playing.
2. The results of the study will be helpful for preparing the training schedules of female players of any game.

3. The results of the study may further help coaches and trainees to train players as per the requirement of the ground conditions.

4. The result of the study will provide the knowledge about the surface which will be more helpful for enhancing performance.

5. The result of the study will helpful for the coaches of different games.

6. The result of the study will help the coaches to know the role of physical, physiological, and anthropometric variables to enhancing the performance.

7. The result of the study will help the coaches to select better grounds to train their players.