Chapter - I
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INTRODUCTION

Hockey is our national game and has attained greater level of popularity all over the World and played on sand, natural grass and artificial turf ground. The modern game of hockey demands that each member of the team be able to play in all positions. A lively attack needs all rounders and they must develop their skills to play in any position. One of the greatest pleasure in the sports is exposure to performance at its highest level. The highest level requires skill attainment, mental toughness, practice and dedication. Team sports require high level of hand and leg power for achieving success at elite level of competitions. As competitions are increasing day by day, the varieties of training also increase as they become important factors to improve the performance.

1.1 HISTORY OF HOCKEY

The precise date and the proper nativity of the game are yet to be finalized. 4,000 years old drawings found in the Benihasan tombs in the Nile Valley, Egypt depicted men playing the game. The first evidence of a team game was found on the base of statues that were part of the wall built by Themi Stocles in 478 BC. The Irish game of hurling dates from at least 1272 BC. The origin of the word hockey is obscure. The word might have been derived from Comocke and the anglo-saxon word for “Hook” hok; alternatively. It might have come from the French word for a shepherd’s crook, hocquet. Hockey was forbidden in the statues of Galway in 1527. Hockey slowly and steadily gained popularity in many other countries. The English polished and improved the proto-type methods of hockey, developing it into modern
kind. Teams are formed at school and college levels and then a proliferation of club teams made the game more popular. In the first international hockey match in 1895, Ireland beat Wales by 3–0. The international rules board was founded in 1895, and hockey first appeared in the Olympic Games as men's competition at 1908 in London. The international hockey federation was founded in Paris at 1924. In India hockey was introduced by the British soldiers and the first hockey club was formed in Calcutta during 1885. The Beighton cup at Calcutta and Aghakhan Cup tournaments at Mumbai have commenced within ten years and Punjab followed suit. Soon Indians became masters in the game and they were the real magicians for many years. Hoodwinking all other teams, entered the Olympic Games in the year 1928, Indian Hockey Juggernaut won six straight Olympic gold medals while winning consecutive matches. The Indian strangle hold over the Olympic gold came to an end when Pakistan defeated India in the final of 1960 Rome Olympics. With the advent of the artificial turf hockey fields and power play tactics, the Indian prowess slowly diminished. India won its last gold medal at Moscow Olympics in 1980. Indian hockey is today a pale shadow of its former self.

1.2 NATURE OF GAME

Hockey is a high intensity, non-continuous game in which physiological demands are considerable, placing it in the category of heavy exercise (Ghosh et al., 1991; Reilly and Borrie, 1992). The unique requirements of field hockey including dribbling the ball and moving quickly in a semi-crouched posture superimpose the work load demanded by the game (Reilly and Seaton, 1990). Hockey requires heavy aerobic demands on players and require them to expand energy at relatively high level (Reilly and Borrie, 1992; Boyle et al., 1994). In terms of energy requirements the
aerobic capacity is very important during matches (Wilmore and Costill, 1999). Hockey involves intermittent running, the alternation of accelerating and decelerating, and changes of direction while sprinting (Spencer et al., 2005). Although great anaerobic capacity is needed during the many brief bursts of high energy release, aerobic capacity also needed for efficient recovery during the short rest periods (Bhanot and Sidhu 1983, Boyle et al., 1994). According to Lothian and Reilly (1994) high intensity activities such as cruising, sprinting activities in which the player is directly involved with the ball make up of 17.5 to 30% of the competition time. In hockey high and low intensity activities alternate by a ratio ranging from about 1 : 4 to 1 : 8. Hockey requires high level of aerobic fitness and it is a prerequisite for a superior anaerobic performance during sustained intermittent activities (Aziz et al., 2000). According to Ghosh and Goswani (1991) the aerobic demand of playing hockey, on Astroturf were 2.26 L/min or 47.3 k³ / min which were 18% higher than the demand of playing on the grassy field. This showed that the players need to possess a high aerobic capacity on Astroturf, the \( V_{O2} \) max values were different according to the players position. The mean \( V_{O2} \) max of the goal keepers were 47.0 ± 1.9 ml/kg/min, 49.8 ± 7.0 ml / kg / min in defenders, 48.9 ± 7.3 ml / kg / min. The epidemiological studies have shown that injuries in hockey are numerous and so there is a need for enforcing strict rules aimed at preventing dangerous use of the hockey stick and careless play of the ball, use of protective equipments, expert training of coaches and officials, adequate nutrition, preseason conditioning, pre-game stretch and warm-up, prompt access to professional first aid and medical care, and full rehabilitation before returning to play are emphasized.
1.3 PREREQUISITE FACTORS FOR PLAYING HOCKEY

Hockey is the game of great skill and to play it well is an art itself. It calls for powerful wrists, keen eyes, intelligence, presence of mind, good eyesight, reaction time, motivation, dedication and balanced diet. It also calls for great sportsmanship, tolerance and coolness. In short, the game demands the best both as a player and as a man.

There are a number of requirements for playing hockey. It involves an enormous amount of sprinting, turning, stopping, starting and back peddling. There are a number of factors which influence a player’s performance. During the game situation, when fatigue starts to affect the player there is a greater chance of lowering of skills performance and decision making. To keep on skill performance, endurance will improve the ability of the heart’s capacity to get oxygen around the body. Muscular strength is important to the hockey player whether it is a case of getting fit enough to last a game.

Flexibility is another key to producing better players at any level of the game and also an important part of overall fitness. Speed is important for ensuring good quality of the skills. The type of speed required varies according to the demand of game. Reaction time is very important for playing hockey whether in offensive or defensive player. An offensive player has to react quickly and execute the goal. The defensive player should be quickly enough to react and execute to tackle successfully. Success in execution of these skills underlines the capabilities of player’s physical and physiological attributes specifically speed, agility, aerobic capacity, strength, Vo$_2$ max and co-ordinative abilities.
1.3.1 PHYSICAL FITNESS

Physical fitness is to the human body what fine tuning is to an engine. It enables the athlete to perform up to his potential. It helps one to look, feel and do his best more specifically. Physical fitness is that organic condition which permits the individual to skillfully utilize the body in activities without experience of fatigue. Physical fitness endows one with the capacity for efficient and prolonged muscular activity. Greater physical fitness, better physical endurance and the precision of movement are essential for sports.

The physical fitness is the sum of five motor abilities namely strength, speed, endurance, flexibility and co-ordinative abilities. This motor abilities and their complex force are basic prerequisites for human motor actions. Therefore, the sports performance in all sports depends to a great extent on these abilities.

Physical fitness is the ability to carry out everyday task with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure time pursuit and to meet unforeseen emergencies (Robert Hockey, 1993). Physical fitness is the ability to perform vigorous physical activity assessed in terms of muscle strength, endurance and flexibility. The circulatory and respiratory systems are also involved because of their role in supplying muscles with blood and oxygen. It can be maintained through regular exercise. In considering muscles, strength is the maximum force that can be exerted by a muscle, and endurance is the ability to perform a muscular activity at less than maximum force. The body will adapt to a regular exercise program by improving the function of the cardiac and respiratory systems. The blood will have a greater capacity to carry oxygen, which in turn will improve the body’s ability to work. The heart and respiratory system will be more efficient during rest and exercise, and the resting heart rate usually reduced. An individual
participating in a regular exercise programme will notice the effects on the skeletal, muscular and nervous systems. The body will show improved flexibility of the joints along with greater muscle strength and muscle endurance. Regular physical activity will help to reduce the risk of heart attack and lower blood triglyceride (fat) and cholesterol levels. The effectiveness of exercise depends on the demand on organs and body systems. Moderations of intensity, duration, and frequency are taken into consideration prior to the exercise (Thomson Gale, 2005).

Physical fitness is to maximize an individual's health, strength, endurance and skill related to age, sex, body strength, structure and physiology. These ends can only be realized through conscientious regulation of exercise, rest and diet. Exercise should be regular and restful than that they extend any fixed number of hours. A properly balanced diet in proteins, carbohydrates, vitamins, and minerals are essential. Although sports are related physical fitness, care must be taken that injuries do not occur (Whorton, 1982). Now-a-days hockey has become a very fast game. So it requires great deal of physical fitness.

1.3.1.1 Speed

Speed is an ability to perform rapidly successive movements over a short period of time in a single direction. Speed is used to develop the co-ordination of muscle contraction in the climate of endurance. Once the level of endurance and strength has been improved, players are able to work on speed with greater effect. The type of speed required varies according to the demands of the player's position. Speed can be looked at as a number of components in hockey namely speed with the ball, speed without the ball, speed on the turn to recover and speed of reaction, (Monika Arora, 2005).
1.3.1.2 Strength

Strength is the ability to exert a force against a resistance. It is a product of voluntary muscular contractions caused by neuromuscular system. Strength is needed in all kinds of work and physical activity. Muscles that are strong result in better protection of body joints and fewer sprains, strains and other muscular difficulties. Furthermore muscle strength helps in maintaining proper posture and provides greater endurance power. The best athletes pay particular attention to develop strength in various muscle groups.

Strength is also a vital factor for the players to play good hockey. Strength is required for acceleration, speed and quick change in direction. Upper body strength allows players to shoot more powerfully and pass over a greater range of distances (Boyle, 1994). Right and left hand grip strength is an important strength variable which is included in this study.

1.3.1.3 Agility

Sheppard and Young (2006) proposed a new definition of agility “A rapid whole body movement with change of velocity or direction in response to a stimulus”.

Agility is the ability to change the direction of the body in an efficient and effective manner. To achieve agility, one requires a combination of several athletic traits including reaction time, speed of movement, strength, balance and coordination. Agility is both general and specific. It is demonstrated in such movement as dodging zigzag running and changing body position quickly. In hockey we use agility in the form of dodging to change the body directions quickly, while maintaining strong control over the ball. The dodge precedes the deception of the
opponent either with ball, stick or body fakes. The defender repeatedly tackles the opponent to capture the ball on the downward is also an example for agility.

1.3.1.4 Muscular Strength

Muscular Strength is the ability of a muscle or group of muscles to generate force in a single maximal effort. It is a measure of how much force muscles can exert. Muscular strength is determined by fast twitch fibers which focus more on quick bursts of energy rather than long, drawn out ones. Muscles grow in and quality in relation to general growth, nutrition and amount of exercise. Physiologically the muscle will increase in strength only if it is called upon to increase its load beyond what is ordinarily required of it. The strength and power is essential for high performance. It also keeps the body in proper alignment, stability and balance, which enhances a player's ability to tolerate the day to day pounding that comes with participating in the game of hockey.

1.3.1.5 Muscular Endurance

Ability of a muscle group to contract over a extended time against moderate resistance. Muscular endurance is determined by how well your slow twitch muscle fibers are developed. Slow twitch muscle fibers can sustain an effort over a much greater period of time. Muscular endurance is very important for sports and who have to sustain an activity for long period of time like hockey. It is very important for every day life activities and operates with muscular endurance as well as help an individual cope with every day stress.

The ability of a muscle to repeat identical movements or pressure or to maintain a certain degree of tension over a period of time (Barry Johnson and Jack
Muscular endurance may be defined as the opposite of muscular fatigue. It is the ability or capacity of muscle group to perform repeated contractions against a load or to sustain a contraction for an extended period of time (Fox et al., 1989).

1.3.1.6 Cardiorespiratory endurance

Cardiorespiratory endurance is the ability of the circulatory and respiratory system to efficiently adjust and recover during exercise. It is also defined as functional efficiency of the heart and lungs. The functional efficiency is the success of the heart, blood vessels and lungs in satisfying the oxygen requirements of the body. Exercise to the large muscles of the trunk and legs are the most effective way to develop it. A high level of cardiorespiratory endurance permits continuous physical activity without a decline in performance and allows for rapid recovery following fatiguing physical activity. In the game of hockey the cardiorespiratory endurance helps the player to run up and down in the field for the full duration of the game.

1.3.1.7 Flexibility

Flexibility is the ability to move joints and use muscles through their full range of motion. Protagonist muscles are the cause for movement of muscles and the antagonistic muscles are the ones that help muscles in opposing the movement. The training helps to improve the range of stretch of the antagonistic muscles.

There are various techniques of stretching grouped as static, ballistic and assisted. In static and ballistic the athlete is in control of the movements. In assisted movement he is controlled by an external force. Flexibility plays an important role in the preparation of athletes by developing range movements to allow technical
development an assisting in the prevention of injury (Harre and Dietrich, 1982). In the
game of hockey flexibility helps to stretch the muscles and increase the bending,
reaching, twisting and turning to tackle and beat the opponent in efficient manner.

1.3.1.8 Co-ordinative abilities

Co-ordinative abilities are dependent on the motor control and regulation
process of central nervous system. The theory of motor co-ordination therefore is the
basis for understanding the nature of co-ordinative ability (Blume 1978, Meinel and
Schnabel, 1987). For each co-ordinative ability, the motor control and regulation
process function in a definite manner. When a particular aspect of these functions is
improved then the sports man is in a better position to do a certain group of
movements which for their execution depends on this type of central nervous systems
functioning pattern.

Co-ordinative abilities have also important and strong links with the motor
skills as motor co-ordination forms the basis of both. Co-ordinative abilities become
effective in movements only through the motor abilities and activity determined
drives and cognitive processes (Hirtz, 1985).

Co-ordinative abilities should not be equated with motor skills, though both
are interrelated and interdependent. Both are determined by the motor co-ordination
process. The difference lies in the degree of generality of the co-ordinative processes.
In a motor skill, processes are largely automatized for the execution of a particular
movement. In co-ordinative abilities these processes are just stabilized and perfected
for the execution of a wide number of movements, however as a positive effect on the
co-ordinative abilities.
Hockey is a technical game which consists of beautiful and graceful movements. These movements are a product of well developed technical skills and co-ordinative abilities. The learning of skill and its stability is directly dependent on the level of various co-ordinative abilities. It is also needed for maximal utilization of conditional abilities technical skills and tactical skills.

1.4 PHYSIOLOGICAL VARIABLES

Physiology is the study of how exercise alters the structure and function of the human body and identification of physiological mechanisms underlying physical activity, the comprehensive delivery of treatment services concerned with the analysis, improvement, and maintenance of health and fitness, rehabilitation of heart disease and other chronic diseases and/or disabilities, and the professional guidance and counsel of athletes and others interested in athletics, sports training, and human adaptability to acute and chronic exercise" (http://asep.org).

Physiological fitness includes non-performance components of physical fitness that relate to biological systems that are influenced by one's level of habitual physical activity. Some of the sub-components of physiological fitness that have gained acceptance. The sub-components are metabolic fitness, morphological fitness, and bone integrity (Bouchard et al., 1990).

For specific physiological systems of the body to be fit they must function well enough to support the particular game. The demands upon the organism is different for various games with respect on neurological respiratory, circulatory and temperature regulating functions. The physiological fitness is specific to the activity.

Physiological systems are highly adaptable to exercise. The response of each system is discrete. Hard work in the heat is necessary to improve the fitness of the
temperature regulation mechanism. Each task has its major physiological components 
and fitness for the task requires effective functioning of appropriate systems. 
Knowledge about the human organism and how it develops, adjusts, adopts and modifies due to various stresses is of paramount importance in the activity.

1.4.1 MAXIMAL OXYGEN CONSUMPTION

Maximal oxygen consumption (Vo2max) is the maximum capacity to transport and utilize oxygen during incremental exercise (Bouchard Claude, 2007). Vo2 is the maximum volume of oxygen that by the body can consume during intense, whole body exercise. Vo2 max is important to explain the contributing or accepting role of muscle oxidative capacity. Every cell consumes oxygen in order to convert food energy to usable ATP for cellular work. However the muscle cell has greatest range in oxygen consumption. The muscle cells that are contracting have high demands for ATP. So it follows that they will consume more oxygen during exercise (Stephen Seiler, 1996). Traditionally the magnitude of an individual Vo2max has been viewed one of the most important predictors of endurance. The ability of the cardiorespiratory system to transport oxygen to the exercising muscles refers to the central component of Vo2max (Roberts and Rogers, 1997).

1.5 SKILL PERFORMANCE

Skills play an increasingly vital role in the quest for victory of any game especially hockey. Players of the teams of national and international repute to perfect their skills and change them into a highly refined and sophisticated art. They constantly keep abreast of the developments in the field of hockey and work towards better performance. There are a number of skills involved in the game of hockey like
dribbling, hitting, scooping, passing and tackling which play a vital role in the success of modern hockey. Skill sets have their own importance and applications to different situations. The motor abilities could well be used with the attainment of perfection in skills. Thus the total performance in the game is based on the perfection of these skills and execution of them successfully.

1.6 FUNDAMENTAL SKILLS OF HOCKEY

The major fundamental skills are dribbling, passing and shooting.

1.6.1 Dribbling

Dribbling is one of the basic and vital skill in hockey. By keeping the ball under control while running, without looking the ball is called as dribbling (Ian Taylor and David Vear, 1988). By doing it one can move to open area with the ball and create the space and produce problem for opponents. There are two types of dribble one is English dribble and the other one is Indian dribble.

1.6.2 Passing

Passing is displacement of ball accurately and powerfully to team mates. In team games, the ability of the players to link together and to maintain possession of the ball is largely dependent upon effective passing which ultimately leads a team to success (Denis Glencross, 1985). The importance of pass is to keep the possession of the ball, and to gain the ground to initiate an effective attack. One must learn to pass the ball in any direction. It is also very useful to learn how to disguise where one intend the pass to go (Norman Huges, 1990). There are different shots to make a pass like push, hit, overhead and flick.
1.6.2 Shooting

It is one of the most fascinating offensive skill. The objective of offense is accurate shooting to pass the ball through the goal post defended by the opponent. According to Norman Huges (1990) shooting goal is a specialized skill which needs constant practice.

1.7 TECHNIQUES

Technique is defined as the motor procedure for tackling a motor task. Motor procedure should be understood as a system of movements of body parts in a defined sequence. The motor procedure or technique is always task or goal oriented. In different sports, sportsmen have to tackle different types of motor tasks. Therefore different motor procedures or techniques are required in different sports. The model of technique is presented in verbal, mechanical, physical and mathematical form. The most common form of presenting the technique is verbal and physical. Sports performances are possible only through sports motor actions or movements. The performance of a sports person is significantly affected by the skill with which these actions or movements are executed by him. The acquisition of sports technical skills therefore is an important aim of sports training. In all sports one or more skills have to be acquired by doing technical training. The role of technical skills in different sports however is different. In sports one or two simple movements have to be learned. The role of technical skills increases manifold in team games like field hockey. The technical skills serve as basic elements of tactical actions which are indispensable for good performance.
1.8 TACTICS

Tactics is the art of competing. Nature and types of tactical tasks are determined by the nature of competition. In short, tactics may aim at regulation of motor actions or at regulation of movement execution. The tactical efficiency consists of three elements. They are knowledge of competition rules, possibilities of exploiting various internal and external factors for achieving best possible results, tactical abilities and skills. Tactical efficiency is important in all sports. It is of paramount importance in team games.

The basic tactics in hockey is to outnumber the opponent in a particular area of the field at a moment in time. When in possession of the ball, this temporary numerical superiority can be used to pass the ball around opponents so that they cannot effect a tackle because they cannot get within playing reach of the ball and to further use this numerical advantage to gain time and create clear space for making scoring shots on the opponent's goal. When not in possession of the ball numerical superiority is used to isolate and channel an opponent in possession and 'mark out' any passing options so that an interception or a tackle may be made to gain possession. In recent years, the penalty corner has gained importance as a goal scoring opportunity, particularly with the technical development of the drag flick. Tactics at penalty corners to set up time for a shot with a drag flick or a hit shot at the goal involve various complex plays, including multiple passes before a deflection towards the goal is made, but the most common method of shooting is the direct flick or hit at the goal.
1.9 NUTRITION

Nutrition fuels the body for daily living and peak performance. One who refines their nutrient intake, the potential for peak performance is in most cases heightened (Kurt Krueger, 1998).

Food supplies the energy for every action and also provides material that our body needs to build up and repair its tissues and to regulate the functions of its organs and systems. To keep our body cells running properly, they must be supplied with correct amount food having required chemicals in ratio of the food. The chemicals in food, which our body needs, are called nutrients. The various kinds of food supply different quantities of energy. The energy value of food is measured in heat units called calories or kilo calories. Calorie is the unit of heat used to express the energy value of food. A day to day intake of food is extremely essential for training (Swaminathan, 1977).

The balanced diet is the intake of appropriate types and adequate amount of food and drinks to supply nutrition and energy for the maintenance of body cells, tissues and organs and to support normal growth and development (Swaminathan, 1977). A perfect food is one which contains all constituents like carbohydrates, proteins, fats, vitamins and minerals in such quantity and proportion that daily needs of the body are fulfilled and a small provision for extra nutrition is provided.

1.10 PSYCHOLOGY

Psychology is another factor that influences a player’s performance. Mental fitness is as important as physical fitness in the case of the individual and the team. The amount of training could help a team achieve consistent success unless their attitude was also psychologically right (Ian Taylor and David Vear, 1998).
Motivation is an internal energy force that determines all aspects of our behaviors. It has its impact on how we think, feel and interact with others. In sport, high motivation is widely accepted as an essential prerequisite in getting athletes to fulfill their potential. Motivation is a dynamic and multifaceted phenomenon. It can be manipulated, to some degree in the pursuit of superior sporting performance. (Deci and Ryan, 1985)

The following factors also play an important role in the player’s performance.

- Pressure of winning and loosing should be minimized by practicing game situation load mentally by them.

- Not to get irritated by the decision of umpire, dirty play of the opponent to irritate you and not to get irritated by fellow players.

- Negative thought in mind must be minimized and public criticism or appreciation should not have an over powering effect on you.

- Emotions have to be controlled to give your best. Your aim to perform best should not be disturbed by any of personal problems that may lead to bad performance. You have to control your personal habits in dieting, testing and recovery as per your requirement.

- Appreciate the fellow players and do not demoralize any one. Try to cover up mistakes of fellow players and play as a team.
• Positive thoughts like "I will score goal", "I can do it", "It is my team", and is more important, than all of us. "I must give my best effort", must be practiced.

• Experience is learning from past and other mistakes. Experienced players should always think of not repeating mistakes once committed.

1.11 SPORTS TRAINING

Sports training is to improve the health and physical condition, to achieve a sporting ambition, to relieve the tension and stress of daily life, to loose weight and to make them feel good. Participating in sports encourages co-operation in team sports. It develops the element of competitiveness and provides a physical challenge and opportunity to meet new people and make new friends.

Sports training have existed since time immemorial. The Egyptian, Greek, Roman, Chinese, Indians and other ancient civilizations used special methods of physical preparation for training soldiers and sports men.

The sports training have gained tremendous popularity all over the world. The popularity is still increasing at a faster pace and this happy trend is likely to continue in the future also. In the history of modern Olympics the number of sports, sports men, sports women and participating countries have also increased steadily. The major contributions on sports training came mainly from German democratic republic, USSR and USA.

Sports training develop a kind of scientific discipline in sports person. It is the over all scientific and systematic channel of preparation of sports persons for the highest level of sports performance. The sports performance, as any other type of human performance is the product of total personality of the sports person. Sports
training are a systematic process extending over a long period. For best results the system of training has to be based and conducted on scientific facts, where it is not possible to do that, the training has to be based on the results of successful practice.

Sports training mainly aims to improve and maintain the physical fitness and acquisition of technical skills. Sports training is not a mere physical activity involving physical movements. It is always performance oriented as it targeted to achieving high performance in competitions. Each and every aspect of sports training leads to improving sports performance. It is to a great extent of an individual matter.

The sports training are to develop the capacities and capabilities of sports person besides exploitation of his potentials and their performance limits. Hidden potentials are trapped through training. Through sports training sports person scales new heights of his own performance and sets a higher target. To realize the maximum benefit the players are to be very disciplined, dutiful and committed to all aspects of training. The training is fully managed through daily training session.

According to Harre (1982) sports training is a process of athletic improvement, which is conducted on the basis of scientific principles through which systematic development of mental and physical efficiency, capacity and motivation enables athletes to produce outstanding and record breaking athletic performances. According to Hardyal Singh (1993) sports training is a pedagogical process, based on scientific principles, aiming at preparing sports man for higher performances in sports competitions. Harre (1986) sports training, based on scientific knowledge, is a pedagogical process of sports perfection which through systematic effect on psycho-physical performance ability and performance readiness aim at leading the sports man to high, higher and the highest performance. Through active and conscious interaction
with the given demands in sports training, the sportsman’s personality develops according to the norms and standards of socialist society.

Sports training are the basic form of an athlete’s training. It is the preparation systematically organized with the help of exercises, which in fact is a pedagogically organized process of controlling an athlete’s development (Matwejew, 1981). Sports training are a planned and controlled process in which, for achieving a goal changes in complex sports motor performance, ability to act and behavior are made through measures of content, methods and organization (Martin, 1979).

It is a pedagogical process based on scientific principles, aiming at preparing sportsmen for higher performance in sports competitions, (Hardyal Singh, 1993). Sports training are a planned and controlled process in which, for achieving a goal, change in complex sports motor performance, ability to act and behavior are made through measure of content, methods and organization (Martin, 1979).

Sports training are a process of athletic improvement which is conducted on the basis of scientific principles through which systematic development of mental and physical efficiently. Capacity and motivation enable athletes to produce outstanding and record breaking athletic performances. In the broad sense sports training is the entire systematic process of the preparation of athletes for the highest levels of athletic performance. It comprises all those learning influences and process, including self tuition by the athletic, which are aimed to improving performance.

1.11.1 Personality development

One of the main objectives of sports training is the all round development of personality of the sports person. The good personality counts a lot in sports competition and attainment of highest possible performance. Various personality traits
such as drive assertion, drive determination, self confidence, leadership, emotional maturity, trainability, conscience and mental toughness can be developed through sports training.

1.11.2 Physical fitness development

Physical fitness consists of strength, speed, endurance, flexibility and other co-ordinative abilities. These abilities are essential prerequisites of high sports performance. Sports training should be concentrated mainly on the development of the kind of fitness that is needed for the specific sports event or game concerned. The development of desired level of fitness and its components takes several year of systematic training. This needs the use of different types of physical exercises and various types of training methods for sports persons in sports training programme.

1.11.3 Skill development

Another vital objective of sports training is the development of skills in a particular sports in which sports person intend to perform. Good skill helps the sports person to make economical and optimum use of his physical abilities. The sports person learns the skill and gets a mastery over it under the conditions specific to their sport. As the sports person develops the level of physical fitness they must keep improving the standard of their skill. Thus these two aspects of sports training i.e. development of physical fitness and skill should go hand in hand.

1.11.4 Tactical development

The importance of tactics is gradually increasing due to neck to neck competition at national and international levels. Thus it is a very important aspect of
any sports training programme particularly at higher level to include tactical training programme, because the sports person must acquire those skills and abilities that will enable to win in the sports.

### 1.11.5 Mental training

In the hi-tech competitions higher demands are put on the mental faculties of sports persons. They are under tremendous stress and pressure, both internal and external. The sports persons must think and act for themselves during sports training and also in competitions, to perform better. This is an important objective of sports training to develop and train the sports person’s intellectual faculties and improve their knowledge of sports training and learn its application in a unique way in training and competitions.

### 1.12 PERIODISATION

Periodisation is very important for a sportsman. It is the systematic formulation of the training process in a training cycle for the purpose of achieving top form in the main competition. Periodisation involves control of load dynamic, continuity, means and methods of training, in order to achieve top form at the right time. Development, maintenance and control of top form are the main aims of periodisation. Bowers and Fox (1979) had divided the year round training programmes of athletes into three phases namely preseason, inseason and offseason. Preseason training phases is the period of eight to ten weeks prior to competition in which training programmes are designed to increase a maximum capacity of the energy system that are predominant when performing a specific event. Inseason training phase is the period where the athlete achieves top form and maintains it as
long as required. Offseason phase of the training programs are usually non-specific. This season is relatively shorter than other seasons and aims at complete physical and physiological recovery.

1.13 PRESEASON TRAINING

The purpose for preseason training is to prepare the athletes for the demands of the upcoming season. It is to get the athlete in the best shape possible to cope with the rigorous practice and game schedule that will follow (Glenn Harris, 2009).

Preseason programme is one that incorporates all of the necessary components to enable players to maximize their performance as soon as the season commences and be able to sustain peak physical condition throughout the season. These fitness components often vary with the individual player, the positional role in the team and the team’s style of play. Other considerations include the physical demands of the game the current level of fitness of a particular player and what the team is striving to achieve. To meet these requirements a well designed preseason programme that address the specific demands of each player is the much needed one. So, it is worth considering physical and physiological tests at the start of preseason schedule to see how the players are doing, and to evaluate their preparation plans. These tests give information on the levels of endurance, speed, muscular endurance, strength, co-ordination, technical, and tactical elements during the preparation period. A preseason preparation period covers the period from the beginning of training until the match. The length of these training periods may differ. During this training period, physical conditioning should be concentrated mainly of games and exercise with a ball. The frequency and number of training sessions should be increased gradually as the season approaches (Owen Anderson, 2008).
The intensity of all aspects of preseason training makes the inclusion of a well-planned and integrated stretching and flexibility programme most important. In this period it is common for the athlete to be subjected to the stress of activity in addition to that provided in the weight room. A musculoskeletal system that is flexible to these diverse physical requirements (Owen Anderson, 2008). Preseason is a much more scientific approach needed, which combines energy system training with skill development (Jim Petruzzi, 2008).

Preseasons are a lot easier now but they are harder in past. All I can remember players did not see a ball for four to five days. As soon as reported for training it was straight into running morning and evening. I think if you asked a lot of older players, they would say that’s exactly what it was like. The difference now-a-days is that you see the ball right away, the first day. Yes, we still do running but it’s not so intense, pounding the roads for a couple of hours. It’s a hell of a lot different (Kevin Philips, 2006).

According to Patryneal (1969) the preseason training is the time to perfect skills. Work on fundamentals, ponder strategy and to strive for high level of conditioning with emphasis on strengthening the muscles involves in the sport and improving the players. Endurance training should lead to a gradual improvement in physical fitness with the peak being reached during the season.

The preseason training as highly important as it includes programmes of fitness training which improves the aerobic power and endurance capacities of players (Thomas Reily, 1990). The aim of the preseason or preparatory period is to create a base for better performance in the competition period. This period is characterized by a sharp increase of volume of load as compared to the intensity of the load. The preseason period, can be divided into three phases having different aims and contents.
Adapting these small sided games to meet the physiological demands of hockey is important. Hockey is played by two teams of 11 players performing in an area of 91.40m × 55m. However during training it is common on practice to reduce both the number of players on the field and the size of the field, which has the effect of increasing the proportion of anaerobic/explosive work required. These small sided games are one of the most common drills used in hockey training. Small sided games were mainly used to develop the technical ability of the players, they are how used an effective tool to improve physiological aspects of the game.

1.13.1 Preparatory period

According to Berger and Minnow (1987) its duration should be not 2/3 to 3/4 of the total duration of the training cycle. The main aim of the preparatory period is to develop the various factors on which the performance depends. It prepares the sports men for achieving top form at a high level in the competition period. The training period is characterized by high volume but medium intensity. Preparatory period is normally divided into two (or) three phases depending upon its total duration. Each phases had definite aims and tasks.

1.13.2 Phase I

This phase is characterized by sharply increasing training volume whether there is very less increase in training intensity. General exercises are used predominantly.

Technical training is mainly restricted to learning of new skills or the skills of other sports. Relearning if needed is also started in this phase. The aim of technique training is not automatisation but skill acquisition up to the level of fine co-ordination.
Tactical training is mainly limited to theoretical sessions to improve tactical knowledge and improvement of psychic and mental qualities/factors needed for quick and accurate observation, perception, and mental solution of tactical situations and tasks.

1.13.3 Phase II

In this phase, high training volume and load is used to develop the factors needed for the performance. Special exercise and high value of general exercise are also used. Conditioning aims at the development of special motor abilities. Technique training is limited to learning and performance of the technique of sport. Tactical training is not an important task.

1.13.4 Phase III

It aims to prepare the sports man for the competition through special exercises and integrating the important factors to achieve the performance level. The third phase is characterized by sharp decrease in training volume on one hand and sharp increase in the training intensity on the other. The volume of tactical training improves all tactics under competition conditions.

1.13.5 Circuit training

This training was developed by Re. Morgan and G.T Adamson in 1954 at the University of Leads, England. This type of conditioning involves almost all the training factors. It can be designed to develop strength, power, muscular endurance, speed, agility, neuromuscular co-ordination, flexibility and cardiorespiratory endurance.

Circuit training is a formal type of training in which an athlete goes through a series of selected exercises that are performed in a sequence or in a circuit. There are
usually six to ten stations in a circuit. The athlete performs a specific exercise at each station and then goes to next station. The idea is to progress through the circuit as rapidly as possible, attempting to improve either by decreasing the total time it takes to complete the circuit or by increasing the amount of work done at each station, or both. The stations are distributed throughout the area unmarked to circuit training. The greater the distance between stations, the greater the degree of cardiovascular conditioning as the individual runs from one station to the next.

Circuit training is an excellent way to simultaneously improve mobility and build strength and stamina. This training format utilizes a group of 6 to 10 exercises that are completed one after another. Each exercise is performed for a specified number of repetitions or for a given time period before moving on to the next exercise. The exercise within each circuit is separated by brief, timed rest intervals each circuit is divided by a longer rest period. The total circuit performance during a training session may differ depending on player’s training level, period of training and training objective.

1.13.6 Interval training

Waldemar Gerschler a professor at the University of Freiburg in Germany and his athletes worked closely with Dr. Hans Reindell, a physiologist and developed this method.

Gerschler’s great contribution was his understanding of the importance of cardiovascular conditioning and his devising a training scheme that maximize that strong legs alone do not make a great runner. He sought a system that would increase the heart’s stroke volume, and hence its ability to deliver blood and oxygen to the legs.

The name of the system comes from the “interval”, or rest period, between fast runs. Gerschler and Reindell considered this the most important part of the work out, and
then controlled it carefully. Believing that the heart adapted and grew stronger during the interval, they would not allow runners to begin the next repeat until their pulse rate had returned to 120 beats per minute. If this did not occur within 90 seconds of the end of the previous repeat, the workout was too difficult and hard to the adjust. Otherwise the heart would be over worked leading to fatigue and exhaustion, rather than to the desired training effect. Interval training involves alternating short bursts of intense activity with what is called active recovery, which is typically a less intense form of the original activity.

There are three types of interval training all of which require the runner to run at above race pace for a given time or distance. The first type is suited bursts of speed during continuous running. The runner increases from a slower pace up to race pace for a fixed distance of time. After the time or distance has been reached, the runner slows back to the previous training pace. These bouts are repeated at regular intervals through out the run. The second type of interval, repeats, are simply repeated runs at or above race pace for a given distance or time. These intervals vary in distances and speed and may even include hill work. The third type of interval, formal intervals, is run on the track at a given distance with a specific goal time.

Interval training utilizes the body's two energy producing systems the aerobic and anaerobic. The aerobic system is the one that allows you to walk or run for several miles that uses oxygen to convert carbohydrates from various sources through out the body into energy. The anaerobic system, on the other hand draws energy from carbohydrate stored in the muscles for short bursts of activity such as sprinting, jumping or lifting heavy objects. This system does not require oxygen. Nor does it provide enough energy for more than the briefest of activities and it's by product, lactic acid is responsible for the ache.
1.13.7 *Fartlek training*

Fartlek is a Swedish term which means "speed play" combines continues and interval training. It is a form of road running or cross country running in which the runner usually changes the pace significantly during the run. It is usually regarded as an advanced training technique, for the experienced runner who has been using interval training to develop speed and to raise the aerobic threshold. However an average runner can also benefit from a simplified form of fartlek training to develop self awareness and introduce variety into the training programme.

Fartlek is similar to interval training and that short, fast runs alternate with slow running or jogging in recovery intervals. However in fartlek the running is done on the road or a parkland or bush tracks. There is an predetermine schedule to follow, but instead the athlete will set his own interval lengths, pace and response to their own feeling of the workload. An advantage of fartlek is that the athlete can concentrate and feel the pace and their physical response to it, there by developing self awareness. Also the athlete is free to experiment with pace and endurance, and to experience changes of pace.

In the team games training session should not just use running, but also jogging and walking to fit in with demands of the game. No hockey player runs for the whole 70 minutes of the match. The pace is varied similarly the direction of work should not always be straight ahead. This may be important for the runner who has to cover the ground as quickly as possible in one direction, but the hockey player has to go forward, backward and side to side. This must all be taken into account if the training session is going to copy accurately the pattern experience in a match and training is to be better to the game.
1.13.8 **Weight training**

Weight training is doing exercise using resistance to build muscle strength and endurance. In weight training one can use equipments or simply his own body weight as resistance. Various equipments have been used in weight training. With proper technique most of the muscles in the body can be strengthened during the training. Before the weight training, the warming up is essential to strengthen the muscles. Always begin with light weight and work towards higher weights cool down and stretch the muscles after the training. If heavy weights are used the 48 hrs rest between two workout sessions to give adequate rest to the building muscle.

Better performance can be the product of a number of factors. This product is primarily the out come of efficient technique the progression of speed and the growing competitive attitude on a sound basis of general endurance, all round strength and general mobility. The development of all round strength is best achieved via circuit training and then progressing this through strength training. Weight training is the most widely used and popular method of increase strength. The exercise must be specific to the type of strength required and is therefore related to the particular demands of the event. Exercise should be identified that will produce the desired development.

Although specificity is important. It is necessary in every schedule to include exercise of a general nature. These general exercises give a balanced development, and provide a strong base upon which highly specific exercise can be built. The amount of weight to be used should be based on a percentage of the maximum amount of weight that can be lifted one time, generally referred to as one repetition maximum(1 RM). The maximum number of repetitions performed before fatigue prohibits the completion of an additional repetition is a function of the weight used, referred to as repetition maximum (RM) and reflects the intensity of the exercise. A weight load that produces fatigue on the
third repetition is termed as three repetition maximum (3 RM) and corresponds to approximately 85% of the weight that could be lifted for 1 RM.

1.13.9 Plyometric training

The ability to generate strength and power is a very important component for success in many sports, particularly in those involving explosive movements. Many type of jumping exercises can be used in plyometric training. To be most effective, the training should contain exercise that match the pattern of movements of the sport.

Speed and strength are integral components of fitness found in varying degrees in virtually sporting movements. The combination of speed and strength is power. The term is used to describe the method of training which seeks to enhance the explosive reaction of the individual through powerful muscular contractions as a result of rapid eccentric contractions. A thorough warm-up is essential prior to plyometric training. Attention should be given to jogging, stretching, striding and general.

1.14 THE PRESENT STUDY

The present study has been done keeping in view the fact to encourage more number of studies in this direction. As far as hockey is concerned, even though it is our national game, a study on training method carried out is limited or less. The scholar has evolved a method to have a study on the impact of preseason training. The training sessions were organized to find out the real impact of them on the players. As the scholar found this study quite useful for those who pursue research in the same line, a well designed analysis method was alone used. This study has its focus on the impact of preseason training and the impact of this on the skill and performance of the player. The researcher felt that a well planned and regulated training regimen only can
bring the player to his peak performance level. This can also help in developing physical and physiological conditions of the players. Hence the investigator has attempted to frame a systematized preseason training programme for training the hockey players. The training methods and the load pattern are aimed at improving the selected physical fitness, physiological and skill demands of intercollegiate hockey players.

1.15 STATEMENT OF THE PROBLEM

The purpose of the study was to determine the effects of regimen of preseason training programme on the development of selected physical fitness, physiological and skill performance variables of intercollegiate hockey players.

1.16 OBJECTIVES OF THE STUDY

- To find out the effect of systematized training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the six weeks of training.
- To find out the effect of systematized training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the six weeks of training.
- To find out the effect of systematized training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the six weeks of training.
- To find out the effect of systematized training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength
and endurance and cardiorespiratory endurance in the further six weeks of training.

• To find out the effect of systematized training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the further six weeks of training.

• To find out the effect of systematized training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the further six weeks of training.

• To find out the effect of systematized training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the twelve weeks of training.

• To find out the effect of systematized training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the twelve weeks of training.

• To find out the effect of systematized training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the twelve weeks of training.

• To find out the effect of traditional training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the six weeks of training.

• To find out the effect of traditional training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the six weeks of training.
• To find out the effect of traditional training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the six weeks of training.

• To find out the effect of traditional training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the further six weeks of training.

• To find out the effect of traditional training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the further six weeks of training.

• To find out the effect of traditional training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the further six weeks of training.

• To find out the effect of traditional training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the twelve weeks of training.

• To find out the effect of traditional training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the twelve weeks of training.

• To find out the effect of traditional training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the twelve weeks of training.
• To compare the effect of systematized training with that of traditional training on selected physical fitness, physiological and skill performance variables in the six weeks of training.

• To compare the effect of systematized training with that of control group on selected physical fitness, physiological and skill performance variables in the six weeks of training.

• To compare the effect of traditional training with that of control group on selected physical fitness, physiological and skill performance variables in the six weeks of training.

• To compare the effect of systematized training with that of traditional training on selected physical fitness, physiological and skill performance variables in the further six weeks of training.

• To compare the effect of systematized training with control group on selected physical fitness, physiological and skill performance variables in the further six weeks of training.

• To compare the effect of traditional training with control group on selected physical fitness, physiological and skill performance variables in the further six weeks of training.

• To compare the effect of systematized training with that of traditional training on selected physical fitness, physiological and skill performance variables in the twelve weeks of training.

• To compare the effect of systematized training with control group on selected physical fitness, physiological and skill performance variables in the twelve weeks of training.
• To compare the effect of traditional training with control group on selected physical fitness, physiological and skill performance variables in the twelve weeks of training.

1.17 HYPOTHESIS

The hypothesis of the study were

• There is no significant difference in the effects of the systematized training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the six weeks of training.

• There is no significant difference in the effects of the systematized training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the six weeks of training.

• There is no significant difference in the effects of the systematized training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the six weeks of training.

• There is no significant difference in the effects of the systematized training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the further six weeks of training.

• There is no significant difference in the effects of the systematized training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the further six weeks of training.

• There is no significant difference in the effects of the systematized training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the further six weeks of training.
• There is no significant difference in the effects of the systematized training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance, cardio respiratory endurance in the twelve weeks of training.

• There is no significant difference in the effects of the systematized training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the twelve weeks of training.

• There is no significant difference in the effects of the systematized training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the twelve weeks of training.

• There is no significant difference in the effects of the traditional training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardio respiratory endurance in the six weeks of training.

• There is no significant difference in the effects of the traditional training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the six weeks of training.

• There is no significant difference in the effects of the traditional training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the six weeks of training.

• There is no significant difference in the effects of the traditional training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardio respiratory endurance in the further six weeks of training.
There is no significant difference in the effects of the traditional training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the further six weeks of training.

There is no significant difference in the effects of the traditional training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the further six weeks of training.

There is no significant difference in the effects of the traditional training on selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance, cardiorespiratory endurance in the twelve weeks of training.

There is no significant difference in the effects of the traditional training on physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the twelve weeks of training.

There is no significant difference in the effects of the traditional training on skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the twelve weeks of training.

There is no significant difference among systematized training, traditional training and control group in developing the physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the six weeks of training.

There is no significant difference among systematized training, traditional training and control group in developing the physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the six weeks of training.
• There is no significant difference among systematized training, traditional training and control group in developing the skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the six weeks of training.

• There is no significant difference among systematized training, traditional training and control group in developing the physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the further six weeks of training.

• There is no significant difference among systematized training, traditional training and control group in developing the physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the further six weeks of training.

• There is no significant difference among systematized training, traditional training and control group in developing the skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the further six weeks of training.

• There is no significant difference among systematized training, traditional training and control group in developing the physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and endurance and cardiorespiratory endurance in the twelve weeks of training.

• There is no significant difference among systematized training, traditional training and control group in developing the physiological variables of resting pulse rate, maximal oxygen consumption and breath holding capacity in the twelve weeks of training.
There is no significant difference among systematized training, traditional training and control group in developing the skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability in the twelve weeks of training.

1.18 SIGNIFICANCE OF THE STUDY

The present study is significant in the following aspects:

- The findings of the study would reveal the training adaptation associated with systematized training, traditional training with regards to the development of the performance of intercollegiate hockey players.
- This study would help to provide a scientific base and guidance to the physical educationist, coaches, sports scientists, physiologists and fitness leaders to develop the physical, physiological and skill performance variables of intercollegiate hockey players.
- This study would help to evolve comprehensive preseason training programme for enhancing the performance of intercollegiate level hockey players.
- Findings of this study would give basic knowledge to the exercise physiologists and coaches to envisage and conduct further research in various training methods, training programmes, training intensity and training load to get necessary recovery and minimize the possibility of experiencing the exhaustion phase.
• The results of this study would add to the quantum of knowledge in the areas of training methods, exercise physiology, sports physiology and fitness.

• The study may guide the hockey players to follow a suitable scientific training programme which will develop their athletic ability, techniques and tactics, increase confidence, reduce injuries and improve their performance.

• The findings of this study will provide detailed insight on systematized training, traditional training that benefit any common person who seek to enhance his (or) her physical fitness in a very short duration.

• Recovery from fatigue and injury being an inbuilt factor in this study contributes to its significance and also proves to be a strategy to be implemented among our sports persons to compete and rise international standards.

1.19 DELIMITATIONS

The present study was delimited in the following aspects.

• This study was delimited to 45 male hockey players of the Vidyasagar College of Arts and Science, Udumalpet, and Dr. Mahalingam College of Engineering and Technology, Pollachi, Coimbatore District, Tamilnadu.

• The age of the selected intercollegiate hockey players ranged from 18-25 years.

• The duration of the training was delimited to 12 weeks

• The present study was delimited to the selected physical fitness variables of speed, agility, right and left hand grip strength, muscular strength and
endurance and cardiorespiratory endurance, physiological variables of resting pulse rate, maximal oxygen consumption, breath holding capacity and skill performance variables of dribbling ability, ball controlling ability, shooting ability and general playing ability. The data was collected baseline and after six weeks and twelve weeks of training.

1.20 LIMITATIONS

The following were the limitations of the present study:

- Certain factors like life style, daily routine work, diet and other factors which may have an effect on the results of the study, were not taken into consideration.
- No attempt has been made to control the factors like air resistance, intensity of light, atmosphere and temperature during training and testing periods.
- No special motivational techniques were used during testing. Therefore the difference that occurred in performance due to lack of motivation was recognized as a limitation of the study.
- The difference in economic and educational background of students that might affect their performances was not taken into consideration.
- The skills of the subjects and their previous experience in physical activities like sports and games were not taken into consideration.
- Physical maturity which might have taken place during the study period was not taken into consideration.
1.21 OPERATIONAL DEFINITION OF TERMS

Load

The amount of weight assigned to an exercise set.

Repetition

The number of times, an exercise can be performed.

Set

A group of repetitions sequentially performed before the athlete stops to rest.

Volume

The number of repetitions multiplied by the number of sets in a given time period.

Speed

Speed is an important motor ability which moves the body or a part of the body as rapidly as possible from one point to another.

Muscular Strength

Muscular strength is the maximum amount of force that can be exerted by a muscle.

Muscular strength and endurance

Muscular strength and endurance refers to the ability of a muscle or a group of muscles to perform repeated contractions against a light load for an extended period of time.
Maximal oxygen consumption

The maximal amount of oxygen that can be consumed per minute during the maximal exercise and it is abbreviated as VO2 max

Resting pulse rate

The pulse rate is the number of heart beats per minute.

Periodisation

Planned variation of training means and methods on a cyclic and periodic asis.