Chapter I

INTRODUCTION

The aim of physical training in the Indian Army is to develop physical fitness through gradual and progressive process to build up a high degree of physical and mental capabilities to withstand fatigue, hardships, pain privations and strain of the battle field.¹

The various types of training is imparted to the recruits, to develop physical toughness and mental robustness, handling of weapons, turnout, bearing and drill, camp and education training to bring them up to the required standards to achieve the aim of the Recruits Training.

To achieve the desired aim, physical training is the first, foremost and most important contributory factor in learning the remaining activities to become an efficient soldier. Though, much historical literature on physical training in the Indian army is not available but it has been found that the physical training was existing even as back as 480 BC and it was used all over the world to develop physical fitness for survival in the

¹Infantry Recruits Training Pamphlet(Delhi:General Staff Branch, Army Headquarters, 1987),p.5.
capacity of protection against enemies. A set of combative activities, strength and endurance, offensive and defensive art of training had been preached and practiced from the time immemorial to prepare the youth for the defence of the country.

Greeks were the first to establish National system of physical training. Later, Germany and Sweeden contributed a lot to the physical training by introducing outdoor mass gymnastics for better health and fitness of the people.

During British regime in India the system of physical training of the British army was followed till 1914. After World War-I 1914-1918, some research on physical training was carried out by the British but no authenticated reference or literature is available to this effect.\(^2\)

It had been authenticated that the programme of physical education was utilized even during World War-II to develop and improve physical condition of members of

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\(^2\)Instructional Notes (Pune: Army School of Physical Training, 1952), p.1.
the Armed forces. Outstanding leaders in athletics and physical education were selected to plan and conduct physical fitness programme for the various branches of the services, local State and National Physical Fitness offices were set up to advise and administer physical training programme for civilians. As an out-growth of these established programme, many tests of physical fitness introduced by the branches of armed forces as well as by individuals in schools and civilian programmes. Although these tests were designated as physical fitness tests referring to the common interpretation, yet in reality they were the tests of motor fitness.³

Physical training has always played a vital part in the military training and the following components of total military fitness were very essential in those days as technique, mental and emotional fitness, physical fitness, will to fight and win. The soldier must be fit (strength, stamina and agility) enough to meet the great demand made upon him.

On the battlefield a soldier's job requires him to carry heavy equipments, marching long distances and overcome many obstacles, be fit to fight for long period without proper rest and sleep. Physical training in the army prepares the recruit for war by developing all round fitness through military skills, mental robustness, character and leadership.  

To visualise the tempo of tasks, a soldier is to confront in the present and future during peace and war times, the standard of physical fitness required by the soldier is becoming higher and challenging one. The speed and intensity of the modern warfare made tremendous stresses on the discipline and physical fitness of a soldier.

During war, soldiers are assigned different types of tasks to make any battle a success. For example, fighting against the enemy in jungles where they are to run and walk miles together. In mountains, they are to walk on different terrains, scale cliffs along with mortars, light machine guns, and personal weapons with their authorised ammunition. In enemy occupied area,

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the para troopers are to negotiate jumps, vaults over natural obstacles. At high altitude the soldier has to fight both the inclement weather and the enemy as well.

In odd hours the soldiers may have to run for assault in order to hold ground or retrieve to gain tactical advantage to fight the modern war successfully to meet all the requirements of the battle field, it is very essential for the soldier to develop courage, leadership, initiative, self confidence and team spirit like qualities to make a concrete foundation of a good soldier which can be obtained only after attaining a high degree of physical fitness and mental alertness.

In the wake of mechanisation and sophisticated equipment, some of the unit commanders have the misconception that the physical fitness is not very important in the present age. Perhaps it is a misleading idea. Infact, it is only the physical fitness that helps the soldier to develop morale, courage, mental alertness, co-ordination and a high degree of accuracy in handling the latest weapons efficiently and effectively.

Besides the fitness of a soldier during war, it is equally important to maintain a high level of fitness standard in peace time too. The soldier may have to
involve himself in sports activities, like hiking, tracking, adventure activities and mountaineering etc. He can do well in competitive sports, if the physical fitness preparations have been done with the latest means on scientific basis to bring desirable changes in physical and physiological variables. Training for such programmes will contribute to develop strength, speed, endurance and other co-ordinative abilities i.e. agility, flexibility, co-ordination and balance etc. It also brings changes in resting pulse rate, blood pressure, haemoglobin and many other variables.

In order to achieve high level of performance in physiological development, all the systems of the body must function well enough to support the activity that the individual performs as per the demand with regards to circulatory, respiratory, metabolic, neurological and temperature regulating functions. Physiological fitness is specific to activity and systems are highly adaptable to exercise.5

Physical fitness is further equated as the general motor ability which has been considered as one's level of ability in wide range of activities. Motor ability is the combination of individual traits such as, strength, endurance, power, agility, balance, reaction time and co-ordination. All these traits function in a co-ordinated manner and an effective sequence to achieve an accurate and an efficient movement required in the soldier.  

Having studied the old pamphlets of 1942, it has been found that the physical training was imparted by the British, on the basis of a set of eleven pamphlets were used to cover different aspects of military physical training. The oldest publication available is of 1942 and the same revised in 1946.

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All the basic and battle physical training pamphlets numbering from one to eleven were modified and amended under the arrangements of Indian Army from time to time and one after the other. The physical training for the conditioning of recruits in the early stages of training is imparted as per the syllabus covered in Basic and Battle Physical Training Pamphlet Number 2, Recruit Training Tables and Pamphlet Number 4, Endurance Training. The pamphlet number 2, Recruit Training Tables have been revised in January, 1963, August 1964 and November 1969 the latest.  

It has been agreed and accepted that the physical and physiological condition of the newly enrolled recruits is very poor, nervous system is not properly developed, with the result his reactions are slow, due to lack of muscular strength and endurance, co-ordination of movements is poor. His cardio-vascular system is also not adapted to strenuous work and is not capable of providing energy to the working muscles as required, therefore, he can not

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undertake the tasks of strength and endurance for long duration.\(^9\)

With the advancement of the time, different research studies have proved on scientific basis, the different methods for conditioning of the body based on allied sciences i.e. physiology, psychology, methods of training, kinesiology and biomechanics etc. To improve upon the motor components and all systems of the body of a recruit, the existing system of physical training in the Army is not sufficient to attain a high degree of physical fitness due to the following reasons:\(^10\)

a) Mobility group of the Recruit Training Table does not provide them enough exercise to warm up the body, unless the body is warmed up properly, the further training (over load) may prove harmful.

b) In the Strengthening group, all the recruits of a group do exercise together but within the limited time these exercises do not provide enough load for


strengthening of all the muscle groups. Half of the time is wasted in bringing the equipment and for certain exercises one has to wait for his turn.

c) During group activity, progression of load goes down completely. Because exercises in this group are done one by one and each student waits for his turn. therefore, it is against the over load principles of training. Certain exercises in this group need technique which cannot be taught within the limited time.

d) Endurance group, 3 minutes walk and 3 minutes run is a part of the table and how for it effects the cardio-vascular endurance, cannot be ascertained.

e) In the Carriage group, more stress is given on posture improvement by standing attention. It is more appropriate to carry out such training during drill periods.

f) Endurance Training syllabus, in vogue is also not very effective for the development of cardio-vascular system. The endurance training is not based on the principle of over load and the total duration of 17 periods is just not sufficient for the development of physical fitness. Even the load of Endurance Training is
not equally distributed throughout the duration of 17 periods. As per the endurance syllabus, running one mile may not be sufficient for cardio-respiratory development and load of running 5 miles can be beyond the capacity of an individual.\[11\]

Physical training or conditioning of the body needs individualised training as per the capability and capacity of a person. The modern physical training programme was therefore, developed after reviewing the latest literature and techniques available on conditioning of the body with regard to physical and physiological fitness. Modern training was imparted on the progressive over load principle keeping in view the basic load components like, intensity, density, duration, frequency, repetition, load and recovery. All the load components were used while imparting different types of conditioning programmes for the development of endurance, strength, speed, flexibility, other co-ordinative abilities and internal systems of the body. It is also very easy for the coach or trainer to

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keep record of the given load in a session and can increase or decrease the intensity of load as per the individual capacity and requirement of the task.

The attained high degree of physical fitness will help the recruit to learn correct technique for the remaining physical activities such as forward roll, backward roll, vaulting the wooden horse, surmounting of obstacles and going over the assault course. Not only this, the achieved fitness will contribute a lot in learning drill movements, co-ordination and technique while handling of weapons which further will help them in improving the accuracy in firing and correct technique with case.

The modern programme includes different methods of training developed on scientific principles for the improvement of physical fitness of recruits. These methods are endurance training, circuit training, speed training, weight training and stretching exercises.

The exercise physiologist claim that endurance training is most important components of physical fitness like strength training. It is the ability which enables a sportsman to do sports activity effectively without getting tired and to recover quickly from fatigue during
and after the activity. Physiologists have proved that endurance training is indispensable for health and prevention of cardiac problems. In other words, the endurance training is mainly for the development of cardiovascular systems. There are different types of endurance and different methods are used for their improvement.\textsuperscript{12} In this study more stress is given for the development of basic and general endurance. Here, it is very essential for the trainer to maintain the record of load, intensity, repetitions and recovery for each subject. The load can be increased or decreased as per the requirement and capability of the subject for effectiveness.

The circuit training is a very effective and popular organisational form of performing physical exercises. These exercises mostly done for the development of strength and endurance abilities especially, strength endurance. In circuit training, there are usually 5 to 15 exercises selected carefully according to their effect on the performance capacity. The sequence of exercises is

organised in such a manner that different muscle groups are exercised in rotation. The places or stations at which the exercises done, are arranged in a circle. The person does one set of each exercise for a definite time or defined number of repetitions and then moves to the next station or place for doing the next exercise. In this manner, he does a set of each exercise till the circuit is over. This is called one round. The circuit training is more suitable for the development of basic endurance, general endurance, speed endurance, strength endurance and power endurance. Circuit training done at high intensity and with sufficient rest period, is also effective for the improvement of maximum strength.\textsuperscript{13}

Speed is the ability to execute motor actions, under given conditions in minimum possible time. Speed unlike the other two conditional abilities, strength and endurance depends much upon the nervous system and as a result it is of more complex nature and comparatively less trainable. Speed is a composition of different abilities such as reaction ability, movement speed, acceleration ability, locomotor ability and speed endurance. These different forms of speed abilities are relatively independent of each other and do not correlate with each other,

\textsuperscript{13}Ibid., p.95.
for example a sportsman having good reaction ability can be poor in acceleration ability and movement speed. Speed is an inherited ability of the individual, however, short sprint and flying start will help to improve the acceleration ability to improve speed component to a great extent.  

Participation in systematic and scientific programme of weight training contributes to develop strength which in terms improves speed and endurance. The weight training workouts develop explosive power as well as cardio-respiratory endurance and also contribute to improve performance in the games and sports in which the above motor qualities are a limiting factor. Methods of weight training have been widely employed by coaches and physical education teachers for conditioning of the body and to attain a high degree of physical fitness to achieve higher level of performance in sports. Even long distance runners and others where economy of body weight has a great importance, have found that work with weight training will improve chronically weak muscle groups and

\[14\text{Ibid., p.148.}\]
result in a better and more injury free performance.\textsuperscript{15-16}

It is very important to perform stretching exercises before and after training. During warm up, the stretching exercises be performed without being strenuous to increase the body and muscle temperature which helps to protect the muscles from tearing when more vigorous exercises are performed. It is equally important to perform stretching exercises to improve flexibility at different joints. The muscle and joint whose flexibility has to be improved, should be stretched to an optimum limit and ability of the muscle fiber to go back to the initial position must not be affected. It is very essential to do light stretching movement during warm-up and optimum stretching after the training session. Stretching exercises help to reduce muscle tension, increase range of motion, prevent muscle injuries, improve co-ordination, promote circulation and remove lactic acid from the blood more rapidly and help for quick recovery.\textsuperscript{17-18} In this experiment stretching exercises


\textsuperscript{17} Edward L. Fox, Sports Physiology (Philadelphia: W.B. Saunders Co., 1979), pp. 206-207.

were performed only after the training session.

It is an accepted fact that the traditional physical training programme in the recruits training for their physical fitness is as old as the Indian Army. Since independence, the same old system of physical training as prepared by the British for the Army is being followed. To keep pace with the advancement of time, in the modern age different methods, prepared on scientific principles with the latest techniques are available for physical training or conditioning of the body. The research scholar undertook the study to investigate the comparative effects of the traditional methods of physical training and modern physical training methods on motor components, physiological variables and anthropometric measurements of recruits in the initial stages of their training in the Indian Army.

**Statement of the Problem**

The purpose of the study was to assess the comparative effects of traditional Army training means and modern training means on selected motor components and physiological variables.

**Sub-Problem**

The secondary purpose of the study was to find out the relationship of selected physiological variables
to motor fitness components.

**Delimitations**

The study was delimited to the physical training of only those recruits who have not done any strenuous physical work prior to their enrolment in the Indian Army.

2. The training programme for the experimental group was consisted of a set of exercises for harmonious development of the recruits which included calisthenics, circuit training, endurance training, speed training, weight training and stretching exercises.

3. The study was confined to the following motor components, physiological variables and anthropometric measurements:

a) Motor Components:
   i) Strength
   ii) Power
   iii) Speed
   iv) Flexibility
   v) Agility
   vi) Dynamic Balance
b) Physiological Variables:
   i) Tidal Volume
   ii) Vital Capacity
   iii) Maximum Breathing Capacity
   iv) Resting Minute Ventilation
   v) Pulse Rate
   vi) Respiratory Rate
   vii) Haemoglobin Concentration
   viii) Cardio-Respiratory Endurance
   ix) Breath Hold
   x) Respiratory Endurance
   xi) Cardiac Assessment Factor
   xii) Speed of Movement
   xiii) Reaction Time
   xiv) Heart Rate After Exercise.

c) Anthropometric Measurements:
   i) Ponderal Index
   ii) Body Density
   iii) Fat Percentage.

**Limitations**

1. The study was carried out on recruits of the Indian Army.
2. The experiment for the study was conducted only in one of the Recruits Training Centre, The Artillary Centre, Hyderabad of the Indian Army.

3. Use of maximum field tests to evaluate the physical performance was also one of the limiting factor of the study.

4. No motivational method was used during conduct of the experiment.

5. Though the investigator tried to make maximum use of the sophisticated equipment but still due to non-availability of some of the instruments to conduct certain tests was also considered a limitation of the study.

**Hypothesis**

It was hypothesised that ten weeks physical training programme imparted by using traditional army training means and modern training means would have significant differences in their effects on the selected motor components and physiological variables.
Definitions and Explanation of Terms

Motor Components

Strength and Power

Muscular strength is defined as a force that a muscle or group of muscles can exert against resistance in one maximum effort, however for the purpose of this study strength refers to the ability of the muscle or group of muscles to overcome resistance repeatedly. On the other hand power is one's ability to get ones body mass moving in the shortest period of time. The physiologist refer to such events as anaerobic i.e. the event one performs in such a short period of time that oxygen is not required in producing the necessary energy.  

Speed

Speed is the fitness with which one is able to move his body from one point to another.  


In this study speed refers to the distance covered per unit time and speed has been measured by 50 meter dash test.

**Flexibility**

Flexibility is defined as the range of possible movement about a joint or a sequence of joints.

Flexibility refers to the ability of an individual to move the body and its parts through as wide a range of motion as possible without undue strain to the articulation and muscle attachments.\(^{21}\)

**Agility**

It is the ability of the body or parts of the body to change direction rapidly and accurately.\(^{22}\)


Agility of a person is also understood as his ability to change direction quickly and accurately while moving rapidly.

In this study agility refers to the ability of the subject to change direction (on the ground or in space) of the body rapidly and accurately through a large range of movements in minimum time.

**Dynamic Balance**

Dynamic balance has been defined as the ability of the individual to maintain his neuromuscular system in a static condition for an efficient response or to control his body in a specific efficient posture while it is moving.

Dynamic balance refers to the ability of the individual to maintain balance during vigorous movement.²³

**Physiological Variables**

**Tidal Volume**

The amount of air breathed in and out per act is constant from breath to breath and is termed as

"Total air volume." Volume of air inspired or expired per breath.

**Vital Capacity**

The sum of the inspiratory and the expiratory reserve volume is called the vital capacity. It indicates the maximum volume of air which can be breathed in or out during one stroke.

Vital capacity is the maximal volume of air that can be forcefully exhaled from the lungs following maximal inspiration.

Maximal volume of air forcefully expired after maximal inspiration.

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25 Fox and Mathews, *The Physiological Basis of Physical Education and Athletics*, p. 646.

26 Ranade; Joshi and Pradhan, *A Text Book of Practical Physiology*, p.603.


28 Fox and Mathews, *Physiological Basis of Physical Education*, p.647.
Maximum Breathing Capacity

It is the maximum volume of air that a person could breathe in or out in one minute called maximum breathing capacity. 29

Minute Ventilation

It is the volume of air that a subject inspires or expires in one minute in resting condition. The total amount of air can be determined by knowing the tidal volume and respiratory frequency. 30

Minute ventilation = tidal volume respiratory frequency.

Minute ventilation may be defined as the volume of air breathed each minute. 31

29 Ranade, Joshi and Pradhan, A Text Book of Practical Physiology, P. 603.


Resting Pulse Rate

Measurement of pulse rate when an organism is under complete physical and mental rest can be termed as resting pulse rate.

The distention of the arterial wall at the beginning of systolic ejection of blood is not confined to aorta but travels down the arteries as a wave followed by a wave of recoil. In the arteries that lie close to the body such as radial artery of the wrist, the arrival of the wave of distention and subsequent recoil may be felt as a distinct throb, the pulse, which afford a convenient method for counting the heart rate.\textsuperscript{32}

Maximum Breath Holding

The maximum period of time of holding breath followed by maximum voluntary inspiration.\textsuperscript{33}

Respiratory Endurance (40 mm)

It is the pressure exerted by exhaled air to maintain mercury level at 40 mm on the manometer for maximum

\textsuperscript{32} Morehouse and Miller, *Physiology of Exercise*, p.82.

\textsuperscript{33} Ranade; Joshi and Pradhan, *A Text Book of Practical Physiology*, p.636.
possible time.\textsuperscript{34}

**Reaction Time**

Reaction time is the interval of time between the presentation of a stimulus and the initiation of the response.\textsuperscript{35}

Phillips and Hornak have indicated that the reaction time is the delay in time between the presentation of a stimulus and the initiation of a volitional response.\textsuperscript{36}

It refers to the ability of an individual to respond to an external stimulus i.e. the time from the occurrence of a stimulus to the completion of a simple muscular contraction is called reaction time.\textsuperscript{37}

\textsuperscript{34} Ibid., p.637.


Haemoglobin

Portion of the red blood cells containing iron and capable of combining with oxygen.\(^{38}\)

**Speed of Movement**

Speed of movement has been defined as the rate at which a person can propell parts of his body through space.

It refers to the time taken from the presentation of stimulus to the completion of a small movement and is given by the sum of reaction time and movement time.

For the purpose of this study the speed of movement was measured by the Nelson's hand and arm reaction test.\(^{39}\)

**Cardio-Respiratory Endurance**

Cardio-respiratory endurance is the ability to continue or persist in strenuous tasks involving large muscle groups for long period of time.\(^{40}\)

\(^{38}\)Shaver, *Essentials of Exercise Physiology*, p.298.


In this study it refers to the ability of the circulatory and respiratory systems to adjust to the effects of exercise or work. For the purpose of this study Cooper's twelve minute run/walk test was chosen to measure cardio-respiratory endurance.

The ability of lungs and heart to take in and transport adequate amounts of oxygen to the working muscles, allowing activities that involve large muscle masses (e.g. running, swimming, bicycling) to be performed over long period of time. 41

**Anthropometric Measurements**

Anthropometry is a science of measuring the size and proportions of the human body. 42

Anthropometric measurements are dimensions of the structure of the human body taken at specific sites to give measure of length, girth and width. 43

41 Fox and Mathews, *Physiological Basis of Physical Education and Athletics*, p. 634.

42 Ibid., P. 632.

Ponderal Index

Body height divided by the cube root of body weight.\textsuperscript{44}

Body Density

Body density is defined as the mass of a substance per unit volume and is expressed as gm/CC.\textsuperscript{45} Body density was calculated from skinfold measurements taken at four sites.

Fat Percentage

Fat is the most variable tissue in the body and is distributed throughout the body primarily under the skin and in the abdominal cavity.\textsuperscript{46}

A compound containing glycerol and fatty acids one of the basic food stuffs.\textsuperscript{47} Fat percentage was calculated

\textsuperscript{44} Fox and Mathews, Physiological Basis of Physical Education and Athletics, p. 643.

\textsuperscript{45} Shaver, Essentials of Exercise Physiology, p. 188.


\textsuperscript{47} Fox and Mathews, Physiological Basis of Physical Education and Athletics, p. 636.
from the body density.

**Weight Training**

Weight training is defined as those exercises that are designed to strengthen specific muscles by causing them to overcome a fixed resistance, usually in the form of a barbell or dumb-bells.\(^{48}\)

This term refers to the exercise phase of the activity where weight in the form of barbells and dumb-bells are used to condition and alter the size of various segments of the body. This is, undoubtedly, the most popular phase. Here the underdeveloped individual strive for an average size in terms of muscular bulk, body weight and size. The athlete strive for increased strength and condition to become a better performer in the selected sports.\(^{49}\)

**Load**

Training load is the physiological and psychological demands put on the organism through motor stimuli


\(^{49}\) Leighton, *Progressive Weight Training*, p.3.
(movements) resulting in improvement or maintenance of performance capacity.\textsuperscript{50}

**Intensity**

It is the rate of doing work or it is the pace at which physical activity is done.\textsuperscript{51}

**Density**

The density characterises the temporal relationship between load and recovery phases in a training session.\textsuperscript{52}

**Volume**

Volume is the total amount of work done in the training session.\textsuperscript{53}

**Duration**

It is the time period for which a single stimulus acts on the organism, optimum duration of stimulus is important to start the desired adaptation processes.\textsuperscript{54}


\textsuperscript{51}Ibid., p. 44.

\textsuperscript{52}Ibid., p. 46.

\textsuperscript{53}Ibid., p. 47.

\textsuperscript{54}Ibid., p. 47.
Frequency

It is the number of times a motor stimulus (repetition) is given. May be during weight training or free hand exercises etc.  

Maximum Strength

It is the highest possible resistance which a sportsman overcomes through voluntary contractions of the muscles.  

Physical Fitness

Physical fitness is the ability to carry out daily tasks with vigour and alertness, without undue fatigue and with ample energy to engage in leisure pursuits and to meet emergency situations.  

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55 Ibid., p.48.

56 Ibid., p.102.

Significance of the Study

Training and conditioning are individualized processes. Physical education teachers and coaches have to thoroughly study the sportsmen under their charge and then developed systematic programme of training so that their performance can be improved to optimal level at the time of competition. While developing efficient training programmes, physical education teachers and coaches have to recognise different weak aspects of the sportsmen those are required to be trained to improve the performance capacity of the sportsmen through scientific training.

The performance level of sportsmen in various games and sports is showing considerable improvement day by day. The main factor responsible for this improvement is the development of new training methods based on scientific principles derived from exercise physiology which are incorporated in basic physical education and advanced sports training.

In the present days competitive struggle is increasing at a fast pace. Development of improved techniques and tactics, new equipment and improved facilities, scientific understanding rendered by the sports scientists etc, can be held responsible for the improved performance. Coaches and physical education
teachers are experimenting on ways and means to find out the best, the easiest and the most economical methods of training for the conditioning of sportsmen in terms of optimal results.

The conditioning programme developed by the scholar which is based on scientific principles for the improvement of physical fitness standard of recruits may be significant in the following ways:

1) The results of the study may help to improve the methods of training for the development of motor abilities and physiological aspects to attain a higher degree of overall physical fitness of the recruits.

2) The findings of the study are likely to provide guidelines to the Army physical training corps instructors for imparting physical training on scientific basis and with the latest techniques.

3) Positive results obtained from the study may help to improve upon the syllabus of physical training for recruits in the Indian Army.

4) This study may also be helpful to the instructors and coaches in the Army to pick up suitable potentials for different games and sports in the initial
stages of their service to prepare them for the National and International level of competitions.

5) The study may give an opportunity and encouragement to the interested instructors, coaches and officers of the Army Physical Training Corps to conduct further studies on different aspects of physical training, games and sports in the Indian Army.

6) Present study may focus the attention of physical education teachers and physical training instructors and coaches in the Army, on those variables which are influenced as a result of training for general physical fitness and will help them to design their training programme to enhance optimal increase in performance capacity.