CHAPTER I

INTRODUCTION

Sports is an institution allied competition activity that involves vigorous physical exertion or the use of relatively complex physical skills by an individual whose participation is motivated by a combination of intrinsic and extrinsic factors. The term sports is commonly used in its broad concept to embrace non-athletic games, play, gymnastics and activities of an individual and team variety in both competitive and non-competitive situations.

Sports and games have been part and parcel of Indian culture and a reflection of a large macro system of the society within which the life exists.

Basketball

Basketball is essentially an indoor game, but in India, it is largely played in the open. Basically it is a passing game but the skill in shooting is very essential. It is a game that provides exercise to every muscle of the body and agility to improve mental reflex. It demands a high degree of physical fitness.

Basketball players move with great speed over a limited space. It being one of the most physically demanding game develops in an individual a great
variety of athletic traits. It involves the skills of passing and throwing the ball, changing the directions quickly with sudden stopping, jumping and maneuvering the opponent both offensively and defensively. To respond to such situations a player should possess good cardiorespiratory endurance to play without undue fatigue.

Basketball game stresses team goals more than individual goals and each player is a part of a team and thus contributes to the success of teammates. However, all participants do not have the same potential to develop into national and international players as such potential is limited by heredity and environmental factors.

Field Hockey

Field hockey is a dynamic team game played by both sexes requiring high level of skills, peak level of conditioning and requires coordinated team effort. Modern hockey demands that all players should be adopted to all the situations either defending or attacking.

The game hockey is largely dependent upon basic and advanced skills, physiological adaptations of the body, psychological built up and motor qualities of the players. The performance in hockey is based on the
proficiency in performance variables, such as dribbling, hitting, shooting, scooping and stopping.

Hodson (1971) has stated that "to play hockey well it also calls for intelligence, keen eyes, powerful wrists, physical fitness and the speed of mind and body". This shows that the game of hockey requires great skills, including concentration of the ball, body control and determination. Ability to execute all strokes with skill and necessary speed are the essential qualities for the top player.

Volleyball

Volleyball players need a high level of fitness to cope with the physical demands of game and to allow for their technical skills to be utilized throughout a match. Therefore, fitness training is an important part of the overall training programme.

Studies done by Clarena (1969), found that volleyball player's physical characteristics have less to do with the success level achieved in volleyball than does the total time the individual has played game.

Studies on the training programme and physiological profile of the 1984 Olympic volleyball Championships Clarena (1969), revealed that the
development of skill is more important than doing large amount of aerobic training for volleyball players.

**Soccer**

Soccer is one of the most popular and most complex of the team games which is played both by men and women. It is an enduring aerobic game which requires speed, power, strength, acceleration and agility.

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The ideal mode of fitness training in soccer is that the exercise performed should resemble match play as closely as possible and such factors as physical conditioning, skill and match experience are fundamentally important in determining level of success.

**Physical Fitness**

Physical Fitness is the central theme of physical education, which precisely refers to that condition of the body to maintain good health, respond to physical effort and physical stress, enjoy the sensations of his or her own
body and function at an optimal mental and physical level. As a relative term, fitness has been studied at length by members of the physical education profession throughout the world. Despite endless dialogues and debates as to its definition and structure, physical fitness is considered as an essential perquisite for work and performance (Greenberg and Pargnam, 1986).

Physical Educators have long believed that exercise is essential to maintain good health. During the past century a great deal of evidence has been reported by the medical researches supporting the value of vigorous exercise for the promotion of health. Exercise improves and promotes physical fitness, muscle tone, and body condition. Regular vigorous exercise also increases the efficiency and capacity of the heart and lungs and helps people maintain proper weight. Individuals who are physically fit tend to be slimmer than those who are unfit. They have greater resistance to disease and recover faster if they do become ill. Physically fit people may be happier and more alert and relaxed. They also may be able to resist the effects of aging better than those who are physically unfit. (Greenberg and Pargnam, 1986)

In India, few studies have been conducted to discover the importance and nature of different physiological profiles on performance. Modern sports scientists and physical educators are interested in human performance in variety of sports and games. Researchers have taken sincere effort to find out
the relationship of different psychological and physiological factors that affect performance in athletics and sports.

Physical fitness helps to enjoy physical activity, sustain skills, learning and enhance performance on the athletic field. Specific physiological systems of the body should be adapted to support a particular game. Since different games make different demands upon the organism with respect to neurological, cardio respiratory and temperature regulating functions, physiological systems are highly adaptable to exercise. (Wilmore, 1982)

**Anthropometric Measurements**

Anthropometric measurements have been a part of physical education research and evaluation since its inception. The earlier research was in the area of anthropometry was with the emphasis on changes in muscle size, brought about through exercises.(Clarke and Clarke, 1989)

Physical educators have long realized that the performance of men and women is greatly influenced by such factors of age, height, arm length, leg length and body structure.

The sculpture of Greece and Rome preserve the ideas of those civilization concerning the idea proportions of the human figure. It is interesting to see in their sculpture the swing of the pendulum of approval from
athlete who where broad shouldered, thick set square chested and very muscular, to athletes who are leaner, more supple, and whose figure are more representative of the skills of the finer coordination. Since the early times there has been continued use of anthropometric measurement to determine its relationship with performance in different games and sports.

Anthropometric variables such as weight, standing height, sitting height, foot length, fore leg length, thigh length, leg length and shoulder width are related to optimum and skilful performance in team as well as individual sport.

Biochemical

The liver is like a big factory that makes many of the things that is need to live, blood sugar being an important chemical compound. The excess blood sugar is stored in the liver as glycogen and is released when the blood sugar level lowers.

Glycogen molecules are large containing thousands of glucose molecules. But glycogenolysis individual muscle cells during exercise breakdown glycogen to glucose to provide energy for contraction. Glycogen is also broken down in liver, with the free glucose being related into the blood
stream and transported to tissues throughout the body (Powers and Howley, 1996).

Dietary lipids contain triglycerides, phospholipids and cholesterol which provide fuel for energy are also used in the absorption of fat soluble vitamins, hormone synthesis, for the basic structure for the cell membranes, in insulation of body and in protection of vital organs (McArdle, Katch and Katch, 1991). The cholesterol concentration in the blood serum is classified into Low Density Lipoprotein (LDL) and High Density Lipoprotein (HDL). The LDL carries more cholesterol than the HDL (Powers and Howley, 1996).

Long duration exercise lasting more than sixty minutes requires fatty acids to provide more fuel by oxidation metabolism, in addition to glucose availability. Games like soccer, hockey, basketball and volleyball are played for more than one hour, but the intensity, type and duration of exercise differs, resulting in differential utilization of a combination of fat and glucose for energy.

Haematological Variables.

There is considerable disagreement as to the effect of training on the red blood cell count. However, there appears to be agreement that, as a result of training, the bone marrow becomes dark red in colour, indicating an
increased rate of red blood cells manufacture. As a result of this augmentation, it seems reasonable to conclude that there is an increase in the number of red corpuscles in the trained individual. However, endurance training causes an increase in plasma volume, resulting in lower hemoglobin levels. (Wilmore, 1982)

Individuals, who follow a sedentary or inactive existence and then pursue strenuous work destroys a considerable number of red blood cells, which take several days to be restored. A period of anemia results and the individual is not fit to follow strenuous muscular effort for a period of several days. However, the trained individual have well developed the red marrow in the bones. Any ordinary destruction of red blood cells, for any given time, does not affect the individual because the loss is quickly made up in the trained individuals since there is a better balance between the destruction and manufacture of red blood cells. (Wilmore, 1982)

More knowledge is needed concerning the effects of training on the white blood cells. However, it seems clear that white blood cells, or leukocytes, increase in number in the blood after a period of muscular work, whether it be mild or severe. The increase in white blood cells seems to vary in proportion to the degree of intensity of muscular work. It has been
documented that the increase can be credited to a redistribution of the cells in the vascular system. (Berk, et al., 1986)

The findings of various researches on anthropometrical, haematological and biochemical variables do not show agreement to the fact whether training or individuals trained in a particular game or sport differ in physical and physiological aspects. Hence it is felt that a comparison especially covering physical, physiological, haematological, anthropometrical and biochemical variables is necessitated.

In the present study, the researcher was interested to compare and analyze the differences in the selected physical, physiological, haematological, anthropometrical and biochemical variables among Tamil Nadu state volleyball, basketball, soccer and hockey players.

**STATEMENT OF THE PROBLEM**

The purpose of the study was to compare and analyze the differences in selected physical, physiological, haematological, anthropometrical and biochemical variables of Tamil Nadu state women basketball, volleyball, soccer and hockey players.

The selected physical, physiological, haematological, anthropometrical and biochemical variables are listed below:
a. Physical:

i. Height (cms)

ii. Weight (kgs)

iii. Percent body fat

iv. Agility (secs)

v. Explosive Leg Strength (cms)

b. Physiological:

i. Vital capacity (litres)

ii. Resting heart rate (beats/min)

c. Anthropometrical:

i. Chest girth (cms)

ii. Thigh girth (cms)

iii. Calf girth (cms)

iv. Upper arm girth (cms)

d. Biochemical:

i. Blood sugar (mg/dl)

ii. Blood cholesterol (mg/dl)
e. Haematological:

i. Haemoglobin (grams percent) and

ii. Differential counts (in percent)

   a. Neutrophils

   b. Eosinophils

   c. Lymphocytes

HYPOTHESIS

It was hypothesised that there would be no significant differences among the four groups, namely, basketball, volleyball, soccer and hockey in selected physical (height, weight, percent body fat, agility and explosive leg strength), physiological (vital capacity and resting heart rate), haematological (haemoglobin, neutrophils, eosinophils and lymphocytes), anthropometrical (chest, thigh, calf and upper arm girths) and biochemical (blood sugar and cholesterol) variables of Tamil Nadu State Women players.

SIGNIFICANCE OF THE STUDY

The study would be significant in the following aspects.

1. This study might be of great use in designing specific programmes to improve the physical fitness levels of the state, university and intercollegiate
women players of different games based on their physical and physiological fitness.

2. The optimum levels of physical, physiological, hematological, anthropometrical and biochemical variables required in different games for improvement in performance could be understood by coaches, physical educationists and sports scientists.

3. The long term effects of training related developments and adaptation in physical, physiological, hematological, anthropometrical and biochemical variables that differ among the games under investigation could be determined.

4. The optimum physical and anthropometrical requirements needed in the selected games would help the coaches and physical educators to select the teams based on body structure and

5. The physical, physiological, hematological, anthropometrical and biochemical values required may differ among the selected games and an indepth understanding would help the coaches, physical educationist and sports scientists provide proper nutritional and vitamin supplementation for optimal growth and physical development of the players in a specific game or sport.
DELIMITATIONS

The study was delimited as follows taking into consideration the purpose of research investigation:

1. Only women players, who had represented Tamil Nadu state during the years 1996-2001 were selected.

2. The age of subjects ranged from eighteen to twenty one years.

3. Major games popular in the state of Tamil Nadu, namely, basketball, volleyball, hockey and soccer were selected, and

4. All the subjects were from women colleges in the city of Chennai, Tamil Nadu.

LIMITATIONS

The results and conclusions of the present investigation would be deduced considering the following limitations:

1. The initial fitness level and the method of training of the subjects were not considered.

2. The nutritional status and the daily dietary intake of the subjects were not considered.
3. The subjects were from different social, cultural and economic backgrounds.

4. The subjects motivational level during testing were not controlled and

5. Only the following variables; namely, a) physical variables: height; weight, percent body fat, agility, explosive leg strength; b) physiological: vital capacity, resting heart rate; c) anthropometrical: chest girth, thigh girth, calf girth, upper arm girth; d) biochemical: blood sugar, blood cholesterol and e) haematological: haemoglobin and differential count (neutrophils, eosinophils and lymphocytes) were analyzed.

**DEFINITION OF THE TERMS**

The important terms used in this study are operationally defined below:

**Height**

The height of the subject is measured in centimeters while standing in erect position. The measuring scale used was a stadiometer. The chin of the subject and the head was held erect. The height was measured to the nearest centimeter.
Weight

Weight is the measurement of total body mass and was measured to the nearest one tenth of a kilogram using portable weighing machine (Bhasen's Slim line, India)

Percent Body Fat

Body composition is a key component of an individual's health and physical fitness status. To understand body composition, the body must be viewed as a two component system: Lean body weight and fat weight. The lean body weight represents the weight of the muscle, bone, integral organs and connective tissues in the body. (McArdle, Katch and Katch, 1991)

The fat weight was measured in millimeters using a skinfold caliper (Lange, USA) and was expressed as percent body fat.

Agility

Agility is an important physical fitness component, often stated as maneuverability or mobility. It is the ability to change the direction of the body and its parts rapidly. Agility is a combination of several athletic traits such as strength, reaction time, speed, movement, power and co-ordination. (Basco and Custufson, 1983) It's display becomes essential in such
movements as dodging, zig zag running, stopping and starting and changing body positions rapidly. The agility was measured to the nearest one hundredth of a second by shuttle run test.

**Explosive Leg Strength**

Explosive leg strength can be defined as the maximal rate at which energy can be produced or work can be done without a significant contribution of aerobic (mitochondria) energy production and was measured by vertical jump test and was expressed in cms. (Fox and Mathews, 1985)

**Vital Capacity**

The volume of air that can be made to pass in and out of the lungs by the most forcible inspiration and expiration is termed as the vital capacity of lungs (Moses, 1995). The vital capacity was measured to the nearest milliliters by using wet spirometer.(Palmer, England)

**Resting Heart Rate**

Heart rate is the number of beats felt in exactly one minute and resting heart rate is defined as the number of beats per minute measured while the individual is at rest (Moses, 1995). The resting heart rate was measured as
number of pulse beats per minute determined at radial artery in the wrist and above the radius bone.

**Chest Girth**

Chest girth is the maximum circumference of the chest in a relaxed state after a maximal possible exhalation and was measured to the nearest centimeter.

**Thigh Girth**

Thigh girth is the maximum circumference of the thigh in the plane at right angle to its body axis, about two third distance from the mid knee to the crotch and was measured to the nearest centimeter.

**Calf Girth**

Calf girth is the maximum circumference of the calf muscle and was measured to the nearest centimeter at the bulkiest portion.

**Upper Arm Girth**

It is the maximum circumference of the upper arm and was measured to the nearest centimeter at the bulkiest portion.
Blood Glucose

Blood sugar refers to a simple sugar than is transported through the blood and metabolized by tissues (Scott and Hawley, 1996). The blood sugar was measured to the nearest milligrams in 100 ml of blood.

Blood Cholesterol

The term cholesterol is derived from the Greek word, "Chola" meaning bile and "stereos" solid. It is a lipid or fatty substance essential for life and found in various tissues and fluids. Elevated levels of it in the blood have been associated with an increased risk of cardiovascular disease. (Wilmore).

Blood cholesterol was operationally defined as the concentration of serum cholesterol expressed as mg/dl percent and was determined by the Wybeng and Pileggi method (1970).

Haemoglobin

According to Murugesh(1993), "Haemoglobin contains globin, a protein which is conjugated with haem. (Haemoglobin = haem + globin) Haem molecule contains 4 pyrite rings with iron in the center. The haemoglobin content of the body is about 15g per 100 ml of blood.
The haemoglobin was expressed as grams per 100 ml of blood and was measured using Sahli haemometer.

**Differential Count**

The differential count may be defined as the individual count of the formed elements of the blood.

**Leukocytes**

Leukocytes (WBC) are formed from undifferentiated stem cells in the bone marrow and can be classified as granular or agranular based on their staining characteristics. One population of the granular leukocytes can be further classified into neutrophils, eosinophils and basophils. Neutrophils are the most abundant of the granular leukocytes (50% to 70%). (Tartora and Anagastakar, 1984).

The two major classifications of agranular leukocytes are lymphocytes and monocytes. The lymphocytes make up an approximately 20% to 40% of the total population. The population of lymphocytes includes T cells, B cells and natural killer cells. There are four sub classifications of T cells (Killer, helper, suppressor and memory T cells) and two percent of B cells (plasma cells and memory B cells). (Tartora and Anagastakar, 1984).
**Neutrophils**

Neutrophils play an important role in the defense of the body. Along with monocytes the neutrophils constitutes the first line of defense against the invading microorganisms. The neutrophils are the free cells in the body and wander freely into the tissue and practically no part of the body is spared by these leukocytes. The granules of neutrophils contain enzymes like proteases, myeloperoxidases, elastases and metalloproteinas. (Guyton, 1991)

**Eosinophils**

Eosinophils play an important role in the defense of the body. These leukocytes are specifically meant for acting against the parasites. The major functions of these cells are detoxification, disintegration and removal of foreign proteins. Eosinophils count increases during parasitic infections and allergic conditions. (Guyton, 1991)

Eosinophils have coarse (larger) granules which stain bright red crorgnge with eosin. The nucleus is bilobed and the character of the cell varies between 15 and 14 microns. (Murugesh, 1993)
Lymphocytes

The lymphocytes have less amount of cytoplasm. The nucleus is oval or kidney shaped occupying the whole of the cytoplasm depending upon the size, lymphocytes are divided into two group as large lymphocytes and small lymphocytes. (Murugesh, 1993)