Chapter I

INTRODUCTION

"Youth is not a time of life, it is a state of mind. It is a taste of the will, a quality of imagination. a vigour of emotion, a predominance of courage over timidity and of the appetite for adventure over love of ease. Nobody grows old by merely living a number of years — people grow old only by deserting their ideals."

"Sports by their very nature are enjoyable, challenging, all absorbing and require a certain amount of skill and physical conditions." In order of human values conquest in the field of sports holds a unique place. It is success, victory, triumph and domination of some over others - team mates and friends - because sport is comradeship and friendship. The sublimity of competition lies in the loser's acclaim for the winner, which along with the friendly handshake acknowledges both defeat.

---

1 Encyclopedia of Sports Sciences and Medicine, s.v. "Values" by William A.R. Orlan.

and triumph. Sport is many sided social phenomenon which under certain social conditions has general, cultural, ideological, aesthetic, pedagogical and economic significance. Hence, the reasons of all increasing attention to sport in a society becomes understandable.

In fact many sports are nothing but artificial forms of cultivating a skill that once was essential in day to day life, like running, throwing, catching, chasing, escaping etc. through volleyball and basketball claim their origins to design deliberately planned to get

---


exercise for the body in a limited space and indoors. if need be.

Health and Sports

In this dynamic world of today, with its widespread political and scientific experimentation, among all the species of the earth, man is the only living being who repeatedly fails to make proper use of his instincts. This situation is worsening, despite all the powerful and ever-increasing efforts of medical science in recent years to make man aware of the fact that preventive maintenance of his body and especially of his heart is the only way to assure a long and healthy life. Daily living in modern society brings on many problems and the labour saving tendency has now reduced the physical activity to a minimum. The biological effect of inactivity is only partly understood but all agree that urbanised...


man is in danger and that is due to the state of involution of the skeletal muscle and peripheral circulation as well as some unsettled psychological conditions. Hence no culture can survive and mature unless its men and women can be protected from threats to their physical, nervous and mental well being, unless they can be permitted to attain and maintain vigorous and abundant vitality, unless they can be helped to recuperate quickly from strain and fatigue. The physical activity in different professions has decreased rapidly and this fact combined with the consequences of the impact of motorizing has diminished the caloric need. At the same time an increased supply of food has become available and as a rule we do not respond to diminished physical activity by a corresponding decrease in caloric intake. Sports activity, thus is certainly essential in modern society as a compensation.

Sports Today

Sports is as old as the human society, and it has

achieved a universal following in the modern times. It now enjoys a popularity which outstrips any other form of social activity. It has become an integral part of educational process. Millions of fans in sports activities are participating with full enthusiasm for the fun of it for health, strength and fitness and it is taking shape of a profession with high skills, with ample financial benefits linked with high degree of popularity to some.

Technology permeates every aspect of life. Sports are no exception to it. Science applied to sport has enabled modern youth to develop physical capacities beyond anything earlier imagined. Sports have become highly competitive and records are being broken with great rapidity.\textsuperscript{12}

With the rapid development of sports to a highly organised and immensely competitive social phenomenon, there has emerged a clear cut classification of sports on the basis of goal and intensity of participation, namely, recreation-sports, health or conditioning.

sports and competitive sports.  

As sport has developed into a distinct scientific discipline in itself and each nation is vying with each other to produce top class players to win laurels in international competitions, considerable research is devoted to identify factors that will be predictive of achieving high level of skill in a given sport with proper coaching.  

The science of coaching for high performance involves selection of potential competitors on validly predictive criterion measures; adjusting the training load, monitoring its effect continuously and providing appropriate psychological and social environmental support and medical services from a specialist in sports medicine. Usually, the team approach consisting of coaches, physiologist, psychologist, trainers and sports medicine fellow is recommended. Training techniques based on new findings in exercise physiology, bio-

---


chemistry, bio-mechanics, sports-medicine, sports psychology etc. are adopted to bring about maximum possible unfolding of potential in sports performance.15,16

The pace of development of the capacity performance in sports is determined by a number of factors. Among these factors, training and competition load play the leading part. By a good training economy and training means correct proportion of volume and intensity of load as well as of load and recovery. Adjusting of load to the individual capacity performance will develop in close dependence upon the pace of the increase in load. With the same talent for a sports event those sportsmen will develop more naturally whose training volume and training intensity is higher. High training and competition loads require high readiness for performance only that one will reach peak performance who fights for them with all his personality.17


17 Abstracts: Orientation Course in Scientific Aspects of Physical Fitness (Gwallor: Lakshmi Bai National College of Physical Education, October 1983).
**Competitive Sports**

Today the preparation of an athlete for top notch achievement is a completely dynamic state, characterised by a high level of physical and psychological efficiency and degree of perfection of the necessary skills and knowledge, teaching and tactical preparation. An athlete arrives at this state only as a result of corresponding training. Thus athlete's training today is a multi-sided process of expedient use of aggregate factors so as to influence the development of an athlete and ensure the necessary level of participation.

Hereditary predisposition is estimated to be two third of the basis of top performance. Certain anthropometric considerations, somatotype features and racial traits are identified as advantageous for performance in top sports. Certain inborn features

---


of proportion of fast and slow muscle fibres, inborn
speed of neural transmission, hormonal balance and
inborn respiratory volumes that are advantageous for eco-
nomic output of work are also determining factors for high
attainment in sports skills.\textsuperscript{22} Intelligence, levels of
aspiration, persistence, self-control, and the like are
also important factors to reach the category of top
sports. Competitive sports event represent the classical
test of physical fitness or performance capacity. Under
such conditions the performance may be measured objectively.
The individual’s performance is the combined result of the
co-ordinated exertion and integration of a variety of
functions. The demand of the actual event must be per-
fectly matched by the individual’s capabilities in order
to achieve top performance and championship. It is
impossible to present one formula that takes into account
all aspects of a man’s maximal work power and capacity.

Natural endowment probably plays a major role in a

\textsuperscript{22} H.S.Sodhi, D.K.Tondon and G.S.Bawa, "The
Physical Characteristics and Performance of Indian
person's performance capacity, at least for those people aspiring to reach the levels required for the attainment of Olympic medals. The more popular an event is, the greater is the chance that an individual with the suitable constitution will participate and thus discover his ability. Obviously, geographic and environmental location are also important. The fact that an increasingly larger number of naturally endowed individuals enter the ranks of competitive athletes may in part explain the gradual improvement of athletic records.

The scientists are interested in analysing as to why the results improve or vary from time to time. Therefore, scientific objective is to evaluate quantitively the influence of various factors upon the performance capacity in different tasks, to examine how these factors vary with sex, age and body size and to study the effect of such factors as training and environment.  

Sports deal with the development of men through the medium of physical activities. Sports are concerned

---

with building up strength and endurance, developing speed, agility, teaching intricate skills, development of personality, and adjustment of one person to another in respect of game tactics and strategies. It is by and large agreed that the three main components of physical fitness are muscular strength, muscular endurance and cardio-respiratory endurance. Irrespective of all the qualities for top notch performance, physical fitness is the basic component or trait for future excellence in sports.

**Cardio-respiratory Fitness**

The capacity for physical work has always been of primary importance to the development of man. At the present time, more and more physical work is being replaced by machines and automation. Man's physical work capacity treats man as a muscle machine and thus a source of mechanical energy. In any type of work an employer would want to find workers with high levels of strength, quickness of movement or endurance.²⁴

characteristic and is measured by the ability of the circulatory system to withstand the strain of heavy and prolonged muscular activity. Endurance helps one to do physical work at a constantly high rate without the onset of fatigue. It may be considered as the ability of the body to withstand the stresses set up by a prolonged activity. Factorial techniques of analysis have resulted in the isolation of four factors in endurance i.e., circulo-respiratory, velocity, muscular structure and body built.  

Cardio-respiratory fitness is an extremely complex one and could be readily understood when the various elements of cardio-respiratory system effected by vigorous exercise are recognised. The elements involve the heart, the vessels that supply blood to cells, the oxygen carrying capacity of the blood and the capillary system receiving the blood.  


When at rest, physiological difference between an athlete with a high level of endurance and a person with a poor endurance are negligible. When they both start working, the difference quickly appear. An athlete with greater endurance is characterised by the ability to withstand high levels of lactic acid and to use larger volumes of oxygen and maintain lower heart rate during prolonged work. The return of the heart rate and lactic acid concentration to the normal is faster in a trained athlete.

To summarise, an athlete with higher endurance can carry on with exhausting work for a longer period and can establish a physiological steady state at higher levels of work. He can recover from work more quickly and is thereby enabled to start a second phase of work sooner than a person with poor endurance. 28, 29, 30


Thus, athlete's training today is a multifocussed approach so as to influence the development of an athlete and ensure the necessary level of preparation.

Therefore, besides monitoring physical fitness and functional ability as measured by arterial pressure, pulse rate and co-efficient of resistance, selected psychological tests, anthropometric and somatotype characteristics and racial traits etc. will be of definite advantage in the selection of top level sportsmen.

**Sports Excellency and Anthropometry**

Athlete for superior performance in any sport is selected on the basis of physical structure and body size he possesses which has proved to be appropriate for high performance in the given sports. 31, 32, 33

---


32 Encyclopedia of Sports Sciences and Medicine, s.v. "Values" by William A.R. Orlan.

Among life's dimension, physique must take its place; it houses the whole life of man; without it, birth is impossible and its death makes the biological end. The study of body build as relates to physical activity is not new to the field of physical education over the years. Such a relationship has been well established and generally accepted by both researchers and practitioners. Much has been learned inside and outside the field of physical education relative to size proportions, compositions and function of the human body. A sports scientist or coach can better prepare, assess, classify, understand and advise the players relative to their capacities and limitations within the structure, function and frame works of an athlete.

In his study of champion athletes, Cureton has concluded that all round athletic ability is characterised by wide shoulders compared to hip width. Track and field champions are significantly differentiated from normal young men by this ratio. It is also stated that Davenport's Crural Index is

---

34 Thomas Kirk Cureton Jr., Physical Fitness of Champion Athletes, p.49.
a valuable guide for the selection of individual's body limit in an agility pattern of bony leverage. Track and field champions are significantly differentiated from normal young men by this ratio. The leg length/trunk length is a similar ratio which indicate agility patterns.

DeGarry, Levine and Carter\textsuperscript{35} after an intensive study of anthropometric measures of Olympic athletes, concluded that top level performance in a particular event demands particular type of body size and shape, other aspects being similar. They established high relationship between structure of an athlete and the specific task or event in which he excelled.

After examining the Montreal Olympic athletes, Carter\textsuperscript{36} and others concluded that jumpers were heavier and had larger thigh and calf girths than the sprinters and distance runners. The long distance runners had smaller

\textsuperscript{35} DeGarry, Levine and Carter, \textit{Genetic and Anthropological Studies of Olympic Athletes}, P. 73.

upper arm and forearm girths than sprinters or jumpers but larger bi-iliac breadth than sprinters. They could not find any significant differences in age, height, sitting height, upper extremity length and bi-acromial breadth.

Well and others37 after examining the marathon runners concluded that distance runners are slight in build with little body fat and large lung volume.

**Body Composition and Sports Proficiency**

Human body as a system which has certain function to perform and which has certain basic materials available to it - fat, viscera, musculoskeletal tissue, the senses and the nervous system. The amount of any material in any physique are largely determined genetically although besides genetic variations some modification can occur. Precisely, how the components or materials of physique are distributed in different parts of the body seems likely to depend upon two

---

factors; first, the amount of each component present. One aspect of the scientific approach which is receiving greater attention is that of body composition. More specifically the measurement of the athlete's body composition to achieve optimal playing weight is gaining significance in the overall training programme. By achieving his optimum weight, the athlete can minimize the negative effect of excess body fat on activity without sacrificing the required nutrition for successful performance. The constitutional complex of factors doubtlessly has a big role to play with regard to trainability as well as for the resistance vis-a-vis negative and unphysiological loads. Genotypical characteristics of the apparatus of motion the circulation, metabolism and nervous system, given by hereditary predisposition, marks up to two-thirds of the basis for top performance always depending on the kind of sports practised. Because of many of these being endogenous and in principle fixed by pre-given factors preclude certain performances from the start, it is of the greatest importance to make a proper choice of children or teenagers for better performance training.38

38Prokop. The International Olympic Academy., p. 191.
In both athletic and cardiorespiratory fitness, most of the physical fitness components of the working of our body matching with different modes and intensities of work. As a matter of fact, all the work is done at the level of muscle and is energy dependant. Energy is synthesised biochemically in the muscle only. Here adipose tissue has nothing to do with energy production except that it is the site of storage of fat. But, if the amount of fat is high, it is always a burden to the subject in relation to his/her physical fitness, as the weight of fat is always as extra load one has to carry during work and moreover extra fat in the form of adipose tissue interferes with efficiency of thermoregulation which is very important during any work to keep the body temperature at a reasonably constant level. Therefore, we can very confidently say that ideal body composition is highly related to physical fitness of any individual.\(^{39}\)

So, the quantification of the physique of the athletes for top notch performance also gives a valuable

\(^{39}\text{R.N.Dey, "Body Composition and Physical Fitness" Abstracts: Scientific Aspects of Physical Fitness (Gwallior: Lakshmibai National College of Physical Education, October 1983), p. 38.}\)
reference point in relating human structure or composition to function. Such a relationship has been well established and generally accepted by both researchers and practitioners. Many studies have well demonstrated the influence of body composition in terms of body density, specific gravity, anthropometric assessments, surface area and body shape on different characteristics of human performance.

The scholar could not locate any such study with special reference to cardiorespiratory fitness in his review of literature. Further, almost all the studies delineate with Olympic or world class athletes in different sports. Hardly, a study was noticed comparing anthropometric and body composition parameters of high and low cardio-respiratory fitness groups.

**Statement of the Problem**

The purpose of this study was to find out whether specific levels of cardio-respiratory fitness proficiency are characterised by distinct anthropometric and body composition variables and also the degree of correlation of specified anthropometric and body composition variables with cardio-respiratory fitness condition.
**Delimitations**

1. The study was delimited to boys studying in secondary schools at K.D.B. High School, Sarigaon, Gujarat.

2. Cooper's 12 Minute Run-Walk Test was used to ascertain cardio-respiratory efficiency groups.

3. For the purpose of this study, the following absolute anthropometric variables were selected:

   (a) Height
   (b) Weight
   (c) Foot length
   (d) Foreleg length
   (e) Leg length
   (f) Thigh length
   (g) Trunk length
   (h) Calf girth
   (i) Thigh girth
   (j) Abdominal girth
   (k) Hip width
   (l) Shoulder width

4. For the purpose of this study, the following relative anthropometric variables were selected:
(a) Shoulder Index
(b) Cervical Index
(c) Leg length/Trunk length
(d) Shoulder width/Hip width

5. For the purpose of this study the following body composition variables were selected:

(a) Body density
(b) Percentage of body fat
(c) Fat weight
(d) Lean body mass

Limitations

In the absence of availability of latest sophisticated equipments for accurate measurement of some anthropometric variables, flexible steel tape and laboratory weighing machine of the Research Department were used, the measurements taken by which are likely to be vitiated by approximation of taking readings and errors due to human perception and handling.

Hypothesis

It was hypothesised that:

1. There will not be any significant difference
between high and low cardio-respiratory fitness groups in selected absolute, relative anthropometric ratios and body composition variables.

2. Measurement of selected absolute anthropometric variables mainly standing height, weight, foot length, foreleg length, leg length, trunk length, calf girth, thigh girth, abdominal girth, hip width, shoulder width will not significantly correlate with the high and low cardio-respiratory fitness.

3. Selected relative anthropometric ratios and subcutaneous body fat are slightly above actually will not significantly correlate with the levels of high and low cardio-respiratory fitness.

4. Selected body composition variables will not significantly correlate with the levels of high and low cardio-respiratory fitness taken up in this study.

Definitions and Explanation of Terms

Anthropometric Measurements

"Anthropometric Measurements are dimensions of the structure of the human body taken at specific sites to give measures of length, girth and width."

40

The description of the specific anthropometric variables selected in this study are given while describing the procedures in Chapter III.

Body Composition

The evaluation of body composition permits quantification of the major structural components of the body, muscle, bone and fat.

Body composition in terms of body density, specific gravity, surface area, body shape, skinfold thickness and lean body mass are widely used. Normally body composition can be determined by the direct and indirect method. Among various indirect methods to determine and predict body composition, skinfold thickness measures was used for the present study.

The description of the specific variables are given while describing the procedure in Chapter III.

Cardio-respiratory Fitness

"Cardio-respiratory fitness is the ability to continue or persist in strenuous task involving large muscle groups for a long period of time." 41

Significance of the Study

1. Even though anthropometry advantage is a recognised fact, the example of a certain individual attaining proficiency inspite of matching anthropometric model places a doubt, whether much reliance can be placed on anthropometry as an essential feature in predicting high and low cardio-respiratory fitness.

2. The study will reveal whether any significant relationship exists between high and low cardio-respiratory fitness groups in the selected anthropometric and body composition variables.

3. The results of the study are likely to highlight the knowledge and role of physical endowments.

4. This study may provide guidance to coaches and trainees in screening players and athletes for different activities depending upon their anthropometric and body composition traits.

5. The findings of the study would add to the existing knowledge in the area of "selection criteria of sportsmen" who are concerned with physical education and coaching in sports.