Chapter - I

INTRODUCTION

Human Physique across the centuries has been the subject of discussion with the scientist, artist and even layman. However, it has not been possible for any of these to say clearly as to what physical characteristics are more suited to what type performance task subjective judgment and hypothetical view have been expressed but these has been lack of empirical data to substantiate various theoretical view points perhaps no serious attempt has been made through either systematic or experimental study to relate performance with certain physical characteristics. It would be million-dollar question if one could point out very precisely as to what contributed by the way of physical characteristics to the elite performance in a game or sports. Most of the game and sports are based upon such fundamental skill that do required typical characteristics of Physique so thickly associated with performance with reference to the Olympic levels of performance.

Tanner¹ observed that lack of proper physique might make it almost impossible for an athlete to reach that degree of success. In general, the most productive study has been of high level of performers at

national and international levels. Theoretically we would expect those who are most successful to have the appropriate structures commensurate with their performance task; therefore, examination of differences between these structures and tasks will increase our understanding of the importance of aspects of physique.

There are numerous factors, which are responsible for the performance of sportsmen. The physique and body composition including the size, shape and form are known to play a significant role in this regard. The performance of sportsmen in any game or event was also dependent on his suppleness skill training, motivation and on various other factors of physiological and biochemical nature, age, sex and physical growth have also been noticed to influence a person's capacity for physical activity.²

Ever since the first modern Olympic games human performance has captured the attention of a wide segment of the population. In addition to the athlete, there was a growing scientific awareness among coaches and investigators. Athletic records were followed by more and more people and data are meticulously kept by officials of various sports and by the media as well. For an athlete achieving peak performance was one of the factors that made competition so self-sustaining. The growth in size

² H.S. Sodhi and L.S. Sidhu, Physique and selection of sportmen (Patiala; Punjab Publishing House, 1984), P.1.
complexity and number of research laboratories had provided an impetus for the study of the athletic performer. Ultimately it will benefit the performer to have information on which to base further performance and training method as well as to help explain the achievement of certain competitive standards.³

The knowledge of body types as described by Sheldon and others has significance in the field of physical education, health education and recreation. The uses, which may be derived of this information, are diagnostic and prognostic in nature. In physical diagnosis the causes of psychological differences may have a partial cause in body morphology. The limits of athletic performance are influenced by body structure, psychological characteristics and in some instances; health levels also have their bases in body structure. Those individuals interested in the “why” of various performances cannot limit body type information.⁴

The biological and social significance of tests of posture, strength, flexibility, endurance or circulatory-respiratory functions are understood

more clearly when constitutional potentialities and limitations are considered.⁵

Athletic ambitions are often frustrated because of the unsuitability of body types. It has been said that we need to dispose the influence to which children were exposed in such a manner that youngster set their hearts upon values which represent the fulfillments of their own constitutional potentialities. Cureton recommends somatotyping as a fundamental procedure for work in body mechanics and physical fitness testing. He emphasized that every test must eventually be normed in terms of constitutional type.⁶

A program of physical education, which consists of appropriate activities and provides for suitable grouping when implemented, will facilitate the attainment of specifically desired outcomes, besides enhancing all round development of the participant. Scientific information will have to take cognizance of the possibilities and limitations for physical development conditioned by the type of physique of an individual.⁷

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⁷ Peter V. Karpovich, Physiology of Muscular Activity (London: W.B. Saunders Company, 1971), P.293.
Prediction of an individual's weight should be made in reference to the somatotype rating. The accurate prediction of future weight may save great frustration because the age-height-weight tables, which do not recognize differences in body types lead to questionable results. Sheldon\(^8\) also reported that influence of heredity upon somatotypes and that body-build might be direct result of heredity or an indirect result of influence of heredity on body physiology. It is possible that dietary habits or early environmental factors play a part in the final determination of somatotype. Endocrine conditions may be the cause of variation in physical type or may be elements in general constitutional pattern.

The concept of somatotyping was appealing because it is a classification of total body form that can be expressed as a simple rating. It provides a gestalt impression of human physique but it was not limited by placing individuals into discrete categories. Somatotyping was a genetic term embracing several different methods, all based on Sheldon's concept of three-component rating. It was a quantitative description of the present morphological conformation and composition of the body. It was expressed in three rating as per Heath and Carter method of somatotype.

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that describes the body as a whole and was a rating of what the body looks like.\textsuperscript{9}

The earliest attempts to study human physique were made from the standpoint of health and behavioral aspects and were based on the premise that man behaves as he does because of what he is. The main obstacle to the study of the relations between body type and physiological functions at various age periods has been the lack of a practical classification of body types. Hippocrates, 430 B.C. described two antithetical types of body build, which he called the habitués apoplectics (short, thick) and habitués phthisicus (long, thin). Hall, in 1797, talked of four types: abdominal, muscular, thoracic (long chest, slender) and nervous (cephalic). Rostan, in 1828, recognized four types: digestive, muscular, respiratory and cerebral.\textsuperscript{10}

Walker\textsuperscript{11} in 1852 recognized three types: nutritive, locomotive and mental. Carus and Beneke in 1852 described three body types: phlegmatic, athletic and cerebral-asthenic. According to Wells, the three categories were vital, motive and mental. According to Huter there body types: food type, strength types and sensation type.

\textsuperscript{11} Ibid, P.319.
Kretschmer\textsuperscript{12} classified human body into Pyknic, Athletic, Asthenic and Dysplastic. Sheldon’s treatise on the body classification was infect a great landmark in the history of somatotyping. He scientifically tried to prove that the entire human population could be classified into Endomorph, Mesomorph and Ectomorph. In due course of time, Heath and Carter added to this Omomorph “The triangular torsotype.”

A shortcoming common to these attempts was the use of a single scale with rather gross and subjective differentiations, which did not permit refined classification of physique.\textsuperscript{13}

Sheldon’s methods of body classification is perhaps, considered to be the first honestly scientific attempts in this direction. Sheldon’s\textsuperscript{14} seven-point rating scale applicable to each of the three categories was based on sound scientific reasoning. According to him by using the intermediary half points the entire population of the world could be classified into 342 sub-classification. The identification of physique or somatotype in this scheme was done on the basis of the relative amounts of fatty tissue, muscular tissue and bony tissue, and nervous tissue present in the body.

\textsuperscript{12} Ibid, P.320.
\textsuperscript{13} Karpovich and Sinning, \textbf{Physiology of Muscular Activity}, P.295
\textsuperscript{14} Sheldon, Steven and Tucker, \textit{The Varieties of Human Physique}, cited by Karpovich and Sinning, \textit{Physiology of Muscular Activity}, PP.295-296.
However, the apparent difficulties involved in this procedure seem to indicate that it was somewhat esoteric and limited use in schools and colleges. Beside this the method is expensive, time consuming and involves high technical training for accurately evaluating physique on the basis of photographic plates. That is perhaps why Sheldon's technique has receded into the background.\footnote{15}

Notwithstanding these shortcomings, Heath and Carter\footnote{16} developed a simplified method for somatotyping rating with the use of selected anthropometric measurements. In addition to its simplicity, feasibility in terms of time and cost this method also provided for changes in somatotype during a person's life time.

Using Sheldon's as well as Heath and Carter's method, numerous attempts have been made to study the relationship of somatotype to health and physical/motor fitness of individuals. A perusal of the related literature would seem to indicate that somatotype were interrelated processes and interact to serve as important factors in determining the health behaviour and fitness needs as well as the interests and abilities of individuals and may be used for classification purposes.

\footnote{15} Karpovich and Sinning, Physiology of Muscular Activity, P.295
However, such findings have been largely made on individuals belonging to extreme categories of somatotype. The few studies done on the average population have used test batteries comprising of items for the various components of fitness like speed, strength, endurance etc. Inspite of their obvious value such test batteries result in scores that do not point clearly as to the area in which an individual is poor or proficient.\textsuperscript{17}

To understand the relationship of somatotype to physical fitness and personality traits, study of isolated variables of motor components and personality traits as they are influenced by somatotype would seem to be well justified and hopefully, may assist in the development of a formula relating these aspects of individual.\textsuperscript{18}

Classifying students into homogenous or heterogeneous group while keeping the requirement of each physical education. Grade, fitness level, Skill level, height, weight academic achievement are same of the criterion commonly used by physical education for classifying students on various situation. However each criterion does not seem to be suitable on all occasions. Miller and Elbel\textsuperscript{19} counted that physical performance such as height and weight are unsatisfactory elements upon which to base a

\textsuperscript{17} J.M. Tanner, The Physique of the Olympic Athletes, PP.21-45
\textsuperscript{18} Ibid., P.25.
\textsuperscript{19} Waldo A. Miller and Edwin R. Elbel, “The Effect upon Pulse Rate of Various Cadences in the Step up Test”, Research Quarterly. 17 (1949): 416
classification of students in physical education, where objective is to achieve peak level performance.

Several investigators have studied the relationship of morphological, anatomical and structural characteristics with physiological and functional, phenomena. Most of them have come the conclusion that a certain correlation exists between the body type and the motor capacity. The correlations between various body measurements and motor performance have been studied extensively. In the recent year some research work had been going on in the basis disciplines pertaining to the body type and sports performance. The concepts of sports performance from the physical education that for us the basis of competitive sports. The programe of sports performance have been given new look. The body type and sports performance infect, seems to have new turn in the form of sports sciences. For many years the research in sports performance was being undertaken within these basis sciences. But with advancement of time the new specializations and micro-specializations have taken a respectable position. As a matter of fact, research in this field now days embrace knowledge from various disciplines of human sciences. The human biologist is interested to study the morphology and motor learning in sports.²⁰

²⁰ H.S. Sodhi and L.S. Sidhu, "Physique and Selection of Sportsmen" p. 204.
It was hoped that the material presented in this study would provide a better understanding of the motor fitness and somatotype components that contribute to the development of athletic excellence. The information should find application in physical education programs, early identification and selection of potential athletic type and perhaps most important a deeper and more significant understanding of the nature of human performance.

In the light of the facts discussed above, it was considered worth while to investigate the relationship of somatotype components to motor fitness components, somatotype components were determined by using Heath and Carter method that determines the relationship of form to function. The idea was to examine morphological factors that were related to end that might affect human physical performance.
Statement of the Problem

The purpose of the study was to investigate somatotyping factors as predictors of performance in motor fitness components of male professional students of Rajasthan University and affiliated Colleges.

Sub-Problem

The sub problem of the study was to compare the performances in different motor fitness components among various dominated somatotype components groups of male professional students.

Delimitations

1. The present study was delimited to the predictions of somatotype components by Heath and Carter anthropometric somatotyping method.\(^{21}\)

2. The study was further delimited to following motor fitness components\(^ {22}\) as below.
   (a) Speed.
   (b) Arms strength.


(c) Abdominal strength.
(d) Legs strength.
(e) Cardio-respiratory endurance.
(f) Agility.
(g) Dynamic balance.
(h) Flexibility.
(i) Two-hand Co-ordination.

3. The study was further delimited to male professional students studying in different physical education courses at Rajasthan University and affiliated Colleges with age ranging from 17 to 25 years.

Limitations

1. Though the scholar made valiant efforts to procure best reliable equipments, however non-availability of sophisticated equipments to measure somatotyping components and motor fitness performance which might have had an effect on the study was considered as one of the limitation of the present study.

2. No motivational technique was used to inspire the subjects to give their best performance, which might have had an effect on the study, was also considered as another limitation for the study.
Hypothesis

1. It was hypothesized that the somatotype components will not have relationship with different motor fitness components.
2. It was hypothesized that there shall not be any significant difference between somatotype components in relation to motor fitness components.

Definition and Explanation of Terms

Motor fitness

A readiness or preparedness for performance with special regard for big muscle activity without undue fatigue. It concerned the capacity to move the body efficiently with force over a reasonable length of time.\(^\text{23}\)

Motor fitness may be defined as an individual's level of standing in terms of his readiness to involve himself in requiring application of such components as speed, strength, endurance, cardio-vascular endurance, agility and flexibility.\(^\text{24}\)


This ability may be defined as a limited phase of motor ability, emphasizing capacity for vigorous work. The aspects selected for emphasis are endurance, speed, strength, agility, flexibility, power and balance.\(^{25}\)

For the purpose of this study the definition of motor fitness given by Barrow & McGee was more suitable

**Strength**

It is a force that a muscle or group of muscles can exert against resistance in one maximum effort.\(^{26}\)

Strength may be defined as the muscular force utilize in the creation or prevention of movement.\(^{27}\)

Strength is defined as the contraction force of muscle, strength, is prerequisite to muscle movement.\(^ {28}\)

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For the purpose of study the definition of strength given by Mathews was more suitable.

**Speed**

It is a force that a muscle or group of muscle can exert against resistance in one maximum effort.\(^{29}\)

Rapidly with which a movement or successive movement of the same kind may be performed.\(^{30}\)

Hockey has defined that speed as the quickness with which one is able to move his body from one point to another.\(^{31}\)

For the purpose of this study, the definition of the speed given by Johnson & Nelson was more suitable.

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Agility

It is defined as the physical ability, which enables an individual to rapidly change body position and direction in a manner.\textsuperscript{32}

Agility may be defined as the parts of the body to change direction rapidly and accurately.\textsuperscript{33}

Agility may be defined as the accuracy and speed with an individual integrates his body parts in various ways.\textsuperscript{34}

For the purpose of this study, the definition of the agility by Johnson & Nelson was more suitable.

Cardio-respiratory Endurance

The result of a Physiologic Capacity of the individual to sustain movement over a period of time.\textsuperscript{35}

\textsuperscript{33} Barrow and Mc Gee, \textit{A Practical Approach to Measurement in Physical Education}, p. 563.
\textsuperscript{35} Barrow and Mc Gee, \textit{A Practical Approach to Measurement in Physical Education}, p. 567.
Cardio-respiratory endurance in the ability to continue or persist in is strenuous task involving, large muscle groups for long periods of time.\textsuperscript{36}

According to Mathew and Fox it is the ability of the lungs and heart to take in and transport adequate amounts of oxygen to the working muscles, allowing activities that involve muscle masses to perform over long periods of time.\textsuperscript{37}

For the purpose of this study the definition of cardio-respiratory endurance given by Mathews and Fox was more suitable.

**Flexibility**

Flexibility is defined as the range of possible movement about a joint or a sequence of joints.\textsuperscript{38}

The degree one is able to move the joint of their complete range of motion.\textsuperscript{39}

\textsuperscript{36} Hockey, Physical Fitness: The Pathway to Healthful Living, p. 93-94.
\textsuperscript{37} Donald K. Mathew and Edward L. Fox, The Physiological Basis of Physical Education and Athletics, (Philadelphia: W.B. Saunders Co., 1976), p. 120.
\textsuperscript{38} Harrison H. Clark, Application of Measurement to Health and Physical Education, p. 120.
In other words, it is ability of an individual to move the body and its parts through as an individual to move the body and its parts through as wide a range of motion as possible without undue strain to the articulations and muscle attachments.\(^{40}\)

For the purpose of this study the definition of flexibility given by Johnson & Nelson was more suitable.

**Dynamic Balance**

The ability of an individual to maintain balance during vigorous movement.\(^{41}\)

Dynamic balance has been defined as the ability of the individual to control his body in a specific efficient posture while it is moving.\(^{42}\)

For the purpose of this study the definition of Dynamic balance given by Johnson & Nelson was more suitable.

\(^{40}\) Johnson and Nelson, *Practical Measurements for Evaluation in Physical Education*, p. 76.


Co-ordination

It may be defined as the ability of the performer to integrate type of movement into specific patterns.\textsuperscript{43}

Co-ordination is the ability of the individual to integrate movement of different kinds into one single pattern.\textsuperscript{44}

For the purpose of this study the definition of Co-ordination given by Johnson & Nelson was more suitable.

Somatotype

A quantification of three primary components determining the morphological structure of an individual, expressed as series of three numerals, the first referring to ectomorphy, the second to mesomorphy and the third to endomorphy. Which are involved in all the element of the body promotion skeletal size, organ size and probably many biophysiological and bio-chemical function it should be noted that the characteristics of these component are not superior.\textsuperscript{45}

\textsuperscript{43} Ibid., p. 565.
\textsuperscript{44} Johnson and Nelson, Practical Measurement for Evaluation in Physical Education., p. 203.
Ectomorphy

In the dominant ectomorphy has a frail, delicate body structure, with thin segments, anteroposteriorly other characteristics are relatively large cranium, small face with bulbous forehead, pointed chin, and sharp nose, lung slender, neck long, narrow thorax, winged scapula and forward shoulders, long arms, muscles not marked, flat abdomen, with hallow above navel, inconspicuous buttocks, and long thin leg.\(^{46}\)

Mesomorphy

In mesomorphy muscle, bone and connective tissue are dominant. The mesomorphic physique is heavy, hard and rectangular in outline, with rugged, massive muscle and large prominent bones, other characteristics are: prominent facial bones, facial long, strong neck, thorax trunk dominant over abdominal volume, broad shoulder, with heavy prominent clavicles, muscular upper arm and massive fore arm, wrist, hand and fingers, large, heavy muscle abdomen slender low waist, heavy buttocks and massive fore legs.\(^{47}\)

\(^{46}\) Sheldon, Stevens and Tucker, The varieties of Human Physique; cited by Harrison H. Clark.; Application of Measurement to Health and Physical Education; p. 88.

\(^{47}\) Ibid.
Endomorphy

In the digestive viscera dominate the body economy. A predominant of soft roundness through the various regions of the body is evident other characteristics are large, sound head, short thick neck, broad thick chest, with fatty breast, short arms with "hammy" appearance, large abdomen heavy buttocks, short heavy legs.\(^{48}\)

Significance of the Study

Physical Education and Sports Scientists in many countries are experimenting the ways and means to find out the best, easiest and most economical methods of selecting and training their sportsmen in terms of time spent in order to get maximum benefit from them. In some of the advance countries, like America, Germany, France, Russia, Australia etc a very scientific and refined method of selection is used in selecting sportsmen for different games and sports as per their requirement and potentialities possessed secondly our sportsmen are not educated and conscious about these latest methods and it is difficult to get their cooperation. Keeping above limitations in sportsmen. The most accurate and scientific method followed is known as muscle biopsy. The muscle biopsy method can be used to identify the potentials even in India but it

\(^{48}\) Ibid.
has certain limitations in our country. The first limitation is in terms of finding mind a feasible which method should be investigated to select sportsmen for different games and sports, so that optimal level of performance can be attained.

Absolute and relative size, somatotype, composition and maturation are morphological factors that may limit human performance. It is inferred at athletes who have, or acquire, the physique for an event are more likely to succeed than those who lack these characteristics. Quantification of physique through kinquanthropometry can provide a better basis for understanding the limits related to biomechanics and physiology of performance.

In light of the above the present study will be of significance in the following ways:

1. The study may help the physical education teachers and coaches in developing and in implementing systematic and scientific training programmes for each body types.

2. The results of the study may educate physical education teachers, coaches and teachers in general, regarding the role played by somatotype components in achieving high performance in different motor ability variables.
3. The findings of the study also may provide guidelines for selection of sportsmen for different games and sports on the basis of their body types.

4. The study may motivate other sports scientists to take up similar studies on physique so that quantification of physique through kinanthropometry can provide a better basis of understanding the limits related to biomechanics, psychology and physiology of performance.