CHAPTER I
INTRODUCTION
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Track and field is one of the world’s oldest sporting activities. We can trace the origin of track-and-field events in ancient Egyptian art. Its dominant presence can also be identified with frequent “races” that took place in ancient Greece before 1000 BC. Without an iota of doubt, it is rightly been designated as the “mother of all games”.

At present, track-and-field consist of running, hurdling, jumping and throwing events held between individuals and teams at indoor and outdoor meets. The running and hurdling competitions make up the track events, while the jumping and throwing contests comprise the field events. In many countries the sports as a whole is called athletics. Running races are the most prominent track events; the range in length from the indoor 50 meter dash to the outdoor marathon.

The first organized track-and-field meet that is called Olympic Games began in 776 BC in Greece. Coroebus, who won the first sprint competition, was regarded as the first Olympic champion. For many years the main Olympic competition was the pentathlon, which consisted of discus, javelin, foot racing, long jumping and wrestling. Other contests, including foot races for men clad in full armor, later joined the games. Notwithstanding, the Roman conquest of Greece in 146 BC, Olympic contests continued to be held for more than 500 years. But the Roman emperor, Theodosius I, discontinued it in 393 AD; because, he treated the Olympic contests as a pagan activity. For eight centuries thereafter, no organized track-and-field competitions occurred.
The uncovering of the ancient athletic site at Olympia and the knowledge gathered from various books relating to the inspiring history of the ancient games influenced the intellectual circle of the world in the 19th century. At this time, it was felt that bringing together of youth, in the spirit of ancient Olympic competitions, would not only contribute to the development of healthy youth, but also lay a foundation of peace in the world.

The credit of reviving the ancient Olympic Games goes to a French Baron, Pierre de Coubertin, who was born in Paris on 1st January 1863. As a young man, Coubertin had refused careers in literature and history. He had chosen to work in the field of sociology and education. He believed that intelligence cannot exist without training of the body. For this reason, he was a great admirer and propagator of school sports. Due to this effort, the first inter-school athletic games were held in Paris in 1889. This was his first step in the direction of revival of Olympics on an international level. According to Prof. Carl Diem of Germany, it was the love of peace and respect for life that drove Coubertin to the idea of reviving the Olympic Games. Coubertin, due to his untiring efforts, succeeded in organizing a “Congress” on 23rd of June 1894 that decided to revive the ancient Olympic Games from the soil of their birth i.e., Greece in 1896. Thus Coubertin had won at last. It was in 1896 in the stadium at Athens (Greece) that the first Olympic Games of the modern era were held.

It is to be noted that the rules of 20th century competitions are quite different from those of ancient times. But the spirit of the sport remains true to its early Greek roots. The modern Olympic motto Citius, Altius, Fortius (i.e.; faster, higher, stronger) best captures track-and-field competition. Each event determines who can run the fastest, who can jump the highest or the longest, or who can throw the farthest. In
In this particular context, it is imperative to highlight the middle and long distance running for the fulfillment of this research.

**MIDDLE DISTANCES:**

Middle-distance events include “races” of 800, 1500 and 3000 meters. Middle-distance runners use a combination of speed and endurance. They must stay in competition but also regulate their speed carefully to avoid tiring too quickly. Some middle-distance runners change their speed several times during the race, while others maintain an even pace throughout the race. Nurmi, who dominated track and field in the 1920, carried a stopwatch during races as a means of checking on his pace. An important element of middle distance races is the kick, a sprint for the finish line on the last lap. Running form for middle-distance event greatly differs from that of sprints. Knee action is much less pronounced, the stride is shorter and the forward lean is less extreme in middle-distance events.

**LONG DISTANCES:**

Run longer than 3000 meters is considered as distance event. The most common distance races are 5000 and 10000 meters. The marathon race is one of the examples of long distance race, which take place on paved roads over a course of 42.195 km (26 mile and 385 yd). Most of the best distance runners are small and light-framed. They use a running style that avoids excess motion. Knee action is slight, arm movements are reduced to a minimum and the strides are shorter than those used in sprinting or middle-distance running. Along with fitness strategy is also very essential for competing in long distance events.
The top racers use a variety of techniques to outperform their opponents, from abrupt changes of pace during the race to fast finishing kicks.

**HISTORICAL ROOTS OF ATHLETICS IN INDIA:**

The roots of athletics in India in its present form can be traced back to the last decade of nineteenth century. Nothing much is known of its early stages, till first known participation of Norman G. Pitchard in 2\textsuperscript{nd} Olympic Games in 1900 at Paris, where he won a Silver Medal in 200m. History does not speak much of this sport between 1900 and 1920. However, athletic competition was held as Inter Provincial Athletic Championship every two years. With the formation of Indian Olympic Association in 1926, its affiliation with IOC in 1927 and taking over the reigns of IOA by late Maharaja Bhupinder Singh as President and Prof. G.D.Sondhi as Secretary in 1928, Athletic Championship became a part of Indian Olympic Games held every two years.

India in the meantime participated (unofficially) in 1920 Olympic Games at Antwerp (Belgium) with 4 Athletes and 1924 Olympic Games at Paris with 8 Athletes under the leadership of H.C. Buck of YMCA Madras. The official participation of Indian athletes started in the 1928 Olympic Games at Amsterdam with a seven member team. Since then India participated under the IOA Banner in 1932 Olympic Games at Los Angeles and 1936 Olympic Games at Berlin with 3 and 5 athletes respectively. Mr. M.C. Dhawan, who participated in 1932 Olympic Games at Los Angeles, became the Secretary of Amateur Athletic Federation of India in 1950.

However, the Amateur Athletic Federation of India was formed in 1946 at the initiative of Maharaja Yadvindra Singh, the then President of Indian Olympic Association, with Prof. G.D. Sondhi as its first President. It got affiliated to IAAF (International Amateur Athletic Federation) in the year 1946. But it followed the IOA for holding the National Athletic
Championship once in two years. It was only in 1949 that AAFI took the decision of holding the National Athletic Championship every year. The AAFI for the first time selected 8 athletes (6 men and 2 women), who participated in 1948 Olympic Games at London. It was for the first time Indian women competed in the Olympic Games. From that time onward India is participating continuously in all Olympic and other games i.e. Asian games, Common wealth games, SAF games etc.

The poor performance of Indian track-and-field athletes at the International level has been a cause of great concern, especially to the coaches, physical educationists and sports scientists. Efforts have been made to improve the standard of our sportsmen for long, but little success has been achieved so far.

It is important to note that in contemporary India the choice of sports is determined by the child’s interest, facilities available and popularity of the sports in that particular society, but it is immaterial whether, his body structure is fulfilling the mechanical requirements of the game or not. If he chooses a wrong activity for which his body structure is not suited a limit is set beyond which, his performance cannot be improved, however, hard he and his coach may try.

However as man develops from birth to maturity some of the most observable changes in his body are those of his physical characteristics - his height, weight, shape and proportions. The patterns of growth of these characteristics result from the interaction of both inborn (genetic) and environmental factors, which are responsible for the performance of a sportsman. The physique and body composition including size, shape and form are known to play a significant role on the performance of an athlete. The performance of a sportsman in any game is also dependent on his suppleness, skill, training and motivation and on various other factor of physiological and bio-chemical nature.
Age, sex and physical growth have also been noticed to influence a person’s capacity for physical activity.

Cureton (1941) stated that in general, people with long legs and long arms and relatively short and small trunks were physically weak in long sustained heavy work, but they might show great speed and endurance at high levels of athletic activity. Long third-class levers are noted for speed and range of action as well as for their efficiency for force.

H. G. Dyson’s (1986) stated that the running speed is the product of length and frequency of stride, their ratio changing from one phase of a race to another and from athlete to athlete yet these two factors are always interdependent and maximum running efficiency exists only when they are in correct proportion, depending mainly on the weight, build, strength, flexibility and co-ordination of the runner. In contradiction to Prof. A.V.Hill’s original hypothesis, that the fastest time for a given middle or long distance could be attained by running at a constant speed, some physiologists have since suggested that the second half of such races should be run faster than the first, with the athlete conserving his anaerobic i.e. oxygen debt reserves until comparatively late in the race.

Tanner (1964) is of the opinion that a person using many smaller strides uses more energy over a given distance then a person using fewer and longer strides (provided the long stride spring naturally from his physique and are not artificially imposed)

Thus physical characteristics play a very vital role in all games and sports whether it is team or individual game, ideal body segments as per the demand of the particular event is necessary for higher achievement in that particular sport. In view of physical and physiological variations playing a significant role with performance of an athlete. Let us discuss certain important aspects associated with it.
SOMATOTYPE:

The term Somatotype is a Greek word, which means “forms of body”. Sheldon first used this word Somatotype in 1940. The greater propagation of interest regarding a particular type of physique that helps an athlete towards greater performance for a particular game, come up around the middle of twentieth century. Heath Carter explained, Somatotype as a description of the present morphological confirmation, expressed in a three numeral rating, consisting of three sequential numerals, always recorded in the same manner. Each numeral represents the evaluation of three primary components of physique, which describe individual variations in human morphology and composition.

He gave Somatotyping methods in 1967. Heath Carter method of Somatotyping is one such attempt, which fulfils to major extent these requirements and is widely in use through out the world during last three decades.

It is based on anthropometric measurements, which are easy to take on the subjects. Heath Carter took ten anthropometric measurements for determining Somatotyping viz. Height, Weight, skin folds of triceps, subscapular, supraspinal and calf regions, biepic condyle diameter of humerus and femur, Girths of biceps and calf muscles.

Heath Carter described these components as:

- Extreme Endomorph
  - Wide hips and narrow shoulders (pear-shaped)
  - A lot of fat on the body, upper arms and thighs
  - Quite slim wrists and ankles
- **Extreme Mesomorph**
  - Broad shoulders and relatively narrow hips (wedge-shaped)
  - Muscular body
  - Strong forearms and thighs
  - Very little body fat

- **Extreme Ectomorph**
  - Narrow shoulders, hips and chest
  - Thin face, high forehead
  - Thin legs and arms
  - Very little muscle or fat

Everyone is a mixture of all three basic body types, with ratings such as 3 4 4 or 3 5 2.

**BODY PROPORTIONALITY:**

The relationship of length to width, height to thickness, length-to-length etc. of various parts of body represents proportions. This importance of proportion becomes evident, when we want to compare...
particular body parts of two persons who are otherwise different in over all size. The proportions or ratio keeps one measurement constant in all subjects compared and evaluate the differences in the other measurements.

**HEART RATE:**

The number of cardiac contractions in one minute is called heart rate. The number of contractions ranges from 60 to 80 b. min.$^{-1}$ the rate and intensity of the cardiac contractions is affected by exercise, long-term training, age, disease, stress, environmental temperature etc. However 72 b. min$^{-1}$ is generally considered as a normal resting heart rate. However, lower resting heart rates than 72 b. min$^{-1}$ are recorded in the trained individuals.

**VITAL CAPACITY:**

It is the maximum volume of air expelled after a maximum inspiration. In quiet respiration the lungs work at about one – tenth of their full capacity and the tidal air volume is between 300 and 500 ccs. If after taking a normal breadth a maximal inspiratory effort is made the additional air inspired is about 1500 ccs and is called complemental air. Similarly the air expired by the maximal effort after a normal expiration is called the supplemental air and it is also around 1500 ccs. The sum of the volumes of tidal, complemental and supplemental air is thus the vital capacity. It is around 3500 ccs in a normal person. Vital capacity depends upon the physical development of an individual.

**SIGNIFICANCE OF THE STUDY:**

The study will be useful to coaches in track and field. As hard empirical facts obtained by us may form the basis of talent selection in
the very field. It is also to be noted that not much empirical work has been done to study the physical and physiological differences between elite middle and long distance runners of India. This research shall highlight the physical and physiological characteristics of middle and long distance runners. It will also study their physique in relation to the mechanical requirement of the two categories of running events. So that children with these inherited physical and physiological characteristics may only be recommended for middle and long distance running.

**STATEMENT OF THE PROBLEM:**

After critically evaluating the various aspects of the study, the researcher had stated the problem as “A study of physical and physiological differences between elite middle and long distance runners of India.”

**HYPOTHESIS:**

After a painstaking review of the related literature and keeping in view the objectives of study, it is hypothesized that significant differences shall be observed in physical and physiological parameters of middle and long distance runners.

**LIMITATION:**

It is assumed that following aspects may bring minor infringement on the results of the study.

1. Age variation.
2. Socio – economic background.
3. Eating habits.
4. Regional differences.
DELIMITATION:

In view of our objectives and facilities available at our disposal, the study is confined to

(A) Following physical variables of elite Indian male middle and long distance runners.

1. Weight
2. Stature
3. Sitting height
4. Shoulder breadth
5. Hip breadth
6. Upper arm length
7. Fore arm length
8. Thigh length
9. Lower leg length
10. Biceps muscles girth
11. Calf muscles girth
12. Triceps skin fold
13. Sub scapular skin fold
14. Supra illium skin fold
15. Calf skin fold
16. Thigh skin fold
17. Humerus biepic condyle diameter
18. Femur biepic condyle diameter
19. Somototype (Heath Carter method ‘1984’)
20. Body proportionality
   I. Sitting height – Stature index
   II. Ponderal index
   III. Thigh length – Lower leg length index
   IV. Upper arm length – Lower arm length index
   V. Hip breadth – Stature index
   VI. Shoulder breadth – Stature index
(B) Following physiological variables of elite Indian male middle and long distance runners.

(1) Heart rate

(2) Vital capacity