Chapter I

INTRODUCTION

The determinants of sports performance are many, and sports scientists have expended considerable effort toward understanding phenotypic variation in size, physique, and body composition; metabolic powers and capacities; strength, speed and skill; and cardio vascular adaptations relative to outstanding athletic performance. These efforts include not only the effects of training and practice, but also age and sex-associated variation. Response to training programme varies with age and from individual to individual.\(^1\)

The contribution of physical exercise to fitness includes the development and maintenance of strength, speed, agility, endurance and skill in persons who are physiologically sound. Regular exercise has also profound effects upon circulation, heart action, respiration\(^2\).

Cooper\(^3\) states that the efficiency of the heart as


a pump improves in response to regular, properly administered exercise. The heart not only becomes stronger and a little larger, but also increases its ability to deliver more blood with each stroke either at rest or during exercise.

Michal and Gallon\textsuperscript{4} reported that the resting and post exercise systolic blood pressures decreased significantly during training. Although pulse rate and pressure curve measurements changed significantly in three to six weeks, the systolic measurements took up to sixteen weeks to change significantly. The resting systolic blood pressure measurements and the secondary measurements after exercise decreased significantly during sixteen weeks of training.

These studies prove that vigorous and regular physical activity affects the efficiency/fitness of an individual not only during physical stress but also when his body is at rest.

Johnes, Shainberg and Byer\textsuperscript{5} have emphasized the physical aspects of fitness: "Total fit individual has


the strength, speed, agility, endurance and social and emotional adjustments appropriate to his age". Of all these, the crucial factor seems to be cardio respiratory endurance which is characterised by moderate contractions of large muscle groups for relatively long periods of time during which maximal adjustments of the cardio-respiratory system are necessary as in sustained running, swimming, climbing, bicycling and the like. When many muscles are worked hard, the circulatory and the respiratory systems are heavily loaded because these two systems directly support muscle work. The effectiveness of these systems then becomes the limiting factor in endurance. It is agreed that in vigorous activities of long duration, oxygen supply to the tissue is the main limitation. Therefore, the primary objective of cardio respiratory endurance training is to improve the supply of oxygen to the working muscles.

It has been observed that besides other factors, sports performance of an individual is dependent upon physical, physiological and psychological factors. Body composition is a vital detrimental variable among these factors. It is generally believed that high percentage of

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fat in relation to total body weight is detrimental and leads to obesity. Research has indicated that the relative degree of "fat free" body weight (lean body weight) is not only important from the point of view of health but also apparently plays an important role in obtaining high levels of human performance in activities where the body weight must be actually moved from one place to another.\(^7\)

High percentage of body fat decreases the ability of the cardio respiratory system to supply oxygen to various parts of the body, thereby lowering one's cardio respiratory endurance capacity. Fat causes poor performance in the area of cardio respiratory endurance because it not only places an overload on the circulatory system as a result of which heart has to pump more blood to a larger vascular system, but also fat acts as dead weight in the body (thus offering extra resistance to movement) while contributing nothing to muscle contraction.\(^8\)

All qualities of physical fitness depend upon the capacity of the organism to manage the energy required for working under continuous supply of oxygen for energy metabolism or energy metabolism with delayed supply of oxygen during recovery stage and conditions of neural

\(^7\)Lallry G. Shaver, *Essentials of Exercise Physiology*, (Delhi: Surjeet Publications, 1982), P. 278.

\(^8\)Ibid
transmission. Intensive burst of activities i.e. executing high load of work with explosive action in a short duration of time such as, explosive take-off in jumps, throwing an implement, kicking the football faster and far etc. depend upon anaerobic capacity.

Anaerobic capacities play an important role in influencing the sports performance, particularly in activities which involve working with maximum intensity for a shorter period of time, such as, sprinting, weightlifting, explosive jumping etc. Under anaerobic conditions a sportsperson has to work incurring oxygen debt. Such type of activities cannot be prolonged for long duration. It is quite evident that when a sportsperson undertakes an anaerobic task, he normally works with medium intensity. Therefore, the body would be able to supply the required amount of oxygen to enable a person to continue activity for relatively longer duration.

Many physiological responses are altered by different types of training programmes. In general, the improvement in each bodily system is of the order of 25 per cent or less, but when taken together, all the effects may result in an improvement of total performance which may be as high as 100 per cent and occurs in both magnitude and duration of the work. People who exercise regularly are capable of greater efforts and resist fatigue better than
sedentary individual\textsuperscript{9}.

Physiological functions are both dynamic (subject to change) and highly adaptive (wide limits for change) and such functions must be utilized and stressed to be maintained or increased. The adaptive limits of the human body are truly remarkable\textsuperscript{10}.

Performance differences between men and women have long been a subject of interest to physiologists, physical educationists, sports scientists, and coaches. These differences have been attributed to both biological and cultural factors, although the relative significance of each has not been ascertained. Differences in body fatness between males and females have been frequently mentioned as one biological factor responsible for variations in physical performance. In children, it has been shown that boys exhibit slightly higher performance levels than girls until adolescence, when the differences favouring the boys become greater\textsuperscript{11}.


According to Astrand and Rodahl\textsuperscript{12} the typical female has a lower cardiac output, smaller heart and lung volume, less hemoglobin, and fewer red blood cells than her male counterpart. Women have approximately 6 to 12 per cent more fat and substantially less strength.

The variables of cardio pulmonary functions, body composition and anaerobic capacity have long been identified as the important factors underlying good athletic performance. The cardio-vascular fitness supports the activity and carries it through, the body composition decides the total work done, whereas the anaerobic capacity supports the performance during oxygen shortage etc.

No study has been found in which men and women have been systematically compared for improvement in cardio-pulmonary functions, body composition and anaerobic capacity as a result of similar training programmes and it is for this reason that the present study has been planned.

\textbf{Statement of the Problem}

The purpose of this study is to determine and compare the alterations in Cardio-Pulmonary Index, Body Composition and Anaerobic Capacity as a result of similar

training programme in males and females.

**Delimitations**

1. The study was delimited to the male and female students of Certificate Course in Physical Education of the Shaheed Kanshi Ram College of Physical Education, Bhago Majra, Distt. Ropar, Panjab.

2. The study was further concentrated on the students in the age group of 16 to 19 years.

**Limitations**

Sincere efforts were made to get the optimum performance during testing and training from the subjects but no motivational techniques were used. Any lack of effort put in by them due to the absence of external motivation was considered as the only limitation of this study.

**Hypothesis**

On the basis of the literature reviewed, research findings and scholar's own understanding of the problem, it was hypothesised that due to similar training programme male
and female subjects would show significant improvement on
the selected variables but would exhibit significant
variations in the pattern of improvement when compared with
social reference to sex for the simple reason of periodic
fluctuations in women.

Definitions and Explanation of Terms

Cardio-Pulmonary Index

Cardio-pulmonary index is a measure of efficiency
of the cardio-pulmonary system based on the formula derived
by Hyman\(^{13}\), which is:

\[
C.P.I. = \frac{V.C. + M.E.P. + M.B.H. + Age}{S.P. + D.P. + P.R.}
\]

where,

- V.C. = Vital Capacity
- M.E.P. = Maximum Expiratory Pressure
- M.B.H. = Maximum Inspiratory Breath Holding Capacity
- Age = Completed years
- S.P. = Systolic Blood Pressure
- D.A. = Diastolic Blood Pressure
- P.R. = Pulse Rate

\(^{13}\) Encyclopaedia of Sports Sciences and Medicine, 1971 ed. S.U. Cardio-Respiratory Endurance by Albert S. Hyman.
Body Composition

Body composition may be defined as the proportion of the lean body mass and depot fat and it is one of the most important morphological features characterising human organism\textsuperscript{14}.

Anaerobic Capacity

Mathews and Fox\textsuperscript{15} have defined anaerobic capacity as the ability to anobilise energy during activities of intense nature i.e. executing intensive work with explosive action in short durations of time such as kicking the football faster and far, explosive take off in jumps, throwing the implement, activity which is performed at maximum rate for short duration. In this study anaerobic capacity has been measured by means of Margaria Power Test and by 50 metre run.


Significance of the Study

P.T. Usha's face saving performance in Athletics (Track and Field) in Seoul Asian games has since become the talk of the masses, especially among the sports generation in our country. This has in fact prompted the top officials in sports circle in particular, and administrators as well as organizers in general, and generated an ever growing awareness of female participation in sports in India. This also has its roots in the miserable failure on the part of the male athletes at the Asian level, what to talk of international level. But of P.T. Usha's performance is not a normal one but rather quite rare when we talk about the women sports in our country. It is generally observed that male and female athletes train together in the camps but it remains to be seen whether they follow the same pattern of adaptation in response to similar type of training, since according to Astrand and Rodahl the females have lower cardiac output, smaller heart and lung volume, less hemoglobin and fewer red blood cells than her male counterparts. Also the women have approximately 6 to 12 per cent more fat and substantially less strength. Differences have also been

observed between the sexes in relation to aerobic power in favour of the males. Therefore, the present study will be of significance in highlighting the effects of similar training programme on males and females. The results of this study would also be of significance in the following ways that it would:

1. Provide assistance to the coaches/physical educators and other concerned in planning and execution of their programmes when faced with problems of sex difference in particular and for their own understanding in general.

2. Add to the existing knowledge in this area.

3. Provide guidelines for planning duration of training programme, especially for alteration of Cardio Pulmonary Index, Body Composition and Anaerobic Capacity.