Chapter 1

INTRODUCTION

The field of physical education and sports are as international disciplines, because they develop international understanding and universal brotherhood in the present politically conflicting lives. Sports movements is considered as one of the major adhesive forces for developing world peace. It may also serve as one of the effective means in solidifying national integration and developing national character. Sports has become the media of international relationship of the countries.¹

The ideas and expression of the international players is to view the sport not only through the individual aspect but primarily through the national one. Sports is a national prestige and international popularity.²

In today's world there is keen sense of competitiveness in every walk of life. The urge for competition has assumed such proportions that each one of us is using his or her might to out-class and excell others in achieving the specified goals or even


²Ibid., p. 29.
to excel in the process of investigation, experiment and research.

The field of games and sports is no exception to this phenomenon or rapid development and progress. After the start of modern Olympic games a tremendous development has taken place in this discipline.  

Sports is as old as the society and it has achieved an 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 follow different sports events all over the world with an enthusiasm bordering on devotion. Many participate in sports activity for the fun of it or for health, strength and fitness. It is taking the shape of a professional to some with high skills; with ample financial benefits linked with high degree of popularity.  

Success in the Olympic games has received considerable attention as an important factor in world recognition. Some authorities suggest that the prestige and visibility associated with achievement in the Olympics may be an essential aspect in a

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nation's plan for economical and political development. The world recognition gained by some countries who have implemented an approach where an emphasis has been placed on international sports competition has led others to explore the potential of this method.  

At present, competitive sports leads to a new era where the competitive sports performance has made scientist of different fields to come to a common platform and work together harmoniously to achieve excellence in a particular discipline. The quest for excellence in Olympic or World Cup events no longer makes allowances for haphazardly constructed coaching or training schedule but the scientists in this area are working day and night to discover new means and methods.

There is a great concern of sport scientists, coaches and teachers of physical education to identify those characteristics of sportsmen that show potential for developing high level of skills in specific sports, so that such potential sportsmen might be identical as early in their lives as possible, so that they might

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be nurtured scientifically to unfold their talents.\(^7\)

Today the preparation of an athlete for achievement is a complex dynamic state, characterised by high level of physical, physiological and psychological efficiency and the degree of perfection of the necessary skills and knowledge, techniques and tactical preparation. Many other factors are also brought into action in his preparation (means of rehabilitating strength after loads, special nutrition, organisation of general regime in accordance with the conditions of sports activity etc.). Thus, athlete's training today is a multi-sided process of expedient use of aggregate factors (means, method and conditions) so as to influence the development of an athlete and ensure the necessary level of preparation.\(^8\)

For the physiological system of the body, to be fit, the system must function well enough to support the specific activity that the individual is performing. Moreover, different activities makes different demands upon the organism with the respect of circulatory, respiratory, metabolic, neurological and temperature regulating functions. Physiological fitness is specific

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to activity. Physiological systems are highly adaptable to exercise. Each task requires different functioning of the appropriate systems.

The primary work of exercise physiologist is to describe the change that occur in organ and organismic function as a result of single (acute) or repeated (chronic) dosage of exercise and to explain how those functional changes occur. The first part of this task, i.e. describing changes brought on by exercise, is much nearer completion than the second explaining the mechanism that produce those changes. As one example of this lag between description and explanation, it has been known for many years that regular exercise such as running and swimming will eventually cause but there is still no experimentally verified explanation of precisely how this training effect is brought about.

Swimming which was considered to be only a survival activity, has now developed into one of the most popular competitive sport at the international and Olympic level. This perhaps one of a few sports where ever increasingl performance are evident now and then and swimmers have attended incredible


standards at a relatively much younger age. One factor for such a high performance is that the human organism is organically and physically in a state of readiness even just a few month after the birth, which is not true in case of many other sports, where a certain level of physical and mental maturity is necessary before one can understand such sports.  

The beginning swimmer is totally involved in any learning experience, and his final level of skill attainment may be very well related to such personal factors as body build; height and weight; strength; endurance; flexibility; balance and coordination; reaction; movement and reflex times; kinesthesia; perception; anxiety; stress and tension; availability of time and facilities; and quality of teaching.  

Swimming practice is an art of the man. They try to make their artificial movement in a graceful manner and instincts quality helps them to swim very rapidly. There is a limitation in the distance he can swim, the speed he can make.  

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performance of the swimmers have been all the time a matter of great concern for the coaching and sports scientists and continuous efforts have been made in this direction. Tanner has stressed that the physique and body composition including the size, shape and form play a significant role in the performance.

The president's council on physical fitness and sports, U.S.A., has recognised swimming as a desirable sport for all ages and abilities. As quoted from the brochure, "vigorous water activities can make a major contribution to the flexibility, strength and circulatory endurance of individuals. With the body submerged in water blood circulation automatically increased to some extent; pressure of the water on the body also promotes deeper ventilation of the lungs; and with well planned activity, both circulatory and ventilation increased still more."

Councilman states that most of the literature suggest that up to a pulse rate of 150 beats per minute the source of energy is aerobic. Above this rate the shift is toward anaerobic


source of ATP. Many factors, however, enter into determining the pulse rate. If the swimmer and coach want to use the pulse rate as an indicator in determining roughly whether the swimmer is performing aerobically or anaerobically in practice, they should use the pulse rate:

<table>
<thead>
<tr>
<th>Pulse Rate Per Minute</th>
<th>Percent Aerobic/Anaerobic</th>
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<tbody>
<tr>
<td>Under 120</td>
<td>Probably 100% aerobic.</td>
</tr>
<tr>
<td>120 - 150</td>
<td>90 to 95% aerobic/5 to 10% anaerobic.</td>
</tr>
<tr>
<td>150 - 165</td>
<td>65 to 85% aerobic/35 to 50% Anaerobic.</td>
</tr>
<tr>
<td>165 - 180</td>
<td>50 to 65% aerobic/ 35 to 50% anaerobic.</td>
</tr>
<tr>
<td>Above 180</td>
<td>Over 50% anaerobic.</td>
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</tbody>
</table>

It is the amount of myoglobin contained in the muscle which determines the colour, according to Mathews, Stacey, and Hoover. Red muscles has more of this protein substance which is chemically related to hemoglobin and like hemoglobin, possesses an attraction for oxygen. It is therefore, aerobic in character, while white fiber is anaerobic, endurance events are considered aerobic events in that they require an efficient oxygen transport and utilization system, while sprint events are anaerobic in that oxygen transport is of little or no importance, depending on the distance.\textsuperscript{17}

\textsuperscript{17} Ibid., p. 108.
The sprinter needs more explosive power and less endurance than the middle distance and distance swimmers. Since he swims the 50, the 100 and sometimes the 200 yards distance he needs good endurance and he should thus not eliminate all endurance work from his training programme. He also needs to do some overdistance swimming and some short-rest-interval training. The sprinter needs to train his system to release fast and to be able to operate in oxygen debt.  

The biomechanics and physiology of swimming are continually interacting. Body density and lung volume determine buoyancy. A decrease in body density and an increase in lung volume increases the buoyancy. Propulsion depends on muscular strength and effective stroke mechanics. Swimming speed will increase until the propulsive force equals water resistance. The success of a swimmer depends on the development of (a) muscular strength and endurance, (b) large aerobic and anaerobic capacities, and (c) efficient stroke mechanics.  

Here are a few of the assumptions we could make: if we train for nothing but endurance (overdistance and interval training).  

\[18\] Ibid., p. 29.  
training), we will improve the quality of the muscle for endurance work, but it will probably make the muscles weaker and there will be negative effect on the speed of the swimmer in the short events. On the other hand if we train the swimmers only with weight lifting or sprint training, we will make the muscles stronger and will improve the speed for a short sprint, but there will be a negative effect on the aerobic capacity or the endurance of the swimmer, based on the decreased in sarcoplasmic protein and a consequent decrease in energy liberating enzymes, possibly in mitochondria. 20

All swims involve the both aerobic and anaerobic work, but in different proportions. A 25 yard to 50 yard sprint may be 75 to 90% anaerobic. Some where above 200 yards work becomes 50 per cent anaerobic (energy stored) and 50 per cent aerobic (oxydize glucose). A 500 yard event would be around 75% aerobic and 1650 yard event around 90 per cent aerobic. As can be seen each race is a combination of types of work. This is why events of different distances require a different type of swimmer. With very few exceptions, such as Shane Gould,

20 Counselman, Competitive Swimming Manual for Coaches and Swimmers, p. 87.
one can not be both an endurance swimmer and also a sprinter. 21

With the rapid growth of freestyle sprint and long distance swimming as a competitive sport lot of research work has been done in other countries to gather information more on physical and physiological aspects in this field and accordingly training athletes on the basis of formed profile for the improvement in the freestyle sprint and long distance swimming performance. Further, it is generally accepted fact that physical fitness is an invariable concomitant of sports proficiency, but, whether the players of a specific sport (swimming) belonging to the free style sprint and long distance swimming groups are influenced equally by the physical and physiological qualities in the same magnitude is not fully investigated. Hence, the research scholar has been interested to compare between the Senior National Sprint and Long Distance Swimmers in Physical and Physiological Variables as well as to prepare a physical and physiological profile on sprint swimmers and long distance swimmers.

**Statement of the Problem**

The purpose of the study was to compare in selected physical and physiological variables between National Sprint and Long Distance Swimmers.

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The purpose of the study was also to prepare the physical and physiological profiles of Indian National level sprint and long distance swimmers.

**Delimitations**

1. The study was delimited to the thirty male freestyle sprint swimmers and thirty male freestyle long distance swimmers, who took part in the Open National Swimming Championship held in the years 1992-93 and/or 1993-94.

2. The study was further delimited to the following physical and physiological variables.

**Physical Variables**

1. Height
2. Arm and Shoulder Strength
3. Grip Strength
4. Body Composition :
   a) Percentage of Body Fat
   b) Lean Body Weight
   c) Weight.

**Physiological Variables**

1. Resting Heart Rate
2. Maximum Oxygen Consumption (VO₂max)
3. Peak Flow Rate
4. Air Flow Rate
5. Vital Capacity
6. Anaerobic Power
7. Positive Breath Holding Capacity
8. Negative Breath Holding Capacity.

Limitations

1. Regular routine, food habits and social back-ground of the sprint and long distance swimmers was taken as a limitation of this study.

2. Non-availability of sophisticated instruments and facilities was also taken as the limitation of the study.

3. No special motivational devices were used to enable the subjects to perform better.

Hypothesis

It was hypothesised that there would be significant differences between national sprint and long distance swimmers in some of the selected physical and physiological variables.

Definition and Explanation of Terms

Physical and Physiological Profile

Physical and Physiological profile may be defined as physical and physiological characteristics of an individual including various factors involved in the task performance of the individual.
Resting Heart Rate

The heart rate (beats per minute) which is derived during the complete resting condition of the organism of the subject.\footnote{22}{Morehouse and Miller, \textit{Physiology of Exercise}, p. 69.}

The distention of the arterial walls at the beginning of systolic ejection of blood is not confined to aorta but travels down the arteries that lie close to the body such as radial artery of the wrist, the arrival of the wave of distention and subsequent recoil may be felt as a distant throb pulse which offers a convenient method of counting heart rate.

\textbf{Maximal Oxygen Consumption (VO}_{2}\text{max}}

The maximal rate at which oxygen can be consumed per minute, the power or capacity of the aerobic or oxygen system.\footnote{23}{D. Mathews and Edward L. Fox, \textit{The Physiological Basis of Physical Education and Athletics} 3rd ed. (Philadelphia : Saunders College Publishing, 19\textsuperscript{1}), p. 640.}

\textbf{Vital Capacity}

1. Maximal volume of air forcefully expired after maximal inspiration.\footnote{24}{Mathew and Fox, \textit{The Physiological Basis of Physical Education and Athletics}, p. 647.}
2. It is the volume of air that can be breathed out by forced expiration after taking forced inspiration.\(^{25}\)

**Peak Flow Rate**

Rate of flow of air per minute at the peak expiratory condition is known as peak flow rate.

**Air Flow Rate**

Air flow rate has been defined as the flow rate of expired air after maximum voluntary inspiration.\(^{26}\)

**Breath Holding Time**

As defined by Moses\(^{27}\) breath holding time is the duration of time, through which one can hold his breath without inhaling or exhaling.

Breath holding could be positive or negative. It is referred to be positive, when breath is held after forceful inhaling the air similarly, it is termed negative, when the breath is held after exhaling the air forcefully.

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Anaerobic Power

1. Anaerobic Power is the rate at which work is done without oxygen.\textsuperscript{28}

2. The Anaerobic Power or capacity is the ability to jump, sprint, put the shot, throw the javeline, or perform fast starts converting energy to power. Power is performance of work expressed per unit of time.\textsuperscript{29}

Body Composition

1. Body composition is the proportion of the lean body mass and depot fat, and it is one of the most important morphological features characterising human organism.\textsuperscript{30}

2. Body Composition is concerned with obesity. In measuring this aspect of the body composition, the total body weight is divided into two components, lean body weight and fat body weight. Lean body weight includes muscles, bones, and vital organs. The underlying presumption is that total weight equals lean weight


\textsuperscript{29}Mathew and Fox, \textit{The Physiological Basis of Physical Education and Athletics}, p. 619.

plus fat body weight. The higher the percentage of fat, the higher the degree of obesity.\textsuperscript{31}

\textbf{Grip Strength}

Grip strength can be defined as the strength of grip of each hand.\textsuperscript{32}

\textbf{Arm and Shoulder Strength}

In this study arm and shoulder strength is calculated by using push-ups and pull-ups in number, height in inches and weight in pounds by applying Roger's formula.\textsuperscript{33}

\textbf{Body Surface Area}

For the purpose of this study body surface area is defined as the total area occupied by the body in the water, expressed in square metres.

\textbf{Free Style Swimming}

1. The "free style swimming" is referred to as the front


crawl stroke in swimming and is presently the fastest stroke man swims.\(^{34}\)

2. In front crawl swimming the person appears to be crawling like a baby, reacting out with one hand at a time. The swimmer lies flat on the water facing down, the arms are pulled alternately from front to back down the imaginary centre line of the body upto the thigh and are recovered out of the water to produce another pull. Both legs move up and down alternately. The number of leg beats to one arm cycle left and right, varies from 2 to 6 as per the built of the swimmers and the distance to swim.\(^{35}\)

**Sprint Swimming**

Sprint events are those events taking roughly a minute or less. These include the 50s and 100s.\(^{36}\)

**Long Distance Swimming**

Long distance events are those requiring more than four minutes, which would be 800 m., 1000 yard, 1500 m. and 1650 yard

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free style events. 37

Significance of the Study

The study may contribute towards the swimming progression in following way:

1. The present study may add the new knowledge in the field of physical education and sports in general and swimming in particular.

2. The finding of the study reveals the extent of physiological adaptive changes as a result of training and participation in competitive swimming (in sprint and long distance swimming) of Indian National Swimmers (senior).

3. Observation of this study if compare with the available data pertaining to physical and physiological profile of sprint and long distance swimmers of international repute will give a clear picture about the status of Indian Swimmers on Physical and Physiological profile in the perspective of international rating.

4. The study will help to evaluate as well as to prepare the training programme so as to bring about the standard of Indian Senior National Swimmers equally to other advanced countries depending upon the physical and physiological variables

37 Ibid.
included in the study.

5. The study will help physical education teachers and coaches to highlight the positive impact of sprint and long distance swimming for a particular period for not only the promising and upcoming swimmers but also for sedentary and normal individuals as well.