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**Original Article**

# A study on the physiological traits of sportsmen with different aerobic capacities

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**Abstract**
In Games and Sports the importance of aerobic potential has been realized by top coaches and everyone tends to spur it up to perform efficiently. A group of 40 male students who were in the age group of 17to 25 years were selected as subjects for the study. They were divided into two groups of 20 each ( n= 20 ) as low and high aerobic capacity groups based on Cooper's 12 minutes run and walk test. Physiological traits were estimated and studied descriptively. The results showed the mean value of lean body mass and total body weight of low aerobic capacity group to be higher than the aerobic capacity group. A significant mean difference was found in hemoglobin content, resting heart rate and vital capacity between the groups.
**Key words**; training, physiological characteristics, sportsmen

## Introduction

Experts have rated Sports as dynamic in nature and progressive in outlook. Elite sportspersons achieve top level performance in competitions by training extensively with fixed targets (Hauerbach, 1967). Physiologically, fitness which may be termed as training effect is achieved through experiences or activities that promote the use of oxygen utilized to burn fuel in working muscles. The term aerobic exercise includes those activities which are performed under sub-maximal level with the speed range of 130-150 heart beats per minute.

The program of such exercises tends to develop cardiovascular fitness. It has been accepted that physiologically, fitness is specific in nature and body systems are highly adaptive to exercise. The aerobic capacity can be judged if studies on the physiological traits qualitatively and quantitatively are taken up. Research studies are abundant in this area (Caputo, et al., 2003; Holm, et al.2004: Impellizzeri,et al., 2005; Sleivert & Tainghue, 2004). The present study was undertaken to find the level of physiological traits descriptively and to compare between high and low aerobic capacity groups.

## Methodolgy

Subjects were selected randomly from a large group of male students who were undergoing physical education courses in India. The age of the students ranged between 17 and 25 years. To determine the aerobic capacity the participants were subjected to the Cooper's 12 minute run and walk test. From the aerobic performance score, the upper 25$^{th}$ percentile scores were taken as high aerobic group and the lower 25$^{th}$ percentile scores were taken as low aerobic group. For each of the group 20 subjects were randomly selected for the study. The physiological variables chosen for the study were hemoglobin content, resting systolic blood pressure, resting heart rate, vital capacity, percentage body fat, lean body mass and total body weight. Standard tests were employed to test each of the variables. Mean and standard deviation as descriptive statistics were computed for each variable of each group. Mean difference "t" ratio was computed between the high and low aerobic capacity group to find out the significant difference if any.

## Results and discussion

The results of the findings of the investigation are presented in the following tables

**Table – I, Mean and Standard deviation of physiological variables, Low aerobic group (N= 20)**

| S.No. | Variable | Mean | Standard Deviation (SD) |
|---|---|---|---|
| 1 | Hemoglobin content | 13.92 | ± 0.45 |
| 2 | Resting systolic blood pressure | 117.70 mmHg | ± 3.95 |
| 3 | Resting diastolic blood pressure | 77.00 mm Hg | ± 3.30 |
| 4 | Resting heart rate | 60.75 B/min. | ± 2.34 |
| 5 | Resting respiratory rate | 19.80 R/min. | ± 1.46 |
| 6 | Vital capacity | 3.11 Lit. | ± 0.26 |
| 7 | Percentage of body fat | 12.88% | ± 1.47 |
| 8 | Lean body mass | 49.69 Kg. | ± 4.63 |
| 9 | Total body weight | 62.57 Kg. | ± 5.01 |

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**Table – II, Mean and Standard deviation of physiological variables, High aerobic group (N=20)**

| S.No. | Variables | Mean | Standard Deviation (SD) |
|---|---|---|---|
| 1 | Hemoglobin content | 15.21 | ± 0.45 |
| 2 | Resting systolic blood pressure | 114.50 mm Hg | ± 5.02 |
| 3 | Resting diastolic blood pressure | 76.25 mm Hg. | ± 3.98 |
| 4 | Resting heart rate | 52.70 B/min. | ± 3.21 |
| 5 | Resting respiratory rate | 17.95 R/min. | ± 1.53 |
| 6 | Vital capacity | 3.67 Lit. | ± 0.26 |
| 7 | Percentage of body fat | 11.87% | ± 1.13 |
| 8 | Lean body mass | 45.53 Kg. | ± 2.29 |
| 9 | Total body weight | 57.40 Kg. | ± 2.57 |

In Table- I and Table- II the mean and standard deviation of the selected physiological variables of the low aerobic capacity group and the high aerobic capacity group are represented. The results above show that mean of hemoglobin content in low group was 13.92 and Standard Deviation (SD) was ±0.45 when compared to the high group of 15.21 and ±0.45 respectively. With regard to the Resting Systolic blood pressure, the low group showed a mean of 117.70 mmHg and SD of ±3.95 and the high group showed 114.50 mmHg and ±5.02 respectively. Thus, there was a difference in the above physiological component with the high aerobic capacity group going a little upward. The Resting Diastolic blood pressure of low aerobic group had a mean of 77.00 mmHg and SD of ±3.30 when compared to the high aerobic group of 76.25 mmHg and ± 3.98 respectively.

The mean and standard deviation of low aerobic group in case of the Resting Heart rate showed 60.75 B/min. and ± 2.34 whereas the same variables for high aerobic group showed 52.70 B/min. and ± 3.21 respectively. The mean of the low capacity group for Resting Respiratory rate was 19.80 R/min. and the SD was ± 1.46 whereas the high aerobic capacity group showed a mean of 17.95 R/min. and SD of ± 1.53. Vital Capacity mean of low aerobic group was 3.11 Lit. and standard deviation was ± 0.26 when compared to the high capacity group which showed a mean of 3.67 Lit. and SD of ± 0.26. Further, the results showed the low group having a mean of 12.88% in the body fat percentage and a standard deviation of ± 1.47 whereas the other group showed 11.88% and ± 1.13 as the mean and SD in the above variable respectively.

With regard to the lean body mass, there was greater attainment by the low aerobic group which showed a mean of 49.69 Kg and a Standard deviation of ± 4.63 when compared to high capacity group whose mean was 45.53 Kg and a SD of ± 2.29. Lastly, the low aerobic capacity group also had a high in the

Total Body Weight with a mean of 62.57 Kg and SD of ± 5.01 corresponding to the high aerobic group whose mean read 57.40 Kg and SD of ± 2.57. This indicates that the scores are ranging and were scattered widely within the normal curve. Probably, such students were fresher and would have been undergoing less physical activity.

**Table – III, Significance of Mean difference of physiological variables among, Low and High aerobic capacity groups**

| S.No. | Variables | Mean of High A.C. Group | Mean of Low A.C. Group | DM | DM | "t" ratio |
|---|---|---|---|---|---|---|
| 1 | Hemoglobin content | 15.21 | 13.22 | 1.99 | 0.46 | 2.80* |
| 2 | Resting systolic blood pressure | 114.50 | 117.70 | 3.20 | 4.48 | 0.71 |
| 3 | Resting diastolic blood pressure | 76.25 | 77.00 | 0.75 | 7.46 | 0.10 |
| 4 | Resting heart rate | 52.72 | 60.75 | 8.05 | 3.12 | 2.58* |
| 5 | Resting respiratory rate | 17.95 | 19.80 | 1.85 | 1.54 | 1.20 |
| 6 | Vital capacity | 3.67 | 3.11 | 0.56 | 0.27 | 2.07* |
| 7 | Percentage of body fat | 11.87 | 12.88 | 1.01 | 1.37 | 0.74 |
| 8 | Lean body mass | 45.53 | 49.69 | 4.16 | 4.02 | 1.03 |
| 9 | Total body weight | 57.40 | 62.57 | 5.17 | 3.54 | 1.46 |

Significant at 0.05 level t. 05 (38) = 2.02

Table – 3 indicates the significance of mean difference of physiological variables between high and low aerobic capacity groups. It reveals that these two groups differ significantly in the hemoglobin content, resting heart rate and vital capacity as the calculated "t" ratio values of 2.80, 2.58 and 2.07 respectively were found to be above the tabulated "t" ratio value of 2.02. The high aerobic capacity group had a high in the above three variables which are considered as the most important factors in endurance activity.

Further the contributing factor which is considered essential for the aerobic performance is the oxygen utilization of the body during work or exercise, which is governed by cardiac output, hemoglobin content, myoglobin content of active muscles and oxygen extraction capacity of muscles. It has been long

established that individuals known to have considerable aerobic capacity usually have a slow resting heart rate (Astrand & Rodahl, 1986). This apart the vital capacity plays a crucial role in outstanding performances (Clausen, 1977). Besides, there are other factors like hemo-dynamic adjustment during exercise, thermoregulatory efficiency, percentage of red muscle fibers in the respective muscles and economy of energy expenditure which have influence on the aerobic potentiality of an individual. Higher amount of vital capacity will definitely help to achieve a higher rate of pulmonary ventilation during aerobic types of work. The programs of physical training result in the decrease of resting heart rate and increase in aerobic potentiality (Tooshi, 1970; Jose.et.al., 2010) and this is also been supported by the findings of the present study. Several researchers (McArdle, 1994; Foster, 1977: Spencer & Gastin, 2001) have indicated in their studies that there is a positive relationship between hemoglobin content, resting heart rate and vital capacity with respect to the aerobic work.

The results of the study also reveal that there is insignificant difference in resting systolic blood pressure, resting diastolic blood pressure and resting respiratory rate which may be due to the fact that all the variables were observed during the basal conditions. Probably, the involvement of these variables during resting condition in relation to their demand was so meager that both the high and low aerobic groups showed insignificant difference.

The insignificant difference of percentage body fat, lean body mass and total body weight may be due to the reason that the deposited fat has no role to play with immediate energy supply mechanism during endurance work. Moreover, all the subjects were professional physical education students who were residing in identical environmental conditions, having almost similar types of physical work load and consuming identical food. High aerobic capacity group might have higher oxygen extraction capacity or it can be inferred that this group may not have higher body mass or total body weight but they obviously have higher efficient and aerobically potential muscle fibers in their body as compared to that of low aerobic capacity group.

**Conclusion**

The study reveals some very interesting but reasonable conclusions which are as follows

1. High aerobic capacity group showed high hemoglobin content, high vital capacity and low pulse rate which are considered the dominating factors for endurance performance. Akin, these factors were found to differ significantly between high and low aerobic capacity groups.
2. Low aerobic capacity group showed high systolic blood pressure, resting diastolic blood pressure, resting respiratory rate, percentage body fat, lean body mass and total body weight. It is inferred that the above factors differ insignificantly between high and low aerobic capacity groups.

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