

# Effect of Aerobic and Anaerobic Exercises on Aerobic Fitness and Power Related to Performance of Athletes in Odisha

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**\*Subhasis Nayak & \*\*Dr. Devendranath Behera**

\*Ph.D. Scholar, Government College of Physical Education, Utkal University, Bhubaneswar

\*\*Retd. Principal, Government College of Physical Education, Utkal University, Bhubaneswar

## *Abstract*

Scientists and physiologists have been of the view that the physical and physiological parameters of an athlete have to do with their performance more than the techniques and tactics of the players. Most of the sports and games demand greater amount of endurance vital capacity hemoglobin, speed, strength, flexibility etc. Exercise physiology concerned with the players responses and adaptation to exercise at the system as well as sub cellular level. Improved cardiovascular function can result in better performance in games and sports. The athletes engaged in various games and sports require aerobic and anaerobic endurance training. With training and conditioning the heart become more efficient and is able to circulate more blood while bearing less frequently for a standard amount of work, the heart beats slowly as the training period proceeds. The heart rate changes indicate a decreasing load on the cardiovascular adaptation to exercise. The purpose of the study was to find out the effect of aerobic and anaerobic exercises on the aerobic capacity and power of athletes of Odisha. Accordingly, it was hypothesized that there may be significant difference between the four Groups under observation in Aerobic capacity and power. The collected raw data were analyzed by using Analysis of Covariance to see the difference between the Pre and Post training effect of different treatments on the selected variables under consideration. The level of significance was set at 0.05. It is concluded that Aerobic training is better than the other three groups under consideration for the development of aerobic fitness. It is concluded that Aerobic training is better than the other three under consideration for the development of power of the lower extremities.

**Key Words:** Aerobic exercises, Anaerobic exercises, aerobic capacity and power

## **Introduction:**

Education can be defined as a change, a modification, or an adjustment on the part of an individual as a result of experience. Education means preparation for life. It helps every individual to become all he incapable of becoming. Education must be concerned with developing optimum organic health, vitality, emotional stability, social consciousness, knowledge, wholesome attitude and spiritual and moral qualities.

A happy child is a pride of a nation, children are the world greatest resources let us have a great millennium ahead with reference to the investment of child's developments which would be an investment of a strong and developing nation like our country India. Man is always striving for perfection in every area of knowledge and practice. Human being is a unique product to nature's creations and evolutions. It is no doubt, on account of highly developed muscular and nervous system, which enables him to think, express and search whatever he wants to do.

A highly systematic, well-developed programme of physical education, sports and games is basically a product of modern historical era. Although exercise fundamentally is a large part of

physical education, sports and games, a close examination of the lives of the previous societies of man reveal that exercise alone is not a true representation of such activities but man has always had a propensity or natural bent for physical education, sports and games.

Scientists and physiologists have been of the view that the physical and physiological parameters of an athlete have to do with their performance more than the techniques and tactics of the players. Most of the sports and games demand greater amount of endurance vital capacity hemoglobin, speed, strength, flexibility etc. Exercise physiology concerned with the players responses and adaptation to exercise at the system as well as sub cellular level. Improved cardiovascular function can result in better performance in games and sports. The athletes engaged in various games and sports require aerobic and anaerobic endurance training.

The coaches provide training for a number of physiological changes such as cardio-vascular endurance, vital capacity, heart rates, hemoglobin, blood pressure, breathing control etc. These modifications can be short termed i.e. casting only for the duration if the activity is continued on regular basis. Knowledge of exercise physiology is essential to the practitioners. It is critical that the practitioner understand the effect of exercise on the individual's body to plan programmes to achieve the desired outcomes and to maintain the effect of such programme on the individuals.

The physiological parameters seems to play a very important role in the modern competitive sports in production of more excellent performance, because competitions are organized more frequently than ever the sum sets at a place at a particular time it may rise at other place, moreover because of physiological parameters and difference in time the athletes the same time at another place. It is well known that the individual performance in any sports activities follows diurnal physiological parameters. Pattern method may be derived to condition the athletes to produce peak performance with change in diurnal physiological parameters.

With training and conditioning the heart become more efficient and is able to circulate more blood while bearing less frequently for a standard amount of work, the heart beats slowly as the training period proceeds. The heart rate changes indicate a decreasing load on the cardiovascular adaptation to exercise.

Vital capacity is the total amounts of air that can be forcibly expire after a complete inspiration has been used frequently as a measure of adequacy of the respiratory system. Although it measures the approximately capacity of the lungs, recent information indicates it is of little use in predicting ability to perform tasks of endurance. Obviously other factors are more important. For example, any limitations of the oxygen delivery system to the cells will reduce the effectiveness of the delivery; regardless of vital capacity is the ability to take in more air per unit of time with fewer, but deeper inspiration, thus prolonging the onset of fatigue in the respiratory muscle.

Consistent overloading of the respiratory system increases the strength and endurance of the respiratory muscles and causes the interior volumes of lungs to the expansion surface are where gases may be transformed to and from the circulatory system. This results in a slower breathing rate, during rest and less increase in breathing rate during heavy work

Endurance like strength is a conditional ability it is primarily determined by energy liberation process. The ability of the human body to maintain a certain level of energy production

forms the physiological basis and also due to its physiological deterrents which has been studied in great detail and depth by the physiologists.

Exercise physiologist, sports scientists, physical educationists and sports training experts have been devising different means and methods to develop human abilities and capacities. On the basis of various experiments, new methods have been designed to develop physical abilities of the individual.

### **Statement of the Problem:**

The research scholar is an athlete and World Athletic Level-1 certificate in athletics. He is serving as a District Sports Officer in Odisha Government and holding the charge of athletic coach. During service he felt that the Odisha athletes possess high level of potential to be a successful athlete. But this is not achieved because the athletes are not trained properly. The training imparted is not properly planned and monitored. He decided to have an in-depth study into his experience. In order to investigate further the problem is stated as “An Analytical Study on Aerobic and Anaerobic Capacity Related to Performance of Athletes in Odisha”.

The purpose of the study was to see effect of aerobic and anaerobic exercises on Aerobic Fitness and Power related to performance of athletes in Odisha. The allied objectives of the present study were: to study the effect of aerobic exercises on Aerobic Fitness and Power related to performance of athletes in Odisha; to study the effect of anaerobic exercises on Aerobic Fitness and Power related to performance of athletes in Odisha; and to study the effect of combination of aerobic and anaerobic exercises on Aerobic Fitness and Power related to performance of athletes in Odisha.

Based upon the reviews of literature and the past experiences of the research scholar, it was hypothesised that there may be significant difference between the four Groups under observation in Aerobic capacity and Power.

The present study was considered to be significant on the grounds that the study may help to set up the target of performance related variables to be achieved, keeping in view the performance demand in Odisha; the study may help to identify the aerobic endurance and anaerobic capacity related changes in athletes and its physical and physiological adaptation; the aerobic and anaerobic capacity variables selected for this study, from athletes, can be a frame of reference, for assessing the implication of training and its effectiveness, keeping in view, the growth and developmental aspects underneath athletics game in different age categories; the study would provide additional evidence either to substantiate or negate the findings of the studies reported in other sports dominated countries and the study would promote enthusiasm and interest among scholars for further research in the field of sports.

The present study was delimited to only to the male athletes who have participated in the district level athletics competition in Odisha state. The study was restricted to 300 male athletes, based on the age of athletes they were divided into four groups of 75 each, namely: Group-I 75 no's athletes - Aerobic Capacity, Group-II 75 no's athletes - Anaerobic Capacity; Group-III 75 no's athletes - Aerobic and Anaerobic Capacity and Group-IV 75 no's athletes - Control Group. The age was in range between 16 to 25 years. Aerobic Capacity was assessed by Coopers 12 minutes run/walk test. Power was assessed by Margaria - Kalamen test.

Few limitations were there like the previous experience of the subjects in the field of sports and games, which might be influencing on the data collection, were not be considered; psychological factors, food habits, rest period, training status life style etc. was not under controlled; socio-economic status of the subjects was not under the control of the research scholar; heredity and environment factors which contribute to variations in anthropometric variables could not be controlled and variations which exist in their training techniques were ignored.

A summary of the writings of recognized authorities and previous researchers provides evidence that the concerned researcher is familiar with what is already known and what is still unknown and untested. In the present study the researcher used the libraries of Utkal University, Bhubaneswar, Degree College of Physical Education, Amravati, L.N.I.P.E., Gwalior. He also used the internet facilities for collecting the review of related literature. The researcher found 46 reviews. It is worth to mention here that the research scholar found no reviews, which were directly related to the present study.

The data for the present study were collected from the players who were residing in Sports Hostel run by Govt. of Odisha under the department of Sports and Youth Services. They were from different eight district of Odisha.

#### **Sampling method:**

The Researcher used available sampling method and the subjects chosen were from different eight district of Odisha.

#### **Selection of the subjects:**

The purpose of the study was to analyze the effect of aerobic and anaerobic exercises on the capacity, speed and agility of Athletics athletes. To achieve this purpose of the study, three hundred men (N=300) Athletes who have participated in the district level Athletics competition from Odisha, India, during the year 2019-2020, were selected as subjects for this study at random.

#### **Selection of variables:**

The criterion variables selected for the purpose of the study were Aerobic Capacity and Power.

#### **Tests used for collection of data:**

- ❖ **Cooper 12-minute walk/run test:** The Cooper 12-minute walk/run test is a popular maximal test of aerobic fitness, in which participants try and cover as much distance as they can in 12 minutes. There are several other variations of running/walking tests, including the Cooper 1.5 mile run test, and also a swimming version.
- **Purpose:** To test aerobic fitness (the ability of the body to use oxygen to power it while running)
- **Equipment required:** Flat oval or running track, marker cones, recording sheets, stop watch.
- **Procedure:** Place markers at set intervals around the track to aid in measuring the completed distance. Participants run for 12 minutes, and the total distance covered is recorded. Walking is allowed, though the participants must be encouraged to push themselves as hard as they

can to maximize the distance covered.

- **Scoring:** The score is the total distance covered by the athlete in 12 minutes both running and walking.

❖ **Margaria-Kalamen Test:** The Margaria–Kalamen monitors athlete's strength and power of lower extremities and helps coaches to see if the athlete's training program is effective. Test is a simple test of power of the lower extremities, involving running up a flight of stairs.

- **Purpose:** To test the power of the lower extremities.
- **Equipment required:** Stopwatch, timing mats (optional), measuring tape, and flight of 12 steps with a starting line of 6 meters in front of the first step. Each step is approximately 17.5 cm high with the 3<sup>rd</sup>, 6<sup>th</sup> and 9<sup>th</sup> step clearly marked. The vertical distance between the 3<sup>rd</sup> and 9<sup>th</sup> step must be accurately measured.
- **Procedure:** The athlete's weight is determined in kilograms. The athlete is given a few practice runs up the steps to warm up. The athlete stands ready at the starting line 6 meters in front of the first step. On the command “Go”, the athlete sprints to and up the flight of steps, taking three steps at a time (stepping on the 3<sup>rd</sup>, 6<sup>th</sup> and 9<sup>th</sup> steps), attempting to go up the steps as fast as possible. The time to get from the 3<sup>rd</sup> step to the 9<sup>th</sup> step is recorded (either using a stopwatch or using switch mats placed on the 3<sup>rd</sup> and 9<sup>th</sup> steps), starting when the foot was in first in contact with the 3<sup>rd</sup> step, and stopped when the foot contacts the 9<sup>th</sup> step. Allow three trials of the test, with 2-3 minutes recovery between each trial.
- **Scoring:** Power (Watts) is calculated from the formula below

$P = (M \times D) \times 9.8 / t$  where P = Power (Watts), M = Body mass (kg), D = Vertical distance between steps 3 and 9 (meters), t = Time (seconds) and 9.8 is the constant of gravity:

#### Analysis of data and interpretation:

Based upon the reviews of literature and the past experiences of the research scholar, it was hypothesized that there may be significant difference between the four Groups under observation in Aerobic capacity and power. The collected raw data were analyzed by using Analysis of Covariance (ANCOVA) to see the difference between the Pre and Post training effect of different treatments on the selected variables under consideration. The level of significance was set at 0.05. The details of the statistical analysis are given in the following pages with respective explanations.

Table No.-1

Analysis of Co-Variance (ANCOVA) showing effect of aerobic and anaerobic exercises on **Cooper 12-minute walk/run test (aerobic fitness).**

Source	df	SS	MS	F-Ratio
Treatments	3	14563.852	4854.617	22.509
Error	295	63622.990	215.671	
Total		78186.842		

‘F’ at 3 and 295 degree of freedom at 0.05 level of significance is 2.6. Because the obtained ‘F’ of 22.509 is more than the Table ‘F’ it is concluded that at least two of the treatment means are significantly different. Hence to discover which means are significantly different, the research scholar applied Scheffe Post-hoc Test. Here an S-Value is calculated which is  $S = \sqrt{F}$  x (Number of

Treatments-1) i.e.  $2.6 \times 3 = 7.8$ . There after a W value (Critical Value for comparison) was calculated which taken into consideration of both the Pre and Post means of the two groups. If the W-Value is found more than the S-Value then it is considered that the two corrected means are statistically significant.

Table No.-2  
Showing the Pre and Post Training Means

Groups	Pre-Training	Post-Training
Aerobics	2267.867	2288.227
Anaerobics	2267.200	2275.067
Both	2267.400	2277.400
Control	2266.800	2267.733

Table No.-3  
Significant difference between pairs of means of four groups under study.

Groups	Pre Diff.	Post-Diff	W-Value	Result
Aerobic-Anaerobic	0.667	13.160	27.18	Significant
Aerobic-Both	0.467	10.827	18.68	Significant
Aerobic-Control	1.067	20.493	65.71	Significant
Anaerobic-Both	0.200	2.333	0.79	Not Significant
Anaerobic-Control	0.400	7.333	8.37	Significant
Both-Control	0.600	9.667	14.32	Significant

\*The Critical S-Value for significance at 0.05 level of significance is 7.80.

From the above table it is observed that the W-Value for the pair of means of Aerobic group with all three i.e. Anaerobic, Both Aerobic-Anaerobic and Control is 27.18, 18.68 and 65.71 respectively which is more than the required S-Value for significance. Hence it is concluded that Aerobic training is better than the other three under consideration for the development of aerobic fitness.

The pre-training the post-training means of all the four different types of training methods Cooper 12-minute walk/run test (aerobic fitness) are shown graphically in Figure No. 1.

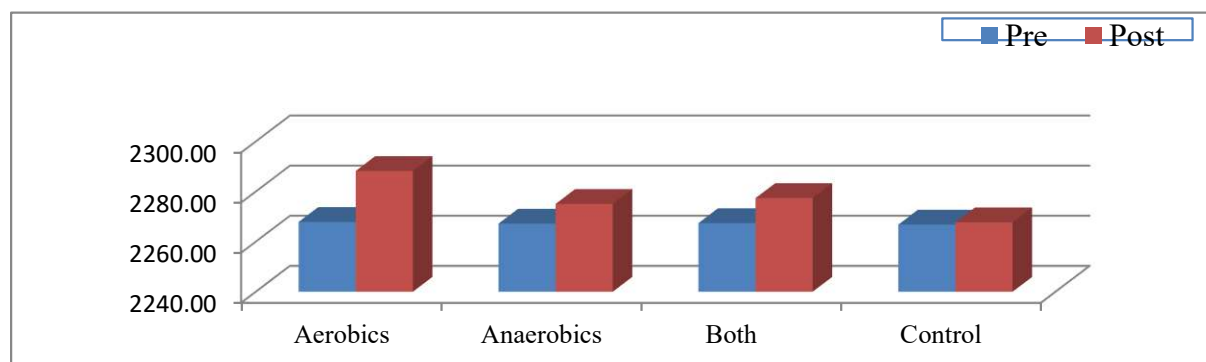


Figure No.-1

Showing Means of Aerobic, Anaerobic, Both and Control Groups under Study pertaining to **Cooper 12-minute walk/run test (Aerobic fitness)**.

Table No.- 4

Analysis of Co-Variance (ANCOVA) showing effect of aerobic and anaerobic exercises on Margaria-Kalamen Test (Power of the lower extremities).

Source	df	SS	MS	F-Ratio
Treatments	3	1035.892	345.297	64.697
Error	295	1574.450	5.337	
Total		2610.342		

'F' at 3 and 295 degree of freedom at 0.05 level of significance is 2.6. Because the obtained 'F' of 64.697 is more than the Table 'F' it is concluded that at least two of the treatment means are significantly different. Hence to discover which means are significantly different, the research scholar applied Scheffe Post-hoc Test. Here an S-Value is calculated which is  $S = 'F' \times (\text{Number of Treatments} - 1)$  i.e.  $2.6 \times 3 = 7.8$ . There after a W value (Critical Value for comparison) was calculated which taken into consideration of both the Pre and Post means of the two groups. If the W-Value is found more than the S-Value then it is considered that the two corrected means are statistically significant.

Table No.-5

Showing the Pre and Post Training Means

Groups	Pre-Training	Post-Training
Aerobics	88.393	95.593
Anaerobics	88.170	93.713
Both	88.505	92.335
Control	88.393	90.626

Table No.-6

Significant difference between pairs of means of four groups under study.

	Pre Diff.	Post-Diff	W-Value	Result
Aerobic-Anaerobic	0.222	1.880	19.21	Significant*
Aerobic-Both	0.113	3.258	69.44	Significant*
Aerobic-Control	0.000	4.967	173.32	Significant*
Anaerobic-Both	0.335	1.378	7.56	Significant Not
Anaerobic-Control	0.222	3.087	57.49	Significant*
Both-Control	0.113	1.708	17.85	Significant*

\*The Critical S-Value for comparison and significance at 0.05 level of sig. is 7.80.

From the above table it is observed that the W-Value for the pair of means of Aerobic group with all three i.e. Anaerobic, Both Aerobic-Anaerobic and Control is 19.21, 69.44 and 173.32 respectively which is more than the required S-Value for significance. Hence it is concluded that Aerobic training is better than the other three under consideration for the development of power of the lower extremities.

The pre-training the post-training means of all the four different types of training methods on Margaria-Kalamen Test (Power of the lower extremities) are shown graphically in Figure No.-2.

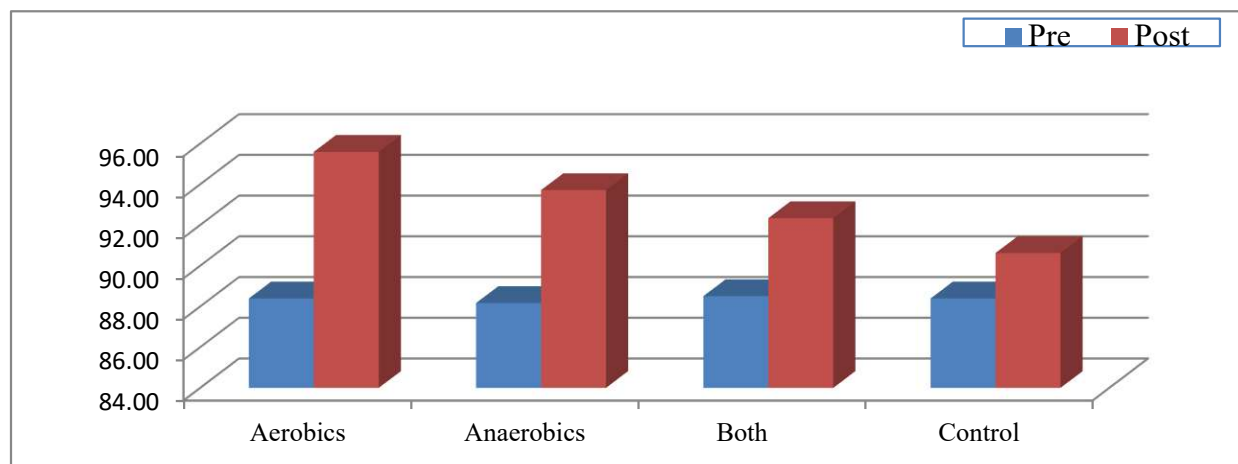


Figure No.-2

Showing Means of Aerobic, Anaerobic, Both and Control Groups under Study pertaining to Margaria-Kalamen Test (Power of the lower extremities).

### Conclusions:

It is concluded that Aerobic training is better than the other three groups under consideration for the development of aerobic fitness. It is concluded that Aerobic training is better than the other three under consideration for the development of power of the lower extremities.

### Recommendations:

On the basis of the results of the statistical analysis of data, the following recommendations are made for further study and follow-up action:

- i. Findings of this study will help to the coaches and managers to train the athletes of Odisha.
- ii. The coaches and physical education teachers should consider the appropriateness of aerobic exercises for the development of aerobic fitness and power of the lower extremities.
- iii. The similar study may be undertaken by selecting players of different levels i.e. Inter-university level, and national standards.
- iv. The similar study may be undertaken by selecting other training methods for the development of required physical components.

### References:

- Barrow, H. M., & McGee, R. (1979). *A Practical approach to measurement in physical education*. Lea and Febiger, Philadelphia.
- Best, J. W. (1983). *Research in education*. Prentice-Hall of India Pvt. Ltd., New Delhi.
- Bucher, C.A. et.al.,(1987). *Foundation of physical education and sports*. Times Mirror Mosby College Publishing, 10th Edition, New York.
- Chatterjee, C.C. (1963). *Human physiology*. Chintamani Publication, Kolkata-
- Clarke, D. H. (1975). *Exercise physiology*. Prentice Hall Inc, Englewood Cliff: N.J.
- Weber, J. C., & Lamb, D. R. (1970). *Statistics and research in physical education*. The C.V. Mosby Company, Saint Louis.

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