

## A Comparative Study of VO<sub>2</sub> Max in Young Female Athletes and Non-Athletes

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### **Abstract:**

**Aims And Objectives:** The purpose of this study was to compare maximum oxygen uptake (VO<sub>2</sub> max) between young female athletes and non-athletes and to show the importance of sports for physical fitness.

**Material & Methods:** The present study was carried out in 50 females between the age group of 18-22 yrs. They were divided into two groups, study group (25 athletes) and control group. (25 non-athletes) The maximum oxygen uptake (VO<sub>2</sub> max) was compared between cases and controls by using Queen' college step test. (Harward step test).

**Results:** The VO<sub>2</sub> max was higher in female athletes than non-athletes.

**Conclusion:** The present study showed VO<sub>2</sub> max levels more in female athletes. Now a days, physical inactivity is seen among students due to sedentary lifestyle which may lead to many health problems. Hence, we suggest that students should get involved in sports and it should make a compulsory subject in colleges.

**Key words:-** VO<sub>2</sub> Max; athlete & non athlete ;Young females

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### **I. Introduction**

In this modern era, most of our youth are having sedentary life-style due to excessive exposure to television, computer ,internet etc. Our students have physical inactivity due to stressful academics and busy schedule in schools, colleges, classes leading to poor health .In western countries, the people are more aware of health as compared to us. Regular exercise and sports is very important in young people in their busy life . Sports maintain physical as well as mental fitness and introduces values such as dedication, discipline and responsibility in us.

Aerobic capacity is an important element of success in sport's achievements .It is the maximum rate of oxygen consumption as measured during incremental exercise.<sup>1</sup> It is also called as Maximum Oxygen Uptake/Maximum Oxygen Consumption/VO<sub>2</sub> max. VO<sub>2</sub> max reflects physical fitness of an athletic individual. It is the best indicator of cardio-respiratory endurance and aerobic fitness.<sup>2</sup> VO<sub>2</sub> max determines performance of an individual on the field of different sports.<sup>2</sup>

The present study was initiated to estimate the VO<sub>2</sub> max in female athletes. Most of the VO<sub>2</sub> max studies are in male athletes. Very few studies have been taken in female athletes. We intended to take VO<sub>2</sub> max levels in female athletes and compare these levels in females having sedentary life-style.

### **Aims And Objectives**

- 1) To determine the VO<sub>2</sub> max levels in female athletes.
- 2) To compare the VO<sub>2</sub> max levels in female athletes with VO<sub>2</sub> max in females with sedentary life-style.

### **II. Material And Methods**

The present observational study was carried out in 50 females in Dept of Physiology, Govt. Medical College, Aurangabad. 25 female athletes (age group 18-22 yrs) were included in the study group. 25 females of same age group having sedentary lifestyle were included in the control group. The subjects in study group were selected from Police Training Institute ,Cidco, Aurangabad .They were doing minimum 3 hrs exercise (like running, jogging etc) daily since 2 years. The females in the control group of the same age having sedentary life-style were not doing any type of exercise. A detailed history was taken including personal history past history and menstrual history. The study was carried out during proliferative phase of menstrual cycle of all the females. General and detailed systemic examination was done of all subjects from study and control group. The subjects having cardio-respiratory diseases or having any major systemic illness were excluded from the study. Informed written consent was taken from each subject involved in this study. Basic data such as Height, Weight are recorded and BMI was calculated by using formula .  
BMI = Wt in Kg / ( Ht in m)<sup>2</sup>

The study was approved by institutional ethical committee .

**Cases-** 25 young female athletes(age grp 18-22yrs) doing regular exercises like running, jogging etc. for 3 hours daily since 2 years.

**Controls-**25 young females (age grp 18-22 yrs) having sedentary lifestyle not doing any type of exercise.

**Procedure**

The VO<sub>2</sub> max was determined 3 hrs. after meal. The VO<sub>2</sub> max was determined by using Queen’s College Step Test.<sup>2</sup> Prior to test, subjects were asked to warm up for 5-7 min ( like brisk walking, stretching etc.) A wooden stepping bench of 16½inch was used along with metronome and stopwatch. Metronome was set at the rate of 24 steps per min. A brief demonstration was given. The subjects were asked to perform up and down stepping cycle for 3 min .After completion of test, pulse rate was measured for 15 sec. in standing position. This recovery pulse rate is converted to beats per minute.

Following equation is used to measure VO<sub>2</sub> max in females

$$VO_2 \text{ max(ml/kg/min)} = 65.81 - (0.1847 \times \text{step test PR/min})^2$$

**III. Observations & Results**

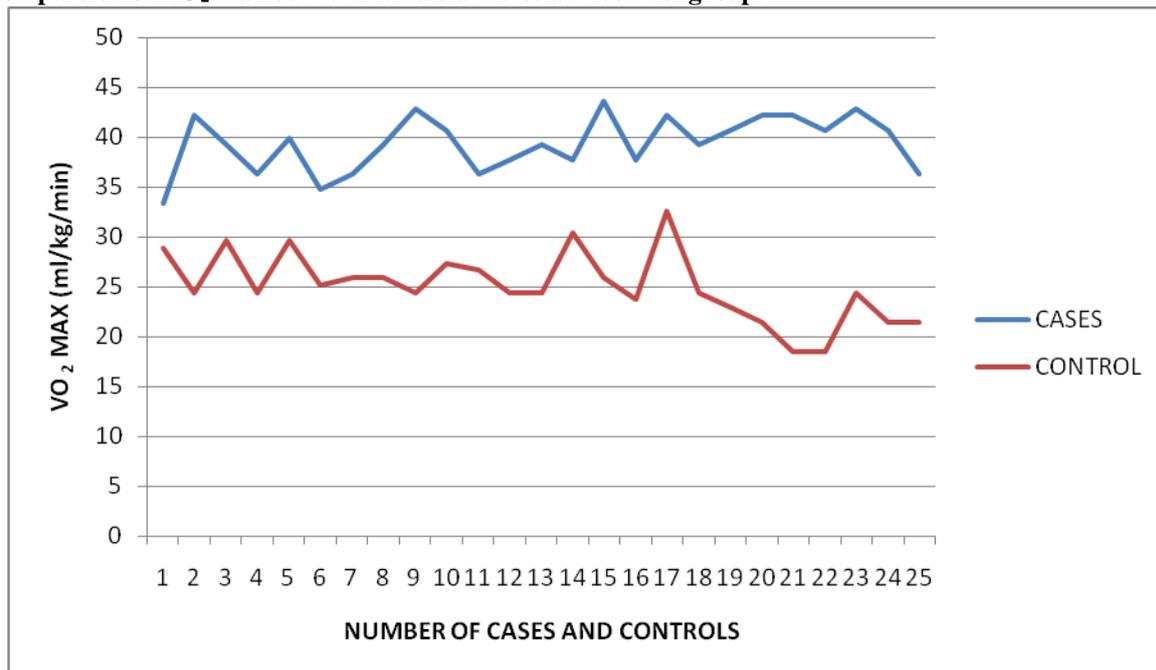
In the present study we observed VO<sub>2</sub> max in female athletes and this was compared to controls.

The mean VO<sub>2</sub> max(ml/kg/min) levels in female athletes was 39.35 ± 2.78. The mean VO<sub>2</sub> max (ml/kg/min) in females with sedentary life style was 25.08 ± 3.48. There was statistically significant increase in VO<sub>2</sub> max in female athletes as compared to females having sedentary life style by applying (unpaired ‘t’ test) by using Microsoft Excel 2007 Software.

**Statistical analysis of VO<sub>2</sub> max (ml/kg/min) between female athletes and control Group:-**

Groups	Mean VO <sub>2</sub> max ±S.D.(ml/kg/min)	‘t’ value	‘p’ value	Significance
Cases (n=25)	39.35 ± 2.78	16.01	p<0.001	Significant
Controls (n=25)	25.08 ± 3.48			

**Comparison of VO<sub>2</sub> max between female athletes and control group:-**



**IV. Discussion**

In the present study we observed VO<sub>2</sub> max in female athletes and this was compared to controls.

The mean VO<sub>2</sub> max(ml/kg/min) levels in female athletes was 39.35 ± 2.78. The mean VO<sub>2</sub> max (ml/kg/min) in females with sedentary life style was 25.08 ± 3.48.

The training of athletes include different exercises like running, jogging and stretching exercises regularly since 2 years .All these flexibility exercises such as stretching improve range of muscle movements

and joints. Aerobic processes are the main source of energy for muscles.<sup>3</sup> VO<sub>2</sub> max is the quantitative statement of individual's capacity for aerobic transfer. In athletes high VO<sub>2</sub> max may be attributed to specific character of their training. High VO<sub>2</sub> max yields more energy and better athletic activity. Factors affecting VO<sub>2</sub> max are age, gender, heredity, body composition, training state and exercise mode.

Physiologically VO<sub>2</sub> max is the intensity of an individual to increase metabolic processes with the requirements of increased physical efforts.<sup>4</sup> This results due to transformation of chemical energy into mechanical one.<sup>5</sup> VO<sub>2</sub> max is the measure of aerobic capacity and determined as international standard of physical capacity.<sup>5,6</sup> It is expressed as liters of O<sub>2</sub>/min or ml of O<sub>2</sub> per kg of body wt/min.

Training increases VO<sub>2</sub> max by increasing the cardiac output secondary to high stroke volume.<sup>7</sup> Training also increases Arterio-venous oxygen difference.<sup>7</sup> Physical training increases VO<sub>2</sub> max 50% by increasing stroke volume and 50% increase is due to increased extraction of oxygen by working muscles which is reflected in an increased arterio-venous difference. The intense aerobic endurance training can induce considerable enlargement of all muscles with a change in cardiac configuration.<sup>7</sup>

Training increases density of capillaries in skeletal muscles. This increased capacity to irrigate the muscles with blood lead to increased vascularization.<sup>8</sup> Training also results in increase in no. of mitochondria with increased capacity to generate ATP aerobically by oxidative phosphorylation.<sup>9</sup>

VO<sub>2</sub> max increases cardio-respiratory fitness and it is the predictor of success in endurance events.<sup>2</sup>

Results of our study are found to be consistent with studies of Hermansen and Andersen (1965)<sup>8</sup> Amanda L. et al(2011).<sup>9</sup> They found significant increase in VO<sub>2</sub> max in trained group as compared to untrained group. Amanda L. et al(2011)<sup>9</sup> reviewed VO<sub>2</sub> max and suggested physical training for improving VO<sub>2</sub> max.

## V. Conclusion

Regular physical exercise definitely improve cardio-respiratory fitness by increasing VO<sub>2</sub> max and decreasing body fat percentage leading to better quality of life. We recommend regular physical exercise in different forms of sports. German Philosopher Sorenson has rightly said "Build more playgrounds than hospitals."

## References

- [1]. Rancovic G, Mutavdzic V., ToskicD ,Preilevic A,Kocic M, Aerobic capacity as an indicator in diff. kinds of Sports. Bosnian J. Basic Medical Sciences 2010;10(1):44-48.
- [2]. Mc Ardle WD Katch FI, Essentials of exercise physiology, 2<sup>nd</sup> ed.2000 ,p.126-140,180-205.
- [3]. Kemper HCG., Activity and training in young athletes. Sports Wycznowy,1992;5-6:49-53.
- [4]. Radosław Laskowski, Ewa Ziemann, Tomasz Grzywacz, Comparison of aerobic capacity in various groups of adolescent athletes, ARCHIVES OF BUDO 2009 ;Vol(5): p-21-25.
- [5]. John F.Moxens ,Kjell Hausken ,Comparing VO<sub>2</sub> max Improvement in Five Training Methods Adv. Studies Theor.Phys.,2012;Vol.(60),no.19,:931-957.
- [6]. Steven A.Hawkins R.A. Wiswell , Rate and Mechanism of Maximal Oxygen Consumption Decline with Aging. Sports Med 2003 ;33(12):877-888.
- [7]. Guyton A.C.,John E Hall(2012);Textbook of medical physiology, 12<sup>th</sup> edition.Sports Physiology :p-1038-1039.
- [8]. Hermansen and Andersen ,Aerobic work capacity in young Norwegian men and women J.Appl. Physiology ;1965;20(3):425-431.
- [9]. Amanda L. Mageean ,R.P.Alexander, C .M.Mier, Repeated Sprint Performance in Male and Female College Athletes Matched for VO<sub>2</sub> max Relative to Fat Free Mass .International Journal of Exercise Science 4(4),2011:229-237.