ORIGINAL ARTICLE

Estimation of VO_2 max before and after Yoga Training in Healthy Male Medical Students

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Abstract

***Background**: Exercise is one of the important tools used by physiologists in understanding co-ordinated function of several systems in the body. Recent advancements in understanding physiology of exercise have shown that regular physical activity promote health and prevent many diseases. Yoga is an ancient system of Indian philosophy. It has been practiced for health and well being. Several researches have shown that regular practice of yoga improves health and well being. But there is paucity of research on changes in VO_2 max following regular practicing of yoga. **Methods**: This study was conducted in KMC Warangal on healthy medical students. VO_2 max was measured using Bruce Treadmill Test which is an indirect test that estimates VO_2 max using a formula For Men VO_2 max = 14.8 - (1.379 x T) + (0.451 x T^2) - (0.012 x T^3) T = Total time on the treadmill measured as a fraction of a minute. Changes in VO_2 max prior to and after regular practice of yoga for 4 months were done. **Results**: VO_2 max of subjects before study were at a lower level as that of sedentary individuals. The control group had VO_2 max of about 36.09ml/kg/min and study group 38.17ml/kg/min. After 4 months of yoga training of the study group the VO_2 max was increased significantly to 41.66ml/kg/min. **Conclusions**: Yoga training improves the VO_2 max in the study group after 4 months. This may be due to the beneficial effects of yoga on respiratory and cardiovascular systems. Yoga has now shown to improve exercise tolerance when practiced regularly.*

***Keywords:** Yoga, VO_2 max (Maximum Oxygen Consumption)*

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Introduction

Exercise is one of the important tools used by physiologists in understanding co-ordinated function of several systems in the body. Recent advancements in understanding physiology of exercise have shown that regular physical activity promote health and prevent many diseases. Yoga is an ancient system of Indian philosophy. It has been practiced for health and well being. Several researches have shown that regular practice of yoga improves health and well being.[1-4]

The word "yoga" comes from a Sanskrit root "yuj" which means union, or yoke, to join, and to direct and concentrate one's attention.[5,6] Many studies in past have shown the beneficial effects of yoga and regular practice of yoga promotes physical and mental well being.[7,8] Sustained yoga practice leads to stimulation of parasympathetic tone and reduction in blood pressure, heart rate.[9] Studies have shown that yoga increases heamoglobin levels and allows for more oxygen to be transported thus enhancing the function of RBC.[8] Yoga also contributes in decreasing viscosity of blood, the twisting poses adopted during various yoga practice increases venous return from internal organs and allows oxygenated blood flow to these areas it also improves maximum uptake and utilization of oxygen during exercise.[10,11]

VO_2 max is defined as "the highest rate of oxygen consumption attainable during maximal or exhaustive exercise".[12] The oxygen consumption in the body increases linearly as the intensity of exercise increase but after a stage it reaches a what is called as plateau level where it no longer increase despite increase in intensity of exercise it is called as VO_2 max. It is generally considered as one of the best indicators of Cardiorespiratory Fitness.[13]

VO_2 max varies greatly between individuals and even between elite athletes that compete in the same sport. Genetics plays a major role in a person's VO_2 max and heredity can account for up to 25-50% of the variance seen between individuals.[14]

Training improves the VO_2 max, in previously sedentary people, training at 75% of aerobic power for 30 minutes 3 times a week over 6 months increases VO_2 max by 15-20%[15] although effects of exercise on VO_2 max has been studied widely there is paucity of data on effect of yoga practice on VO_2 max. The present study tries to determine effect of yoga on VO_2 max.

Materials and Methods

This study compares the effect of yoga on VO_2 max of young untrained Medical College students. In this study about 60 healthy disease free male medical students (aged 20-25 years) were selected, they were divided in to two groups randomly, the first group was designated as the Control Group the second group was designated as the Study Group. VO_2 max was measured using Bruce Treadmill Test which is an indirect test that estimates VO_2 max using a formula For Men VO_2 max = 14.8 - (1.379 x T) + (0.451 x T^2) - (0.012 x T^3) where T = Total time on the treadmill measured as a fraction of a minute.[12] A motorized threadmill Afton company with a speed range from 1 - 11/Kmph was used for the study. Although the most precise method of measuring VO_2 max is by analysis of expired air during a maximal laboratory exercise test but, this is not always possible in which case the indirect activity and was allowed to carry on their regular routine. After 4 months the VO_2 max of both control and the study group was measured. Collected data was entered in the Microsoft Word Excel Sheet 2007 version and the data obtained were analyzed using the SPSS (Statistical Package for the Social Sciences) 17 Version.

Ethical Clearance: the study was approved by Ethical Committee of Kakitya Medical College Warangal, all the participants were willing voluntarily to participate in the study. The complete study design was explained to all the participants. A written consent was obtained.

Results

Chart- 1: Values of VO_2 max in ml/kg/min of control group before and after 4 months

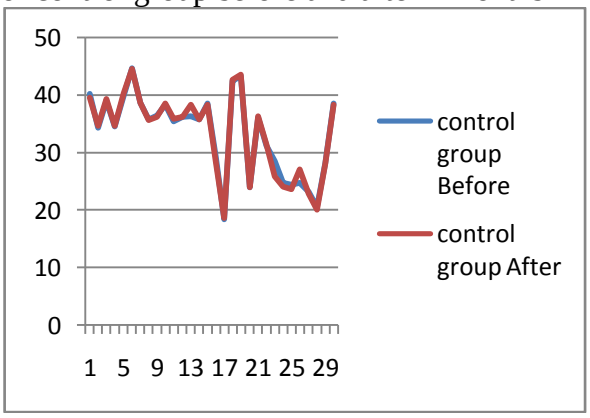

Chart- 2: Values of VO_2 max in ml/kg/min in study group before and after Yoga training for 4 months

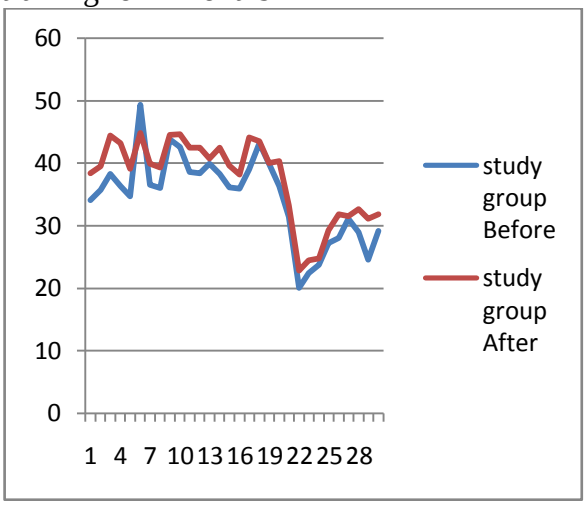

Table 1 shows values of VO_2 max between the control group and the study group. The VO_2

max levels of both the control group and study group were at lower levels in both groups with study group having mean values of 36.09 ml/kg/min and study group at 38.17 ml/kg/min but the study group who practiced yoga for four months showed an increase in mean value of 41.66 ml/kg/min the calculated p value was 0.01 which was significant.

Table- 1: Comparison of Maximal Oxygen uptake VO_2 max (ml/kg/min) uptake between control and study groups before and after 4 months of study

Group	Yoga Training	Mean VO_2 max	SD	SE	P value	Result
Control Group	Before	36.09	6.23	6.18	>0.05	N.S
	After	36.13	6.26			
Study Group	Before	38.17	2.76	2.52	0.01	Significant
	After	41.66	2.29			

Discussion

Regular yoga practices probably cause prolong stimulation of parasympathetic tone, in addition it increases the ability of muscles to utilize more oxygen. Which may be due to postures adopted in yoga practice, better agility of muscles and better utilization of oxygen due to increase in activity of oxidative enzymes.[4-11]

VO_2 max of subjects before study was at lower level as that of the sedentary individuals (control group 36.09 ml/kg/min) and study group 38.17 ml/kg/min. The study group showed significant increase in VO_2 following yoga training as compared to the control group who had no significant difference in the VO_2 max before and after 4 months period. The results obtained in this study were similar to that of Raju *et al* who found that significant reduction of post exercise minute ventilation and oxygen consumption after 90 days of yoga training.[16] Bouchard and malina[17] showed that upto 60% of variance in physical fitness is attributed to environmental and behavioral factors.

One study by Catherine Woodward shows that yogic practices enhance muscular strength and body flexibility, promote and improve respiratory and cardiovascular function, and enhance overall well-being and quality of life.[1] Another study by Karambulkar and Balasubramanan had shown improvement in aerobic power and significant increase in cardiovascular endurance after yoga training.[18,19] In a similar setting by Ganguly S.K[20] has shown that short term yoga training produced several beneficial effects on cardiovascular efficiency of subjects. Andreacci *et al* 2005[21] have showed that VO_2 max in children mainly depends on haemoglobin concentration, while Gutin et al showed that obese black children were less active when compared with their white peers and was significantly correlated to cardiovascular fitness.

Conclusion

Within the limitation of the present study it can be concluded that Yoga training improves the VO_2 max in the study group after 4 months. The study shows that yoga which not only includes certain postures and exercises but also a form of meditation where individuals derive both spiritual and physical well being. This may be due to the beneficial effects of yoga

Acknowledgement

Authors wish to thank Dept of Physiology KMC Warangal for their support in conducting this study.

Source(s) of support: *Nil*
Conflict of Interest: *None declared*

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increase quality of life. Int J Yoga 2011; 4(2): 49–54.

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