National Journal of Physiology, Pharmacy and Pharmacology

RESEARCH ARTICLE

# Modulation of $VO_2$ max by Rajyoga meditation in young adult males

**Komal Ajay Meshram[1], Ajay Wasudeo Meshram[2], Dalia Biswas[1]**

[1]Department of Physiology, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India, [2]Department of Biochemistry, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India

**Correspondence to:** Ajay Wasudeo Meshram, E-mail: meshram.ajay66@gmail.com

**Received:** July 01, 2017; **Accepted:** July 31, 2017

## ABSTRACT

**Background:** Relaxation of body mind with positive approach has been successfully achieved by Rajyoga meditation. It is the science and art of harmonizing spiritual mental and physical energy. Meditation has a number of positive effects on the physiology of human body. Physical fitness depends mainly on cardiorespiratory endurance of an individual. $VO_2$ max (maximal oxygen uptake/maximal aerobic power/aerobic capacity) is widely accepted as the best measure of cardiorespiratory endurance. **Aims and Objectives:** To find out the effect of Rajyoga meditation on $VO_2$ max. **Materials and Methods:** 40 healthy male volunteers in the age group of 18-20 years were included in the study. They were randomly allocated into control and intervention groups by blind-cheat technique with 20 participants in each group. Group-A participants were control while Group-B participants were given intervention in the form of Rajyoga meditation under the guidance of Rajyoga trainer for duration of 4 months. $VO_2$ max was assessed in both groups using AD-instrument before and after 4 months study. **Results:** Student's paired *t*-test was used to compare pre- and post-interventional results. Increased $VO_2$ max was seen in intervention group as compared to control group. $P < 0.05$ was considered statistically significant. **Conclusion:** $VO_2$ max indicates aerobic capacity and physical fitness of an individual. Increased $VO_2$ max after Rajyoga meditation ensures good cardiorespiratory endurance.

**KEY WORDS:** Rajyoga Meditation; $VO_2$ max; Physical Fitness; Aerobic Capacity

## INTRODUCTION

To achieve harmony between the physical, mental, intellectual, and spiritual personalities of man meditation is being widely used. It is the highest spiritual discipline. Meditation is designed to help the individual develop a state of mind which is positive or benevolent toward oneself and others.

Relaxation of body mind with positive approach has been successfully achieved by Rajyoga meditation. It provides training in realization of true self. Rajyoga is the path of Yoga that focuses on meditation and contemplation.[1] Rajyoga meditation of Brahma Kumaris is a behavioral intervention which is simple to practice. Rajyoga is one of the training courses of Rajyoga Education and Research foundation of Brahma Kumaris World Spiritual University.[2] It is the science and art of harmonizing spiritual mental and physical energy through connection with the ultimate source of spiritual energy called the supreme soul. It is the state of soul consciousness and positive life style.[3]

Nowadays, persons are more interested in "physical fitness" than any time before. Physical fitness is essential for human beings to adjust well with his environment as his mind and body are in complete harmony. It is the ability to carry out daily task with vigor and alertness, without undue fatigue, with ample energy to enjoy leisure time pursuits, and to meet unforeseen emergencies.[4] General fitness implies

| Access this article online | |
|---|---|
| **Website:** www.njppp.com | Quick Response code |
| **DOI:** 10.5455/njppp.2018.8.0723431072017 | |

the ability of a person to live most effectively with his and her potentials, which depend upon the physical, mental, emotional, social, and spiritual components of fitness which are highly interrelated.

Physical fitness of an individual depends on oxygen which can be transported by the body to working muscles to use that oxygen; hence, $VO_2$ max which means maximum oxygen uptake capacity is widely considered to be reliable indicator of fitness.[5,6] $VO_2$ max depends mainly on cardiorespiratory endurance of an individual and is widely accepted as the best measure of cardiorespiratory endurance.[4] $VO_2$ max refers to the level of oxygen consumption beyond which no further increase in oxygen consumption occurs with further increase in the severity of exercise. It is expressed in liters or milliliters per minutes. However, the absolute value is highly affected by body weight, so it is often expressed as ml/kg/min.

In the laboratory setting, the most accurate way to assess $VO_2$ max is undoubtedly through applying a maximal graded exercise test (GXT) performed to volitional exhaustion on a motorized treadmill or cycle ergometer while expired air is analyzed continuously by gas analyzers.[7] However, equipment costs and staff training limit direct measurement mainly to research and few clinical settings.[8] In addition, studies demonstrating the effect of Rajyoga meditation on $VO_2$ max in young healthy population are lacking. Hence, worth present study was under taken to find out the effect of Rajyoga meditation on $VO_2$ max in young healthy males and analyzing $VO_2$ max by indirect estimation using metabolic analyzing system (AD-instrument).

## MATERIALS AND METHODS

### Study Setting

The study was carried out in Exercise Physiology laboratory, Department of physiology Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, after Institutional Scientific and Ethics Committee approval.

### Study Design

The study design was interventional study.

### Study Duration

The study duration was 6 months.

### Sample Size

Participants of age group 18-20 years were recruited from Datta Medical Institute and Medical College, Sawangi (Meghe), Wardha. Total sample size was 40; calculation was done based on standard deviation taken from previously done study.[4] Considering dropout sample size kept was 10% more than expected. They were randomly allocated into two groups by blind-cheat technique with 20 participants in each group. Group-A participants were control while Group-B were given intervention in the form of Rajyoga meditation under the guidance of Rajyoga trainer for duration of 4 months. All the participants were instructed not to do any other physical exercises and meditation during the present study.

### Inclusion Criteria

1. 18-20 years male who were willing to do Rajyoga meditation for 4 months duration
2. Participants giving consent
3. No previous experience of practice of yoga or meditation.

### Exclusion Criteria

1. Participants addicted to smoking and drinking
2. Suffering from or diagnosed with any chronic diseases
3. Participants with chronic obstructive pulmonary disease, cardiovascular disorder, hypertension, or diabetes
4. Major surgery in recent past participants were excluded from study.

### Study Protocol

Participants were explained about the detailed plan of work, aim of present research project, and briefed regarding study protocol. Written informed consent was obtained from them.

### Measurement of Parameters

Participants were familiarized with the laboratory environment and were given instructions about the experimental procedures before the day of recording of parameters. On the day of recording they were advised to abstain from tea, coffee, and any medication 24 h before recording of parameters. The actual recording protocol included morning recordings after a light breakfast. In both groups, VO2 max was recorded before the start of the study and was repeated after 4 months.

### $VO_2$ max Assessment Procedure

Participants were asked to perform the maximal GXT on a treadmill (Precor 9.1/9.2, Ambala). In treadmill GXT, protocol participants were required to walk at a brisk pace at level grade for 3 min, followed by jogging at a self-selected speed at level grade (4.3-7.5 mph) for an additional 3 min.[9] Participants used hand signals to inform the test administrator when a comfortable jogging pace was achieved. Thereafter, the treadmill grade was increased 2.5% every min (treadmill speed remaining constant), until participants achieved volitional fatigue, and were unable to continue despite verbal encouragement. Heart rate-max (HR) was recorded as the highest observed HR during the final stages

of the GXT. Metabolic analyzer was used to measure oxygen consumption (AD instrument). The highest full-minute oxygen uptake value observed during the final stages of the GXT was recorded as $VO_2$ max.

$VO_2$ values were considered maximal when at least two of the following three criteria were satisfied:[10]

a) Respiratory expiration ratio ≥1.1
b) Maximal HR of <15 bpm below age-predicted HR max (220-age) and
c) Leveling off of $VO_2$ despite an increase in work.

### Intervention

Rajyoga meditation was taught to the participants by Rajyoga trainer. They were delivered lessons regarding Rajyoga meditation for 8 consecutive days and each lesson lasted for 45 min. Out of which last 20 min were devoted to a guided commentary. They were also shown pictures, diagrams, and audio cassettes related to Rajyoga meditation. Participants practiced the same, 5 days/week for 30 min daily morning (6.30-7 am) for a total duration of 4 months in a silent dimly lit room.[1]

Rajyoga consisted of following three steps:

1. Initiation: The participant sits quietly comfortably and focuses his eyesight on the point of light which represents the supreme power
2. Concentration: Now he concentrates on the point of light
3. Meditation: In this stage, he meditates on the divine qualities and powers of supreme soul keeping his eyesight fixed on the point of light.

### Data Analysis

All data obtained were presented as mean and standard error of mean. Statistical Package for the Social Sciences software (version 20) was used for data analysis. Pre- and post-intervention comparisons were made using Student's paired *t*-test within the group. In between the study and control groups, comparison was made using Student's unpaired *t*-test.

## RESULTS

The observations of the present study were depicted in Tables 1 and 2. In Table 1, Student's paired *t*-test was used to determine mean $VO_2$ max within the groups. *P*-value was statistically not significant in control group $P < 0.902$, while in intervention group $P < 0.0001$ which was highly significant after intervention. In Table 2, Student's unpaired *t* test was used to determine mean VO2 max between two groups. *P*-value was statistically not significant in control group $P < 0.054$, while in intervention group $P < 0.0001$ which was highly significant after intervention.

**Table 1:** Comparison of $VO_2$ max within the groups before and after 4 months study period

| Group | Mean±SD | SEM | *t* value | *P* value |
|---|---|---|---|---|
| Control group | | | | |
| Before | 30.90±2.44 | 0.54 | 0.12 | 0.902 |
| After | 30.95±3.17 | 0.71 | | |
| Intervention group | | | | |
| Before | 29.65±1.38 | 0.31 | 14.46 | 0.0001* |
| After | 40±3.47 | 0.77 | | |

*Significant difference, SD: Standard deviation, SEM: Standard error of the mean

**Table 2:** Comparison of $VO_2$ max in between two groups before and after 4 months study period

| Group | Mean±SD | SEM | *t* value | *P* value |
|---|---|---|---|---|
| Before | | | | |
| Control | 30.90±2.44 | 0.54 | 1.98 | 0.054 |
| Intervention | 29.65±1.38 | 0.31 | | |
| After | | | | |
| Control | 30.95±3.18 | 0.71 | 8.57 | 0.0001* |
| Intervention | 40.00±3.47 | 0.77 | | |

*Significant difference, SD: Standard deviation, SEM: Standard error of the mean

## DISCUSSION

On analyzing the results of present study before and after 4 months of regular Rajyoga practice, it was found that there was highly significant improvement in mean $VO_2$ max in intervention group as compared to control group as shown in Tables 1 and 2.

This increase in $VO_2$ max after intervention in our study is supported by similar findings of Doijad et al. who found improvement in $VO_2$ max in healthy individuals after short term practise of yogic exercises on aerobic capacity. These changes can be attributed to generalized decrease in vascular tone during meditation resulting from stimulation of parasympathetic activity which increases muscle blood flow and results in increased oxygen consumption by the muscles.

Ahmed et al.,[11] Bhutkar et al.,[12] and Yadav and Das[13] found significant improvement in lung functions after yoga practice in healthy individuals which is consistent with the findings of our present study. During meditation, person concentrates on breathing and removes attention from worldly worries and "de-stress" himself. This may decrease release of adrenaline, i.e., decrease sympathetic activity and hence decrease in HR, blood pressure, including respiratory rate. During daily practice of meditation by concentrating, on breathing the basic activity of bulbopontine complex is modified in such a way as to slow down its rhythm by voluntarily prolonging the phases of inspiration and expiration by stretching to

their fullest extent. Thus, making the lungs to work to their maximal extent to take oxygen and expire carbon dioxide maximally.

Ray et al.[14] observed significant improvement in $VO_2$ max after Yogic training. Raju et al.[15] have found a significant increase in oxygen consumption per unit work after yoga training which are similar to our study. Improvement in lung functions as well as cellular machinery explains raised $VO_2$ max after regular practice of meditation.

Bera and Rajapurkar in 1993[16] reported significant improvement in cardiovascular endurance as a result of yoga training. Balasubramanian and Pansare in 1991[17] observed significant increase in aerobic power ($VO_2$ max) of muscles after yoga training. These changes can be explained on the basis that during meditation body achieves an altered state of consciousness in a brief period where relaxation response is produced in which the body metabolism slows down and HR, blood pressure, and breathing decreases thus facilitates uptake of oxygen.[18,19]

However, the studies that contradicted our findings were of Kodgire[20] who studied the effect of yoga and on selected physiological variables of healthy individuals. Results of their study concluded after yoga training there was no increase in $VO_2$ max. In addition, Hovsepian et al.,[21] who studied the effect of yoga on pulmonary function tests and physical fitness parameters in 60 healthy students concluded that yoga training can lead to significant improvement in most variables except $VO_2$ max. The reason why they could not get increased $VO_2$ max in their participants after yoga training could be lesser duration and frequency of practise of yoga. In their study, participants practiced yoga 1 h twice a week for 3 months which could be not sufficient to increase aerobic capacity and hence the $VO_2$ max.

Increased $VO_2$ max in our study implies that Rajyoga meditation can help in improvement of aerobic capacity of an individual and should be incorporated in daily life style. Limitation of our study was that only male participants were included in the study. However, further research with large sample size and for varied age groups is required for applying these results to population in general.

## CONCLUSION

The results of our study and their explanations would justify the incorporation of Rajyoga meditation as part of our lifestyle as well a part of course in the medical education. $VO_2$ max indicates physical fitness of an individual and increased $VO_2$ max after Rajyoga meditation ensures good cardiorespiratory endurance. It can be of value in conditions of low cardiorespiratory reserves, especially in patients in whom heavy exercises are contraindicated.

## ACKNOWLEDGMENTS

We would like to thank all the participants for their cooperation and Rajyoga trainer of DMIMS (DU) for conduction of meditation sessions. Special thanks to university "Datta Meghe Institute of Medical Sciences deemed to be University" for giving me opportunity to carry out this study.

## REFERENCES

1. Meshram K, Meshram A. Usefulness of Rajyoga meditation in assessment of general well being of badminton players an experimental study. Int J Pharm Biol Sci. 2016;7(1):161-6.
2. Naik A, Patel S, Biswas DA, Verma M. Effect of Rajyoga meditation on intelligence quotient of attention deficit hyperactivity disorder. J Yoga Phys Ther. 2016;6:242.
3. Pazare K, Biswas DA, Meshram AW. Modulation of anaerobic biomarker and ung functions by Rajyoga meditation in young badminton players. Int J Med Sci Public Health. 2013;2(3):654-9.
4. Doijad V, Kamble P, Surdi DA. Effect of Yogic exercises on aerobic capacity($VO_2$ max). Int J Recent Trends Sci Technol. 2013;3(6):119-21.
5. Kharbanda M, Bagade A, Jibhkate A. Effect of exercise on aerobic power and correlation of aerobic power with body mass index and physical fitness score in medical students. Asian J Biomed Pharm Sci. 2015;5(43):21-6.
6. Bowers RW, Fox EL. Sports Physiology. 3rd ed. Boston: McGraw Hill; 1988.
7. George JD, Paul SL, Hyde A, Bradshaw DI, Vehrs PR, Hager RL, et al. Prediction of maximum oxygen uptake using both exercise and non-exercise data. Meas Phys Educ Exerc Sci. 2009;13:1-2.
8. Lee JM, Bassett DR Jr, Thompson DL, Fitzhugh EC. Validation of the Cosmed Fitmate for prediction of maximal oxygen consumption. J Strength Cond Res. 2011;25(9):2573-9.
9. George JD, Vehrs PR, Allsen PA, Fellingham GW, Fisher AG. $VO_2$max estimation from a submaximal 1-mile track jog for fit college-aged Individuals. Med Sci Sports Exerc. 1993;25(3):401-6.
10. Kline GM, Porcari JP, Hintermeister R, Freedson PS, Ward A, McCarron RF, et al. Estimation of max $VO_2$ from a 1-mile track walk, gender, age and body weight. Med Sci Sports Exerc. 1987;19(3):253-9.
11. Ahmed QR, Sau SK, Kar SK. An evaluation of pulmonary parameters in two groups of subjects during Yoga practice. Nepal Med Coll J. 2010;12(3):180-2.
12. Bhutkar PM, Bhutkar MV, Taware GB, Doijad V, Doddamani BR. Effect of Surya Namaskar practice on cardio-respiratory fitness parameters: A pilot study. Al Ameen J Med Sci. 2008;1(2):126-9.
13. Yadav RK, Das S. Effect of yogic practice on pulmonary functions in young females. Indian J Physiol Pharmacol. 2001;45(4):493-6.
14. Ray US, Mukhopadhyaya S, Purkayastha SS, Asnani V, Tomer OS, Prashad R, et al. Effect of yogic exercises on physical and mental health of young fellowship course trainees. Indian J Physiol Pharmacol. 2001;45(1):37-53.
15. Raju PS, Prasad KV, Venkata RY, Murthy KJ, Reddy MV.

Influence of intensive yoga training on physiological changes in 6 adult women: A case report. J Altern Complement Med. 1997;3(3):291-5.
16. Bera TK, Rajapurkar MV. Body composition, cardiovascular endurance and anaerobic power of yogic practitioner. Indian J Physiol Pharmacol. 1993;37(3):225-8.
17. Balasubramanian B, Pansare MS. Effect of yoga on aerobic and anaerobic power of muscles. Indian J Physiol Pharmacol. 1991;35(4):281-2.
18. Kiran, Chalana H, Arora A, Girgila K. Effect of short term Rajyoga meditation on anxiety and depression. Pak J Physiol. 2014;10:18-20.
19. Punita P, Trakroo M, Palamalai S, Subramanian S, Bhavanani A, Madhavan C. Randomized controlled trial of 12-week yoga therapy as lifestyle intervention in patients of essential hypertension and cardiac autonomic function tests. Natl J Physiol Pharm Pharmacol. 2016;6(1):19-26.
20. Kodgire UD. Comparative effect of Yoga and aerobic exercises on selected physiological variables of school girls. IRMRJ. 2014;11(6):1141.
21. Hovsepian V, Marandi SM, Kelishadi R, Zahed A. A comparison between Yoga and aerobic training effects on pulmonary function tests and physical fitness parameters. Pak J Med Sci. 2013;29 1 Suppl:317.

**How to cite this article:** Meshram KA, Meshram AW, Biswas D. Modulation of $VO_2$ max by Rajyoga meditation in young adult males. Natl J Physiol Pharm Pharmacol 2018;8(1):42-46.

**Source of Support:** Nil, **Conflict of Interest:** None declared.