

Effect of Rajayoga Meditation on Physiological Variables in Healthy Adults – A Comparative Study

Suchitra. P¹, Sudhakaran. M. C²

¹Senior Resident, Department of Physiology, Government Medical college, Thrissur, India

²Associate Professor, Department of Physiology, Govt. Medical College, Idukki, India

Received: 02-04-2021 / Revised: 17-06-2021 / Accepted: 15-07-2021

Abstract

Introduction: In modern world unhealthy habits of lifestyle and stress are increasing and they are risk factor for wide variety of diseases including cardiovascular diseases. Rajayoga a meditation technique works at mind and reduces stress. Current study was designed to evaluate the effect of Rajayoga on physiological variables and anthropometric parameters. **Objectives:** To study the effects of Rajayoga meditation on physiological variables in healthy adults like heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate and body mass index.

Methods: A comparative cross-sectional study was conducted comparing sixty healthy subjects practicing Rajayoga meditation (meditators) and sixty normal healthy subjects who were not practicing yoga or meditation (non meditators). The heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate and body mass index were measured in these subjects and compared. The standard technique, unpaired t Test was applied to compare physiological variables of two groups of study subjects. **Results:** Meditators had significantly lower readings of cardiovascular parameters like heart rate ($p < 0.001$), systolic blood pressure ($p < 0.001$) and diastolic blood pressure ($p = 0.027$) compared to non-meditators. Respiratory parameter, respiratory rate was found to be significantly lower in meditators compared to non-meditators ($p < 0.001$). Anthropometric parameter, body mass index was found to be significantly lower in meditators compared to non meditators ($p < 0.001$). **Conclusion:** The findings of the current study suggest that practicing Rajayoga regularly will positively affect the cardiorespiratory parameters and the body mass index which in turn may reduce the cardiovascular co-morbidities and improve overall health and wellbeing.

Keywords: Rajayoga meditation; Heart Rate; Blood pressure; Respiratory Rate; Body mass index

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

In modern world unhealthy habits of lifestyle and stress are increasing. Unhealthy lifestyle and stress are interrelated and act as risk factors for wide variety of diseases. Stress has negative impact on cardiovascular functions like altered cardiovascular reactivity and increased blood pressure which can be related to autonomic dysfunctions. The effect of stress has far-reaching adverse consequences in morbidity and mortality. Stress may directly or indirectly cause disease by inducing smoking, substance abuse or altering eating habit, which by themselves act as risk factors. Stress effects neuroendocrine system and immune system. It causes immune suppression and sympathetic activation resulting in hypertension, metabolic syndrome and coronary artery diseases.[1] In India coronary artery disease is one of the major causes of mortality and morbidity. Risk factors of coronary artery disease are obesity, hypertension, hypercholesterolemia, physical inactivity, stress and hormonal influences.[2] Psychosocial stress factors like work place stress, family and socioeconomic stress increases cardiovascular disease risk, Physiological, emotional and behavioral changes occur as an adaptive response to stress for maintaining homeostasis. Chronic stress may cause maladaptation leading to poor lifestyle habits, systemic inflammation and abnormal coagulation

*Correspondence

Dr. Sudhakaran. M. C

Associate Professor, Department of Physiology, Govt. Medical College, Idukki

E-mail: sudhakaranmc999@gmail.com

activity like increased fibrinogen. Psychological distress increases cardiovascular disease risk.[3] These stressors lead to cardiac mortality and morbidity like altered cardiac regulation due to changes in sympathetic nervous system myocardial ischemia, myocardial infarction and even sudden death.[4]Rajayoga a meditation technique works at mind. Meditation relaxes body and focus thoughts on one thing for prolonged period which in turn reduce stress hormones. Rajayoga is a simple cost-free technique which tilts the autonomic response of the system more towards parasympathetic than sympathetic. It has positive effect on all systems of our body.Rajayoga is one of the techniques of meditation which involves concentration but no physical object. Meditation has positive effects on human Physiology which include the reduction in blood pressure and heart rate. Regular practice of Raja Yoga meditation can positively improve overall health, help in effective stress management, has a preventive and adjunct therapeutic effect on many Lifestyle related diseases.[1]

Rajyoga meditation is also named as Ashtanga yoga since it is organised in eight steps. The eight Limbs include; 1) Yama- self-control 2) Niyama - Discipline 3) Asana - Physical exercises 4) Pranayama - Breath exercises 5) Pratyahara - Withdrawal of senses from external objects 6) Dharana - Concentration 7) Dhyana - Meditation 8) Samadhi - Complete realization.[5,6]

Current study was designed to evaluate the effect of Rajayoga and physiological variables like heart rate, systolic diastolic blood pressure and respiratory rate and its effect on body weight and body mass index, comparing rajayoga meditation practitioners to non-practitioners.

Materials and Methods

A comparative cross sectional was conducted in people attending three Raja Yoga meditation centers at Thrissur town and age and sex

matched normal people from various departments of Government Medical College Thrissur. The study was conducted during the period of one year from May 2018 to May 2019. The study was conducted in 20 healthy subjects who give consent, from each of the three centers in Thrissur (total 60) - who practice Rajayoga meditation for at least 1 hour per day for at least one year (Meditators). 60 age and sex matched normal healthy subjects who were not practicing yoga or meditation (non-meditators) was selected from several departments of Government Medical College Thrissur. A non-probability purposive sampling technique was used to select the centers based upon Logistic feasibility.

Inclusion criteria

- A) Healthy subjects practicing Rajayoga meditation for at least 1 hour per day for at least one year.
- B) Age group: 20 - 55 years.
- C) Belong to both genders.
- D) Healthy subjects from various departments of Government Medical College Thrissur who are not practicing any forms of yoga and meditation was selected as a normal population.

Exclusion criteria

- A) Subjects with any known cardiorespiratory diseases or systemic illness.
- B) Subjects with mental illness.
- C) People taking medications that may alter autonomic reflexes.
- D) Subjects practicing any other forms of yoga.
- E) People using cigarette or alcohol.
- F) Subjects with history of major surgery in recent past.
- G) Pregnant and puerperal mothers.

Sample size calculation

For 5% level of significance and 80% power; sample size n

$$n = \frac{(\sigma^2_1 + \sigma^2_2) (z\alpha/2 + z\beta)^2}{d^2}$$

$$= \frac{[(4.67)^2 + (4.15)^2] \times [1.96 + 0.84]^2}{(75.91 - 78.38)^2}$$

$$= 59.16 = 60$$

So, the minimum required sample size = 120 (60 in each group). Sample size calculation was based on a previous similar study by Moumita Ghar et al.

Methodology

20 healthy volunteers who fulfilled the inclusion criteria and exclusion criteria and has been practicing Rajayoga meditation at each Rajayoga meditation center (total 60) at Thrissur for at least one hour daily for at least one year was selected as studies subjects (meditators).

The following test were done to assess the following physiological variables

- A) Heart rate - Heart rate was measured using stethoscope by auscultating chest.
- B) Blood pressure - Blood pressure was taken in a sitting and relaxed position with a standardized electronic sphygmomanometer. Both systolic and diastolic blood pressure were recorded.
- C) Respiratory rate - Rate of respiration was counted by counting the frequency of breathing by observing abdominal wall movements for a full minute.
- D) Body mass index - Weight of the subject was taken in kilograms using a weighing machine and height was measured in meters using standardized measure, using measuring tape against wall, bare foot. Body mass index is calculated by using the formula

$$\text{Body Mass Index} = \frac{\text{Weight (kg)}}{\text{Height}^2 (\text{m}^2)}$$

Study tools

- A) Stethoscope for measuring the heart rate.
- B) Electronic sphygmomanometer for measuring systolic and diastolic blood pressure.
- C) Weighing machine for measuring weight.
- D) Measuring tape for measuring height.

Data analysis

Mean, Standard deviation etc was found out to explain basic demographic profile of people. The standard technique, unpaired t-test was applied to compare physiological variables like heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate, body mass index of two groups of study subjects. SPSS 22 (IBM 22.0) was used for analysis.

Results

Table 1: Demographic variables of study participants (n=120)

Variables	Meditators	Non-Meditators	p-value
Age	43.35±7.73	42.27±9.4	0.493
Males	34	36	0.583
Females	26	24	
Height	158.5±20.5	165.67±9.8	0.001*
Weight	60.20±10.17	73.82±11.84	
BMI	23.28±3.8	26.91±3.67	

As per table 1. The mean age of 120 participants in the study was 42.81 ± 8.61 years. Out of 120 participate in the study 70 were male and 50 were females. Meditators included 34 males and 26 females. Mean age of meditators was 43.35 ± 7.73 years. Non meditators include 36 males and 24 females. Mean age of the non-meditators was 42.27 ± 9.444 years. Age of the meditators and non-meditators were comparable (p value 0.493) but was not significant. Male and female distribution between the group was also compatible (p-value

0.583) which was also not significant. Meditators had mean height of 158.58 ± 20.55 cm while non-meditators had mean height of 165.67 ± 9.82 cm. Mean weight of meditators was 60.20 ± 10.17 kg while non-meditators had mean weight of 73.82 ± 11.84 kg. The calculated Body mass index (BMI) in meditators was 23.28 ± 3.82kg / m2 . In non-meditators the calculated Body mass index (BMI) was 26.91 ± 3.67 kg / m2. The difference of body mass index was statistically significant with a p-value of < 0.001.

Table 2: Comparative Heart rate, Respiratory rate, and Blood pressure of study participants (N=120)

Variables	Meditators	Non-Meditators	p-value
Respiratory rate/min	18.10±4.7	24.10±3.6	0.001*
Heart rate /min	70.13±10.02	78.43	0.001*
Systolic Blood pressure	110±6.94	124±13.48	
Diastolic blood pressure	72±5.6	76.68±12.50	0.001*

As per table 2 The mean respiratory rate in meditators was 18.10 ± 4.76 per minute. The main respiratory rate in non-meditators was 24.10 ± 3.65 per minute. The meditators had lower respiratory rate

which was statistically significant with a p value of < 0.001. The mean heart rate in Meditators was 70.13 ± 10.02 per minute while non meditators had mean heart rate of 78.43 ± 9.98 per minute. The

Meditators had statistically significant lower heart rate with a p value of < 0.001 . The mean systolic blood pressure (SBP) and in Meditators was 110.00 ± 6.94 mm of Hg; while non meditators had a systolic blood pressure (SBP) of 124.13 ± 13.48 mm of Hg. The mean diastolic blood pressure (DBP) and in meditators was 72.72 ± 5.63 mm of Hg while non meditators had a diastolic blood pressure (DBP) of 76.68 ± 12.50 mm of Hg. Both systolic blood pressure and diastolic blood pressure was lower in meditators and difference was statistically significant with the P value of < 0.001 and 0.027 respectively.

Discussion

The current study we evaluated the effect of Raja Yoga meditation on physiological variables in healthy adults like heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate and body mass index between two groups namely meditators and non-meditators. Meditators were practice meditation for at least 1 hour per day for at least one year. Meditators had significantly lower readings of cardiovascular parameters like heart rate, systolic blood pressure and diastolic blood pressure compared to non-meditators. Respiratory parameters evaluated was respiratory rate and found to be significantly lower in meditators compared to non-meditators. Anthropometric parameters studied was body mass index and found to be statistically significant lower in meditators compared to non-meditators. In a recent study published by Moumita Ghar et al; Effect of Rajayoga on cardiorespiratory parameters in Indian adult population was studied. The study compared anthropometric measurements resting pulse rate, blood pressure followed by the orthostatic tolerance test, isometric hand grip test and pulmonary function test in practitioners of rajayoga meditation and non-practitioners from general population. Seema Maini studied the effect of rajayoga meditation on the heart rate, blood pressure and ECG. There were 50 participants as meditators and 50 participants as non meditators. Finding of the study was that mean heart rate, systolic blood pressure, diastolic blood pressure, heart rate was significantly lower in subjects who practiced Rajayoga. ECG showed only decrease heart rate in the meditators and no other significant changes. The current study had a higher sample size 60 participants in each group [2]. The effect of rajayoga meditation on respiratory system cardiovascular system and lipid profile was studied. By Vyas R et al. Non meditators were compared to short-term meditators and long-term meditators. The found that both short and long-term meditators had higher vital capacity, tidal volume and breath holding time; lower diastolic blood pressure, lower serum cholesterol and a better lipid profile. [7] Current study compared the effects of rajayoga meditation on physiological variables in healthy adults like heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate and body mass index in meditators and non-meditators. Similarly, studies compared effect of yoga on heart rate, blood pressure and body mass index. Satyanarayana et al in a prospective cohort study included 50 subject their study and compared effect of yoga after 6 months of yoga practice. The study found that yoga practicing caused significantly reduced systolic blood pressure, mean arterial pressure, heart rate and body mass index, findings were like current study. [8] Bhashankar JR et al conducted a case control study in hundred participants after dividing them to meditators and non-meditators. They found that heart rate, systolic and diastolic blood pressure was low in meditators. These findings are similar to the current study. [9] Kiran et al investigated the effect of rajayoga meditation on cardiovascular autonomic Activity. The case control study with 50 subjects each and meditators and non-meditators. They found significant favorable difference of heart rate, systolic blood pressure, diastolic blood pressure and valsalva ratio in rajayoga meditators. [10] Most of the Literature available about the effect of rajayoga meditation on cardiovascular parameters like heart rate, systolic blood pressure and diastolic blood pressure point towards the statistically significant reduction of these parameters in meditators

Conflict of Interest: Nil Source of support: Nil

compared to non-meditators. [11,12,13] Current study also found statistically significant reduction of these parameters in meditators compared to non-meditators. Previous research works in this field suggests statistically significant improvement in respiratory parameters in practitioners of Rajayoga. In current study respiratory rate had a statistically significant reduction in meditators compared to non-meditators.

Conclusion

There is an increase in unhealthy habit of lifestyle and stress in modern world which leads to increased incidence of lifestyle and stress related diseases especially cardiovascular diseases. Direct or indirect effects of stress adversely affect human health in the modern society. Stress reduction technique includes pharmacological and non-pharmacological methods like yoga and meditation. Yoga and related meditation techniques originate in ancient India and their relevance in today's modern world is increasing in India where coronary heart disease is one of the major cause of mortality and morbidity yoga and meditation can influence the mortality and morbidity or they can act as a preventive technique. Rajayoga is a meditation technique done at level of Mind. During meditation body is relaxed and concentrates mind on one thing for an extended duration period which in turn help in reducing stress. Rajayoga meditation is cost-free, simple to learn and practice.

References

- Ghar M, Chaudhari A, Rahaman WB, Majumdar S, Biswas A, Goswami A. A study of the effect of Rajayoga on cardiorespiratory parameters in young adult Indians. *Saudi J sports Med.* 2016; 16(2):111.
- Maini S, Kaur H, Maini N. Effect of Raja Yoga meditation on the heart rate, blood pressure and ECG. *J Clin Diagn Res.* 2011;5:4.
- Von Kanel R. Psychological distress and cardiovascular risk: what are the links? *J Am Coll Cardiol.* 2008;52(25):2163-5.
- Dimsdale JE. Psychological stress and cardiovascular disease. *J Am Coll Cardiol.* 2008; 51(13):1237-46.
- Lasater J. The heart of Patanjali. *Yoga J.* 1997;137:134-44.
- Raja Yoga (Internet). [cited 2019 Jun 11]. Available from: <https://www.yogaindailylife.org/system/en/the-four-paths-of-yoga/raja-yoga>.
- Vyas R, Dikshit N. Effect of meditation on respiratory system, cardiovascular system and lipid profile. *Indian J Physiol Pharmacol.* 2002;46(4):487-91.
- Satyanarayana P. Effect of Yoga on Heart Rate, Blood Pressure, Body Mass Index. *IOSR J Dent Med Sci.* 2013;8(2): 36-9.
- Bharshankar JR, Mandape AD, Phatak MS, Bharshankar RN. Autonomic Functions In Raja-yoga Meditators. *Indian J Physiol Pharmacol.* 2015;59(4):396-401
- Kiran, Thaman R, Bassi R, Girgla K. Comparison of Autonomic Function using Valsalva Ration, heart rate and Blood Pressure in Meditators and Non-meditators. *Curr trends Diagn Treat.* 2017; 1(1):6-9
- Vaccarino V, Kondwani KA, Kelly ME, Murrain NV, Boyd L, Ahmed Y et al. Effect of meditation on endothelial function in Black Americans with metabolic syndrome: a randomized trail. *Psychosom Med.* 2013;75(6):591-9.
- Zamarra JW, Schneider RH, Besseghini I, Robinson DK, Salerno JW. Usefulness of the transcendental meditation program in the treatment of patients with coronary artery disease. *Am J Cardiol.* 1996;77(10):867-70.
- Ornish D, Scherwitz LW, Doody RS, Kesten D, McLanahan SM, Brown SE et al. Effects of stress management training and dietary changes in Treating Ischemic Heart Disease. *JAMA.* 1983; 249(1):54-9.