e-ISSN: 0976-822X, p-ISSN:2861-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(3); 246-252

Original Research Article

# A Hospital Based Analytical Observational Assessment of the Effect of Yoga on Respiratory Endurance Test in Medical Undergraduates

**Kumari Abha[1], Chandrakant Prasad, Dinesh Kumar[3]**

[1]Tutor, Department of Physiology, Government Medical College, Bettiah, Bihar, India

[2]Assistant Professor, Department of Physiology, Government Medical College, Bettiah, Bihar, India.

[3]Professor, Department of Physiology, Government Medical College, Bettiah, Bihar, India.

**Received: 09-01-2023 / Revised: 17-02-2023 / Accepted: 28-03-2023**
**Corresponding author: Dr. Kumari Abha**
**Conflict of interest: Nil**

**Abstract**

**Aim:** The aim of the present study was to investigate the effect of yoga on respiratory endurance test in medical students.

**Methods:** This study was conducted in the Department of Physiology, Government medical college, Bettiah, Bihar, India. After approval of Ethical Committee, eighty medical students between the age group of 18 to 24 years (20 ± 2 years) of both the sexes were selected. Informed and written consent were taken from all the participants involved in the study. The duration of the study was six months. 100 normal medical students of MBBS were randomly selected and included in our study.

**Results:** The MVV, 40 mm endurance and chest expansion were significantly increased ($p<0.005$) in the pranayama group (Group-II) and suryanamaskar group (Group-III). But the RR was significantly decreased ($p<0.005$) in pranayama (Group-II), suryanamaskar (Group-III) and combined group (Group-IV) than control group (Group-I), ($p<0.005$).

**Conclusion:** The regular practice of pranayama and Suryanamaskar practice induces more beneficial effects than physical exercise which mostly affects skeletal muscles.

**Keywords:** pranayama, suryanamaskar(SN), respiratory endurance, peak expiratory flow rate, vital capacity.



## Introduction

Cardiovascular disease (CVD) is the leading cause of death and disability in all developed countries. An integral part of primary prevention mainly focusing on modifiable risk factors is physical activity. [1] One form of physical activity to be potentially used is yoga, a system of physical practices and breathing techniques aimed at achieving better health and inner balance. These activities are recommended, for instance, in guidance provided by the American College of Sports Medicine. [2] Worldwide, studies have been published that document the beneficial effect of regular yoga exercises on human health. Innes et al. [3,4] repeatedly carried out a meta-analysis of literature regarding the effects of yoga on indices of CVD risk associated with insulin resistance and suggested beneficial changes in blood

pressure, abdominal obesity, lipid and coagulation profiles, oxidative stress, sympathetic activation, improved risk profiles in adults with type 2 diabetes mellitus, and several clinical endpoints. These findings were confirmed by other authors as well. [5]

On the other hand, Lau et al [6] conducted a meta-analysis of studies in 2012 that would confirm the effectiveness of yoga for secondary prevention of CVD. In the main databases, they found no eligible randomized controlled trials meeting the inclusion criteria (at least a 6-month follow-up period, patients diagnosed with CVD, studies comparing a group practicing yoga and controls receiving no intervention or interventions other than yoga). Yoga is an ancient philosophic system that originated in India, with the primary objective of development of the union of mind and body through a combination of exercise, respiration, and meditation to achieve psychosomatic harmony. [7,8] Yoga consists of a holistic combination of postural exercises (Asanas), relaxation, and voluntary breathing exercises (Pranayamas). All over the world, Yoga has gained popularity as an alternative form of physical activity since it offers a different experience when compared to traditional physical exercise training and is less strenuous and more enjoyable. [9]

Yogic exercises are popular all over the world in these days which increase longevity and have therapeutic and rehabilitative actions. [10] Asanas involved in surya namaska, a component in the yogic system tunes the range of flexibility of the practitioners. Hence selective package of yogic exercises (pranayama and suryanamaskar) would prove a positive impact among the student population in executing the skills for the better performance in their education as wholesome shaping of human body and mind. [11] Govindarajulu (2003) observed the effects of Yoga practices on flexibility and cardio respiratory endurance on high an out school girls where he found significant improvement on those selected variables after the training period. [12]

The aim of the present study was to investigate the effect of yoga on respiratory endurance test in medical students.

## Materials and Methods

This study was conducted in the Department of Physiology, Government medical college, Bettiah, Bihar, India. After approval of Ethical Committee, eighty medical students between the age group of 18 to 24 years (20 ± 2 years) of both the sexes were selected. Informed and written consent were taken from all the participants involved in the study. The duration of the study was six months. 100 normal medical students of MBBS were randomly selected and included in our study. The participants were divided into four groups namely; control, pranayama, suryanamaskar and combined group of pranayama and suryanamaskar.

General characteristics (age, body weight, height, and body mass index: BMI) were observed in subjects. All subjects were assigned to learn the whole yoga protocol and were explained in detail by the investigator. On the first day of study, subjects came to the training room and endurance tests were assessed using standard test. These were pre yoga exercise values. After six months of yoga training, the same tests were conducted which were designated as the post yoga values.

### Inclusion criteria:

- Medical students of age between 18-24 years
- Only volunteers who were interested in practicing Yoga
- Non-alcoholic & non-smokers

### Exclusion Criteria:

- Previous experience of yoga training
- History of major medical illness in the past e.g., Tuberculosis, Hypertension, Diabetes mellitus, Bronchial asthma etc

- History of major surgery in the recent past

All tests were carried out in the laboratory of the Department of Physiology, Government medical college, Bettiah, Bihar, India. The laboratory environment was, quiet the temperature was between 33 0C–35 0C and the lighting subdued. The study did not involve intravascular instrumentation at any stage. The participants were explained in detail about the study protocol and written informed consent was obtained from them. The subjects were advised to come at 7:45 am completely relaxed with empty bowel and bladder. All subjects who were included in the study (yoga group) were advised to refrain from smoking and alcohol during the entire study period.

All the subjects were asked to practice daily for about one hour. Yoga classes started with a brief prayer. Preparatory practices like breath-body coordination and joint loosening exercises were undertaken for 10 minutes. The duration of the study was six months; the yoga training was performed for 30 min, daily for 5 days a week. This was followed by 30 minutes of either pranayama (Group-II) or suryanamaskar (Group-III) or combined Group (pranayama and suryanamaskar).

At the end of yoga training exercise, attendance was taken and the subjects were motivated to practice regularly. Some of the classes were preceded by talk on diet and lifestyle modification in controlling chronic lifestyle disorders.

**Endurance Test**

MVV (Maximum Voluntary Ventilation): was measured by asking the subject to breathe as deeply and rapidly as possible for 15 seconds into the computerized spirometer model, RMS 401with the Helios software and the results in L/min were recorded in sec.

40 mm Endurance Test: After a deep expiration, the subjects were asked to inspire to the maximum. A clip was applied to the nose and the subject asked to expire into the mercury manometer up to the level of 40mm and to maintain it as long as possible. The maximum possible maintenance time were recorded in sec.

Chest Wall Expansion: The degree of expansion of chest was measured by placing an inch tape just below the nipple around the chest with its mark at the middle of the sternum. Instruction was given to the subjects to breath in and out as deep as possible. Readings were taken after 2 or 3 breaths. Measurement of the chest circumference was done at the end of deep inspiration and expiration and values were expressed in centimeters.

Respiratory rate (RR): RR measured by counting the number of breaths for one minute at rest through counting how many times the chest rises.

Time of exercise was 7:45 am.

**Statistical analysis**

All the values obtained before and after performing Pranayama, Suryanamaskar and combined pranayama, suryanamaskar yogic exercises were expressed as mean ± SD. The data were analyzed by SPSS 16. 0 version one way ANOVA followed by paired t test (Dennett's test) which was used to compare pre and post training results. P values of less than 0.05 were accepted as significant difference between the compared values. Comparison of respiratory endurance in pranayama, suryanamaskar and combined pranayama and suryanamaskarar procedures.

**Table 1: Equal distribution of participants into groups for the 6 months duration of the study**

| Groups | No. of participants | Duration of training |
|---|---|---|
| Group-I (before yoga group) | 25 | - |
| Group- II (Pranayama) | 25 | 6 months |
| Group-III (Suryanamaskar group) | 25 | 6 months |
| Group-IV (Combined group of pranayama & suryanamaskar) | 25 | 6 months |

## Results

**Table 2: Comparison of respiratory endurance in pranayama, suryanamaskar and combined pranayama and suryanamaskarar procedures**

| Parameters | Before yoga (Group-I) (n=25) (Control) | After Pranayama (Group -II) (n=25) | After Surya namaskar (Group -III) (n=25) | Combined Group- (Group-IV) (n=25) |
|---|---|---|---|---|
| **RR/min** | 18.12 ± 1.59 | 16.04 ± 1.45 | 15.55 ± 0.35 | 14.0 ± 1.70 |
| **MVV (L/min)** | 97.03 ± 1.16 | 107.23 ± 0.94 | 110.80 ± 1.46 | 110.10 ± 1.70 |
| **40mm endurance** | 25.95 ± 0.55 | 26.14 ± 1.28 | 27.03 ± 0.55 | 27.03 ± 1.52 |
| **Chest expansion (cm)** | 2.28 ± 0.57 | 3.00 ± 0.53 | 3.79 ± 0.95 | 3.01 ± 1.15 |

The MVV, 40 mm endurance and chest expansion were significantly increased ($p<0.005$) in the pranayama group (Group-II) and suryanamaskar group (Group- III). But the RR was significantly decreased ($p<0.005$) in pranayama (Group-II), suryanamaskar (Group-III) and combined group (Group-IV) than control group (Group-I), ($p<0.005$).

## Discussion

Medical students are confronted with a variety of life stressors from both college and home. Unmanaged stress is now considered to be an important contributing and/or causal factor in the development of numerous physical and mental health problems that are prevalent in adolescents, including anxiety, depression, and other behavioral problems. [13] In a recent study, Malathi and Parulkar [14] have reported that yoga training course of six weeks duration produces a significant decrease in visual and auditory reaction times (RTs). Being an interesting and novel observation, this needs confirmation. Further, Nayar et al [15] have observed a significant increase in breath holding time after yoga training whereas Gopal et al [16] have reported a slightly lower breath holding time in yoga trained subjects. Physical performance improvement is possible owing to both better economy of breathing and improvement in cardiovascular reserve, with other factors such as psycho-physiological and better relaxation possibly contributing. [17]

Pranayama and suryanamaskar practice showed a significant improvement in MVV. These findings concur with the study conducted by Joshi, et al in 1992 who reported a statistically significant increase in MVV. The RR was significantly decreased in the post yoga group ($p< 0.05$) than the pre yoga group. [18] Practicing Pranayama and suryanamskara for few weeks, there was a new pattern of breathing which was slower than its basal rhythm

leading to decrease in respiratory rate. Yogic practices also improved respiratory muscle endurance. 40mm endurance time, also a showed statistically significant improvement, indicates better respiratory endurance in post yoga group after regular practice of pranayama and suryanamaskar. At the end of 6 weeks Yoga training, chest wall expansion significantly increased ($p < 0.05$) in middle level of the thoracic cage (4th intercostal space) when compared to their pretest values.

Rajesh et al (2004) found a significant improvement in all pulmonary function with a significant decrease in RR could be mainly due to regulated, slow, deep and controlled breathing for prolonged period during pranayama practice leading to increase in the strength and endurance of expiratory as well as inspiratory muscles and contributing to enhanced voluntary control of breathing. As a technique, pranayama can assume rather complex forms of breathing, but the essence of the practice is slow and deep breathing. Such breathing is economical because it reduces dead space ventilation. It also refreshes air throughout the lungs, in contrast with shallow breathing that refreshes air only at the base of the lungs. [19] Bhutkar et al (2008) showed a statistically significant improvement in SBP, DBP, FEV1, PEFR, MVV, lung compliance and airway resistance as compared to baseline in CAD patients after 3months of regular practice of pranayama and asanas. [20]

Increase in inspiratory and expiratory pressures suggests that yoga training improves the strength of expiratory and as well as inspiratory muscles. Respiratory muscles are like skeletal muscles. Yogic techniques involve isometric contraction which is known to increase skeletal muscle strength. Breath holding time depends on initial lung volume. Greater lung volume decreases the frequency and amplitude of involuntary contractions of respiratory muscles, thereby lessening the discomfort of breath holding (Mandanmohan et al., 2003). During yoga practice, one consistently and consciously over-rides the stimuli to respiratory centers, thus acquiring control over the respiration. This, along with improved cardio-respiratory performance may explain the prolongation of breath holding time in yoga trained subjects. Hence daily practice of both Suryanamaskar and pranayama could also be part of physical fitness and life style modification program in maintaining better physical and mental health [21].

## Conclusion

Our study showed that the pulmonary function test values improved after short term (6 months) pranayama practice. Regular, slow and forceful inspiration and expiration for a longer duration during the pranayama practice, leading to strengthening of the respiratory muscles. Pranayama training causes improvement in the expiratory power and decreases the resistance to the air flow in the lungs. Pranayama training causes an increase in the voluntary breath holding time. This may be due to acclimatization of the chemoreceptors to hypercapnoea. Pranayama is a type of yogic breathing exercise. This resultant effect of pranayama can be used as lung strengthening tool to treat many lung diseases like asthama, allergic bronchitis, post pneumonia recoveries, tuberculosis and many occupational diseases.

## References

1. Perk J, De Backer G, Gohlke H, Reiner Z, Verschuren WM, Albus C, et al. European Guidelines on Cardiovascular Disease Prevention in Clinical Practice; 2012.
2. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM, Nieman DC, Swain DP. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently

healthy adults: guidance for prescribing exercise. Medicine and science in sports and exercise. 2011 Jul 1;43(7):1334-59.
3. Innes KE, Bourguignon C, Taylor AG. Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with yoga: a systematic review. The Journal of the American Board of Family Practice. 2005 Nov 1;18(6):491-519.
4. Innes KE, Vincent HK. The influence of yoga-based programs on risk profiles in adults with type 2 diabetes mellitus: a systematic review. Evidence-Based Complementary and Alternative Medicine. 2007 Dec 1;4 (4) :469-86.
5. Yang K. A review of yoga programs for four leading risk factors of chronic diseases. Evidence-Based Complementary and Alternative Medicine. 2007 Dec 1;4(4):487-91.
6. Lau HL, Kwong JS, Yeung F, Chau PH, Woo J. Yoga for secondary prevention of coronary heart disease. Cochrane Database of Systematic Reviews. 2012(12).
7. Godoy DV, Bringhenti RL, Severa A, Gasperi RD, Poli LV. Yoga versus aerobic activity: effects on spirometry results and maximal inspiratory pressure. Jornal Brasileiro de Pneumologia. 2006;32:130-5.
8. Chanavirut R, Khaidjapho K, Jaree P, Pongnaratorn P. Yoga exercise increases chest wall expansion and lung volumes in young healthy Thais. Thai J Physiol Sci. 2006 Apr;19(1):1-7.
9. Hagins M, Moore W, Rundle A. Does practicing hatha yoga satisfy recommendations for intensity of physical activity which improves and maintains health and cardiovascular fitness?. BMC complementary and alternative medicine. 2007 Dec;7(1):1-9.
10. Karmur KA, Joshi VS, Padalia MS, Sarvaiya JL, Karmur KA. Effect of ten weeks yoga practice on pulmonary function tests. Int J Biomed Adv Res. 2015;6(9):682-5.
11. Johnson PC, Mariayyah P. Effect of selected hathayogic practices in enhancing kicking ability in soccer playing. Journal of Exercise Science and Physiotherapy. 2007 Dec;3(2):168-70.
12. Govindarajulu N, Gannadeepam J, Bera TK. Effect of Yoga practices on Flexibility and cardio-respiratory endurance of high school girls. Yoga Mimamsa. 2003;34(2):64-70.
13. Sharma RA, Gupta N, Bijlani RL. Effect of yoga based lifestyle intervention on subjective well-being. Indian J Physiol Pharmacol. 2008 Apr 1;52(2):123-31.
14. Malathi A, Parulkar VG. Effect of yogasanas on the visual and auditory reaction time. Indian J Physiol Pharmacol. 1989 Apr 1;33(2):110-2.
15. Nayar HS, Mathur RM, Kumar RS. Effects of yogic exercises on human physical efficiency. The Indian Journal of Medical Research. 1975 Oct 1;63 (10):1369-76.
16. Gopal KS, Bhatnagar OP, Subramanian N, Nishith SD. Effect of yogasanas and pranayamas on blood pressure, pulse rate and some respiratory functions. Indian J Physiol Pharmacol. 1973.
17. Ray US, Pathak A, Tomer OS. Hatha yoga practices: energy expenditure, respiratory changes and intensity of exercise. Evidence-Based Complem - entary and Alternative Medicine. 2011 Jan 1;2011.
18. Joshi LN, Joshi VD, Gokhale LV. Effect of short term'Pranayam'practice on breathing rate and ventilatory functions of lung. Indian J Physiol Phamscol; 1992; 36 (2): 105. 1992 ;108.
19. Sharma RK, Deepak KK, Bijlani RL, Rao PS. Short-term physical training alters cardiovascular autonomic response amplitude and latencies. Indian journal of physiology and pharmacology. 2004 Apr 1;48(2):165-73.
20. Bhutkar PM, Bhutkar MV, Taware GB, Doijad V, Doddamani BR. Effect of

suryanamaskar practice on cardio-respiratory fitness parameters: A pilot study. Al Ameen J Med Sci. 2008;1(2) :126-9.
21. Madanmohan, Mahadevan SK, Balakrishnan S, Gopalakrishnan M, Prakash ES.. Effect of six weeks yoga training on weight loss following step test, respiratory pressures, handgrip strength and handgrip endurance in young healthy subjects. Indian J Physiol Pharmacol. (2008) P. 164-170.