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RESEARCH ARTICLE

# Comparison of peak expiratory flow rate and blood pressure in healthy subjects performing yoga and healthy subjects performing aerobics

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## ABSTRACT

**Background:** Exercise is any bodily activity that enhances or maintains physical fitness and thereby overall health. Non-pharmacological mode of treatment of respiratory ailments and hypertension is gaining popularity, of which yoga and aerobic exercise are well sought -after. Both of these help in improving cardiorespiratory functions. **Aim and Objective:** The aim of this study was to analyze the effects of yoga and aerobic exercise on peak expiratory flow rate (PEFR) and blood pressure (BP). **Materials and Methods:** A total of 86 healthy subjects aged between 30 and 40 years doing respective exercise regularly for ≥6 months, 5 days/week; without any comorbid respiratory or cardiovascular ailments such as ischemic heart disease/diabetes mellitus/asthma/chronic obstructive pulmonary disease were enrolled in this cross-sectional study. Demographic details such as age, gender, and history of respiratory or cardiac symptoms were taken by detailed medical history and physical examination. PEFR and BP of subjects of both the groups were measured and evaluated. PEFR was measured using Wrights handheld peak flow meter. BP was measured using sphygmomanometer. **Results:** Statistically significant ($P < 0.05$) difference was seen in PEFR of subjects doing yoga versus aerobics. About 43.75% of males doing yoga had PEFR between 351 and 400 L/min, while same for aerobics was 25%. About 50% of females doing yoga had PEFR between 301 and 350 L/min, while same for aerobics was 35.7%. **Conclusion:** PEFR was found statistically higher in subjects doing yoga than aerobics. No significant correlation could be found between BP and yoga/aerobics as various factors, especially genetics, affect it which is a limitation of this study.

**KEY WORDS:** Aerobic Exercise; Blood Pressure; Peak Expiratory Flow Rate; Yoga

## INTRODUCTION

Relationship between physical inactivity and cardiovascular (CV) disease started getting acceptance in the medical community in 1996 when the American Heart Association published information advocating the benefit of physical exercise for improvements in metabolic, hemodynamic, hormonal, neurological, and respiratory function.[1]

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### Aerobic Exercise

The American College of Sports Medicine (ACSM) defines aerobic exercise as any bodily rhythmic activity in nature that uses large muscle groups and can be maintained continuously,[2] for example, cycling, dancing, jogging, swimming, walking, etc. The effect of these activities can be realized through aerobic capacity. The aerobic capacity is defined by the ACSM as the product of the capacity of the cardiorespiratory system to supply oxygen and the capacity of the skeletal muscles to utilize oxygen.[3] Inherent effect of

physical exercise is mainly due to an increase in the cardiac output and enhancement of the innate ability of muscles to extract and to utilize oxygen from the blood. In addition, it also enhances or maintains high-density lipoprotein cholesterol level,[4] adipose tissue distribution,[5] and insulin sensitivity[6] as well as cognitive function.[7]

### Yoga

Yoga is a familiar practice in Indian culture, as mentioned in *Rig Veda.* It is a practice to connect mind with body. Yoga balances physical, mental, emotional, psychological, and spiritual aspects of life. By the practice of mudra, asana, shuddhi kriyas, pranayama, bandha, and meditation, yoga helps harmonize the emotions, mind, and body.[8] Major principles of yoga include meditation, proper breathing, proper exercise, relaxation, proper diet, and positive thinking. Yoga emphasizes on very slow respiration, deep breaths with sustained breath-hold after each inspiration.[9] Practicing yoga contributes in the enhancement of pulmonary ventilation and higher oxygen absorption and thereby improves lung capacity.

### Peak Expiratory Flow Rate (PEFR)

PEFR is the highest flow value measured (L/min) during forced expiration. It is an effort dependent value. It is a measurement of how fast a person can exhale after full inspiration. It helps to detect the severity of disease by measuring airway obstruction.[10] Factors affecting PEFR are airway obstruction, closure and compression of small airways, strength of expiratory muscles and the lung as well as chest mechanics.

## MATERIALS AND METHODS

The objective of this cross-sectional study was to analyze PEFR and blood pressure (BP) in people doing yoga or aerobics regularly for 6 months, 5 days/week in the age group of 30–40 years.

### Ethical Permission

The study began after permission of the Institutional Review Board and Ethical Committee of NHL Municipal Medical College. Consent of all the subjects was taken and confidentiality of data has been maintained.

This study was performed at Hetal's Yog Clinic (yoga), Ambawadi and Transform aerobic classes, Gulbai Tekra (aerobics). PEFR and BP of a total of 86 subjects were evaluated and analyzed, of which 42 subjects were of yoga (26 female and 16 male) and 44 were of aerobics (28 female and 16 male).

PEFR was measured by Rossmax™ Wright's handheld peak flow meter. A total of three readings (L/min) where participants gave their maximum effort were taken. Average of three readings was considered. BP was measured by SmartCare™ electrical sphygmomanometer. Since various factors affect systolic and diastolic pressure, mean BP is used, which determines the perfusion to various organs. The normal value of mean BP is 60–100 mmHg: [mean BP = DBP + (PP)/3].

All yoga subjects performed yoga *asanas* daily in the morning hours from 6:30 am–7:30 am at the yoga center, under the supervision of qualified yoga instructors. Yoga exercises included *Surya Namaskar* for 10 min and *asanas* with 1 min hold in each position (Padmasana, Sarvangasana, Halasana, Chakrasana, Dhanurasana, Bhujangasana, Paschimottanasana, and Matsyasana) for 20 min followed by Pranayam for 20 min and meditation for 10 min. All aerobic exercise subjects performed exercise from7:00 am to 8:00 am. The regime included high-intensity floor exercise/steppers for 30 min, strengthening exercise for 20 min. and cool down for 10 min.

### Inclusion Criteria

Subjects aged between 30 and 40 years and practicing yoga/aerobics regularly for 6 months, 5 days/week, and willing to participate in the study (note: Physiologically, body takes ≥6 months to completely adapt to any new changes in the environment).

### Exclusion Criteria

Subjects not meeting age criteria, period of activity criteria, not willing to participate were excluded from the study.

- Subjects with hypertension/diabetes mellitus/any heart diseases/chronic renal diseases
- Subjects with chronic respiratory diseases such as asthma and chronic obstructive pulmonary disease
- Smokers
- Pregnant women.

## RESULTS

### Variations in PEFR

There was a statistically significant relation ($P < 0.05$) between PEFR and people doing either yoga/aerobics. Higher

**Table 1:** Statistical analysis of PEFR (L/min, 1 pm) samples collected

| Variables | Yoga males | Aerobics males | Yoga females | Aerobics females |
|---|---|---|---|---|
| Max value | 550 | 410 | 500 | 420 |
| Min value | 330 | 290 | 200 | 200 |
| Mean value | 389.38 | 344.38 | 342.31 | 321.07 |
| Standard deviation | 57.79 | 32.65 | 67.90 | 59.46 |
| *P*-value | <0.05 | <0.05 | <0.05 | <0.05 |
| Sample size | 16 | 16 | 26 | 28 |

PEFR: Peak expiratory flow rate

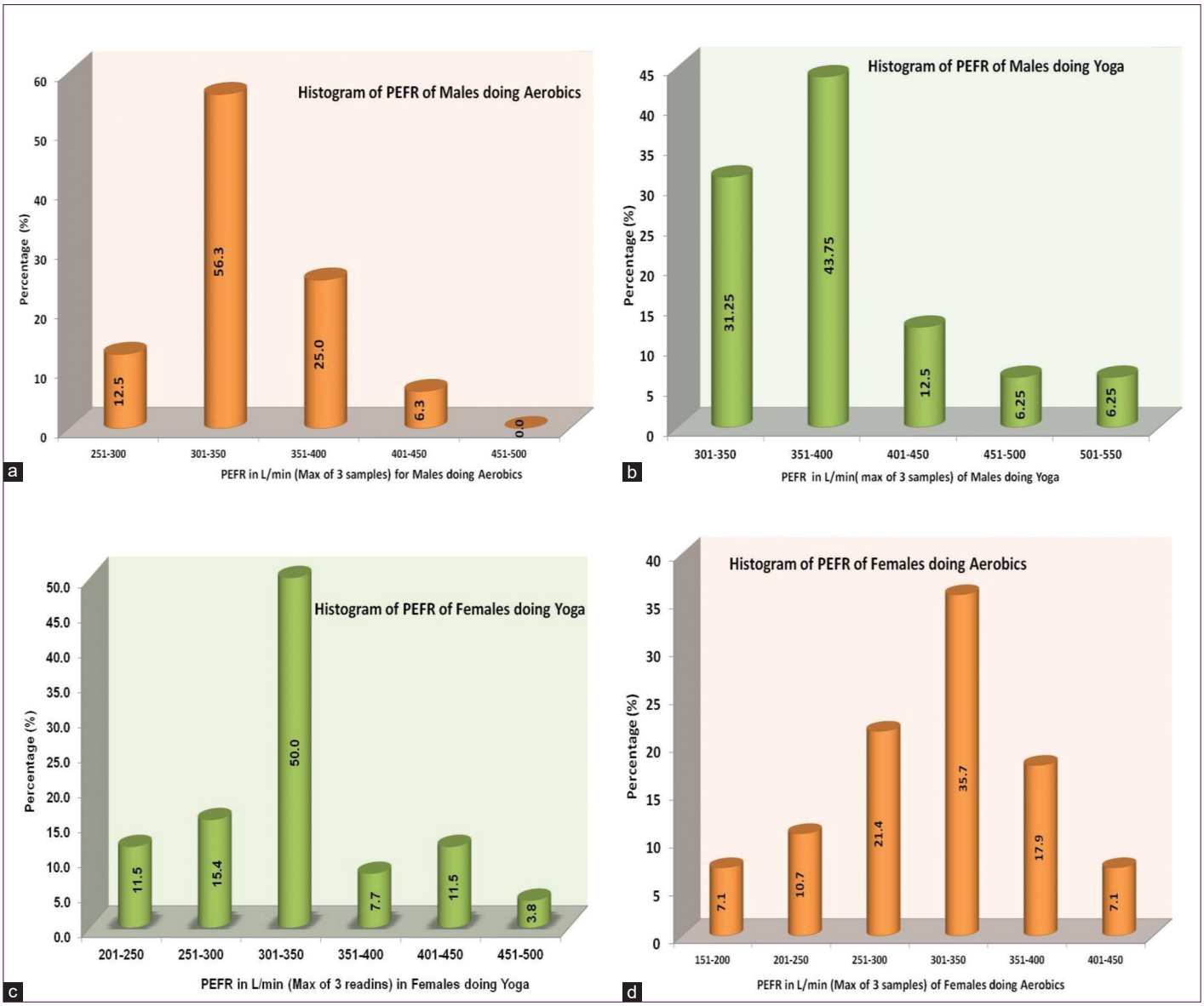


**Figure 1:** (a) Histogram of peak expiratory flow rate (PEFR) of males doing aerobics; (b) histogram of PEFR of males doing yoga; (c) histogram of PEFR of females doing aerobics; (d) histogram of PEFR of females doing yoga

average values of PEFR were seen in subjects doing yoga than aerobics [Table 1 and Figure 1].

### Variations in BP

There was no statistically significant relationship found between BP and people doing yoga versus aerobics ($P > 0.05$) [Table 2 and Figure 2].

## DISCUSSION

The aim of this study was to analyze the effectiveness of yoga/aerobics in improving PEFR or maintaining BP. About 43.75% of males doing yoga had PEFR between 351 and 400, while that for aerobics was 25%; 50% of females doing yoga had PEFR between 301 and 350, while that for aerobics was 35.7%. Daily yoga practice improves pulmonary ventilation and gas exchange, so it is useful in the prevention, cure, and rehabilitation of patients with respiratory illnesses.[11]

**Table 2:** Statistical analysis of BP (mmHg) samples collected

| Variables | Yoga males | Aerobics males | Yoga females | Aerobics females |
|---|---|---|---|---|
| Max value | 104 | 101 | 105 | 101 |
| Min value | 90 | 87 | 83 | 83 |
| Mean value | 98 | 94 | 83 | 83 |
| Standard deviation | 4.57 | 4.16 | 4.96 | 4.2 |
| *P*-value | >0.05 | >0.05 | >0.05 | >0.05 |
| Sample size | 16 | 16 | 26 | 28 |

BP: Blood pressure

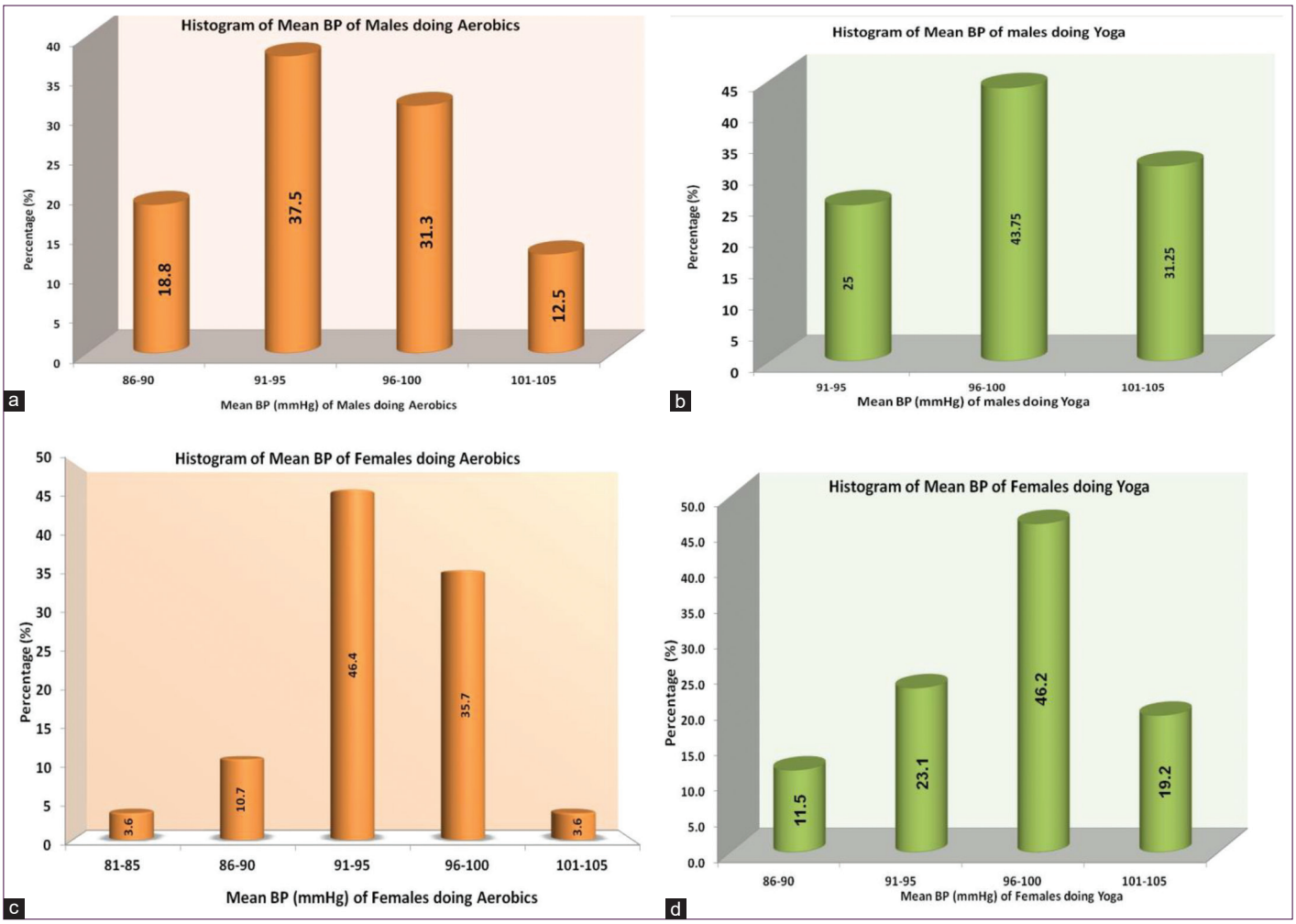


**Figure 2:** (a) Histogram of blood pressure (BP) of males doing aerobics; (b) histogram of BP of males doing yoga; (c) histogram of BP of females doing aerobics; (d) histogram of BP of females doing yoga

Other researches which support this study are: McCall[12] conducted research on yoga to see its impact on various health ailments, such as pain, cancer, stress/anxiety, CV disease, depression, hypertension, respiratory conditions, and diabetes. In addition, the role of yoga has gradually extended from complementary and alternative medicine to performance enhancement.[13] Yoga is used to improve physical flexibility and body coordination through asana, which has similar components such as stretching and strengthening exercises.[14,15]

Pranayama, one of the main breathing exercise in yoga requires voluntary control of respiratory muscles and involves different breathing speeds, i.e., shortening and elongation of breathing through three phases: (1) Puraka (inhalation), (2) Kumbhaka (retention), and (3) Rechaka (exhalation).[16] This increases lung compliance and expansibility which causes overall increase in ventilatory function. Another study has shown that there is a significant relationship between aerobics exercise and pulmonary function in healthy young subjects due to increased strength of respiratory muscles.[17]

Clark found that medically supervised physical exercise significantly improved cardiorespiratory strength, ventilatory responses, and decreased breathlessness in asthmatic patients.[18] Kaufman *et al*. studied the effect of aerobic exercise on ventilatory efficiency and threshold in overweight children. The study found positive effect of physical exercise on overweight children to reverse the decrements in cardiopulmonary function.[19] Another Iranian study by Farid *et al.* also showed an improvement in pulmonary function in asthma patients while undergoing with aerobic exercise.[20] Indian study by Akhani *et al.* found that yoga improves respiratory efficiency in healthy subjects and recommended it as a routine an part of healthy lifestyle. It can also be recommended as an adjunctive or substitute to conventional therapy for respiratory ailments.[21] Another study concludes that yogic exercises have a great value in improving cardiorespiratory efficiency, general health, and physical fitness. Its role in prevention, control, and rehabilitation of many diseases is also beyond doubt.[22] Regular practice of yoga improves pulmonary functions in mild-to-moderate cases of bronchial asthma, when used adjunctively with standard pharmacological treatment.[23]

This study shows a similarity with other studies[12,18,19,22,23] about the relationship between an increase in PEFR and healthy subjects doing yoga or aerobics. More increase in PEFR is seen in subjects doing yoga.

### Strengths

Meticulously statistical analysis was done and p value was obtained to prove statistically significance. Authentic subject selection was done on the basis of inclusion and exclusion criteria.

### Limitations

Due to the limited sampling size, healthy participants from only mid-high socioeconomic class, the results cannot be used in a generalized way to other sections of society. Since most of the subjects were taking anti-hypertensives regularly, all the values fell into the normal range. The limited-time period for the study of BP variations as it is a dynamic quantity and cannot be evaluated properly after one reading.

## CONCULSION

By the results of this study, it can be concluded that yoga is more helpful in improving ventilatory and pulmonary function and can be used in rehabilitation of asthmatic patients. Effects of yoga may be due to (1) asanas help in strengthening of respiratory muscles (2) retention of breath during various pranayama causes temporary hypoxia in tissues which can stimulate hypoxia-induced angiogenesis and hence increases tissue perfusion. This causes an increase in oxygen and nutritional supply to tissues and helps in tissue repair, maintenance of cellular homeostasis, and forms resistance against infectious agents.

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## REFERENCES

1. Fletcher GF, Balady G, Blair SN, Blumenthal J, Caspersen C, Chaitman B, *et al*. Statement on exercise: Benefits and recommendations for physical activity programs for all Americans. A statement for health professionals by the committee on exercise and cardiac rehabilitation of the council on clinical cardiology, American heart association. Circulation 1996;94:857-62.
2. Wahid A, Manek N, Nichols M, Kelly P, Foster C, Webster P, *et al*. Quantifying the association between physical activity and cardiovascular disease and diabetes: A systematic review and meta-analysis. J Am Heart Assoc 2016;5:e002495.
3. American College of Sports Medicine. ACSM's Guidelines for Exercise Testing and Prescription. USA: Lippincott Williams & Wilkins; 2013.
4. Williams PT. High-density lipoprotein cholesterol and other risk factors for coronary heart disease in female runners. N Engl J Med 1996;334:1298-303.
5. Schwartz RS, Shuman WP, Larson V, Cain KC, Fellingham GW, Beard JC, *et al*. The effect of intensive endurance exercise training on body fat distribution in young and older men. Metabolism 1991;40:545-51.
6. Rosenthal M, Haskell WL, Solomon R, Widstrom A, Reaven GM. Demonstration of a relationship between level of physical training and insulin-stimulated glucose utilization in normal humans. Diabetes 1983;32:408-11.
7. Spirduso WW. Physical fitness, aging, and psychomotor speed: A review. J Gerontol 1980;35:850-65.
8. Saraswati SS. Introduction to yoga. In: Saraswati SS, editor. Asana Pranayama Mudra Bandha. 4th ed. Munger, Bihar, India: Yoga Publication Trust; 2008. p. 1-5.
9. Yadav RK, Das S. Effect of yogic practice on pulmonary functions in young females. Indian J Physiol Pharmacol 2001;45:493-6.
10. David P. Johns and rob pierce. In: Pocket Guide to Spirometry. 2nd ed. New York: McGraw-Hill Medical; 2007. p. 1-30.
11. Madanmohan, Udupa K, Bhavanani AB, Vijayalakshmi P, Surendiran A. Effect of slow and fast pranayams on reaction time and cardiorespiratory variables. Indian J Physiol Pharmacol 2005;49:313-8.
12. McCall MC. In search of yoga: Research trends in a western medical database. Int J Yoga 2014;7:4-8.
13. Bryan S, Pinto Zipp G, Parasher R. The effects of yoga on psychosocial variables and exercise adherence: A randomized, controlled pilot study. Altern Ther Health Med 2012;18:50-9.
14. Gothe NP, McAuley E. Yoga Is as good as stretching-strengthening exercises in improving functional fitness outcomes: Results from a randomized controlled trial. J Gerontol A Biol Sci Med Sci 2016;71:406-11.
15. Sharm L. Benefits of yoga in sports-a study. Int J Phys Educ Sports Health 2015;1:30-2.
16. Dinesh T, Gaur G, Sharma V, Madanmohan T, Harichandra Kumar K, Bhavanani A. Comparative effect of 12 weeks of slow and fast pranayama training on pulmonary function in young, healthy volunteers: A randomized controlled trial. Int J Yoga 2015;8:22-6.
17. Chaitra B, Narhare P, Puranik N, Maitr V. Moderate intensity aerobics training improves pulmonary function in young Indian men. Biomed Res 2012;23:231-3.
18. Clark CJ. The role of physical training in asthma. Chest 1992;101:293S-8.
19. Kaufman C, Kelly AS, Kaiser DR, Steinberger J, Dengel DR. Aerobic-exercise training improves ventilatory efficiency in overweight children. Pediatr Exerc Sci 2007;19:82-92.
20. Farid R, Azad FJ, Atri AE, Rahimi MB, Khaledan A, Talaei-Khoei M, *et al*. Effect of aerobic exercise training on pulmonary function and tolerance of activity in asthmatic patients. Iran J Allergy Asthma Immunol 2005;4:133-8.
21. Akhani P, Banode S, Shah N. Effect of 4 weeks' yoga practice on respiratory function tests in young adults. Natl J Physiol Pharm Pharmacol 2019;9:493-7.

22. Mahajan N, Goyal P, Pandya J. The effect of yoga on cardiorespiratory and physical efficiency of the healthy subjects. Natl J Physiol Pharm Pharmacol 2019;9:543-6.
23. Pushpa K, Sharma D. Yoga as a complementary therapy improves pulmonary functions in patients of bronchial asthma: A randomized controlled trial. Natl J Physiol Pharm Pharmacol 2018;8:1704-8.

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