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]

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: \[ \text{mean BP} = \text{DBP} + \frac{(\text{PP})}{3} \].

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 from 7:00 am to 8:00 am. The regime included high-intensity floor exercise/stappers 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>
<thead>
<tr>
<th>Variables</th>
<th>Yoga males</th>
<th>Aerobics males</th>
<th>Yoga females</th>
<th>Aerobics females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max value</td>
<td>550</td>
<td>410</td>
<td>500</td>
<td>420</td>
</tr>
<tr>
<td>Min value</td>
<td>330</td>
<td>290</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Mean value</td>
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<td>344.38</td>
<td>342.31</td>
<td>321.07</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>57.79</td>
<td>32.65</td>
<td>67.90</td>
<td>59.46</td>
</tr>
<tr>
<td>( P )-value</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
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<td>&lt;0.05</td>
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<tr>
<td>Sample size</td>
<td>16</td>
<td>16</td>
<td>26</td>
<td>28</td>
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PEFR: Peak expiratory flow rate
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

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Max value</td>
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<td>101</td>
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<tr>
<td>Min value</td>
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<tr>
<td>Mean value</td>
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<td>94</td>
<td>83</td>
<td>83</td>
</tr>
<tr>
<td>Standard deviation</td>
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<td>4.16</td>
<td>4.96</td>
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<tr>
<td>(P)-value</td>
<td>&gt;0.05</td>
<td>&gt;0.05</td>
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</tr>
</tbody>
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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.\(^{[11]}\)
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 exercises 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 aerobic exercise.[20] Indian study by Akhani et al. found that yoga improves respiratory efficiency in healthy subjects and recommended it as a routine as 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.

CONCLUSION
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.

ACKNOWLEGMENTS
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REFERENCES