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Comparison of Peak Expiratory Flow Rate and BMI Between Yogic and Sedentary Population in Rajshahi City

Farhana Rahman[1]*, Swati Sarker[2], Fatema Tuz Zohura[3], Shahin Mahmuda[3], Md. Mohimanul Hoque[4], Amena Akter[5]

[1]Medical Officer, CWC, CMH Savar, Dhaka, Bangladesh
[2]Department of Community Medicine, Rajshahi Medical College, Rajshahi, Bangladesh
[3]Department of Physiology, Rajshahi Medical College, Rajshahi, Bangladesh
[4]Department of Medicine, Rajshahi Medical College, Rajshahi, Bangladesh
[5]Department of Transfusion Medicine, Rajshahi Medical College, Rajshahi, Bangladesh

Abstract: ***Background:*** Peak expiratory flow rate, or PEFR, is one of the most crucial pulmonary function tests. It is accurately evaluated with a spirometer and serves as a predictor of life expectancy. Healthy people who practice yoga have better respiratory efficiency, and it can be a vital component of a balanced lifestyle. ***Methods:*** This cross-sectional type of comparative study was carried out in the Department of Physiology, Rajshahi Medical College, Rajshahi over a period of one year from July 2022 to June 2023 among 30-50 years aged male and female who were the resident of Rajshahi City. A semi-structured questionnaire and Spirometer were used to gather information from 260 respondents, among them 130 were yogic and 130 were sedentary workers. ***Results:*** Out of 260 respondents, the mean age of the yogic respondents was 36.59 ± 4.46 years and the sedentary worker respondents was 37.41 ± 5.01 years. The mean BMI of the sedentary workers was higher than the yogic respondents and it was statistically significant. Yogic respondents had higher PEFR value than the sedentary worker and it was statistically highly significant ($p < 0.001$). ***Conclusion:*** This study emphasized the need of change our sedentary lifestyle and practice of yoga on regular basis irrespective of age and gender.

Keywords: Yoga, sedentary workers, PEFR and BMI.

Original Researcher Article

Correspondence:
Dr. Farhana Rahman
Medical Officer, CWC, CMH Savar
Dhaka, Bangladesh
Email: drfarhanarahman2013@gmail.com
https://orcid.org/0009-0004-8429-564X

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Article at a glance:

Study Purpose: *The purpose of this study was to assess and compare the PEFR and BMI between the yogic and sedentary working group.*
Key findings: *The study revealed that the sedentary worker's had higher BMI and poor performance on PEFR as compared with yogic.*
Newer findings: *Male and female sedentary workers also had poor performance on PEFR as compared with yogic male and female ($p < 0.01$ and $p < 0.001$, respectively).*
Abbreviations: *BMI: Body mass index, TLC: total lung capacity, ERV: expiratory reserve volume and PEFR: Peak expiratory flow rate.*

INTRODUCTION

In Bangladesh, the prevalence of respiratory illnesses is rising daily as a result of air pollution. Based on the most recent data released by the World Health Organization in 2020, lung illness accounted for around 6.58% of all deaths in Bangladesh.[1] Today's sedentary job is also on the rise, and the combination of air pollution and sedentary labor puts us in a terrible predicament. Because of this, pulmonary function measurement has become increasingly important in the modern era. Both patients with obstructive and restrictive lung disorders and those with normal pulmonary function can have their pulmonary function evaluated qualitatively and quantitatively through pulmonary function testing. Peak expiratory flow rate is a crucial metric for characterizing lung function.[2] Yoga is the best approach to maintain healthy lungs since it lowers stress and strengthens the lungs, which improves lung function.[2]

Yoga combines a number of exercises that require strong inhalation to residual volume and forceful expiration to total lung capacity (TLC). All of the exercises are performed through the nostrils, which provide resistance by reducing cross-sectional area and turbulence. Yoga poses help open up the airways by removing mucus. Thus, practicing yoga helps the respiratory system to empty and fill more fully and effectively.[3,4] During inspiration, yogic breathing increases the negative pressures in the abdominal and thoracic cavities, causes the diaphragm to travel farther than it would normally, and facilitates the diaphragm's efficient movement. Asanas such as bow pose and pranayama strengthen the lungs while breathing, which enhances lung capacity and improves respiratory efficiency. In yoga asana, the skeletal muscles are released from excessive tension, which facilitates improved thoracic relaxation. It appears that all of these techniques raise expiratory reserve volume (ERV), which raises pulmonary function.[5,6] Hence, by strengthening the respiratory muscles, yoga raises peak expiratory flow rates and aids in the reduction of body fat in different areas. Many postures, particularly those that involve twisting and bending forward and backward, aid in reducing fat in the hips, abdomen, and other areas.

Yoga poses have the potential to enhance breathing patterns by expanding and effectively improving the perfusion of many alveoli. A yogic regimen may alter the environment to promote diffusion and transport at the bronchioles, alveoli, and especially at the alveolar-capillary membrane. Numerous studies have demonstrated that practicing yoga reduces coronary artery stenosis, angina episodes, sympathetic activity, delays atherosclerosis, and enhances pulmonary function.[7,8] Although there has been much research done overseas, not as much has been done on the pulmonary function of regular sedentary and yoga practitioners as it has in our society. Thus, the purpose of the study was to compare the effects of sedentary people and healthy, physically fit yogis on peak expiratory flow rates and BMI. The results of the study could help the general public and medical professionals understand how yoga affects lung function testing.

METHODS

This cross-sectional comparative study was conducted in the Department of Physiology, Rajshahi Medical College, Rajshahi from July 2022 to June 2023 to assess peak expiratory flow rate and BMI among Yogic individuals in comparison to sedentary individuals. The general objective of the study was to assess and compare the PEFR and BMI between the yogic and sedentary groups. Specific objectives were to measure PEFR and BMI among the yogic group, measure PEFR and BMI among the sedentary group and compare PEFR and BMI between the yogic and sedentary groups. Male and female individuals aged 30-50 years with and without practicing yoga were enrolled in this study. Before conducting of the study, a semi-questionnaire was designed according to the objectives of the study and the data were collected by using this questionnaire.

Adult 130 respondents under practicing yoga aged 30 to 50 years were included in one group and similar number of sedentary workers aged 30 to 50 years were included in another group purposively. Data were collected from different yoga centers of Rajshahi city and sedentary workers were collected from neighbors, relatives and stuffs of Rajshahi Medical College and Hospital. At first, based on inclusion criteria (apparently healthy individuals aged 30-50 years of both genders, practicing pranayama, yoga asana, meditation and other yogic techniques for at least 1 h/day in last 6 months, sedentary worker-not practicing yoga) and exclusion criteria (smokers and alcoholics, subjects with active respiratory disorders, pregnancy, obesity, history of chronic systemic disorders and any drug treatment that can change respiratory functions such as steroid, bronchodilator, beta blocker etc), history was taken from each respondent.

Individuals who were matched according to the selection criteria of the study, they were informed about the purpose of the study. After knowing the purpose of the study, individuals who gave consent to participate in the study, were finally selected as a study subject. The data were collected based on variables of interest. Before the peak expiratory flow rate measurement, respondents were allowed to take rest at least 30 minutes. Then anthropometric measurements like

height and weight of each subject were measured. Information was collected regarding the socio-demographic data, smoking history, recent respiratory illness, medications used, family history of any bronchial asthma and systemic disorders.

The peak expiratory flow rate measurement was carried out in a well-ventilated spacious room with ambient temperature ranging from 28°C to 35°C. The measurement was taken between 8 am to 12 pm to avoid diurnal variations in pulmonary functions. The test was carried out by a well-trained doctor familiar with digital spirometer after well-informing every respondent about the instrument and the technique of test. Data were analyzed by using the 'Statistical Package for Social Sciences (SPSS)' software, version-24. Categorical variables were summarized by using number and percentage while continuous variables by mean ± standard deviation (SD). An Unpaired t-Test was used to compare BMI and PEFR between the yogic and sedentary workers and also male and female between the two groups separately. A p-value < 0.05 was considered statistically significant for all tests.

RESULTS

Table 1: Distribution of the respondents by age (n=130 in each group)

Age in years	Yogic group	Sedentary worker group	p-value
	Frequency (%)		
30-39 years	95 (73.10%)	91 (70.00%)	
≥ 40 years	35 (26.90%)	39 (30.00%)	
Total	130 (100.00%)	130 (100.00%)	
mean±SD	36.59 ± 4.46 years	37.41 ± 5.01 years	0.17

In both yogic and sedentary workers groups, majority of the respondents were within the age group of 30-39 years and it were 73.10% and 70.00%, respectively. The mean ages were 36.59 ± 4.46 years and 37.41 ± 5.01 years, respectively in the yogic and sedentary workers groups(Table-01).

Table 2: Distribution of the respondents by BMI (n=130 in each group)

BMI (kg/m²)	Yogic group	Sedentary worker group	p-value
	Frequency (%)		
Normal (18.5 to 24.9)	41 (31.50%)	33 (25.40%)	
Overweight (25 to 29.9)	89 (68.50%)	97 (74.60%)	
Total	130 (100.00%)	130 (100.00%)	
mean±SD	25.82 ± 1.98 kg/m²	26.61 ± 2.65 kg/m²	0.03

In both yogic and sedentary worker groups, majority of the respondents were overweight and they were (68.50%) and (74.60%), respectively. Sedentary worker respondents had higher BMI (26.61 ± 2.65 kg/m²) than yogic respondents were (25.82 ± 1.98 kg/m²) and it was statistically significant (p=0.03) (Table-02).

Table 3: Comparison of measured PEFR between the yogic and sedentary worker respondents

Variables	Measured PEFR (L/s) (mean ± SD)		p-value
	Yogic group	Sedentary worker group	
Male respondents (n=65 in each group)	8.25 ± 1.23	7.05 ± 1.18	< 0.001
Female respondents (n=65 in each group)	5.72 ± 0.60	5.16 ± 1.08	< 0.01
All respondents (n=130 in each group)	6.98 ± 1.60	6.10 ± 1.47	< 0.001

(Data were analyzed by **Unpaired t-Test** and were presented as **mean ± SD**. p value < 0.05 was considered as significant.)

Measured PEFR among yogic males was higher than the sedentary worker males (mean difference 1.21, 95% CI [0.79, 1.62]), t (df=128) = 5.70 and it was statistically highly significant ($p < 0.001$). Measured PEFR among yogic females was also higher than the sedentary worker females (mean difference 0.55, 95% CI [0.25, 0.86]), t (df=99) = 3.60 and itwas statistically highly significant ($p < 0.01$). Similarly, measured PEFR among yogic respondents was higher than the sedentary worker respondents (mean difference 0.88, 95% CI [0.50, 1.25]), t (df=260) = 4.61 and it was statistically highly significant ($p < 0.001$) (Table- 03).

DISCUSSION

The global concern for respiratory health is growing as a result of bad lifestyle choices and increased globalization. The pulmonary function tests are crucial for assessing an individual's level of fitness. Parameters measuring respiratory muscle strength and lung function are significantly improved by yoga intervention. Probably the greatest lifestyle that has ever been developed in human history is yoga.[11] In this study, the mean ages of the yogic and sedentary worker respondents were 36.59 ± 4.46 years and 37.41 ± 5.01 years, respectively. Similar findings were found in a study done by Jiwtode and Mahajan.[9] But dissimilar findings were found in a study done by Peter *et al*.[10] where mean age of yogic group was 29.86±2.98 years and sedentary worker group was 30.26±2.90 years. Lower age was found in a study done by Vedala *et al*.[11] where mean age was 29.7±6.3 years and 30.8±7.1 years in yogic and sedentary worker respondents. Age of yogic and sedentary worker respondents were 26.0±5.0 years and 25.8±4.5 years, respectively in a study done by Bhagel *et al*. This dissimilarity might be due to regional variation. In developed countries people practice yoga from younger age but in middle and low-income countries people practice it in late age.[10,12]

In the current study, the mean BMI of the yogic respondents was 25.82 ± 1.98 kg/m2 and the sedentary worker respondents was 26.61 ± 2.65 kg/m2 and it was statistically significant (p=0.03). Nearly similar findings were found in a study done by Peter *et al*.,[10] in India where mean BMI of the yogic respondents was 22.26±3.67 kg/m2 and the sedentary respondents was 23.09±3.16 kg/m2. BMI was significantly low in yogic group with the study done by Vedala *et al*.[11] In the present study, measured PEFR in the yogic male group was 8.25 ± 1.23 L/s and in the sedentary worker male group was 7.05 ± 1.18 L/s and it was statistically highly significant ($p < 0.001$). Similar findings were found with the study done by Akhani *et al*.[13] where PEFR in yogic males was 455.08±38.30 L/s and in sedentary males was 419.73±48.67 L/s and it was statistically significant ($p < 0.05$). In this study, measured PEFR in the yogic female group was 5.72 ± 0.60 L/s and in the sedentary worker female group was 5.16 ± 1.08 L/s and it was statistically highly significant ($p < 0.01$). Similar findings were found with the study done by Akhani *et al*.[13] where PEFR in yogic females was 383.88±26.40 L/s and in sedentary females was 382.72±26.63 L/s and it was statistically significant ($p < 0.05$). Males had a significantly higher PEFR compared to females which could be due to the high stature, muscle build and decreased body fat as compared to females.

In the current study, measured PEFR in the yogic group was 6.98 ± 1.60 L/s and in the sedentary worker group was 6.10 ± 1.47 L/s and it was statistically highly significant ($p < 0.001$). Similar findings were found in a study done by Peter *et al*.10 where among the yogic respondents PEFR was 77.58±17.10% and the sedentary worker respondents PEFR was 64.26±27.86% and it was statistically highly significant ($p = 0.001$). PEFR value was not similar to the study because in this study PEFR was measured in L/s and Peter *et al*.[10] measured the value in percent. Similar findings were also found with the studies done by Vedala *et al*.,11 Nagarathna and Nagendra ,[14] Khurde *et al*.,[15] Prakash and and Meshram[16] and Akhani *et al*. Overall increase and decrease in three-dimensional size of the chest during quite and forceful respiratory acts with powerful assistance from chest wall, respiratory muscles, abdominal muscles causing PEFR to increase significantly.[13]

Regular forceful inspiration and expiration for prolonged periods during yoga lead to the strengthening of the respiratory muscles, both

voluntary and involuntary. This helps the lungs to inflate and deflate maximally. This maximum inflation and deflation are an important physiological stimulus for the release of lung surfactant and prostaglandin into the alveolar spaces thereby increasing the lung compliance and decreasing the bronchial smooth muscle tone, respectively. There were some limitations of the study such as it was a cross-sectional type of comparative study in a single community with comparatively small sample size. Purposive sampling technique was applied. So, selection bias could not be avoided. FEF25–75% and MVV were not considered in the study. As only four yoga centre were situated in Rajshahi city, so the study result might not represent the exact scenarios of the whole country.

CONCLUSION

Sedentary lifestyle is associated with higher incidence of obesity, development of lung diseases and cardiovascular morbidity. In this busy life, people should try to be involved in such physical activities or sports which give them better health.

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Declarations

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Conflict of interest: Authors declared no conflict of interest.

Ethical approval: Ethical approval of the study was obtained from the Ethical Review Committee, Rajshahi Medical College, Rajshahi. Informed consent was taken from all participants. All the study methodology was carried out following the relevant ethical guidelines and regulations.

Consent for publication: Taken.

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