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A Cross Sectional Study on Peak Expiratory Flow Rate (PEFR) and BMI among construction site workers in Chennai District of Tamilnadu

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ABSTRACT

Background: The construction industry is undeniably one of the most hazardous job environments.[1] Obese people are more likely to experience respiratory symptoms. Peak Expiratory Flow Rate (PEFR) is the most commonly used pulmonary function test to evaluate the respiratory health status. **Objective:** The objectives was to assess the association of BMI with PEFR which reflects the respiratory function of construction workers and to study possible factors associated with the respiratory function of these construction workers.

Methods: An observational cross sectional study was carried out on 100 healthy construction workers from various construction sites at Thirunelveli district. Data on socio demographic profile and information regarding the smoking and comorbidities status, height, weight, BMI was estimated and Peak Expiratory Flow Rate was measured using peak flow meter.

Results: The mean age of the study participants was 34.4±12.2 years, BMI was 23.14±3.7, height was 156.4±11.1 cm and weight was 57.3±13.1 kg. It was found that as the years of experience increases, PEFR is reduced. Among those participants who smoke majority of them had reduced PEFR values and majority of study participants who were overweight and obese had abnormal PEFR values.

Conclusion: According to the current study, the obese population has impaired peak expiratory flow rate (PEFR). Smoking and increased number of years of experiences impacts the lung function.

INTRODUCTION

The construction industry is undeniably one of the most hazardous job environments.[1] The risks in the construction sector are eight times greater than those in any manufacturing sector. It is a labor-intensive job, and construction workers put themselves through dangerous work for pitiful pay.[2] The occupational exposure limits of air pollutants at construction sites are often higher than the standards. In the beginning, fine dust particles of asbestos, silica, cement, and sand irritate the lungs, produce mucus hypersecretion, and trigger up an inflammatory response. This may result in reduced lung function and faulty oxygen diffusion, which may then cause acute respiratory distress syndrome (ARDS) or chronic obstructive pulmonary disease (COPD). [3] Obese people are more likely to experience respiratory symptoms such as shortness of breath, especially during exercise, even if they have no evident respiratory infection. Since obesity stiffens the respiratory system and increases the mechanical effort required for breathing, it is evident that it may have a direct impact on respiratory health. It also increases carbon dioxide production and oxygen demand. One more contributing component is the impaired immune system. The Consensus Statement for Asian Indians Updated BMI Cut-offs: Obesity: >25 kg/m^2, Overweight: 23.0-24.9 kg/m^2, and Normal BMI: 18.0-22.9 kg/m^2. [4] Depending on the restrictive or constructive respiratory condition and lung impairment, the construction worker may exhibit the following clinical symptoms if they have a respiratory disorder: rhinitis, chest tightness, wheezing, and a persistent cough or phlegm. [5]

The strength of the respiratory muscles, thoracic cavity compliance, airway resistance, and the lungs' elastic rebound all influence pulmonary functioning. Various expiratory flow rates are used to depict airway narrowing. [6] The most accurate tests to evaluate a person's respiratory system are pulmonary function tests. Peak Expiratory Flow Rate (PEFR) is the most used pulmonary function test because it is a simple yet accurate diagnostic and prognostic test technique that may be used to diagnose bronchial asthma and lung obstructive illnesses. PEFR is defined as the maximum expiratory flow rate, measured in Litres/min, attained with a maximally forceful effort from a position of maximal inspiration.[7] Hence the Current study aimed to assess and compare the Peak Expiratory Flow Rate (PEFR) and BMI among the construction site workers in Thirunelveli District.

Methodology:

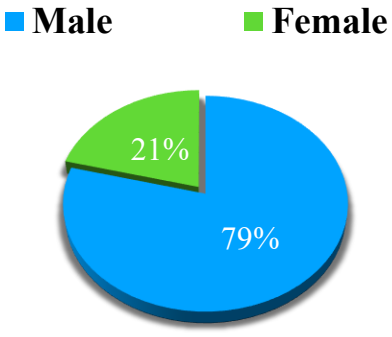
An observational cross sectional study was carried out on 100 healthy construction workers. They were selected by Multistage sampling, Construction sites in Chennai district of Tamilnadu near rural field practice were listed and among them 4 sites were

selected randomly in each of the sites selected by using lottery method 25 participants were selected hence total of 100 participants were selected from all 4 sites. The inclusion criteria was age group of 15 to 60 years, both male and female workers, working 6 hours at least a day and 5 days per week. Participants with respiratory conditions, chest deformities, athletes, or those engaged in any other regular physical activity were not allowed to participate. Additionally, those who were unwilling to cooperate, and who were suffering from known respiratory ailments even before joining the construction site were excluded. An informed and written consent was obtained from the subjects who were willing to participate in the study. Information such as years of experience, tobacco chewing, smoking, family history of respiratory illness, and other co-morbidities were collected. Wright's Peak flow meter was used to measure the peak expiratory flow rate. The participants were instructed to stand erect, hold the peak flow meter horizontally in front of their mouth, inhale deeply, and securely seal their lips around the mouthpiece to prevent air from escaping around their lips. The individuals were instructed to exhale as forcefully and quickly as they could, and the number that the cursor displayed was recorded. Each patient underwent three repetitions of the above mentioned sequence. The analysis was conducted using the highest of the three measurements. Body weight (kg)/ height (m^2) was the formula used to get the BMI.[6] Approval was obtained from the Institutional Ethics committee before starting the study. The data collected was entered into Microsoft excel sheet. Mean and Proportions were calculated and statistical tests such as chi-square test and Independent sample T test was done. Independent sample T test was done to compare the mean values of PEFR and BMI. P value of <0.05 was considered as significant. Analysis was carried out using IBM SPSS software version 26.

Results:

A total of 100 construction workers were included in this study irrespective of their place of origin, majority of them were hailing from Northern parts of India 74%, majority were illiterates 47% and belonged to low socioeconomic class 73%. The mean age of the study participants was 34.4±12.2 years, BMI was 23.14±3.7, height was 156.4±11.1 cm and weight was 57.3±13.1 kg. The distribution of study participants based on gender is shown below in Figure 1

Figure 1: Distribution of study participants based on gender



The associated aggravating factors which may be responsible for abnormalities in Peak expiratory flow rate among the study participants were assessed and they are mentioned as frequency in Table 1. It was observed that majority of them had work experience of more than 1 year, majority were smokers and most of the smokers had history of chronic cough.

Table 1: Frequency distribution of factors influencing PEFR (Peak Expiratory flow rate) among study participants (N=100)

Factors	Frequency n%
BMI	
Normal	73%
Overweight/Obese	27%
Years of experience	
< 1 year	38%
> 1 year	62%
Family history of respiratory illness	
Present	8%
Absent	92%
Tobacco chewing	
Present	46%

Absent	54%
Smoking	
Present	59%
Absent	41%
Comorbidities	
Present	28%
Absent	72%
Acute illness	
Cough +	29%
Nasal congestion +	14%

Chi square test was done to estimate the association between the above mentioned factors such as gender, BMI, years of experience, family history of respiratory illness, smoking and comorbidities with PEFR. It was found that as the years of experience increases, PEFR is reduced and more number of females had less than normal PEFR value compared to that of males and both these associations had statistical significance as shown in Table 2 and Table 3. Among those participants who smoke majority of them had reduced PEFR values and majority of study participants who were overweight and obese had abnormal PEFR values, however these associations were not statistically significant.

Table 2: Chi square test; Association between PEFR and Gender:

	PEFR < normal	Normal	P value
Gender			
Male	30	49	<0.001*
Female	17	4	

P value is significant <0.05*

Table 3: Chi square test; Association between PEFR and years of experience:

	PEFR < normal	Normal	P value
Years of experience			
<1 year	37	25	0.001*
> 1 year	10	28	

P value is significant <0.05*

The overall mean of Peak Expiratory Flow Rate among study participants was found to be 431.9+91.4 litres, 463.9$\pm$69.8 litres in males and 311.76$\pm$56.5 litres in females. Independent sample T test was done to compare the mean values of PEFR and BMI, there was a statistically significant difference observed between overweight/ obese and PEFR (t(38.4)= 2.20; p=0.03) as illustrated in Table 4.

Table 4: Independent sample T test; To compare means of BMI and PEFR:

	PEFR MEAN	T value	Df	P value	Mean difference	95% confidence interval	
BMI category						**Lower**	**Upper**
1 - Normal	445.3+82.6	2.2	38.4	0.03*	49.6	4.16	95.0
2 - Overweight/obese	395.7+105.3						

DISCUSSION

The finding of this study has enumerated the association between the BMI and PEFR among the construction site workers, where respiratory acute illness symptoms was evaluated, such as cough, breathlessness, etc. Similarly, a systemic review by **Boadu EF et al, [1]** work related respiratory conditions affecting construction workers identified to be cough, dyspnea, whistling/ wheel in chest, and chest congestion/ tightness, where some of the chronic respiratory conditions enumerated are cancer, silicosis, lung impairment and fibrosis. In a cross sectional survey by **Purani R et al, [2]** they had used the scoring from two part St. George Respiratory Questionnaire (SGRQ) that summarises the overall respiratory health status, translated into the local language, which includes the patient past 3 months history of any respiratory symptoms, current physical status and physical activity and psycho social function. A comparative analysis of pulmonary fitness of construction workers in Delhi in light of the Building and Other Construction Workers Act done by **Krishnakumar, et al, [3]** in which the independent *t*-test was performed to compare between exposed group and non exposed group of workers showed that there was no statistically significant difference of age, weight, and height, BMI with $P > 0.05$. In the test group of migrant construction workers, extended exposure to air pollutants connected to construction resulted in a significant decrease in PEFR similar to our study. The current study showed a statistical significance of the reduction PEFR among the construction workers who had more years of experience and BMI representing overweight/ obese category. A very similar study by **Chitnis P et al, [4]** shows a significant decrease in PEFR in obese males may indicate the presence of peripheral air flow restriction where PEFR snd BMI association was evaluated among young adults.

CONCLUSION

According to the current study, the obese population has impaired peak expiratory flow rate (PEFR). Appropriate and prompt weight loss guidance will also aid in avoiding respiratory issues. Awareness Education and training for proper use of the protective measures and ensuring the usage of PPE's through regular evaluation of the site may reduce the impact of environmental factors on the respiratory health of the construction workers. Periodical screening of workers and guidance on balanced diet and enlightening them on timely approach to medical professionals during their early symptoms for a desirable management may alleviate the disease burden.

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Ethical Approval: Approved

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