

Assessment of Peak Expiratory Flow Rate in Industrial Workers of MIDC, Lote

Naima Khot¹, Dr. Shweta Phadke²

¹Intern, ²Ex-Principal and Professor;

Lokmanya Tilak College of Physiotherapy Kharghar, Maharashtra University of Health Sciences, Kharghar, India.

Corresponding Author: Naima Khot

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ABSTRACT

Background: Various occupational hazards are seen in the workers working in different industries. In the industrial area, the workers might have effect on their health due to extended hours of working and exposure to various substances emitted from different industries in the environment. So, to assess lung function Peak Expiratory Flow Rate is measured.

Materials and Method: A cross sectional study was carried on 120 male industrial workers between the age group of 21-50 years. The aim of the study was explained and informed consent was taken. Peak Expiratory Flow Rate was measured by using Wrights peak flow meter. The use of instrument was demonstrated to all participants. The data was analysed using descriptive statistics in Microsoft Excel 2021.

Result: The highest of the three readings obtained was considered as peak flow rate, using statistical method mean was calculated. The mean of Peak Expiratory Flow Rate was 381.0 L/min. With years of exposure, the results show slight difference in peak flow rate. The industrial workers were using protective equipments while working.

Conclusion: This study can be used to take earliest preventive measures in workers to avoid respiratory conditions. Monitoring of Peak Expiratory Flow Rate at regular intervals can be planned to detect respiratory pathophysiology in workers.

Keywords: industrial workers, Wrights peak flow meter, peak expiratory flow rate.

INTRODUCTION

Thousands of workers in different industrial setup often get exposed to various hazardous substances. These substances can be dust or other particles which are harmful to the human body. There are many industrial areas developed by Maharashtra Industrial Development Corporation. Maharashtra Industrial Development Corporation (MIDC), Lote Parshuram industrial area is one of the declared chemical industrial area developed by them. This area is spread out in 2738 acres with approximately more than 457 industries. ⁽¹⁾ The area is divided into

four zones which includes A, B, C, and D. It is situated in Ratnagiri district of Maharashtra. This area includes various industries like chemical, packaging, pesticides and many production units. There are small-scale as well as large scale industries.

Being industrial area, the workers are prone to have effects on their health due to extended hours of working and exposure to various substances emitted from different industries in the environment. The occupational diseases at workplace develop due to inhalation of the dust or pollutants,

affecting the membrane structure and mechanical efficiency of lungs. ⁽³⁾ The occupational illness commonly includes allergic respiratory diseases such as asthma and rhinitis, contributed by environmental factors. ⁽³⁾ The early identification of occupation related hazards in the workers at risk helps to prevent further deterioration of their condition and undertake necessary precautions. ⁽¹³⁾ So, periodic evaluation of lung functions in the workers is important. Peak Expiratory Flow Rate is a convenient pulmonary function test. ⁽¹⁴⁾

A study was conducted in Hyderabad, which concluded that industrial workers may develop respiratory changes depending upon the chemical fumes and dust exposure as mean Peak Expiratory Flow Rate was statistically highly significant in cases and decreased with increase in duration of exposure to fumes and dust. ⁽⁵⁾

To assess the health of lungs in workers, Peak Expiratory Flow Rate is measured. Peak Expiratory Flow Rate (PEFR) is the maximum forceful air expired out of the lungs after deep inhalation. It measures the lung function. ⁽¹⁾ Any change in Peak Expiratory Flow Rate from normal values indicates of obstruction or accumulation of particles in the lungs. Variations in Peak Expiratory Flow Rate values can be either physiological or pathological due to the time of the day or air pollution and deconditioning respectively.

A small handheld device used to measure the value of Peak Expiratory Flow Rate is called as Peak Expiratory Flow Meter. It is a simple and timesaving test. It is measured in Litres/min. ⁽¹⁾ Normal range of Peak Expiratory Flow Rate for males is 450-550 L/min and females is 370-550 L/min. ^(6,7) Most commonly used peak flow meter is Wrights peak flow meter. This peak flow meter is easy to use, inexpensive and reliable tool to assess obstructive airway disease. ⁽⁹⁾

Hence, workers here are likely to get exposed to various pollutants in the working environment and also there is unavailability of sufficient research in this area.

MATERIALS & METHODS

Study Design: Cross sectional survey

Sampling Method: Purposive sampling

Sample size: 150

Study Setup: Maharashtra Industrial Development Corporation (MIDC), Lote (Zone B).

Inclusion Criteria:

- Male workers.
- Exposure or working for more than 1 year
- Age 21-50 years.

Exclusion Criteria:

- Cardiovascular disease
- Respiratory disease
- Any diagnosed chronic disease
- Autoimmune disease
- Immuno-deficiency
- Surgical intervention (Abdominal & Thoracic)
- Smoking/ Tobacco addiction
- Spinal Condition
- Traumatic chest injury
- Rib fracture.

Outcome Measures: Mini Wright Peak Flow Meter, Self-made questionnaire.

PROCEDURE:

An approval was taken from the institutional ethics committee of TMV'S Lokmanya Tilak College of Physiotherapy, Kharghar.

Permission was taken from the concerned industries.

Consent letter from the participant.

Demographic details of participant. Height and Weight of the participant were measured.

Peak flow meter was used to measure the Peak Expiratory Flow Rate values in participants. Use of instrument was demonstrated.

Participants were evaluated on fixed time of a day in standing position.

Following steps to measure Peak Expiratory Flow Rate:

1. Ask the patient to loosen any tight clothing as it may disturb breathing deeply.
2. The device should be held horizontally making sure that the fingers are not on the markings.
3. Instruction: Place the mouth piece in between the lips and maintain air tight seal. Breathe in as deeply as you can.
4. Blow into the mouth piece as quickly and as hard as you can in one blow. (Avoid putting tongue on the piece as it will obstruct the air entry)
5. As the air enters the device through the mouthpiece, the small arrow on the device moves, this measures the airflow in L/min.

Three readings were taken during the test and the best of the three values were considered for data analysis.

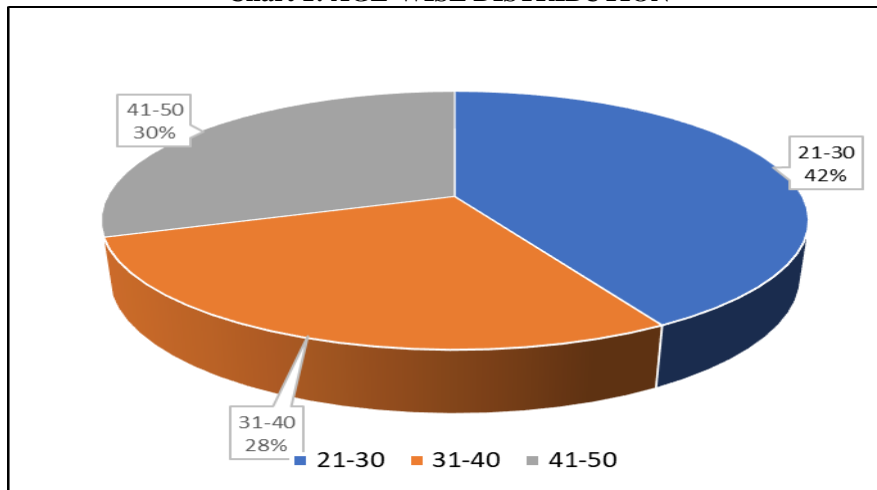
STATISTICAL ANALYSIS

Descriptive statistics was used to summarize the data collected by using MS Excel. Graph and pie charts were used to analyze and present the collected data.

Total of 150 samples were collected from small scale industries in Zone B of Maharashtra Industrial Development Corporation (MIDC), Lote.

RESULT

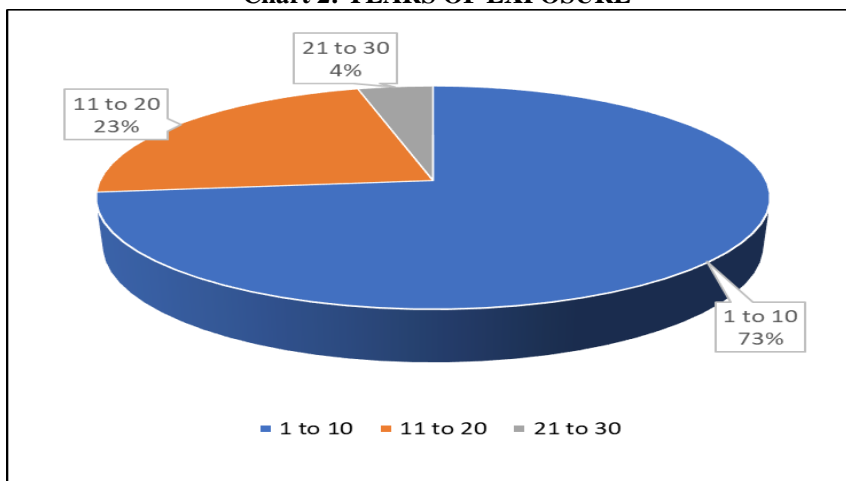
Chart 1: AGE-WISE DISTRIBUTION



Age group (in years)	Number of workers
21-30	50
31-40	34
41-50	36

Conclusion: Out of 150 workers, 50 workers were present in 21 to 30 age group.

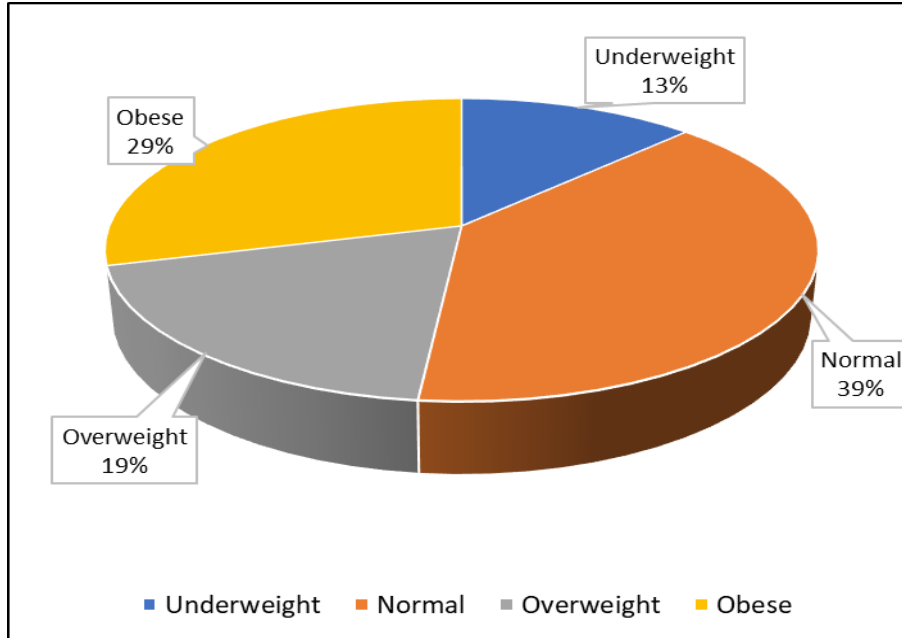
Chart 2: YEARS OF EXPOSURE



Years of Exposure	Number of Workers
1-10 years	88
11-20 years	27
21-30 years	5

Conclusion: About 88 workers were having working exposure for 1 to 10 years group.

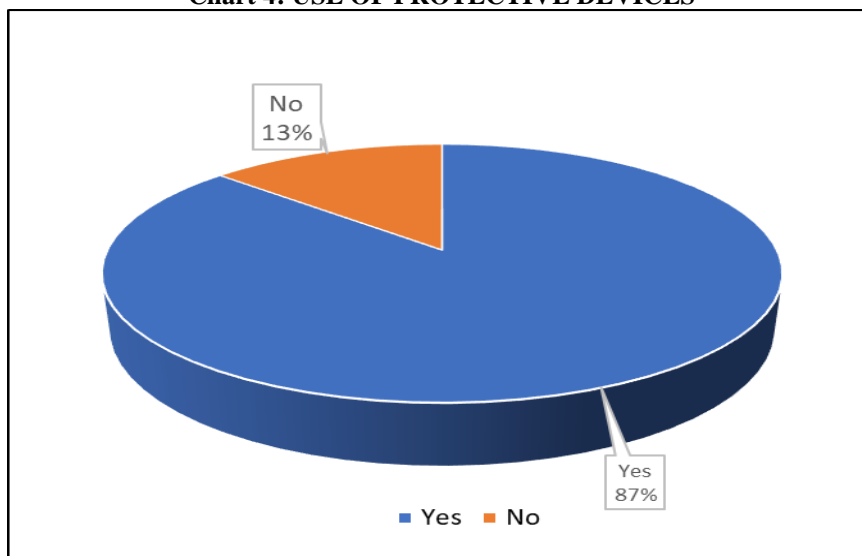
Chart 3: BODY MASS INDEX



BMI Category	Number of workers
Underweight	15
Normal	47
Overweight	23
Obese	35

Conclusion: 47 workers had normal body mass index.

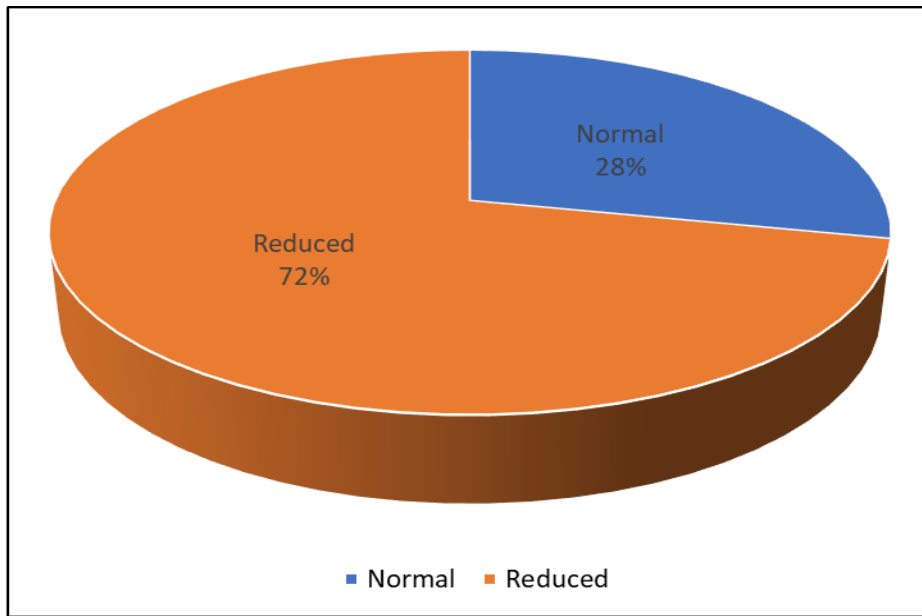
Chart 4: USE OF PROTECTIVE DEVICES



Protective device	Number of workers
Yes	104
No	16

Conclusion: 104 workers were aware and using protective devices while working.

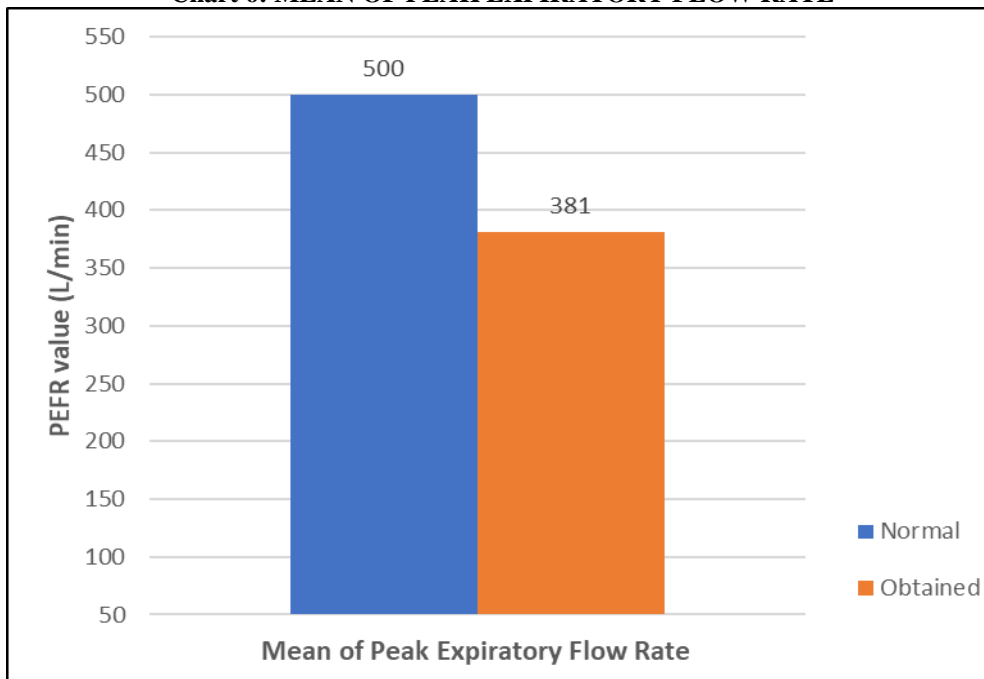
Chart 5: INTERPRETATION OF PEAK EXPIRATORY FLOW RATE



Interpretation Of Peak Expiratory Flow Rate	Number Of Workers
Reduced	86
Normal	34

Conclusion: It is seen that out of 120 workers, 72% workers have reduced Peak Flow Rate values.

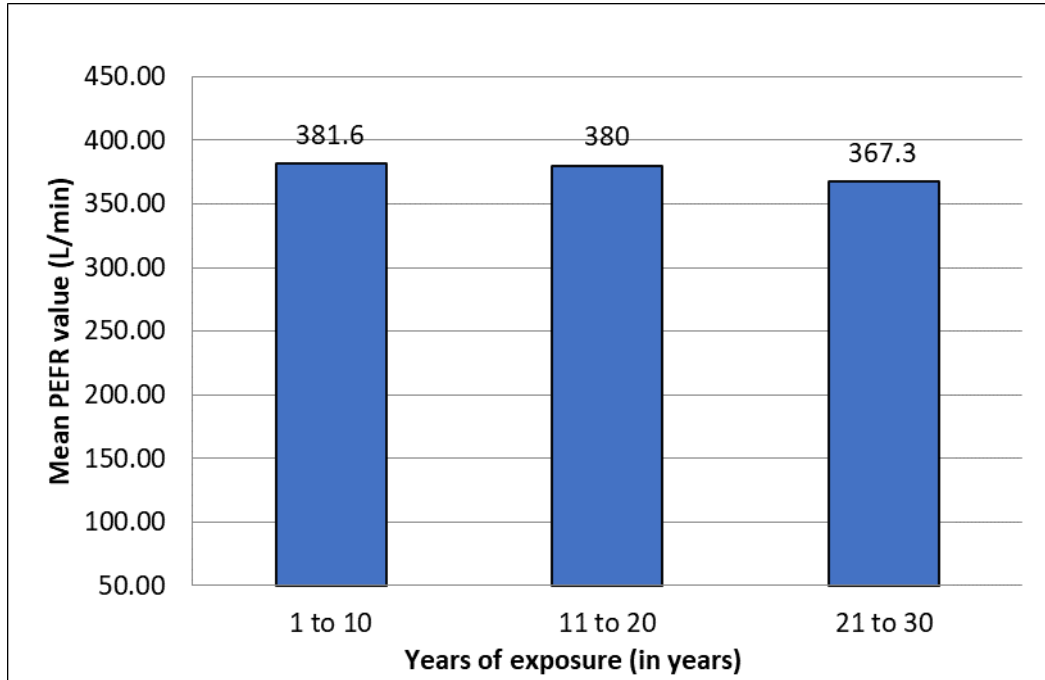
Chart 6: MEAN OF PEAK EXPIRATORY FLOW RATE



Mean Peak Expiratory Flow Rate	Value (L/min)
Normal	500
Obtained	381

Conclusion: In comparison to normative mean Peak Expiratory Flow Rate value, there is reduction in mean Peak Expiratory Flow Rate value obtained in workers.

Chart 7: RELATION OF PEAK EXPIRATORY FLOW RATE WITH YEARS OF EXPOSURE



Years of Exposure (in years)	Mean Peak Flow Rate (L/min)
1-10	381.6
11-20	380
21-30	367.3

Conclusion: It represents slight reduction in average Peak Flow Rate values with years of exposure.

DISCUSSION

The present study was done to assess Peak Expiratory Flow Rate in industrial workers in Maharashtra Industrial Development Corporation, Lote. It was conducted in workers of zone B. Being industrial area the workers are exposed to dust or pollutants in the environment during working years which impacts the occupational health of the workers. Supervising health of workers can help us identify at risk individuals and take necessary precautions at earliest. ⁽⁸⁾ Thus, to assess lung function in workers peak expiratory flow rate was measured. Peak Expiratory Flow Rate is the maximum air exhaled after deep inspiration. It is simple and reliable test to be performed. ⁽¹⁾ Wrights peak flow meter was used to assess PEFR values in workers.

Permission was obtained from small scale industries, which in all had 150 workers. These included chemical, engineering work, manufacturing, pharmaceutical and other small-scale industries. The age of the

participants was between 21 to 50 years. All 150 participants were male workers and working for more than 1 year. The workers working in shifts were covered during their day shifts. All the workers were working for 8 hours per day and 6 days in a week. Use of device was demonstrated every time before assessment in different industries. Three readings were taken during the test and the best of the three values was considered for data analysis. Self-made questionnaire was administered. 30 workers were excluded due to history of tobacco and smoking. Data analysis of 120 workers was done.

The workers were distributed into three different groups based on age. 42% workers were present in 21-30 age group, 28% workers in the 31-40 and 30% workers in the 41-50 age group respectively as demonstrated by Chart 1. According to years of exposure, the workers were divided into three categories. Among 120 workers, 73% workers were working for 1 to 10

years, 23% were working for 11 to 20 years and remaining 4% had exposure between 21 to 30 years as represented in Chart 2. Then the body mass index category of workers was calculated. 15(13%) workers were underweight, 47(39%) had normal body mass index, 23(19%) were overweight and remaining 35(29%) were obese. Chart 3 illustrates body mass index category of workers. Chart 4 demonstrates use of protective devices by the workers while working. Out of 120 workers, 87% workers reported use of protective devices.

Out of 120 workers, 86 workers have reduced peak expiratory flow rate which accounts for approximately 72% of workers while 34 (28%) workers have normal peak expiratory flow rate as depicted in Chart 5. Results in our study show that mean peak expiratory flow rate was reduced in industrial workers as compared to normal mean peak expiratory flow rate value for males. The mean of peak expiratory flow rate of 120 workers was calculated as 381.0 L/min. Chart 6 shows comparison of normal mean peak flow rate value with mean peak expiratory flow rate obtained in workers.

To obtain the relation of peak expiratory flow rate with years of exposure, mean peak expiratory flow rates of all years of exposure group was calculated. The mean peak expiratory flow rate value obtained for workers having 1 to 10 years of exposure was 381.6 L/min, for 11 to 20 years of exposure was 380 L/min and 367.3 L/min for workers with 21 to 30 years of exposure. Chart 7 represents reduction in mean peak flow rate with years of exposure. The results showed slight reduction as the workers in second and third category were less as compared to first group.

Aditi Tanna, et al carried out study on "Assessment of Peak Expiratory Flow Rate in Building Construction Workers In Maharashtra". Similar study was done in Pravara Institute Of Medical Sciences, Loni where 50 construction workers working where included in the study. The result showed that the peak expiratory flow rate was reduced in building construction

workers those who were working for more than 2 years on the construction sites.⁽¹⁾

The reduced peak expiratory flow rate value among the industrial workers could be due to extended exposure to the environmental dust or pollutants which cause effect on respiratory system.⁽¹⁰⁾ Inhalation of dust or fumes causes irritation to the mucus lining and hypertrophy of the mucosal cells, leading to decrease in elastic capacity of the lungs. There is obstruction to exhaled air due to lodged particles in the lungs causing decrease in peak expiratory flow rate.^(1, 9)

So, the result of present study showed that mean peak expiratory flow rate was reduced in workers. In view of years of exposure, slight difference in mean values of peak flow rates was obtained. The demographic data revealed that workers were conscious about use of protective and safety equipments. However, with large sample relation of peak flow rate with body mass index and age could be studied further.

CONCLUSION

The results conclude that there is reduction in Peak Expiratory Flow Rate in industrial workers in Zone B of Maharashtra Industrial Development Corporation, Lote.

Years of exposure have slight effect on Peak Expiratory Flow Rate values.

The workers are well-aware about use of protective devices while working.

Results of Peak Expiratory Flow Rate can help us to take earliest preventive measures to avoid airway disorders in workers.

Declaration by Authors

Ethical Approval: Approved

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