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Comparison of Peak Expiratory Flow Rate of Citizens of Delhi and Jaipur Due to Pollution

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Abstract

Introduction: The effects of air pollution include breathing and respiratory problems, aggravation of existing disease and alterations in the body defense systems against foreign materials. Peak flow readings are higher when we are well, and lower when the airways are constricted. From changes in recorded values, we may determine lung functionality, severity of asthma symptoms, and treatment options. The was aimed to establish normal values of PEFR in people, to find out the correlation of pollution parameters with PEFR.

Methodology: 100 subjects (50 from Delhi and 50 from Jaipur) were involved in the research, after having detailed history of occupation and pulmonary diseases to exclude the subjects having any threat of pulmonary restriction. BMI was calculated. Command was given subject to expire in the peak flow meter fast and hard as he/she can. 3 PEFR values were taken and maximum value were noted.

Results: PEFR value is highly significant and comparable and other factors are not significant as all other factors of both the cities were same.

Conclusion: PEFR Delhi is less than PEFR Jaipur. It can be said that it because of the increased air pollution in new Delhi as compared to the Jaipur.

Keywords: PEFR-peak expiratory flow meter; pollution; BMI.

Introduction

Clean air is what all living humans and animals needs for good health and well-being. However, due to unstoppable urban development, the air is continuously polluted. Urban ambient air is more polluted than overall atmosphere, due to high density of human population and their activities in urban areas; it produces air pollutants with a higher rate as compared to less-developed areas and natural environment.

Air pollution is physical or chemical changes brought about by natural processes or human activities that result in air quality degradation. The release of large amounts of smoke and other forms of waste into the air caused an unhealthy condition because the pollutants were released faster than they could be absorbed and dispersed by the atmosphere.[1]

In urban areas vehicular pollution is predominant and significantly contributes to air quality problems. Road traffic produce volatile organic compounds, suspended particulate matter (SPM), oxides of sulphur (SOx), oxides of nitrogen (NOx), and carbon monoxide (CO), which makes adverse health effects on the exposed population. The particles emitted from the vehicular exhaust of more than 10-micron size are held in upper respiratory tract and particles less than 10-micron size (PM10) accumulates in the lung and produces respiratory abnormalities. The effects of air pollution include breathing and respiratory problems, aggravation of

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existing disease and alterations in the body defence systems against foreign materials, damage to lung tissue, carcinogenesis and premature death.[2]

Peak expiratory flow rate is the maximal expiratory flow rate sustained by a subject for at least 10 milliseconds expressed in Litre per minute (L/min). PEFR had been used as measurement of ventilatory capacity for long since mainly because of a much simpler and less tiring procedure than maximum voluntary ventilation (MVV), single forced expiration in a simplified device min-Wright peak flow meter is now required and easily available for measurement of its value.[3]

Many researches have shown the peak flow meter use in clinical practice. A peak flow meter is a small hand-held device that measures how fast a person can blow air out of the lungs when there is forceful exhalation, after maximum inhalation. This measurement is called the 'peak expiratory flow' (PEF). The peak flow meter helps to assess the airflow through the airways and thus help to determine the degree of obstruction along them. The measurement of PEF was pioneered by Dr Martin Wright who produced the first meter specifically designed to measure this index of lung function. Since the original design was introduced in the late 1950s, and the subsequent development of a more portable, lower-cost version (the 'Mini-Wright' peak flow meter), other designs and copies have become available across the world. Brands of electronic peak flow meters are also being marketed.

Types of peak flow meters

There are several brands of peak flow meters available which all perform the same function. However, there are two major types: the low-range peak flow meter for small children between 4 and 9 years of age, and for adults with severely impaired lung function; and the standard-range peak flow meter for older children, teenagers, and adults. It is important that the doctor or healthcare provider prescribes the appropriate device for each individual. Adults have larger airways than children. If given a low-range peak flow meter, they will continually have maximum peak flow rates even when having severe shortness of breath. This may jeopardize proper management; they therefore need the much larger standard range.[4]

are higher when we are well, and lower when the airway routes are contracted. From changes in recorded qualities, we may decide lung usefulness, seriousness of asthma indications, and treatment alternatives.

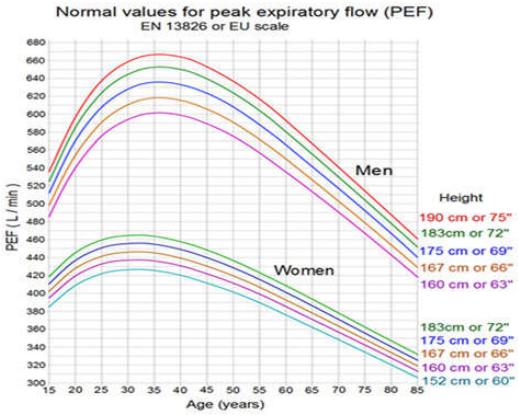

Fig. 1: Normal values for peak expiratory flow (PEF) EN 13826 or EU scale

Fig. 2: Peak Flow Meter.

Fig. 3: Mouth Peice.

Fig. 4: Subject performing expiration in PEFM

Estimation of PEFR requires some training to effectively utilize a meter and the typical expected worth relies upon a patient's sex, age and stature (figure 1). It is traditionally decreased in obstructive lung problems, for example, Asthma, COPD or Cystic Fibrosis.

Peak flow readings are regularly ordered into 3 zones of estimation as indicated by the American Lung Association; green, yellow, and red. Specialists and wellbeing professionals create the board plans dependent on the green-yellow-red zones..

Green Zone: 80 to 100 percent of the usual or normal peak flow readings are clear. A peak flow reading in the green zone indicates that the lung function management is under good control.

Yellow Zone: 50 to 79 percent of the usual or normal peak flow readings indicates caution. It may mean respiratory airways are narrowing and additional medication may be required.

Red Zone: Less than 50 percent of the usual or normal peak flow readings. Indicates a medical emergency. Severe airway narrowing may be occurring and immediate action needs to be taken. This would usually involve contacting a doctor or hospital.[5]

Materials and Methods

A prospective cross-sectional study design with 2 different groups from New Delhi and Jaipur were studied. The study was carried out in 2 different cities [Jaipur and New Delhi] in and around educational institutions.

The study protocol was approved by Institutional Ethical Committee of BCIP COLLEGE, kalkaji. 180 subjects population was observed in the study out of which 30 subjects withdrawn voluntarily and 50 subjects were excluded on bases of exclusion criteria. Both male and femaleSubjects without any history of chest infection or any chronic pulmonary disease were included in the study. Subjects below 5 years and a bove 60 years, any known case of asthma or chronic lung disease, smokers, H/O respiratory illness within week prior to study, Any other medical illness or Thoracic deformity were excluded in the study. Instruments used in study were Peak flow meter and standard Weighing machine.

Peak expiratory flow rate (PEFR), Height, Wight and Body Mass Index were measured as outcome for data recording in both the groups.

How to use

Peak flow meter: The purpose and procedure of the test should be explained to the subject followed by a demonstration of its performance. Individual ought to play out the test in standing position holding the peak flow meter evenly without meddling with the development of the marker (bolt) or covering the opening. The individual ought to request to take full breath at that point breathe out it by intense termination as quick as conceivable subsequent to keeping up impermeable seal among lip and mouth bit of the instrument. Perusing should be taken keeping the instrument level position (figure 4).

Procedure

100 subjects fulfilling the criteria belonging to respective states with 50 from Delhi and 50 from Jaipur were studied in the research including both males and females(graph 1), after having detailed history of occupation and pulmonary diseases to exclude the subjects having any threat of pulmonary restriction. Aim of the study was informed to check the PEFR levels of 2 cities to compare and proving the harm of pollution. Subjects were informed for further physical examination (height, weight measuring and BMI calculation). As a pre-test assessment, parental history, subject examination and the subject's history was taken to rule out if the subject was normal or having history of any present or past illness. History was taken to exclude the subjects as per the excluding criteria.

On the data collection day, the subject was asked quOn the data collection day, the subject was asked questioned related to their past and present illness and demographic data including the name, sex, age, address and occupation prior to commencement of data collection procedure. Height, weight, BMI, resting heart rate and PEFR were noted. Subject was explained the procedure to use the peak flow meter. Command was given subject to expire in the peak flow meter fast and hard as he/she can. 3 PEFR values were taken simultaneously and maximum value were noted (Figure 1,2,3 & 4).

Data analysis: Data was analyzed using SPSS, 2 tailed t test was used for both groups to allow an equal likelihood for finding significant differences between subjects of Delhi and Jaipur. Correlation was used to correlate between the all the factors of the collected data.

Results and Discussion

Total 100 subjects were selected for data collection,50 from Delhi and 50 from Jaipur. All subjects were normal without having any respiratory disease. P

value - statistically significant as P < 0.05 and statistically highly significant as P < 0.001 were considered. Age- p value wss greater than 0.05 , BMI- p value wss greater Than 0.05, PEFR- P value was less than 0.01, it was highly significant (Table 1 and Graph 1).

Table 1: Sample distribution statistics of age, height, weight, BMI and PERF max

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	Group Statistics					
	Place	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**P-value**
Age	Delhi	50	25.40	8.619	1.219	.785
	Jaipur	50	24.94	8.215	1.162	
Height	Delhi	50	168.620	9.0658	1.2821	.035
	Jaipur	50	164.720	9.2119	1.3028	
Weight	Delhi	50	63.616	13.1801	1.8640	.220
	Jaipur	50	60.560	11.5160	1.6286	
PEFR max	Delhi	50	459.00	81.947	11.589	.005
	Jaipur	50	502.40	69.033	9.763	
BMI	Delhi	50	22.446000	4.0100491	.5671066	.714
	Jaipur	50	22.184000	3.0474051	.4309682	

Table 2: Correlation statistics for subjects in Delhi

		Age	**Height**	**Weight**	**PEFR Max**	**BMI**
Age	Pearson Correlation	1	.212	.294*	.088	.266
	Sig. (2-tailed)		.139	.038	.543	.062
	N	50	50	50	50	50
Height	Pearson Correlation	.212	1	.594**	.571**	.152
	Sig. (2-tailed)	.139		.000	.000	.292
	N	50	50	50	50	50
Weight	Pearson Correlation	.294*	.594**	1	.423**	.872**
	Sig. (2-tailed)	.038	.000		.002	.000
	N	50	50	50	50	50
PEFR Max	Pearson Correlation	.088	.571**	.423**	1	.171
	Sig. (2-tailed)	.543	.000	.002		.234
	N	50	50	50	50	50
BMI	Pearson Correlation	.266	.152	.872**	.171	1
	Sig. (2-tailed)	.062	.292	.000	.234	
	N	50	50	50	50	50

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3: Correlation Statisticsforsubjectsin Jaipur

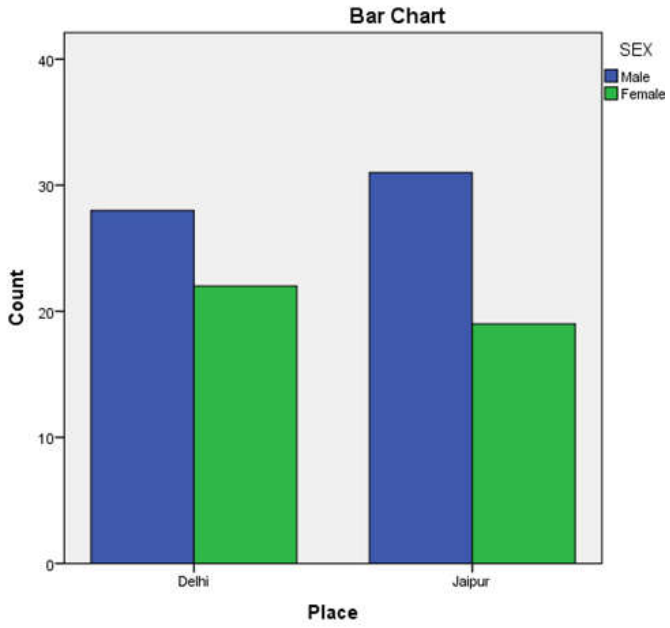
	Age	**Height**	**Weight**	**PEFR Max**	**BMI**	
Age	Pearson Correlation	1	.114	.318*	.226	.334*
	Sig. (2-tailed)		.429	.024	.115	.018
	N	50	50	50	50	50
Height	Pearson Correlation	.114	1	.728**	.566**	.213
	Sig. (2-tailed)	.429		.000	.000	.137
	N	50	50	50	50	50
Weight	Pearson Correlation	.318*	.728**	1	.512**	.820**
	Sig. (2-tailed)	.024	.000		.000	.000
	N	50	50	50	50	50
PEFR Max	Pearson Correlation	.226	.566**	.512**	1	.275
	Sig. (2-tailed)	.115	.000	.000		.053
	N	50	50	50	50	50

BMI	Pearson Correlation	.334*	.213	.820**	.275	1
	Sig. (2-tailed)	.018	.137	.000	.053	
	N	50	50	50	50	50

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Graph 1: Gender distribution statistics in studied population



Pollution Levels

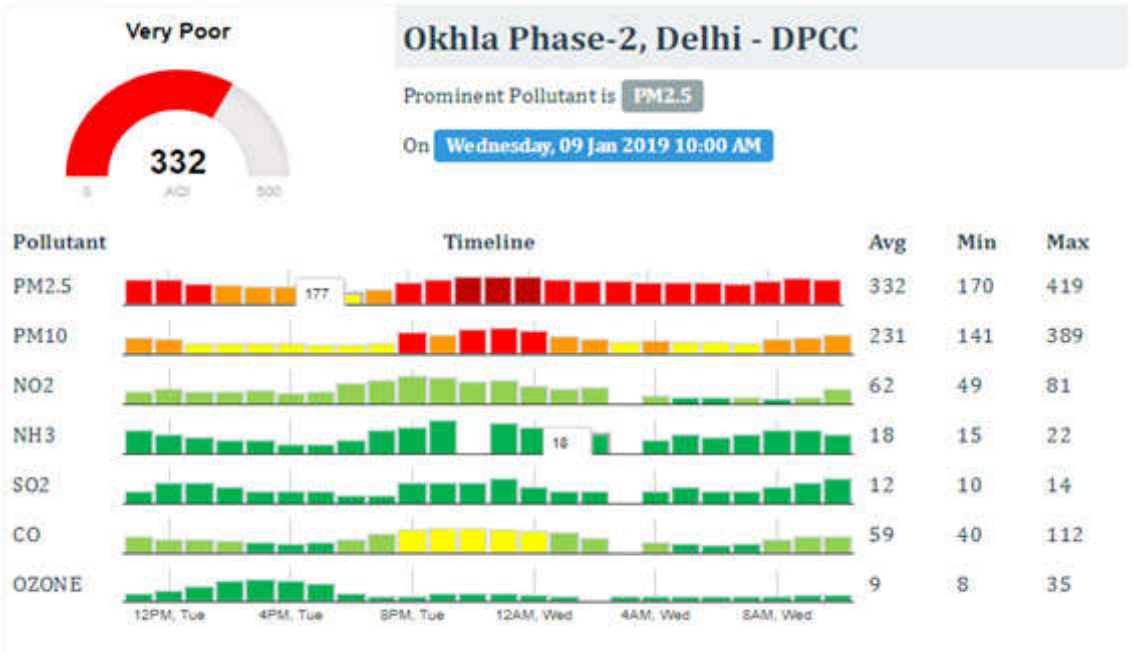


Fig. 5A: Pollution Levels in Delhi and Jaipur at the time of research

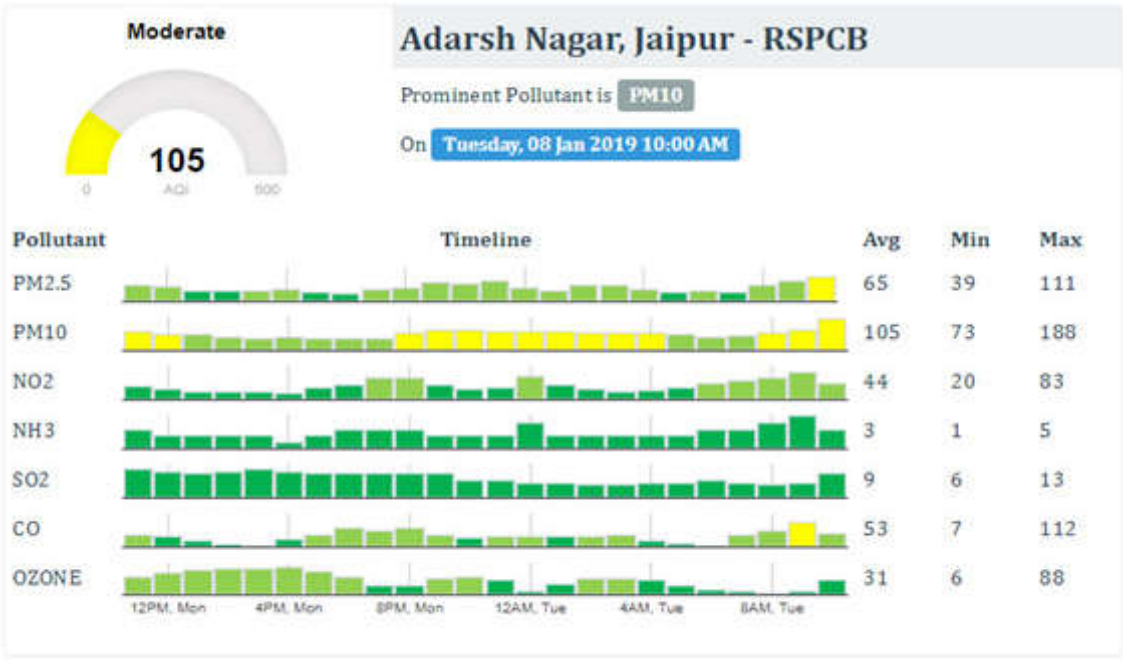


Fig. 5B: Pollution levels in Delhi and jaipur at the time of research

AQI	Remark	Color Code	Possible Health Impacts
0-50	Good		Minimal impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort to the people with lungs, asthma and heart diseases
201-300	Poor		Breathing discomfort to most people on prolonged exposure
301-400	Very Poor		Respiratory illness on prolonged exposure
401-500	Severe		Affects healthy people and seriously impacts those with existing diseases

Fig. 6: Source-National Air Quality Index https://app.cpcbccr.com/AQI_India/#.[6]

Analysis of data revealed that PEFR of Delhi subjects was less than PEFR of Jaipur subjects. It may be said that the difference obtained in PEFR was because of the increased air pollution in new Delhi as compared to the Jaipur.

Discussion

Air contamination is a most significant issue of the current time everywhere on the world particularly in the huge urban communities due to the enormous degree of industrialization. The arrival of such air contaminations in weighty focuses, for example, brown haze, particulates, strong materials, and so on are getting settled over the city, causing air contamination and wellbeing dangers to the individuals. Loads of messy squanders delivered by individuals on regular schedule particularly in the enormous urban areas dirtying the entire climatic air generally .

The arrival of vaporous poisons from consuming fuel of engine vehicles, modern cycles, consuming of trash, and so on are adding to the air contamination. Some common toxins like dust, dust, soil particles, flammable gases, and so forth are additionally the wellspring of air contamination.

Delhi has a high number of naturally well-disposed CNG-run transports. Notwithstanding this, the air contamination because of vehicular outflow is enormous. It is a result of the diminished green cover over Delhi. The previous twenty years have seen an uncontrolled development of land everywhere on the city. Impact of air pollution on morbidity and mortality increases with the exposure levels but there are no thresholds below which the adverse effects of the pollution do not

occur. Therefore, the mortality and morbidity is increased by the pollution in all parts of the world, but at least half of the disease burden is borne by the populations of developing countries. People with existing cardiac or pulmonary disease are at increased risk of acute symptoms or mortality.

Long-term exposure to combustion-related fine particulate air pollution is an important environmental risk factor for cardiac, pulmonary and lung cancer mortality.[7]

In metropolitan territories vehicular contamination is dominating and essentially adds to air quality issues. Street traffic produce unstable natural mixes, suspended particulate issue (SPM), oxides of sulfur (SOx), oxides of nitrogen (NOx), and carbon monoxide (CO), which makes antagonistic wellbeing consequences for the uncovered populace (Fig. 5 a&b and 6). The particles transmitted from the vehicular fumes of more than 10-micron size are held in upper respiratory lot and particles under 10-micron size (PM10) gathers in the lung and produces respiratory irregularities. The impacts of air contamination incorporate breathing and respiratory issues, irritation of existing sickness and changes in the body safeguard frameworks against unfamiliar materials, harm to lung tissue, carcinogenesis and unexpected passing.[2]

The PEFR is one among the lung work test which is useful in assessing obstructive lung infections particularly bronchial asthma. It is likewise useful in checking the infection movement and reaction to treatment. The Peak Expiratory Flow Rate (PEFR) is an exertion subordinate boundary, arising out of the huge aviation routes inside around 100-120 msec of the beginning of constrained termination. It stays at its top for 10 msec . It is all around recorded in writing that a wide scope of geological, climatic, anthropometric, healthful, and financial states of India are related with provincial contrasts in lung work. Other than anthropometric and financial components, height is a significant determinant of lung work.[8]

Many research has shown the effect on PEFR due to pollution. There is a marked decrease in PEFR value due to respiratory problems caused by pollution. Aritra Sanyal and Lalit H. Nikam conducted research on effect of air pollution on peak expiratory flow in taxi drivers and train drivers and they concluded that Air pollution is affecting the lung function of every individual in this world and the decreased lung function is directly proportional to the amount of time the person is spending in the polluted air. As taxi drivers spend major part of their day in polluted air, their lung function had decreased more compared to the local train drivers, who don't have to spend that much time in the polluted air, because their job is restricted to a particular corridor where dust & fumes of other vehicles are comparatively less.[9]

This research was aimed to find the difference between the PEFR levels of citizens of two different cities (Delhi and Jaipur) as there are different pollution levels in both the cities, Delhi has a higher pollution level causing respiratory problems and breathing problems due to excessive vehicular and industrial pollution whereas Jaipur has very low pollution levels as compared to Delhi (Fig. 5 and 6).

Therefore the result of the data collected shown that PEFR Delhi was less than PEFR Jaipur. This may be because of the increased air pollution in New Delhi as compared to the Jaipur which inturn indicates towards declining health of the population at risk in the studied area.

Conclusion

The study concludes that there may be a correlation between pollution and PEFR values of both the cities. On the basis of the results found in present study, it may be concluded that "There is a significant difference of PEFR among normal young adults of Delhi and Jaipur, without any history of respiratory disorder".

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