

CONCENTRATION OF AIR POLLUTANTS AND THEIR HEALTH EFFECTS ON RESIDENCE OF PESHAWAR, PAKISTAN

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ABSTRACT

Objective: To find out the variation in concentration of different pollutants at different sites and health related problems faced by individuals.

Material and Methods: A cross-sectional study was done in Peshawar City, Khyber Pakhtunkhwa province of Pakistan between January 2017 to May 2017. A total of 94 different participants were recruited through non-probability convenience sampling technique to find health effects due to air pollution. Concentration of air pollutants were determined using air quality detector device.

Results: Our study results showed that concentration of NO₂ and particulate matter were elevated well above the normal limits. Out of the total study subjects; about 17% participants Vital Capacity (VC), 9% Forced Vital Capacity (FVC) and 22% Forced Expiratory Volume in 1 Sec (FEV1) were below normal. Further elaborating, out of these total results 13% Vital Capacity, 16% Forced Vital Capacity & 37% Forced Expiratory Volume in 1st Second in females was less than normal value of 70%. Whereas, 16% Vital Capacity, 6% Forced Vital Capacity and 9% Forced Expiratory Volume in 1st Second in males was less than the normal value of 70%.

Conclusion: It is concluded that air pollution is a rising issue in this modern day causing many problems and requiring concern and action.

Key Words: Air pollution, air quality, emissions, health hazard.

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INTRODUCTION

Air Pollution is defined as presence of harmful level of gases in the environment. Most common sources of these gases includes automobile emission, burning of fossil fuels, industries and generation of power¹. Globally, air pollution is regarded as the most common cause of disease burden. Air pollution is having unwanted effects not only on respiratory function but also on cardiovascular, skin and metabolic diseases². Due to industrial revolution and economic development quality of air has been effected tremendously. Global concern about health of individual due to air pollution was noticed after smog incidents in Pennsylvania and London. Worldwide about 3.7 million deaths per year are attributed to air pollution until recently³.

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Air Pollution has profound effects on individual. Pre-existing chronic diseases is exacerbated due to exposure to significant quantities of air pollution⁴. Not only adults but children are also prone to health consequences due to air pollution. Studies done in California, China and Pakistan show various health related effects including blood pressure, asthma, chronic lung diseases including bronchitis in children exposed to air pollution^{5,6,7}.

Air Pollution is also a major issue in Pakistan. In 2012, according to the World Economic Forum, three Pakistani cities, Karachi, Rawalpindi and Peshawar were listed among the 20 most polluted cities in the world. Karachi ranks number 5 just ahead of Peshawar and Rawalpindi which stands at 6th and 6th position in this list by WHO⁸.

The WHO report listed 1600 cities in 91 countries and ranked them according to the quality of their air, which is measured for concentrations of PM 10 and PM 2.5 that are particles smaller than 20 or 2.5 microns. These are harmful toxins that can sling to the lungs and cause disease⁹. In Peshawar, according to WHO

database the annual mean concentration of PM 10 particles is 540 µg/m³ (above WHO guidelines) and the concentration of PM 2.5 particles is 111 µg/m³ (above WHO guidelines)¹⁰.

A study in 2015 revealed that in Pakistan 1,10,000 deaths in total occurred due to air pollution. According to these figures, Pakistan hails at the 3rd place in the world, following China which is ranked 1st and India which is ranked 2nd¹¹. In present study concentration of different gases in air was assessed in different areas of Peshawar and health issues faced by individuals. Lung function was also assessed in normal individuals as well as smokers.

MATERIAL AND METHODS

A cross-sectional study was done in Peshawar City, Khyber Pakhtunkhwa province of Pakistan between January 2017 – May 2017. A sample size of 94 participants were taken using WHO calculator for sample size with 95% confidence interval and 5% margin of error.

Traffic wardens, students and road side vendors were included in the study through Non-probability convenience sampling. A pretested questionnaire was distributed among all participants to assess the health effects caused due to air pollution. Air pollution detector was used to find the concentration of various pollutants in air. Lung function tests were assessed using spirometer. Results obtained were analyzed using S.P.S.S version 20 for windows.

RESULTS

Table 1 shows the concentration of different gases in air. Concentration of CO and SO₂ was within normal range. NO is also within normal range except in air samples from Kohat Road. NO 2 concentration is elevated tremendously in all places except Army Stadium area. Particulate matters is also elevated well beyond the normal range in all sampled areas.

Table 2, 3 and 4 shows association of different lung function test between smokers and non smokers, exposed to pollution. P-value in all cases is less than 0.05 showing that there is a statistical significance difference in all test values. In other words smokers are more effected by air pollution. Figure 1 shows the survey results of the vitalography (LFTs) conducted to measure the effects of air pollution on different groups of people belonging to different walks of life. Standard of 70% is taken which defines the normal value for the various results. Out of the total about 17% participants had Vital Capacity (VC), 9% had Forced Vital Capacity (FVC)and about 22% had Forced Expiratory Volume in 1 Sec (FEV1) below normal. Further elaborating, out of these total results 13% Vital Capacity, 16% Forced Vital Capacity and 37% Forced Expiratory Volume in 1st Second in Females is less than normal value of 70%. Whereas, 16% Vital Capacity, 6% Forced Vital Capacity and 9% Forced Expiratory Volume in 1st Second in males is less than the normal value of 70%.

Table 1: concentration of different pollutant gases in different sites of Peshawar City

S. No.	Location	Parameters				
		CO (mg/m ³)	NO (µg/m ³)	NO ₂ (µg/m ³)	SO ₂ (µg/m ³)	PM _{2.5} (µg/m ³)
	Normal value	<10	<40	<80	<120	<15
1.	Karkhano Market	7.8	19.7	133.5	52.4	80
2.	Hayatabad Phase III Chowk	6.1	23.4	142.9	56.3	90
3.	University of Peshawar	4.8	25.8	154.2	62.9	40
4.	GT Road University Town	4.5	36.9	173	55	48
5.	Army Stadium Chowk	9.3	25.8	35.4	44.5	58
6.	Mufti Mehmood Flyover	5.1	38.1	161.7	41.9	86
7.	Bacha Khan Chowk	4.5	36.9	167.3	36.7	76
8.	Governor House Chowk	6.5	19.7	118.4	23.6	40
9.	Qayyum Stadium Chowk	4.8	39.4	169.2	70.7	42
10.	Pishtakhara Chowk	6.3	23.4	116.6	47.2	58
11.	Kohat Rd Ring Road Junction	7.0	49.2	203	78.6	60
12.	Lahori Gate	7.7	27.1	142.9	39.3	48
13.	Khyber Bazar Chowk	7.0	24.3	146.6	38	46
14.	Charsadda Road	8.2	22.1	142.9	49.8	54
15.	Pindi Bus Stand	6.7	14.8	116.6	45.9	51

Table 2: Shows association of Vital Capacity between smokers and nonsmokers

Smoker	Vital Capacity (VC)	
	Above 70	Below 70
No	55.7%	9.3%
Yes	21.6%	10.3%
p-value	0.01	

Table 3: Shows association between Forced Vital Capacity (FVC) between smokers & nonsmokers

Smoker	Forced Vital Capacity (FVC)	
	Above 70	Below 70
No	58.8%	6.2%
Yes	28.9%	3.1%
P-value	0.023	

Table 4: Shows association of Forced Expiratory Volume in 1st second between smokers and nonsmokers

Smoker	Forced Expiratory Volume in 1st Second (FEV1)	
	Above 70	Below 70
No	49.5%	15.5%
Yes	23.7%	8.2%
P-value	0.012	

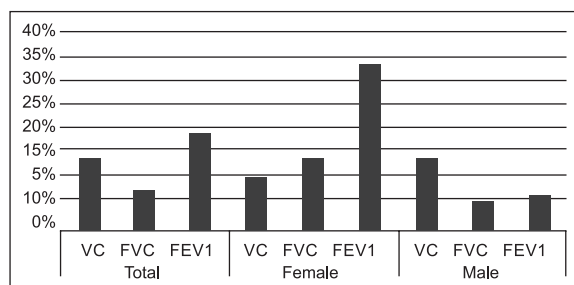


Figure 1: lung function test (LFTs) of the participant

DISCUSSION

Due to rapid industrialization Pakistan is progressing and economy of the country is increasing but on the other hand it has a negative consequences on the environment. Among other consequences; air pollution is a major issue that has a serious effects on the quality of life. Air Pollution is also a major public Health issue in Peshawar. Current study was done with the aim to determine the pollution level and undesirable effects faced by individuals.

Our study results showed that concentration of Nitrogen dioxide (NO₂) and particulate matter are elevated well above the normal limits. Most common effects perceived by the individuals were skin allergies, breathing problems and eye irritation. Lung function test

shows decreased values in majority of individuals. A Review study conducted by Dockery and Pope in United states demonstrated that increase in concentration of particulate matter have a negative influence on health¹². Our study also demonstrated increased concentration of particulate matter in different sites and health consequences due to it.

Majority of pollutants that are found in exceeding quantity include sulphur dioxide (SO₂), Nitrogen Dioxide (NO₂) and particulate matter. Our study showed high level of NO₂ and Particulate matter. Kazmi et al demonstrated increased concentration of mentioned air pollutants in Tehran and annual mortality due to these gases and recommended urgent action by government to limit adverse effects on health¹³. In contrast to our study this study demonstrated that majority of health related effects were on respiratory and cardiovascular systems.

Zhang et al in their study in China stated that air pollution has profound effect on health. Their study showed high levels of particulate matter, SO₂ and NO₂ as in our study¹⁴. Due to high concentration of gases in air, health effects of air pollution on individuals are also profound. Air pollution is a major cause of respiratory diseases particular asthma¹⁵. It is also studied that air pollution damages the nervous system¹⁶. Air pollution also effects cognitive levels in small children as documented in a study by Jordi et al¹⁷. Various other studies in Pakistan also demonstrated air pollution and it's related health outcomes.

A study in Quetta by Zafar Ilyas et al showed high CO concentration. NO₂ and Particulate matter concentration was also high while SO₂ concentration was normal. Most common health effects in this study were respiratory diseases and allergies of different kind¹⁸. These results were similar to our study but our study showed normal CO concentration. Another study in Lahore also showed high concentration of particulate matter near various primary schools¹⁹.

A study on NO₂ concentration along N5 motorway was carried out by Yasir et al and it showed high concentration of this dangerous gas. High population area along N5 motorway was the main cause of high NO₂ concentration while heavy traffic was the secondary cause of NO₂ that was concluded in this study.

CONCLUSION

Keeping in view of high level of pollutants and various health effects it is concluded that air pollution is a major issue in Peshawar. Government should device strict polices to control air pollution to save our future generation from it's devastating consequences.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

- Iftikhar B:** Planned study.
Khan ZA: Manuscript study
Khalil KUR: Statistical analysis.
Khan OS: Air quality assessment
Assmullah: Referencing.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.