Jr. of Industrial Pollution Control 39(1)1-7(2023)
www.icontrolpollution.com
Research Article

ASSESSING THE STATUS OF AIR QUALITY AND ITS IMPACTS ON PUBLIC HEALTH: A CASE STUDY OF SHEIKHUPURA, PAKISTAN

MARIA LATIF*, RABIA FATIMA, RAB NAWAZ, IQRA NASIM, MUHAMMAD ATIF IRSHAD

Department of Environmental Sciences, The University of Lahore, Lahore, 54000, Pakistan

Received: 05-Jan-2023, Manuscript No. ICP-23-85497; **Editor assigned:** 08-Jan -2023, Pre QC No. ICP-23-85497 (PQ); **Reviewed:** 23-Jan-2023, QC No. ICP-23-85497; **Revised:** 25-Jan-2023, Manuscript No.ICP-23-85497 (A); **Published:** 06-Feb-2023, DOI: 10.4172/0970-2083.001

Key words: Air pollution, Atmospheric contaminants, Human health Impacts

ABSTRACT

Air pollution is now acknowledged as a worldwide concern rather than a native or local issue. In current eras, one of the major threats that people are struggling with is air pollution, causing harmful effects on the ecosystem and individual's health. Particulate matter, sulphur dioxide, nitrogen oxides, carbon monoxide, and ozone are the main air pollutants. The concentration of these pollutants rises, and it may cause major respiratory issues that result in an increased death rate. The current study aims to assess the air quality status in Sheikhupura and identify air pollution causes and their terrible effects on human health. The questionnaire-based survey was conducted in selected Sheikhupura areas to learn more about how the locals felt about the current level of air pollution and potential solutions. Respondents (n=120) were chosen using a multistage sampling process, and data was gathered by creating close-ended questions. In end, data were analyzed by statistical tools. The majority of the respondents provided evidence that air pollution is dangerous to people's health and is the root cause of numerous diseases. Emerging atmospheric risks in District Sheikhupura are caused due to ungoverned urban transportation and urban sprawl, particularly a growing industrial development. So, it has been concluded that to create a plan for effective managing actions to control air pollution, it is essential to consider people's perceptions. That helps to monitor air contamination and reduce its severe health impacts by upgrading regulations to control pollution.

INTRODUCTION

Currently, air pollution that is linked to increasing urbanization and economic development is one of the biggest issues in public health and has been identified as one of the key drivers of the global burden of disease (Sokhi, et al., 2022). The majority of low- and middle-income nations today experience air pollution, particularly in urban areas (Zhang, et al., 2022). According to World Health Organization (WHO), any biological, chemical and physical means that changes environmental conditions and causes outdoor and indoor toxicity is termed as air pollution (Puri, et al., 2017). Atmospheric contamination is a combination of many elements including sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM), ozone (O_3) and volatile organic compounds (VOCs) that posed severe risks (Mannucci, et al., 2015). Particularly in developing nations like Pakistan that lack effective warning, protection, and management mechanisms, the intensity and effects of these risks have increased (Anwar, et al., 2015). In Pakistan, alarming death rates are been reported as a result of exposure to elevated levels of air pollution, particularly particulate matter (Anjum, et al., 2021; Bilal, et al., 2021). According to the World Bank's estimates, Pakistan's yearly disease burden from outdoor air pollution is responsible for around 22,000 premature adult deaths and 163,432 disability-adjusted life years (DALYs) lost (Anjum, et al., 2021). In Sheikhupura, the major causes of atmospheric contamination are industrialization, urbanization and extensive increased use of vehicles (Janjua, et al., 2021). Vehicles discharge, factories and burning of fossil fuels are also ultimately source of PM, SO_2, CO and NOx that have been reported to arise in greater amount in Sheikhupura. As a result, immediate severe and long-lasting impacts on human health are caused such as lung cancer, respiratory issues, heart prob-

***Corresponding author's email: maria.latif@envs.uol.edu.pk**

lems and many chronic diseases (Tiwary and Williams, 2018). Ozone is the key factors adding to the worsening of asthma whereas; recently increasing evidence also suggest that long-term exposures to air pollution, especially traffic related air pollution (TRAP) and its surrogate, nitrogen dioxide can contribute to new onset asthma in both children and adults (Kurt, et al., 2016). The devasting capability of PM conversely connected with its particle size that might go through lung and enter in the blood (Tiny particles of PM2.5) (Mannucci, et al., 2015). Deaths associated with cardiovascular happens to increase about 11% by a long lasting disclosure of 10g/m^3 to PM2.5.The threat of lung cancer is considerably high due to vehicular discharge that includes PM2.5, SO_2 and NOx showed by a systematic review (Kurt, et al., 2016). As a result, susceptible people are child, elders and persons with long lasting diseases (Hamanaka, et al., 2018). The city of Skeikhupura fast growing economy and population are important factors in the city's expanding vehicle ratio, which continuously adds smoke and harmful chemicals to the environment and causes numerous health problems for the locals. In light of the pollution issues, current study created with the objectives to investigate the socioeconomic characteristics of the respondents, the causes and consequences of air pollution on human health, and to suggest steps for its remediation.

MATERIALS AND METHODS

This study was mainly conducted in three different areas of sheikhupura, Pakistan. The areas include 3 sites (Area 1 Khalid Road, Area 2 E-community and Area 3 Kharianwala. Selection of these areas was done because they represent a wide range of air pollution conditions. Fig.1. presents the sampling sites. From Lahore, Sheikhupura is situated at 36 km northwest and is a well-known district of Punjab. The longitude of Sheikhupura is 73.985023 and the latitude of Sheikhupura is 31.716661. In comparison to other thirty-six districts of the province Punjab, Sheikhupura ranked 7th in area and 3rd in population. Sheikhupura is linked with its nearby urban hubs such as Gujranwala which is 54 Km, Faisalabad which is 94 Km and Sargodha which is 143 Km at distance.

In order to get the primary data, a pre-tested questionnaire was created. Socio-demographic features (Age, marital status, level of education, and income) made up the first unit of the data. The number of respondents was 120 approximately evenly distributed across areas (40 from each area) with both male and female participants. To examine how their perspectives and ways of thinking vary due to the age gap, all age groups participated in the question-and-answer session to analyze their awareness and impact of air pollution on teenagers to elder ones. The main questions of the research includes: What is the air quality in Sheikhupura City? What contributed to the city air pollution? Which kinds of factories are there in their City? Did anyone in your family get sick? If so, what illness was it? What, in your opinion, are the treatments for air polluti on? A questionnaire was created based on these study questions in order to collect the necessary information. About 120 questionnaires from the sample locations were completed during the field survey. ANOVA test for statistical analysis was done by using SPSS to examine the data.

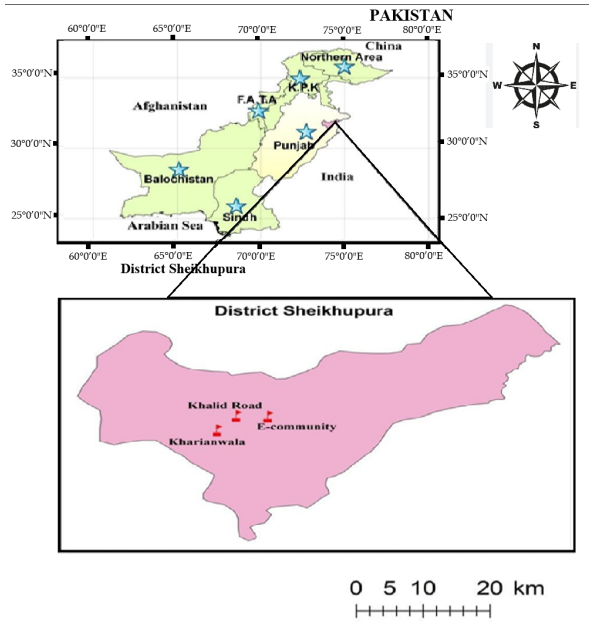

Fig. 1 Map of the study area. **Note:** ( ) Selected areas; ( ) District Sheikupura.

RESULTS AND DISCUSSION

Survey results of socio-economic characteristics collected from different areas of Sheikhupura respondents are summarized in Table 1 in terms of age, gender and education etc.

Tab. 1. Percentage comparison of general information of respondents in selected areas (N=120)

General Information	Variable	Frequency	Percentage (%)
Gender	Male	70	58
	Female	50	42
	Total	120	100
Age Group (Years)	<20	9	7.5
	20-29	29	24
	30-39	40	33
	40-49	22	18
	>50	20	17
	Total	120	100
Marital status	Married	62	52
	Unmarried	58	48
	Total	120	100
Education level	Illiterate	4	3
	Primary	6	5
	Middle	7	6
	Matric	11	9
	More	92	77
	Total	120	100

Family members	1-4	34	28
	5-8	48	40
	9-12	19	16
	13-16	10	8
	>16	9	8
	Total	120	100

Cities' air, particularly in emerging nations, is becoming a major environmental concern. The interaction between the dispersion and emission of harmful pollutants from factories is what causes the air pollution. The amount of air pollution brought on by the release of gases, smoke, and dust particles into the atmosphere is excessive (Munsif, et al., 2021). To maintain their survival and wellbeing, all living things require clean air but its pollution cause severe impacts. Pollution of air created both short term and long-term consequences on health (Figs.2a and 2b). Acute bronchitis arose from the immediate impacts on the respiratory system, while the long-term effects led to lung cancer, bronchial asthma, chronic bronchitis, and respiratory allergies (Bonita, et al., 2006; Willis, et al., 2010). In current study, we found that 65% respondents were suffering from chronic diseases and 35% were not having any chronic disease. Airways sensitivity illness like asthma, lung cancer, lymphomas, leukemia (genotoxic properties), chronic obstructive lung disease and heart diseases are categorized as chronic effects. People who have chronic respiratory diseases are more vulnerable to the negative effects of high ambient air pollution levels. Air pollution's effects on the respiratory system have been widely documented in recent years. Acute chronic obstructive pulmonary disease (COPD) exacerbations, asthma onset, more hospitalizations, increased respiratory mortality, and a higher prevalence of childhood asthma are some of the negative effects. Other factors include a decline in pulmonary function, an increase in infections, respiratory symptoms, and a decrease in lung function (Nishimura, et al., 2013; Shah, et al., 2004). On status of air quality in their respective area, majority of respondents (42%) perceived that air quality of their area is polluted 59% respondents claims that air pollution harms people's health. Results are somewhat consistent with (Shakeel, et al., 2018) as who reported that concentration of NOx and SO_2 of Sheikhupura is higher than NEQs and cause health impacts. The increased traffic during the previous few years may be the main cause of the increased NOx levels in the air. According to the Transport Planning Unit, Sheikhupura's road traffic has increased by up to 50% over the previous few years, particularly among those with high and middle incomes. While the use of coal and furnace oil in brick kilns as well as the use of diesel and gasoline for transportation may be the reason of an increase in the concentration of SOx emissions. This outdoor air pollution primarily affects humans, it is more severe than indoor pollution since it is a major contributor to coronary, respiratory, cardiopulmonary, and cardiac disorders. Contaminants like PM and ozone, NO_2 present in higher concentration in ambient air cause disease and symptoms includes severe eye irritation and lung and throat irritation. Long-term exposure to high temperatures can cause fatal heat-related conditions such as heat cramps, heat exhaustion, heat stroke, and syncope. Vehicles increases the likelihood of acquiring asthma and COPD. Additionally, air pollution has been linked to an increase in hospitalization and health related deaths. Overall, 63.3% of respondents thought that traffic was the biggest source of air pollution. When we examined about disease symptoms (Figs.3 and 4), the respondents viewed that pollution by vehicles and growing industries caused 39% people had allergies, 36% people had health conditions that make them susceptible to environmental problems, 10% people had immune system suppressed by diseases, 9% cardiovascular diseases, 4% asthma, 1% chronic respiratory diseases and 1% people had lung diseases reported. When respondents ask if they feel these symptoms more severe outdoor they perceived that YES. The main reason identify working in polluted outdoor workplace environment as shown in Fig. 5. All triggered by working outdoor, as air pollutants are emitted into the atmosphere mostly due to industrial emission, vehicular discharge and burning of waste. In Pakistan air contamination is a quickly increasing environmental issue (Abbas and Awan, 2018; WHO, 2018). In accordance with the Pakistan Environmental Protection Agency (Pak-EPA), air contamination intensities for the main cities of Pakistan have noted 7 times greater than recommended by the (WHO, 2019). Particularly ineffective use of energy, enhanced development in vehicular quantity and vehicle kilometers covered, open burning of solid waste including plastic and growing industrialized activities without acceptable air contamination control are one of the main issues for worsening ambient atmospheric quality of Pakistan (Parekh, et al, 2001; ADB and CAI-Asia, 2006; Tahir and Khan, 2008).

In order to check either the spatial variation of diseases equally prevailed or significant in all areas, ANOVA test applied as shown in above Table 2. As $p<0.01$ so it significantly differences. The main reason is that industries are more Kharian Wala. Diseases also compared area wise as shown in Fig. 4. Area 3 Kharianwala also reported high lung diseases as along the facilities present along road side (Table 3).

Survey results regarding respondents perceptions about air quality also summarized in Table 4 that show their changing behaviors and interest about pollution problem in their areas.

The other reason reported in this survey that respondents have not adequate knowledge about air pollution and awareness of air pollution effects on health as only 35% respondents were aware of how bad air pollution is in their area and mostly people were not aware of the effect of air contamination on the health of human beings and the importance of medication care (Table 5). Respondents only prefer to went to hospitals when they experienced any symptoms.

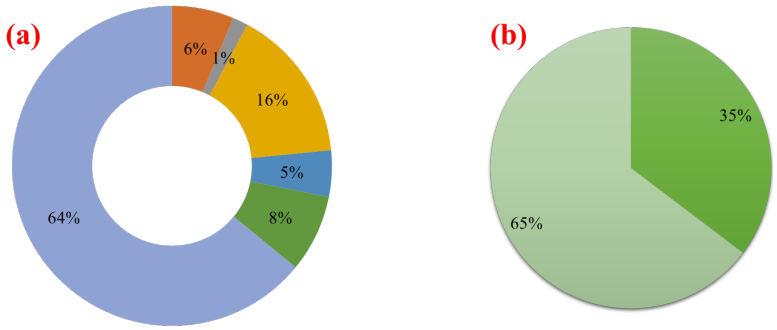

Fig. 2 (a) depicts the status of hereditary diseases (b) shows status of past medical history in terms of chronic diseases reported among the respondents of sheikhupura. **Note:** (a) High blood pressure; Thalassemia; Diabetes; Cardiovascular; Migraine; Other; (b) Yes; No.

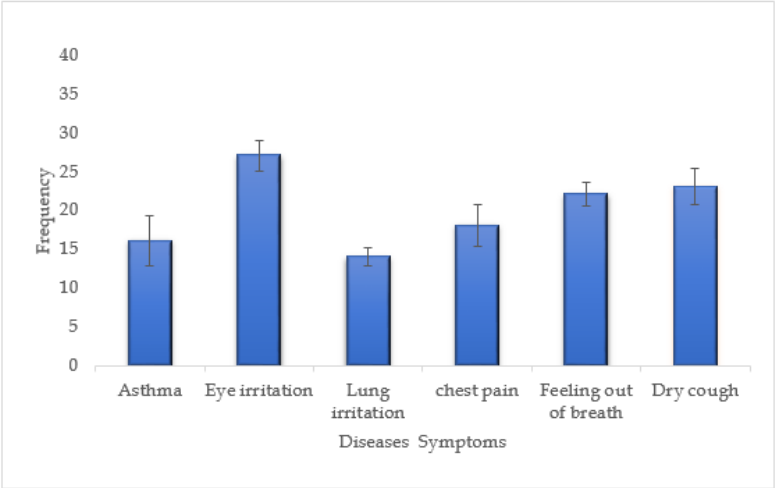

Fig. 3 Types of disease symptoms caused by air pollutants among respondents.

Tab. 2. Comparison of spatial variation of diseases through ANNOVA test

Source of variation	SS	df	MS	F	p-value	F crit
Between groups	119.33	6	19.89	5.72	0.003	2.84
Within groups	48.67	14	3.47	-	-	-
Total	168	20	-	-	-	-

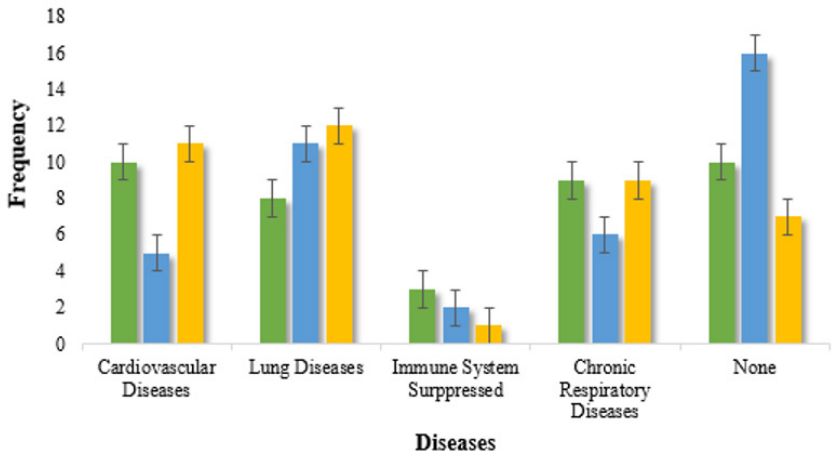

Fig. 4 Area-wise comparison of diseases among respondents. **Note:** Area 1; Area 2; Area3.

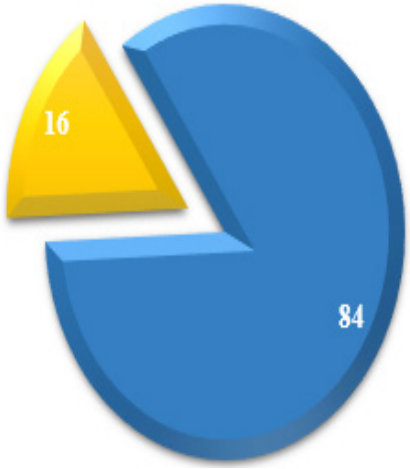

Fig. 5 Percentage comparison of respondents perception about feel this condition more sever either working outdoor or living in indoor places. **Note:** Outdoor; Indoor.

Tab. 3. Comparison of Spatial variation of diseases symptoms among all areas through ANNOVA test.

Source of variation	SS	df	MS	F	P-value	F crit
Between groups	242.67	5	48.53	7.16	0.002	3.11
Within groups	81.34	12	6.78	-	-	-
Total	324	17	-	-	-	-

Tab. 4. Percentage comparison of air quality observation and symptoms among respondents.

Air quality observation	Variable	Percentage
Air quality in selected areas	Excellent	1
	Above Average	1
	Average	41
	Below Average	3
	Poor	39
	Very Poor	14
Use of mask for air quality more than COVID-19	Yes	23
	No	77
Air quality improvement from Past 5 years	Yes	7
	No	93
Time spend outside the home	More than 12 hour's	51
	10 hours	11
	8 hours	7
	other	30
Knowledge of other people with similar health conditions	Yes	47
	No	53
Seasonal influence of diseases	Yes	86
	No	14
Duration of diseases suffering in a year	1 to 2 times	47
	3 to 5 times	21
	More than 5 times	19
	Other	13

Table 5. Respondents opinion regarding awareness about air pollution in Sheikhupura City areas.

Question	Variable									
Awareness about how bad is air pollution?	Very aware		Aware		Need improvement		Not aware		Total	
	F	P	F	P	F	P	F	P	F	P
	42	35	21	17.5	11	9.166667	46	38.33333	120	100
Note: *F=Frequency *P=Percentage										

(Mannucci, et al., 2015) stated that with rapid growing industrialization that linked to increase atmospheric contamination, women, elders, persons with past ailments and infants seem particularly vulnerable to the toxic impacts of the ambient air contamination. But the residents don't take medication immediately as reported in study area. As most of the people get a health checkup only when needed, only 7% people often get a health checkup twice in a year and on the other hand 1% people never get a health checkup. That's why participants of this survey had moderately physical impaired health. Results obtained on the basis of medication taken in past 24 hours that showed 56% of the respondents had not taken any medication in the past 24 hours and 44% of the respondents had taken different kinds of medications in the past 24 hours. In Pakistan Self-medication uses are communal in public through a series of socio demographic features, affordability, representing severe problems of health education and approach to health services. In this study, participants believed that maintaining roads properly, using high-quality oil, following sanitation and disposal procedures, planting trees, and creating green spaces may all help to reduce air pollution. Because greenery lessens the negative impacts of pollution, green spaces (parklands and resort areas) play a key role in lowering air pollutants from the environment. So, strong institutions required.

CONCLUSION

With the rapid population growth and urbanization, emerging health issues are becoming a universal concern due to combined air pollution. Ungoverned transportation and rapid industrial growth is the key contributor for the deteriorated quality of air in Sheikhupura as conditions such as asthma, respiratory and cardiovascular diseases that are more severe outdoor. Most people had allergies such as eye irritation and skin ailments in theses selected areas. So, it is concluded that there is a need of awareness related air contamination, health impacts and medication care. In this regard, upgrading regulations is a significant measure to control pollution. Among the control solutions, there is a need of constant observance of air contaminants and detection of their sources in the city. Monitoring of air pollutants and determination of their origins as well as construction of a uniform and continuous monitoring system across city is required to fill the current information gap.

REFERENCES

Sokhi RS, Moussiopoulos N, Baklanov A, Bartzis J, Coll I, Finardi S and Kukkonen J. 2022. Advances in air quality research–current and emerging challenges. Atmospheric Chem Phys. 22(7):4615-4703.

Zhang X, Han L, Wei H, Tan X, Zhou W, Li W and Qian Y. 2022. Linking urbanization and air quality together: A review and a perspective on the future sustainable urban development. J Clean Prod. 346(23)130988.

Puri P, Nandar S, Kathuria S and Ramesh V. 2017. Effects of air pollution on the skin: A review. Indian J Dermatol Venereol Leprol. 83(4):415-423.

Mannucci PM, Harari S, Martinelli I, and Franchini M. 2015. Effects on health of air pollution: a narrative review. Intern Emerg Med. 10(6):657-662.

Anwar MN, Shabbir M, Tahir E, Iftikhar M, Saif H, Tahir A and Nizami AS. 2021. Emerging challenges of air pollution and particulate matter in China, India, and Pakistan and mitigating solutions. J Hazard Mater. 416(8):125851.

Anjum MS, Ali SM, Subhani MA, Anwar MN, Nizami AS, Ashraf U and Khokhar MF. 2021. An emerged challenge of air pollution and ever-increasing particulate matter in Pakistan; a critical review. J Hazard Mater. 402(4):123943.

Bilal M, Mhawish A, Nichol JE, Qiu Z, Nazeer M, Ali MA and Ke S. 2021. Air pollution scenario over Pakistan: Characterization and ranking of extremely polluted cities using long-term concentrations of aerosols and trace gases. Remote Sens Environ. 264(1):112617.

Janjua S, Powell P, Atkinson R, Stovold E, and Fortescue R. 2021. Individual-level interventions to reduce personal exposure to outdoor air pollution and their effects on people with long-term respiratory conditions. Cochrane Database Syst Rev. 8(5):2-8.

Tiwary A and Williams I. 2018. Air pollution: measurement, modelling and mitigation. CRC Press. 722.

Kurt OK, Zhang J and Pinkerton KE. 2016. Pulmonary health effects of air pollution. Curr Opin Pulm Med. 22(2):138.

Hamanaka RB and Mutlu GM. 2018. Particulate matter air pollution: effects on the cardiovascular system. Front Endocrinol. 9(2): 680.

Munsif R, Zubair M, Aziz A and Zafar MN. 2021. Industrial air emission pollution: potential sources and sustainable mitigation. In Environmental Emissions. Intech Open. 258-260.

Bonita R, Beaglehole R and Kjellström T. 2006. Basic epidemiology. World Health Organization.

Willis HH, MacDonald Gibson J, Shih RA, Geschwind S, Olmstead S, Hu J and Moore M. 2010. Prioritizing environmental health risks in the UAE. Risk Anal. 30(12):1842-1856.

Nishimura KK, Galanter JM, Roth LA, Oh SS, Thakur N, Nguyen EA and Burchard EG. 2013. Early-life air pollution and asthma risk in minority children. The GALA II and SAGE II studies. Am J Respir Crit. 188(3):309-318.

Shah SD, Cocker DR, Miller JW and Norbeck JM. 2004. Emission rates of particulate matter and elemental and organic carbon from in-use diesel engines. Environ Sci Technol. 38(9):2544-2550.

Shakeel M, Arshad Q, Saeed R, Ahmed T, Khan HMT, Noreen M and Munir A. 2015. Application of GIS in Visualization and Assessment of Ambient Air Quality for SO2 and NOx in Sheikhupura City. Pakistan. Journal of Geography & Natural Disasters. 5(3):1-7.

Abbas F and Awan HS. 2018. What determines health status of population in Pakistan?. Soc Indic Res. 139(1):1-23.

World Health Organization. 2009. The state of food security and nutrition in the world 2019: safeguarding against economic slowdowns and downturns. Food and Agriculture Org. 27-118.

Parekh PP, Khwaja HA, Khan AR, Naqvi RR, Malik A, Shah S., Khan K and Hussain G. 2001. Ambient air quality of two metropolitan cities of Pakistan and its health implications. Atmos Environ. 35(34):5971-5978.

ADB and CAI-Asia. 2006. Country Synthesis Report on Urban Air Quality Management Indonesia. Asian Development Bank and the Clean Air Initiative for Asian Cities. 5(2):25-30.

Tahir SNA and Khan S. 2008. Measurement of atmospheric dry deposition flux and resultant deposition velocity of inorganic pollutants in the provincial capital of Punjab, Pakistan. Environ Forensics. 9(4):290-294.