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Hazards of Air Pollution and Human Health: Perception of Local People: A Case of Multan City

Syeda Azra Batool
(Corresponding Author)
Professor, School of Economics, Bahauddin Zakariya University, Multan, Pakistan.
Email: azrabatool@bzu.edu.pk

Safeer Ahmad
M.Phil. Student, School of Economics, Bahauddin Zakariya University, Multan.

Arshad Jamshaid
M.Phil. Student, School of Economics, Bahauddin Zakariya University, Multan.

Abstract

The menace of pollution has cast innumerable detrimental effects on both the natural environment and human health by causing diseases and mortality. The objective of this study was to elucidate the impact of air pollution on human health. To attain this objective, a convenient sample of 196 respondents was recruited from Multan City, Punjab, Pakistan. The data were collected by using self-reported questionnaire, containing socio-economic and demographic information, causes and impacts of air pollution on human health of the respondents followed by recommendations. The respondents believed that there exists moderate air pollution in the city of Multan. The major causes of air pollution counted by the sample included traffic, waste burning, and open sewage. A significant mean difference was found between males and females about the impact of air pollution on human health. Females were found more sensitive in terms of behavioral effects of air pollution as compare to their male counterparts. The most common health issue found in the study area was asthma (23.5%) followed by sore throat (22.4%), and allergy (19.4%). It was also concluded that air pollution is a serious issue in Multan. The sample suggested the spread of greenery and public parks all around the city and ban on the mobility of vehicles emitting high pollution.

Keywords: Health hazards, pollution, causes of pollution

Introduction

The increasing proportion of the global population living in urbanized areas has put considerable pressure on local environments and increased air pollution. Any chemical, physical, or biotic influences introduced by human activities that disrupt the natural features of the environment are referred to as an air pollution. Man-made sources of air pollution include industries, automobiles, power generation, motorized vehicles, solid fuel cooking, fossil fuel combustion in brick kiln industries, open burning of municipal waste, heating, cigarette smoke, materials used in furniture making, carpets, air conditioners, home cleaning, and insecticides (Tanimowo, 2000).

Although a range of physical activities (volcanoes, fires, etc.) can emit various pollutants into the atmosphere, anthropogenic activities are the primary source of air pollution in the environment. Hazardous chemicals can accidentally leak into the atmosphere, but a variety of air pollutants are emitted by factory plants and other operations, which can have negative health and environmental

consequences. An air pollution is described as any product that can affect humans, animals, plants, or materials. In the case of humans, an air pollution may cause or lead to an increase in mortality or serious illness, as well as pose an actual or prospective health risk. The scientific, epidemiological, and/or animal studies show that exposure to a substance is correlated with adverse consequences, are used to determine whether or not a substance poses a health danger to humans. "Risk" in the context of human health refers to the likelihood that harmful health outcomes may occur (Kampa & Castanas, 2008).

Air pollution has been linked to climate change on the earth. There are many types of air pollution, such as greenhouse gases, the most significant of which is CO_2, which accounts for about 60% of overall Green House Gases (GHG) emissions (Khan et al., 2011). Anthropogenic practices contribute to climate change and global warming by rising CO_2 levels through vehicle emissions, which traps heat energy from the sun in the atmosphere, and releasing emissions from power plants and various manufacturing plants that burn fossil fuels. Carbon dioxide levels in the atmosphere have remained between 200 and 300 ppm, and now approaching 400 ppm, with the concentration continuing to rise (EPA, 2011). If such a situation cannot be carefully monitored and managed now, global warming and climate change are likely to become more common in the coming years. Global warming and climate change could result in a variety of health risks, including excessive heat, drought, the spread of vector-borne diseases, allergens, and exceptionally poor air quality, which can lead to a variety of respiratory diseases.

As an environmental health indicator, air pollution measures the condition of the atmosphere in terms of air quality and the ability for people to be released into the atmosphere emissions that are harmful to their health. Air pollution has both acute and delayed health consequences. The respiratory system bears the immediate symptoms, resulting in acute bronchitis, while chronic bronchitis, lung cancer, bronchial asthma, and respiratory allergies are the most frequent delayed effects associated with air pollution (Bonita, Beaglehole and Kjellström, 2006; Denny and Loda, 1986; Park, 2009; Willis et al., 2010).

The World Health Organization (WHO) projected in 2016 that ambient fine particulate matter air pollution, or PM2.5, was responsible for 4.2 million deaths per year (WHO, 2016). PM2.5 is produced by a variety of sources, including energy production, households, industry, transportation, waste, agriculture, desert dust, and forest fires. Particles can travel hundreds of kilometers in the atmosphere, and their chemical and physical characteristics can change dramatically over time and space (Shaddick et al., 2020). $PM_{2.5}$ refers to particles having a diameter of 2.5 m that decrease vision in the air and cause a variety of health concerns (WHO, 2006). It has been shown that when $PM_{2.5}$ concentrations rise, people become more vulnerable to illnesses such as acute respiratory symptoms, asthma, myocardial infarction, lung cancer, and mortality (Laden et al., 2006; Slaughter et al., 2003).

Environmental pollution, found in the air, water, or soil, and exacerbated by anthropogenic actions of man, is a challenge in both developed and developing nations, disrupting the habitat around them. Indoor air pollution, polluted outdoor air, inadequate sanitation, and tainted water all contribute to poor health. Both developed and developing countries are at risk due to air pollution. The vehicular and industrial sectors are the primary causes of air pollution. In many developing countries cities, the issue of urban air pollution has reached alarming levels (Shahid & Hussain, 2015).

Particulate matter 2.5 air pollution trends can be observed from year 2010 to 2017 in the case of Pakistan and neighboring countries. It can be noted that as of 2017, Pakistan's mean annual exposure (micrograms per cubic meter) to $PM_{2.5}$ air pollution was 58.28. This indicator has fluctuated between a top of 68.54 in 2011 and a minimum of 58.28 in 2017. The $PM_{2.5}$ is highest in Nepal and India. The

trend of Sri Lanka shows a minimum level of particulate matter 2.5 in air. In 2017 Pakistan's $PM_{2.5}$ is above that of Afghanistan, Bhutan, and Sri Lanka. India was observed to be most affected by PM_{25}.

Pakistan, like many other countries around the world, is facing environmental issues. The growth of the industrialized sectors leads to progress, but increased smoke, particulate matter, and effluents have harmed the atmosphere (Ajmal et al., 2016). As the subsistence workers move from rural areas to cities in search of jobs, most cities in Pakistan are rising faster than the national average. Existing cities are growing, new urban areas are being developed, and adjacent cities are merging. The urban landscape of Pakistan shows a transformation. Feudal towns have evolved into modern settlements, cities have evolved into metropolises, and metropolises have evolved into megacities. Because of the expanding economic base, people are migrating from rural areas and the urban fringe to the central city in search of a better standard of life (Ilyas et al., 2010).

Many studies are been undertaken to probe into the connection between air pollution and disease rates in humans in developed countries, where air pollution levels, climatic conditions, and a variety of other variables vary greatly from those in most of the developing countries. Air pollution is a major issue in Asian cities, with potentially significant health consequences. The World Health Organization (WHO) reports that per year, urban air pollution costs the world 4.2 million healthy life-years to the global loss. Inefficient energy usage, rapid growth in the number of vehicles and vehicle kilometers traveled, increased industrial activity without sufficient air pollution control, and open burning of solid waste, including plastic, are all contributing to Pakistan's deteriorating air quality. (Parekhet al., 2001; Tahir et al, 2010).

Due to its geographical location, Pakistan has been ranked in the top ten countries most affected by climate change in the last 20 years by German Watch. According to the Global Climate Risk Index annual report for 2020, Pakistan lost 0.53 percent of its GDP, suffered US$ 3792.52 million in economic damages, and experienced 152 severe weather events between 1999 and 2018 (Pakistan Economic Survey, 2019-20). Pakistan (in the South Asian region) is the world's fifth-most populous country, with a population of over 211.17 million people in 2019. The annual GDP per capita was projected to be $1284.702 (World Bank, 2019). Due to the COVID-19 shocks, real GDP growth for 2019–2020 was projected to be -0.39%, compared to 1.91 percent in the previous fiscal year 2018–19 (Pakistan Economic Survey 2019-20).

The city of Multan's rapidly growing population and economic growth is a significant contributors to a rise in vehicle ratios, which continuously emit smoke and poisonous gases into the environment, causing several health problems for people. Motorcycles, motorcycle rickshaws, and four-wheelers are examples of motor vehicles. Motorbikes and rickshaws are big polluters of the air. Multan regularly had elevated PM2.5 readings in the early days of 2021 and the very tail end of 2020, showing that it does indeed have a pollution issue, a problem that is shared by many other cities in Pakistan. The PM2.5 readings ranging from as low as 40.3 $\mu g/m^3$ to as high as 136.3 $\mu g/m^3$ were reported in late December of 2020. Air pollution is related to a variety of health problems. The rapid aging of the lungs, scarring of the lung tissue, and injury or irritation of the respiratory tract lining are only a few of them. Such injuries to health lower total lung capacity and make one more susceptible to respiratory diseases in the future. Intensified asthma attacks, influenza, bronchitis, and emphysema are only a few examples.

Controlling air pollution in Pakistan has not yet become a democratic issue due to lack of suitable information for policy and decision-makers, despite the presence of some infrequent reports identifying airborne particulate matter as a major health and environmental concern in Pakistan's

urban are (Colbeck, Nasir, & Ali, 2010). However Pakistan Clean Air Program has been designed by Pakistan government.

Keeping in view that Pakistan is a major contributor in the world pollution and its negative impacts in densely populated area of Pakistan including Multan, it was decided that primary data should be collected on the causes of pollution, its impacts on human health, and recommendations in Multan city, one of the most populated districts of Punjab.

Literature Review

Different studies corroborate the impact of air pollution on human health followed by recommendations.

Parekh et al.(2001) analyzed the ambient air quality of two Pakistani metropolitan cities. Both Karachi and Islamabad have very high particulate loading in their ambient air, according to this investigation. The regular time series revealed that, at times, air quality fell short of the WHO minimum level by almost an order of magnitude during the study period. Both cities have serious air quality issues. It was critical for city and state governments to respond quickly and adopt a regulation plan to be executed.

Mishra (2003) investigated the impact of cooking smoke on the recorded incidence of asthma in elderly men and women aged 60 and above. The study used data from 38,595 elderly people who took part in India's second National Family Health Survey in 1998-1999. Logistic regression was used to predict the effects of cooking smoke exposure on the recorded prevalence of asthma, as determined by the type of fuel used for cooking (biomass fuels, cleaner fuels, or a combination of biomass and cleaner fuels). Even after controlling for the impact of a variety of potentially mitigating causes, the results showed that elderly men and women living in households using biomass fuels had a slightly higher incidence of asthma than those living in households using cleaner fuels. Active cigarette smoking, but not occupational tobacco smoke, was linked to a higher incidence of asthma in the elderly. The presence of a separate kitchen in the home and a higher household living level is linked to lower asthma prevalence.

Ghose et al.(2005) examined the ambient air quality in Kolkata, India. The effects of monitoring ambient air quality as well as micrometeorological data were addressed. The area's air quality levels were assessed, and a questionnaire survey was performed to measure allergic reactions and toxicity levels in order to determine respiratory disorders. The data was analyzed to determine the critical condition resulting from air pollution emissions, as well as the effects on human health related to reparable diseases (RDs) in the area's middle-class sub-population (activity-wise). According to the study, the state of air quality was critical, and it had escalated the problems to a dangerous level.

Marcilio and Gouveia (2007) used locally produced impact factors to measure the impact of air quality on morbidity and mortality in the Brazilian urban population. The number of hospitalizations and deaths attributed to air pollution in seven Brazilian cities was estimated using concentration-response coefficients. Poisson regression coefficients were derived from Brazilian time-series analyses. Individuals aged 65 and over, as well as children under the age of five, were included in the study. Mean air pollution levels were responsible for more than 600 deaths from respiratory causes in the elderly and 47 deaths in children last year, leading to 4.9 percent and 5.5 percent of all deaths from respiratory causes in both age classes, respectively. Air pollution was also responsible for over 4,000 hospital visits for respiratory diseases.

Ilyas et al. (2010) examined the impact of air quality on health in Quetta. The effects of monitoring ambient air quality as well as micrometeorological data were addressed. The area's air quality levels were assessed, and a questionnaire-based survey was performed to measure allergic reactions and

toxicity levels in order to determine respiratory disorders. The data were analyzed to determine the critical situation resulting from air pollution emissions and the effects on human health related to reparable diseases (RDs) in the middle-class sub-population (activity-wise) in the study area. The exacerbation of asthma, allergies, and other respiratory diseases is intensified by air pollution. Quetta was classified as one of the most polluted areas of Pakistan. According to the study, the polluted air had become life-threatening. The evaluation of air quality and its effect on human health as a result of RDs in the region revealed a high degree of imprint score. SPM was said to cause a high rate of premature death, with children being the most affected in Quetta.

Naddafi et al. (2012) investigated the effects of air pollution on the health of residents of Tehran, Iran's most populous city. The World Health Organization (WHO) strategy was implemented with the help of the Air 2.2.3 program developed by the WHO European Centre for Environment and Health, Bilthoven Division. Human toxicity and well-being impacts were assessed using ozone, nitrogen dioxide, sulfur dioxide, and particulate matter with an aerodynamic diameter of 10 m (PM10) in terms of attributable proportion of the health result, annual number of excess cases of mortality for all reasons, and cardiovascular and respiratory diseases. The PM10, SO2, NO2, and O3 annual averages in Tehran were 90.58, 89.16, 85, and 68.82 g/m3, respectively. In terms of short-term impacts, PM10 had the greatest impact on the health of Tehran's 8,700,000 residents, resulting in an excess of overall mortality of 2194 out of 47284 in a year. Sulfur dioxide, nitrogen dioxide, and ozone caused 1458, 1050, and 819 extra cases of gross mortality, respectively. The extent of the health effects predicted for Tehran highlights the need for immediate measures to reduce the health risk of air pollution, according to the findings.

Anwar et al.(2012) undertook the study based on major pollutants from various sources and their effects on human health in Bahawalpur, Punjab, Pakistan. Statistical Techniques were used to tabulate the data collected after the field testing is completed (Chi-Square and Correlation). Increased human activity in urban areas means more demand for electricity, products, and services on the one hand and more emissions and pollution on the other. The findings of the study revealed that air pollution was a serious problem in Bahawalpur. Open drains, sewerage smells, garbage disposal, and, most importantly, cars constantly add contaminants to the environment. People suffer from a variety of diseases, with skin allergies being one of the most common. Since there were scant public parks or green fields in the study area to help reduce air pollution.

Jeong (2013) investigated the effects of air pollution on the longevity and morbidity of Suwon residents. This study used the AirQ2.2.3 program to measure the short-term mortality effects of air emissions, as recommended by the World Health Organization (WHO). Human consumption and health consequences were assessed using regular PM10, O3, NO2, and SO2 concentrations in terms of attributable proportion of the health result, annual number of excess cases of mortality for all conditions, and cardiovascular and respiratory diseases. PM10 had the greatest health impact of the four air pollutants studied on Suwon's 1,118,000 residents, causing an excess of total mortality of 105 out of 4,254 in a year. Sulfur dioxide has the least negative impact on human health. In a single year, ozone and nitrogen dioxide caused 42.7 and 81.3 excess cases of gross mortality, respectively.

Nursan et al.(2014) studied the experience and perceptions of parents of high school students in Turkey's Skarya province regarding the health consequences of environmental hazards. The 362 randomly selected parents completed a questionnaire on their socio-demographics and a list of environmental hazards, including tobacco use, sun exposure and skin cancer, global climate change, air pollution, noise exposure, smoking during pregnancy and low birth weight, radon exposure and lung cancer, radon reduction, and air pollution. Water pollution, cigarette smoke in the environment, air pollution, ozone degradation, radon gas exposure, soil pollution, and noise pollution, formaldehyde in furniture, plant ozone, and pesticides were also discussed with the participants. The findings showed that 226 (62.4%) of the participants were female, and 284 (78.5%) were between the

ages of 31 and 45. There were 246 high school or university graduates (68 percent). While 357 (98.6%) of the participants were aware that smoking was harmful to their health, radon gas exposure was also common (n=194; 53.6%). Unsafe water was cited as the most threatening risk (n=311; 85.9%), while noise pollution was cited as the least concerning environmental risk (n=134; 37.0 percent).

Khan et al.(2014) investigated the spatial distribution of environmental risk factors in Bahawalpur district, Punjab, Pakistan. The Punjab Bureau of Statistics compiled the most recent report of the Multiple Indicator Cluster Survey (2007-2008) of the Bahawalpur district. Primarily, the study examined the district's geographical and demographic background, including Ahmadpur East, Khairpur Tamewali, Yazman, Hasilpur Bahawalpur Sadder, and Bahawalpur City, as well as all of its sub-administrative units. Secondly, many public health indices were prioritized. Improved water sources, domestic water management, physical proximity to a water stream, sewage, bacterial accumulation of water, excreta disposal, waste water drainage, solid waste disposal, and hand washing practices were among them. The findings showed that the current status of these indicators creates an atmosphere that is vulnerable to a variety of significant health threats.

Shahid and Hussain (2015) investigated the air pollution and related issues in Faisalabad, Pakistan. Based on livelihood patterns, the study area was divided into three zones: residential, commercial, and industrial, in order to compare the health impacts of various types of pollution in different human activity areas. The findings of the field study were also supported by hospital records. In the industrial sector, industrial effluent gases and poor indoor air quality play a key role, while in other areas, vehicular noise and congested housing trends are the major causes. Respiratory diseases mostly affect infants and the elderly. This may be due to an aggregation of air pollution, which would necessitate an in-depth investigation to determine the root cause of the problem. Air pollution-related respiratory conditions were common in the industrial region. Cardiovascular and vector-borne diseases, which were linked to environmental hazards such as wastewater stagnation, dust, and solid waste issues, were prevalent in the commercial region, whereas diseases such as breast cancer, cardiac problems, and obesity, which were linked to their eating patterns, were stated to predominate in the residential zone.

Ajmal et al. (2016) investigated the causes of air pollution and its devastating effects on human health in Dera Ghazi Khan City using a multistage sampling technique to get a perception of the local people's understanding of the current air pollution situation and their attitudes toward air pollution control initiatives. The majority of interviewees stated that air pollution was extremely harmful to people's health and is the source of many diseases. The sample believed that proper road maintenance, the use of high-quality oil, proper waste disposal and sanitary systems, as well as plantation and development of green areas, could help to control air pollution. Open spaces (parklands and resort areas) play an important part in mitigating air pollution in the environment because greenery curtails the pollution's negative impact. Findings showed that sore throat diseases (19.2 percent), asthma (35.8 percent), allergies (24.2 percent), and cancer diseases (7.3 percent) were the top health diseases listed by respondents.

Haque and Singh (2017) assessed the air quality in Kolkata Metropolitan City, India. To assess the impact of pollution on health, a standardized survey, through a questionnaire, was conducted in a few local dispensaries that were located in areas with varying levels of indoor air contamination. A total of 100 citizens were surveyed at three dispensaries. Acute respiratory infections (60 percent), chronic obstructive pulmonary diseases (7.8%), upper track respiratory infection (1.2 percent), influenza (12.7 percent), and acid-fast bacillus were among the respiratory diseases that had outnumbered waterborne diseases (14.9 percent). Despite the fact that the pollution level was considered critical, only 39.3 percent of respondents believed that outdoor (air) pollution had harmed their health.

Gu et al.(2019) investigated the relationship between air pollution and human health by using the household registration data from the China Migrant Dynamic Survey in 2014. The findings of the instrumental variable (IV)-Probit model revealed that rising levels of air pollution had a substantial negative impact on citizens' health. The study discovered that male's health was more vulnerable than that of females' health. And urban inhabitants were more vulnerable to air pollution than the rural ones. Whereas, education had a positive effect on citizens' health.

Different studies examined the impact of air pollution on human health at national and international levels. Most of the studies measured the air quality by using different measures of air pollution however some studies available in literature that conducted surveys to assess the perception of respondents about the health effects of the air pollution. At national level, only a limited number of studies have been undertaken on this issue viz., Ajmal et al. (2016) investigated the causes of air pollution and its devastating effects on human health in DG Khan. Shahid and Hussain (2015) investigated the air pollution and related issues in Faisalabad. Khan et al. (2014) investigated the spatial distribution of environmental risk factors in Bahawalpur district. Anwar et al. (2012) based the study on major pollutants from various sources and their effects on human health in Bahawalpur. Ilyas et al.(2010) examined the impact of air quality on health in Quetta. Parekh, et al., (2001) analyzed the ambient air quality of two Pakistani metropolitan cities. However, up to this time, no study in case of Multan district was undertaken. So, this is first-ever study that assessed the impact of air pollution on human health by using a survey method.

The findings of this study would be useful for the local government of Multan district as well as for the provincial and central governments to formulate such policies to minimize if not fully control, the issue of air pollution in Multan district. Some studies used causes of air pollution, some other studied the impacts of air pollution but the current study would be a comprehensive one as it covered both the causes and effects of pollution followed by recommendations.

Research Question: What are the causes, effects, and remedies of air pollution in city district, Multan Punjab, Pakistan?

Data and Methodology

Sample and Procedure

The objective of the current study was to analyze the causes, and impact of air pollution on human health in Multan City district, Punjab, Pakistan followed by the recommendations, using a self-reported structured questionnaire through a convenient sampling technique. Multan district is divided into four Tehsils: Multan City, Multan Saddar, Jalalpur Pir Wala, and Shuja Bad. The disproportionate convenient sample of 196 working people(male and female) from two tehsils of Multan, namely, Multan City and Multan Cantonment, 98 from each tehsil, age ranged from 22 to 65 year, was chosen by using the formula developed by Cochran (1963). The working people were selected for the study as they mostly work outside their homes and are more likely to be affected by air pollution. The non-working people were excluded from the study. The questionnaire was constructed following different researchers viz., Ajmal et al.(2016), Tanvir et al. (2016), Shahid and Hussain (2015), Khan et al. (2014) Anwar et al. (2012), Ilyas et al. (2010) regarding causes of air pollution and its devastating effects on human health.

The respondents were surveyed at workplace, at their home, and by phone calls. The data were collected in the months of September and October in 2020. Out of 246 questionnaires 196 questionnaires were completely filled and used for analysis.

Analysis

This study is descriptive in nature. The responses of respondents were collected, coded, and entered into the SPSS 18.0. The frequencies, percentages are presented in the form of tables and bar charts. The Independent Sample t-test was also used to test the significant mean difference between males and females on the impact of pollution.

Overall 53(27.04%) female and 143 (72.96%)male respondents participated in the survey. The number of unmarried and married respondents was 63(32.1%) and 133(67.9) respectively. It was found in the survey that education levels of the participants varied as follows: 11(5.6%) primary or middle, 40(20.4%) matric, 43(21.9%) intermediate, 52(29.4%) bachelors, 42(21.4) masters, and 2(1%) M.Phil.

The monthly income of the participants in Pakistani rupees, from all sources varied as follows: 24(12.2%) had 15000 and below, 70(35.7%) had 15001 to 30000, 67(34.2%) had 30001 to 45000, 20(10.2%) had 450001 to 60000, 11(5.6%) had 60001 to 75000, and 4(2%) had 75000 or above.

The age of the respondents varied as follows: 92(46.9%) aged between 22 to 32 year, 71(36.2%) ages between 33 to 43 year, 18 (9.2%)respondents have ages between 44 to 54 year, and 15(7.7%) respondents have ages between 55 to 65 years.

Perception of Local people about Pollution

Table 1

Q: How do you rate the air quality in Multan?

Scale	Frequency	Percent
Less Polluted	67	34.2
Moderately Polluted	95	48.5
To Great Extent Polluted	34	17.3
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about how they rate the air quality in Multan. Table 1 displays their responses. It is found that 67(34.2%) respondents believed that air quality in Multan is less polluted, 95(48.5%) respondents believed that air quality in Multan is moderately polluted, 34(17.3) respondents believed that air quality in Multan is polluted to a great extent.

Table 2

Q2: Do you feel that your health suffers from pollution?

Scale	Frequency	Percent
To Some Extent	55	28.1
To moderate Extent	79	40.3
To Great Extent	62	31.6
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about how they feel that their health suffers from pollution. Table 2 displays their responses. It is found that 55 (28.1%) respondents believed that their health suffers from air pollution to some extent, 79 (40.3%) respondents believed that their health suffers from air pollution to moderate extent, 62(31.6%) respondents believed that their health suffers from air pollution to great extent.

Table 3

Q3: In the presence of pollution, what type of mood do you feel in everyday life?

Scale	Frequency	Percent
Absolutely Good	41	20.9
To Some Extent Good	64	32.7
Not Good	91	46.4
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about what type of mood did they feel in everyday life in Multan City district. Table 3 displays their responses. It is found in the survey that 41(20.9%) respondents maintained that their mood is not affected by the air pollution, 64 (32.7%) respondents maintained that their mood is affected by the air pollution to some extent, 91(46.4%) respondents maintained that their mood is affected by the air pollution at a great extent. The findings exposed that air pollution affects the behavior or mood of people of Multan in everyday life.

Table 4

Q4: Who do you blame responsible for ever-increasing pollution?

Response	Frequency	Percent
Central Government	40	20.4
City Council	101	51.5
Local People	55	28.1
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about who did they blame responsible for ever-increasing pollution. Table 4 displays their responses. It is found in the survey that 40(20.4) respondents held the central government as responsible for the air pollution, 101(51.5%) respondents held the city council as responsible for the air pollution, 55 (28.1%) respondents held the local people as responsible for the air pollution.

Table 5

Q5: Do you Fee air pollution affects on your health?

Scale	Frequency	Percent
Always	11	5.6
Often	56	8.6
Sometimes	55	28.1
Rarely	56	28.6
Never	18	9.2
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about how often did they feel air pollution effects on their health. Table 5 displays their responses. It is shown that 11(5.6%) respondents always, 51(28.6%) often, 55(28.1%) sometimes, 56 (28.6%) rarely, and 18(9.2%) never felt the effect of air pollution.

Table 6

Q6: How often do you feel Ear, nose, and throat problems?

Scale	Frequency	Percent
Always	11	5.6
Often	56	28.6
Sometimes	31	15.8
Rarely	62	31.6
Never	36	18.4
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about how often did they feel their ear, nose and throat had problems. Table 6 displays their responses. It is found that 11(5.6%) respondents always, 56 (28.6%) often, 31(15.8%) sometimes, 62 (31.6%) rarely, and 36(18.4%) respondents never felt the ear, nose and throat problems.

Table 7

Q7: How often do you feel respiratory problems?

Scale	Frequency	Percent
Always	4	2.0
Often	10	5.1
Sometimes	16	8.2

Rarely	62	31.6
Never	104	53.1
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about how often did they feel respiratory problems. Table 7 displays their responses about respiratory problems due to air pollution. It is evident that 4(2%)respondents always, 10(5.1%) respondents often felt the respiratory problems, 16(8.2%) respondents sometimes felt the respiratory problems, 62(31.6%) respondents rarely felt the respiratory problems, 104 (53.1%) respondents never felt the respiratory problems. The findings show that people in Multan facing the respiratory problem due to the air pollution.

Table 8

Q: How often do you feel *Coughing or wheezing?*

Scale	Frequency	Percent
Always	13	6.6
Often	15	7.7
Sometimes	39	19.9
Rarely	64	32.7
Never	65	33.2
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about how often did they feel coughing and wheezing problems. Table 8 displays their responses about facing coughing or wheezing problems due to air pollution. It is found in a survey that 13 (6.6%)respondents always felt the coughing or wheezing problems, 15 (7.7) respondents often felt the coughing or wheezing problems, 39(19.9%) respondents sometimes felt the coughing or wheezing problems, 64(32.7%) respondents rarely felt the coughing or wheezing problems, 65(33.2%) respondents never felt the coughing or wheezing problems.

The findings show that people in Multan face coughing or wheezing problems due to air pollution.

Table 9

Q: How Often Do You Feel Headache Dizziness?

Scale	Frequency	Percent
Always	10	5.1
Often	56	28.6
Sometimes	42	21.4
Rarely	48	24.5
Never	40	20.4

Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about how often did the feel headache and dizziness problems. The Table 9 displays their responses It is found in a survey that 10(5.1%) respondents always felt the headache dizziness, 56 (28.6%) respondents often felt the headache dizziness, 42 (21.4) respondents sometimes felt the headache dizziness, 48(24.5%) respondents rarely felt the headache dizziness, 40 (20.4%) respondents never felt the headache dizziness. The findings show that people in Multan face headache dizziness due to air pollution.

Table 10

Q10: How Often you Feel Reduce Energy Level?

Scale	Frequency	Percent
Always	2	1.0
Often	12	6.1
Sometimes	27	13.8
Rarely	73	37.2
Never	82	41.8
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about how often did the feel reduced energy level problems. Table 10 displays their responses. It is found in a survey that 2 (1%) respondents always felt the reduced energy level, 12 (6.1%) respondents often felt the reduced energy level, 27(13.8%) respondents sometimes felt the reduced energy level, 73(37.2%) respondents rarely felt the reduced energy level, 82(41.8) respondents never felt the reduced energy level. The findings show air pollution have little impact on reducing energy levels.

Table 11

Q11: How Often Do You Feel Sleeping disorder or insomnia?

Scale	Frequency	Percent
Always	10	5.1
Often	13	6.6
Sometimes	30	15.3
Rarely	66	33.7
Never	77	39.3
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about how often did they feel sleeping disorders or insomnia problems. Table 11 displays their responses. It is found in a survey that 10(5.1%) respondents always

felt the sleeping disorder (insomnia), 13(6.6%) respondents often felt the sleeping disorder, 30(15.3%) respondents sometimes felt the sleeping disorder, 66 (33.7%)respondents rarely felt the sleeping disorder, 77(39.3%) respondents never felt the sleeping disorder. The findings show that some people in Multan face a sleeping disorder named as insomnia due to air pollution.

Psychological and Behavioral Impacts of Air Pollution

In this section, psychological and behavioral impact of air pollution has been discussed.

Table 12

Q12: Do You Feel Depressed?

Response	**Frequency**	**Percent**
No	152	77.6
Yes	44	22.4
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about did they feel depression problems. Table 12 displays their responses. It is found that 42(22.4) respondents feel depressed due to air pollution while 152(77.6) respondents do not have a problem of depression due to air pollution.

Table 13

Q13: Do you Jog faster and for a short time?

Response	**Frequency**	**Percent**
No	35	17.9
Yes	161	82.1
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about did they jog faster and for short time in Multan City district. Table 13 displays their responses. It is found that 161 (82.1)respondents jog faster due to air pollution while 35(17.9) respondents do not.

Table 14

Q14: Do you feel Anxiety?

Response	**Frequency**	**Percent**
No	173	88.3
Yes	23	11.7
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about did they feel anxiety problems. in Multan City district? Table 14 displays their responses. It is found that 23(11.7) respondents feel anxiety due to air pollution while 173(88.3) respondents do not have a problem of anxiety due to air pollution.

Table 15

Q15:Do you feel Aggressiveness?

Response	**Frequency**	**Percent**
No	160	81.6
Yes	36	18.4
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about did they feel aggressiveness problem in Multan City district. Table 15 displays their responses. It is found that 36 (18.4)respondents become aggressive due to air pollution while 160 (81.6)respondents do not feel aggressive.

Table 16

Q16: Do you feel Aggressiveness during cold days?

Response	**Frequency**	**Percent**
No	139	70.9
Yes	57	29.1
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about did they feel aggressiveness during cold days in Multan City district. T Table 16 displays their responses. It is found that 57(29.1) respondents become aggressive due to air pollution while 139 (70.9)respondents do not feel aggressive during cold days.

Table 17

Q17:Do you feel Aggressiveness during hot days?

Response	**Frequency**	**Percent**
No	151	77.0
Yes	45	23.0
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about did they feel aggressiveness during hot days in Multan City district. Table 15 displays their responses. It is found that 45(23.0%) respondents become aggressive due to air pollution while 151 (77.0%)respondents do not feel aggressive during hot days.

5. Health Impacts of Air Pollution

In this section, the health impacts of air pollution are discussed in terms of different diseases such as asthma, allergy, sore throat, and cancer.

Table 18

Q18: Do you feel Asthmatic symptoms?

Response	**Frequency**	**Percent**
No	150	76.5
Yes	46	23.5
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about did they feel asthma problem in Multan City district. Table 18 displays their responses. It is found that 46 (23.5%)respondents facing the disease asthma while 150(76.5%) respondents do not have the problem of asthma.

Table 19

Q19: Do you feel Allergy?

Allergy	**Frequency**	**Percent**
No	158	80.61
Yes	38	19.39
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about did they feel allergy problem in Multan City district. Table 19 displays their responses. It is found that 38(19.39%)respondents facing the problem of allergy while 158(80.61%) respondents do not have the problem of allergy.

Table 20

Q20: Do you feel Sore throat?

Response	**Frequency**	**Percent**
No	152	77.6
Yes	44	22.4
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked the question about did they feel sore throat problems in Multan City district. Table 20 displays their responses. It is found that 44(22.4%)respondents facing the problem of a sore throat while 152(77.6%) respondents do not have the problem of a sore throat.

6. Major Causes of Air Pollution in Multan

In this section, the causes of air pollution identified by the respondents in Multan have been discussed.

Table 21

Q21: Do you observe traffic Mess in the city?

Response	**Frequency**	**Percent**
No	60	30.6
Yes	136	69.4
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked whether mess of traffic was the cause of pollution problem in Multan City district. Table 21 displays those 136(69.4%) respondents believed that traffic is the major cause of air pollution in Multan while 60 (30.6%)respondents believed that traffic is not a major cause of air pollution. As the population of Multan is growing day by day and vehicles on the roads also increasing at alarming rate. These vehicles especially, motorbikes, Rickshaws, and four-wheelers are causing air pollution in Multan.

Table 22

Q22: is open Sewage is the cause of pollution in the city?

	Frequency	**Percent**
No	163	83.2
Yes	33	16.8
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked whether open sewage was the cause of pollution problem in Multan City district. Table 22 displays those 33(16.8%) respondents believed that open sewage is the major cause of air pollution while 163(83.2%) respondents believed that open sewage is not a major cause of air pollution in Multan.

Table 23

Q23: is Waste Water the cause of Pollution in the city?

Response	**Frequency**	**Percent**
No	174	88.8
Yes	22	11.2
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked whether waste water was the cause of pollution problem in Multan city district. Table 23 displays that 22(11.2%) respondents believed that wastewater is the major cause of

air pollution while 174(88.8%) respondents believed that wastewater is not a major cause of air pollution in Multan.

Table 24

Q24: Is Waste Burning cause of pollution in the city?

Response	**Frequency**	**Percent**
No	160	81.6
Yes	36	18.4
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked whether waste burning was the cause of pollution problem in Multan City district. Table 24 displays that 36 (18.4%) respondents believed that waste burning is the major cause of air pollution while 160(81.6%) respondents believed that waste burning is not a major cause of air pollution in Multan.

Preventive Measures to Control the Air Pollution in Multan

In this section preventive measure identified by the respondents to control the air pollution in Multan has been discussed.

Table 25

Q25: Can the improvement of roads curtail the pollution in the city?

Response	**Frequency**	**Percent**
No	152	77.6
Yes	44	22.4
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked whether improvement of roads could curtail the pollution problem in Multan City district. Table 25 displays that 44(22.4%) respondents believed that improvements of roads can be a preventive measure to control the air pollution while 152(77.6%) respondents believed that improvements of roads are not an important measure to control the air pollution in Multan.

Table 26

Q26: Does Ban on high-emission vehicles can curtail pollution in the city?

Response	**Frequency**	**Percent**
No	57	29.1
Yes	139	70.9
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked whether ban on the high-emission vehicles could curtail the pollution problem in Multan City district. Table 26 displays that 139(70.9%) respondents believed that a ban on high-emission vehicles can be an important preventive measure to control air pollution while 57 (29.1%)respondents believed that a ban on high-emission vehicles is not an important measure to control the air pollution in Multan. As traffic was found as a major cause of air pollution in Multan so that respondents suggest that a ban on high-emission vehicles could be an important preventive measure to control the air pollution in Multan.

Table 27

Q27: can proper sanitary system curtail the pollution in the city?

Response	**Frequency**	**Percent**
No	142	72.4
Yes	54	27.6
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked whether the proper sanitary system could curtail the pollution problem in Multan City district. The Table 27 displays that 54 (27.6%)respondents believed that a proper sanitary system should be prevailed to control air pollution while 142(72.4%) respondents believed that a proper sanitary system is not an important measure to control the air pollution in Multan.

Table 28

Q28: Can Proper disposing material system curtail Pollution in the city?

Response	**Frequency**	**Percent**
No	160	81.6
Yes	36	18.4
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked whether proper disposing material system could curtail the pollution problem in Multan City district. The Table 28 displays that 36 (18.4%)respondents believed that a proper disposing material system should be prevailed to control the air pollution while 160(81.6%) respondents believed that a proper disposing material system is not an important measure to control the air pollution in Multan.

Table 29

Q29: Can Greenery / plantation should be increased curtail pollution?

Response	**Frequency**	**Percent**
No	75	38.3
Yes	121	61.7
Total	196	100.0

Source: Author's Calculations by Using Survey Data, 2021

The respondents were asked whether greenery/ plantation could curtail the pollution problem in Multan City district. Table 29 displays that 121(61.7%) respondents believed that greenery/plantation should be increased to control the air pollution while 75(38.3%) respondents believed that greenery/plantation is not an important measure to control the air pollution in Multan.

Independent Sample T-test Analysis

Independent sample test was applied to test the significance mean difference of males and females on impact of air pollution on human health. Table 30 shows no significant mean difference between males (Mean= 3.6603, SD= 0.5011) and females (Mean= 3.7385, SD= 0.5416) regarding the impact of air pollution on physical human health (t-statistic= -0.949, p-value=0.553). Significant mean difference was found between male (Mean= 0.3596, SD= 0.1267) and female (Mean= 0.3847, SD= 0.1540) about the impact of air pollution on behavioral effects on human health (t-statistic= -2.694, p-value=0.025). Females were found to have more behavioral effects of air pollution on health as compare to that of their male counterparts.

Table 31

Independent Sample T-test to Test the Significance Mean Difference of Gender on Impacts of Air Pollution on Human Health

Variables	Gender	N	Mean	SD	t-statistic	p-value
PHYI	Male	143	3.6603	0.5011	-0.949	0.553
	Female	53	3.7385	0.5416		
BEHI	Male	143	0.3596	0.1267	-2.694	0.025
	Female	53	0.3847	0.1540		

Source: Author's Calculations by Using Survey Data, 2021

Discussion

Air is imperative for human existence and other living organisms. Adverse air quality creates harmful effects on human health. The key objective of this study was to analyze the impact of air pollution on human health. This study was descriptive in nature. To attain the objectives of the study the convenient sample from 196 respondents was collected from the Multan city district.

It was found through survey from the respondents that Multan District had a problem of air pollution with moderate air pollution. The major cause of air pollution was found to be traffic, waste burning, and open sewage. Due to air pollution, people are facing a lot of health problems. The most common health issue found in the current study was asthma (23.5%) followed by sore throat (22.4%), allergy (19.39%). These results are also comparable to the outcomes of the study by Anwar et al. (2012), which reported impacts of pollution as manifested by suffering of residents of Bahawalpur city from diseases like asthma (23.0%), skin allergy (29.0%), and throat infection (19%). The results of the present study are also supported by the outcomes derived by Ajmal et al. (2016) that health problems like asthma (35.8%), throat infection (19.2%), and allergy (24.2%)are common in Dera Ghazi Khan. The result of the study conducted by Hussain et al. (2003) is also in line with this study, which reflected the effects of pollution in form of various ailments like throat infection (75.0%), influenza (56.7%), and depression (65.0%) in Faisalabad. Whereas, this study indicated the rate of depression to be 22.4%. High rate of asthma in the study area indicates that the level of pollution is high in the

area and air pollution is a serious issue. People also reported that they have the eye, nose, and respiratory problems due to air pollution.

The findings also show that air pollution also influences the psychological and behavioral health of people. Respondents reported that there are no preventive measures to control the air pollution in Multan. High-emission vehicles are operating on roads without any hurdles. The sample of the present study suggested that greenery and public parks should be maintained and increased and there should be a ban on high emission vehicles.

No significant mean difference was found between males and females about the impact of air pollution on physical human health. The significant mean difference was found between males and females about the behavioral impact of air pollution. Females were found to have more behavioral effects of air pollution as compare to that of males.

Conclusion

This study attempted to analyze the impact of air pollution on human health in Multan city district, Punjab, Pakistan. We can conclude that Multan District has serious problem of air pollution. The sample perceived that the air quality of Multan was adverse. The major cause of air pollution a found to be traffic, waste burning, and open sewage. Significant mean difference was found between male and female about the impact of air pollution on behavioral effects on human health. Females were found to have more behavioral effects of air pollution on health. Due to air pollution, people are facing a lot of health problems. The most common health issue found in this study was asthma (23.50%) followed by sore throat (22.40%), allergy (19.39%). High rate of asthma in the study area indicates that the level of pollution is high in the area and air pollution is a serious issue. People also reported that they have the eye, nose, and respiratory problems due to air pollution. The findings also show that air pollution also influences the psychological and behavioral health of people. Respondents reported that there are no preventive measures to control the air pollution in Multan. High-emission vehicles are operating on roads without any hurdles. The sample of the present study suggested that greenery and public parks should be maintained and increased and there should be a ban on high emission vehicles.

Recommendations

Based on the findings of the study following recommendations are suggested by the researcher to control the air pollution generally in Pakistan and specifically in Multan district: Greenery has a strong impact on improving the air quality and reducing the air pollutants from the atmosphere. The green places should be increased; trees should be planted at a greater rate so that the air quality of the atmosphere may improve. To reduce air pollution, it is necessary to aware the people about pollution and its effects. For this purpose, environmental education should be included in a curriculum at school, college, and university levels. Nowadays print and social media are important tools to aware people of any matter. Residents of the country, government organizations, and private entities should educate people about the importance of reducing air pollution and its impacts on health. Government should design and implement environmentally friendly policies. To reduce the air pollution in the atmosphere government should involve stakeholders in policymaking to prevent the citizens from harmful effects of air pollution. Traffic was found to be a major cause of air pollution. Government should ban the high emitted vehicles. Motor vehicle rules must be designed by the central government and local government must ensure it. Improvement of roads can also be helpful in the reduction of air pollution.

Limitations

This study was based on the data that was collected from 196 respondents Multan district. Due to shortage of time and resources other districts of Punjab were skipped. In future further studies can be conducted in other districts of Punjab, Pakistan. The sample size can also be increased to capture the clear picture of the impacts of air pollution on human health. This study was only limited to the data of working people of Multan district. Further studies can also use the data of both working and non-working people.

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