Investigation of the air pollutants factors in Qala-e-Naw city, Badghis province, Afghanistan

Ahmad Zaher Firoozkohi
Abdul Ghani Rahimi
Sfiullah Safa Afzaly
Badghis Higher Education Institution, Afghanistan

Abstract: Air pollution and environmental degradation have become global issues. Despite the relatively low density of factories, smoke, and heavy traffic in the Badghis province, it is still affected by various factors contributing to air pollution. Due to the importance of public health and the environment, it is necessary to identify the sources of pollution in this province and consider solutions to address them. This research was conducted in 2023 by distributing questionnaires and conducting face-to-face interviews to examine the factors contributing to air pollution in Qala-e-Naw city, Badghis province. The study population consisted of 100 government employees who were randomly selected using the Cochran formula. The raw data was analyzed using SPSS software. The research results indicate that the factors contributing to air pollution in Qala-e-Naw city, Badghis province, have a significant and positive impact. After conducting the significance test, the sig value was found to be 0.000, which is less than the alpha level of 0.05. Therefore, the main hypothesis of the research has been confirmed. The first sub-hypothesis regarding the impact of old vehicles on air pollution has a significant and positive effect, as indicated by the significance test with a sig value of 0.01, which is lower than the alpha level of 0.05. Therefore, the first sub-hypothesis is confirmed. The second sub-hypothesis regarding the lack of green spaces and its significant and positive impact on air pollution in Qala-e-Naw city, Badghis province, is also supported. After conducting the significance test, the sig value is found to be 0.000, which is smaller than the alpha level of 0.05. Hence, the second sub-hypothesis is confirmed. The third sub-hypothesis related to the establishment of factories and their significant and positive impact on air pollution in Qala-e-Naw city, Badghis province, is also confirmed. The significance test yields a sig value of 0.000, which is less than the alpha level of 0.05. Therefore, the third sub-hypothesis is supported. The fourth sub-hypothesis regarding the positive and significant impact of unawareness of people on air pollution in Qala-e-Naw city, Badghis province, is supported. The significance test resulted in a sig value of 0.000, which is smaller than the alpha level of 0.05. Therefore, the fourth sub-hypothesis is confirmed. Similarly, the fifth sub-hypothesis regarding the positive and significant impact of deforestation on air pollution in Qala-e-Naw city, Badghis

province, is also confirmed. After conducting the significance test, the sig value is found to be 0.000, which is less than the alpha level of 0.05. Hence, the fifth sub-hypothesis is supported. As a result, the factors contributing to air pollution in Qala-e-Naw city, Badghis province, are evaluated positively.

Keywords: Qala-e-Naw, air pollutants, environment

INTRODUCTION

The increasing emissions of greenhouse gases and global warming, along with air pollution and other environmental degradation, have driven countries to adopt policies aimed at reducing greenhouse gas emissions and taking action. This is because the costs, both in terms of human life and finances, of air pollution are far greater than commonly perceived. According to the latest reports from the World Health Organization (WHO, 2015), the economic costs of air pollution in some countries have reached a quarter of their gross domestic product. Furthermore, air pollution is a significant factor that impacts health and is the leading environmental risk factor for human health (Landrigan, et al., 2018). Based on this understanding, the outcomes of the 21st World Climate Conference emphasized the need to address the challenges of climate change in major cities and slow down the pace of climate change on our planet (Williamson, 2013).

Recent findings by scientists indicate that air pollution worldwide annually causes over 5.5 million premature deaths, with more than half of these deaths occurring in Asian countries such as India and China. Among the most significant pollutants, those arising from greenhouse gases pose a serious threat to many countries. Given its pervasive nature and noticeable presence in most regions of the world, reducing carbon dioxide emissions plays a crucial role in protecting the environment and living organisms (Samani et al., 2017). According to the Intergovernmental Panel on Climate Change (IPCC) report in 2014, carbon dioxide accounts for 76% of total greenhouse gas emissions. Therefore, reducing carbon dioxide emissions can be seen as playing an important role in environmental conservation (Samani et al., 2017).

In today’s world, pristine and untouched nature is rarely found. Every day, vast natural spaces are being encroached upon by residential, commercial, industrial, and service areas. Another part of the natural environment is also being destroyed due to unplanned and improper use of forests, pastures, agricultural lands, and unsustainable mining practices, leading to the loss of their vital ecological value (Firoozi, 2005).

The topic of investigating air pollutants in Qala-e-Naw city, Badghis province, is one of the most significant subjects, deserving great attention. This title aims to inform and raise awareness among the citizens of Qala-e-Naw and readers of this work regarding various environmental pollutants, such as vehicle emissions,

industrial pollution from factories surrounding the city, dust pollution in the urban activities of the residents. these issues are addressed in different departments, such as the Department area, and the use of insecticides in different parts of the city due to their accessibility for daily of Chemistry and Biology in the field of ecology and environmental studies, and the fields of biology and chemistry in various science courses. Students in these departments greatly benefit from this content as an essential part of their curriculum. Furthermore, other institutions can also make comprehensive use of this research.

This research aims to investigate the factors contributing to air pollution in Qala-e-Naw city, Badghis province.

Research hypothesis

Main Hypothesis: It appears that the major contributors to air pollution in the central region of Badghis province are, in order, old vehicles, lack of green spaces, establishment of factories, unawareness of people, and deforestation.

Subsidiary Hypotheses:

1- Old cars have an impact on air pollution.

2- The absence of green spaces plays a role in air pollution.

3- Establishing factories has an impact on air pollution.

4- Lack of awareness people has an impact on air pollution.

5- Deforestation effects on air pollution levels.

These hypotheses provide a framework for further investigation into the specific factors contributing to air pollution in Qala-e-Naw, Badghis province.

Material and Method: This research was conducted in the year 2023 to investigate the factors contributing to air pollutants in Qala-e-Naw, Badghis province. The primary data was collected through face-to-face interviews and the distribution of questionnaires among a randomly selected sample of 100 government employees using the Cochran formula. The second set of data was gathered from relevant books, scientific articles, and internet sources. The collected data was analyzed using the SPSS software for statistical analysis.

Result: According to the information provided, the results indicate that 100% of the participants included in the study are male, as shown in Table 1.

Table 1

Gender Distribution of Participants in the Study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Man	100	100.0	100.0	100.0

Output source: SPSS

The Ages of Participants:

The ages of the participants included in the study are divided into five categories: (20-30), (31-35), (36-40), (41-50), and over 50 years. As shown in Table

2, 6.0% of the participants fall within the age range of (20-30) years, 24.0% are aged between (31-35) years, 26.0% fall within the age range of (36-40) years, 25.0% are aged between (41-50) years, and 19.0% of the participants are over 50 years old.

Table 2

Age of Persons

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30	6	6.0	6.0	6.0
	31-35	24	24.0	24.0	30.0
	36-40	26	26.0	26.0	56.0
	41-50	25	25.0	25.0	81.0
	More than 50 years	19	19.0	19.0	100.0
	Total	100	100.0	100.0	

Output source: SPSS

The main hypothesis of the research: The factors contributing to air pollution in Qala-e-Naw have a significant and positive impact. As shown in Tables 3 and 4, 54 respondents selected the option "Very High," 34 respondents selected the option "High," and 12 respondents selected the option "Moderate." Based on the results of the Chi-square test, the significance level (sig) is equal to 0.000, which is smaller than the alpha level of 0.05. Therefore, the main hypothesis of the research is confirmed.

Figure 3

The impact of air pollutants

	Observed N	Expected N	Residual
medium	12	33.3	-21.3
High	34	33.3	0.7
very high	54	33.3	20.7
Total	100		

Output source: SPSS

Table 4

Kai Skewer Statistical Test

Test Statistics

Chi-Square	26.480[a]
Df	2
Asymp. Sig.	0.000
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 33.3.	

Testing sub-hypotheses

The first hypothesis is that old cars have a positive and significant effect on air pollution.

Based on the results obtained from the research, it is observed that 16 respondents selected the option “Moderate”, 41 respondents selected the option “High”, and 43 respondents selected the option “Very High”. According to the results of the Chi-square test, the significance level (sig) is equal to 0.01, which is smaller than the alpha level of 0.05. Therefore, the first sub-hypothesis, “Old vehicles have a

significant and positive impact on air pollution", is confirmed, as shown in Tables 5 and 6.

Table 5

The impact of old cars on air pollution

	Observed N	Expected N	Residual
medium	16	33.3	-17.3
high	41	33.3	7.7
very high	43	33.3	9.7
Total	100		

Output source: SPSS

Table 6

Kai Skewer Statistical Examination

Test Statistics

Chi-Square	13.580[a]
Df	2
Asymp. Sig.	0.01
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 33.3.	

The second hypothesis is that the lack of green space has a significant effect on air pollution and has a significant positive effect.

Based on the results obtained from the research, it is observed that 12 respondents selected the option "Moderate", 45 respondents selected the option "High", and 43 respondents selected the option "Very High". According to the results of the Chi-square test, the significance level (sig) is equal to 0.00, which is smaller than the alpha level of 0.05. Therefore, the second sub-hypothesis, "Lack of green spaces has a significant and positive impact on air pollution", is confirmed, as shown in Tables 7 and 8.

Table 7

The impact of lack green space on air pollution

	Observed N	Expected N	Residual
medium	12	33.3	-21.3
high	45	33.3	11.7
very high	43	33.3	9.7
Total	100		

Output source: SPSS

Table 8

Kai Skewer Statistical Test

Chi-Square	20.540[a]
Df	2
Asymp. Sig.	.000
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 33.3.	

The third subsidiary hypothesis is that the establishment of factories has a positive and significant effect on air pollution.

Based on the results obtained from the research, it is observed that 2 respondents selected the option "Moderate," 35 respondents selected the option "High," and 63 respondents selected the option "Very High." According to the results of the Chi-square test, the significance level (sig) is equal to 0.00, which is smaller than the alpha level of 0.05. Therefore, the third sub-hypothesis, "Establishment of factories has a significant and positive impact on air pollution," is confirmed, as shown in Tables 9 and 10.

Figure 9

The Impact of Factories on Air Pollution

	Observed N	Expected N	Residual
medium	2	33.3	-31.3
high	35	33.3	1.7
very high	63	33.3	29.7
Total	100		

Output source: SPSS

Table 10

Kai Skewer Statistical Test

Test Statistics

Chi-Square	55.940[a]
Df	2
Asymp. Sig.	.000
a.0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 33.3.	

Fourth hypothesis: Lack of awareness of people has a positive and significant effect on air pollution.

Based on the results obtained from the research, it is observed that 1 respondent selected the option “Low”, 16 respondents selected the option “Moderate”, 29 respondents selected the option “High”, and 54 respondents selected the option “Very High”. According to the results of the Chi-square test, the significance level (sig) is equal to 0.00, which is smaller than the alpha level of 0.05. Therefore, the fourth sub-hypothesis, “Lack of awareness among people has a significant and positive impact on air pollution”, is confirmed, as shown in Tables 11 and 12.

Table 11

The impact of lack awareness of people on air pollution

	Observed N	Expected N	Residual
low	1	25.0	-24.0
medium	16	25.0	-9.0
high	29	25.0	4.0
very high	54	25.0	29.0
Total	100		

Output source: SPS

Table 12

Kai Skewer Statistical Test

Test Statistics

Chi-Square	60.560[a]
Df	3
Asymp. Sig.	.000
a.0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 25.0.	

Fifth sub-hypothesis: Forest cutting has a positive and significant effect on air pollution.

Based on the results obtained from the research, it is observed that 4 respondents selected the option “Moderate”, 32 respondents selected the option “High”, and 64 respondents selected the option “Very High”. According to the results of the Chi-square test, the significance level (sig) is equal to 0.00, which is smaller than the alpha level of 0.05. Therefore, the fifth sub-hypothesis, “Deforestation has a significant and positive impact on air pollution”, is confirmed, as shown in Tables 13 and 14.

Table 13

The Impact of cutting Forest on Air Pollution

	Observed N	Expected N	Residual
medium	4	33.3	-29.3
high	32	33.3	-1.3
Very high	64	33.3	30.7
Total	100		

Output source: SPS

Table 14

Kai Skewer Statistical Test

Chi-Square	54.080[a]
Df	2
Asymp. Sig.	.000
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 33.3.	

DISCUSSION

The study indicates that air pollution caused by old vehicles, especially diesel engines, is one of the main contributors to air pollution. Research findings in St. Petersburg (Lozhkin et al., 2018) also suggest that air pollution from exhaust gases emitted by old vehicles in many courtyard wells in St. Petersburg, especially in high-traffic areas, is a matter of concern. High levels of particulate matter and nitrogen dioxide indicate potential health risks and emphasize the need for targeted reduction measures, which align with the findings of this research.

The majority of participants in this study believed that the lack of green spaces has a significant impact on air pollution. Markovich (2017) highlighted the overall role of green spaces in community health, emphasizing three key functions: 1)

capacity for damage reduction (e.g., reducing exposure to air pollution, noise, and heat), 2) capacity for restoration (e.g., attention restoration and physiological stress recovery), and 3) building capacity (e.g., facilitating social cohesion and promoting physical activity). Therefore, the lack of green spaces is recognized as another important factor contributing to air pollution in Badghis.

Furthermore, 63% of respondents identified the establishment of factories, particularly gypsum factories, as a major contributor to air pollution in Badghis. Similar results were found in a study conducted by Dubey in 2013, where air pollution from lime and cement production industries was found to pose serious occupational health hazards and adverse effects on crops, gardens, and buildings. People living in proximity to these industries may be exposed to higher levels of pollutants. The production of cement and gypsum requires a significant amount of energy, primarily from coal, which results in considerable carbon dioxide emissions.

The research results clearly demonstrate that deforestation also has a significant impact on air pollution. While the study focused less on the direct relationship between changes in forest area and air pollution levels, the importance of forests in carbon dioxide absorption and controlling atmospheric particulate matter has been widely recognized and evaluated positively. The cutting down of forests leads to an increase in greenhouse gas emissions. These findings align with the findings of Lanielle in 2003.

CONCLUSION

Based on the obtained results, the factors contributing to air pollution in Qala-e-Now, Badghis Province, have shown significant and positive effects, with less than the alpha level of 0.05. Therefore, the main hypothesis of the research has been confirmed. The first sub-hypothesis regarding the impact of old vehicles on air pollution has also been supported with a significance level of 0.01. The second sub-hypothesis regarding the lack of green spaces' influence on air pollution in Qala-e-Now, Badghis Province, has been confirmed with a significance level of 0.000. The third sub-hypothesis regarding the establishment of factories' contribution to air pollution has been confirmed with a significance level of 0.000. The fourth sub-hypothesis regarding people's lack of awareness about air pollution has been confirmed with a significance level of 0.000. Lastly, the fifth sub-hypothesis regarding the impact of deforestation on air pollution has been confirmed with a significance level of 0.000. In conclusion, the factors contributing to air pollution in Qala-e-Now, Badghis Province, have been evaluated positively.

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