



Statistical analysis of industrial water pollution and assessment of water quality, impact on students of Department of Industrial Chemistry Federal University Lokoja (FUL) Campus

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Abstract

Water is one of the most essential resources for sustaining life on Earth. Access to clean and safe water is fundamental for drinking, cooking, sanitation, agriculture, and many other human endeavors, access to clean, safe water is essential. However, industrial waste, agricultural runoff, improper waste management, and environmental contamination frequently damage the quality of water. This study assesses the industrial chemical pollution on natural water and evaluates the quality of water as well as possible health effects on the community of Federal University Lokoja due to water contamination in federal university Lokoja. These findings highlight significant disparities in perceived water quality across sources within the institution, with sachet water emerging as the most concerning, pointing to the need for improved water safety standards and quality monitoring. It shows a gender balance and with slight pre-dominance of female students. This distribution indicates that the sample is predominantly made up of students, which is reflective of the broader population composition within the university setting. This implies industrial activities is considered as significant factors that leads to water pollution. We conclude statistically that there is no significant relationship between source of drinking water and illness due to water consumption among people in FUL. This implies illness may not be strongly associated with sources of water drinking.

Keywords: Water pollution, Industrial waste, illness, source and water

Introduction

Water is life as a common proverb in Nigeria. Water is being polluted through discharge of waste everyday into the Lokoja River, Chemical discharge on land also either flows to the river or get absorbed and contaminate water underground. The department of industrial chemistry depends on public water commonly known as pure water for drinking and borehole water for hostel domestic purposes. One of the most vital natural resources is water, which should be developed, distributed, protected, and managed carefully as a resource for every country. To prevent more water issues, its infrastructure should also be adequately maintained. This study aimed to assess Lokoja's water infrastructure, with an emphasis on pinpointing areas in need of renovation. The study's objectives included mapping the main water pipeline distribution network and obtaining geometric and attribute data on storage tanks and reservoirs in the area that was assigned [1.. 7].

This is especially true in emerging nations where infrastructure and environmental regulations may not always keep up with the rapid rise of urbanization and industry. In these situations, contaminated water can result in the spread of diseases that are transmitted through the water, exposure to toxins, and long-term health problems [5, 8].

Drinking contaminated water can cause cholera, typhoid, gastrointestinal disorders, and other waterborne infections. Furthermore, renal damage, neurological diseases, and developmental problems are among the long-term health issues that can arise from exposure to heavy metals including lead, mercury, and cadmium. Thus, to protect the community's health, it is imperative to monitor and evaluate

the water quality in Lokoja, especially on the university campus. Water is vital for man's existence and without it; there would be no life on Earth. Cities are growing very rapidly and water is required for cooking, washing, bathing, drinking, and industrial purposes. Sadly, there are numerous sources of contamination that are posing an increasing threat to Lokoja's water supplies. Untreated household sewage is dumped into rivers and streams as a result of the city's expanding population and inadequate waste treatment facilities. In addition, industrial processes like mining and small-scale manufacturing add to the heavy metal and other dangerous chemical contamination of water. Due to pesticide, herbicide, and fertilizer runoff into surrounding rivers and groundwater, agricultural operations in the Lokoja area also contribute to water pollution. The water quality that the people of Lokoja, especially the faculty, staff, and students of FUL, utilize has been deteriorated by these issues together [4, 12].

Simultaneously, areas with low water quality, particularly in underdeveloped nations, are prone to waterborne illnesses such cholera, typhoid, and gastroenteritis. The high density of living in dorms, dining halls, and campus infrastructure makes the university population more susceptible to these health hazards. Furthermore, prolonged exposure to tainted water containing heavy metals like lead, mercury, and cadmium can have detrimental effects on health, particularly on developing children and young people. These effects can include brain impairment, kidney failure, and developmental problems. Therefore, putting into practice efficient water management and health intervention techniques requires an awareness of the extent of water contamination and the

health effects it has on the Federal University Lokoja population [3, 11].

The enormous industrial and urban growth that Lokoja has seen over the past two decades has put a great deal of strain on the city's natural resources, especially its water supply. Numerous sources of pollution affect the rivers in Lokoja, including as untreated home sewage, runoff from surrounding agricultural operations, and industrial waste from small-scale industries [1, 7]. These pollutants deteriorate the quality of the water, making it perhaps unfit for human consumption and putting the public's health at serious danger.

Poor water quality has far-reaching effects on the FUL population, which depends on the nearby water sources. Students, employees, and teachers may be exposed to waterborne pathogens like cholera, typhoid, and bacteria that cause diarrhea as a result of contaminated water. These infections are frequently found in areas with poor sanitation and water treatment facilities. Furthermore, heavy metals like lead, mercury, and arsenic, often found in industrial effluents, can accumulate in water bodies, leading to long-term health consequences such as neurological damage, kidney failure, and developmental disorders. Therefore, ensuring water quality on and around the FUL campus is essential to safeguarding the health and well-being of the university community [2, 9].

The water quality on campus has a direct impact on the health and happiness of the FUL community. Waterborne disease outbreaks among professors, staff, and students can result from contaminated water, particularly in high-density living and working environments. The FUL population is more susceptible to health concerns associated with water due to the university's reliance on water from the Rivers Niger and Benue as well as the absence of routine water quality monitoring. By giving a thorough evaluation of the water quality in Lokoja and concentrating on the water sources utilized by Federal University Lokoja, this study aims to address these issues. The study will advance knowledge of the health dangers associated with contaminated water and provide useful suggestions for enhancing water management and safety on campus and in the larger Lokoja community. This study assess chemical pollution of natural water, also evaluate the quality of water and evaluate the possible health effects on the community of Federal University Lokoja of water contamination [6, 10].

Literature Review

Significant levels of contamination from chemical and biological contaminants were found in the River Niger, according to research done by Adekola *et al.* (2010) [2]. The

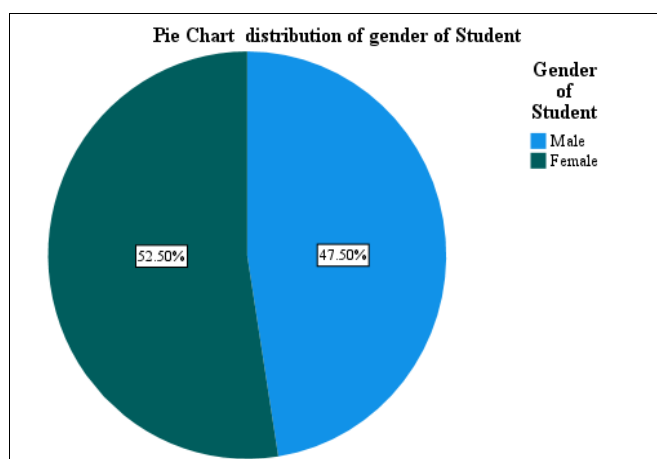
study stressed the necessity of stricter laws and ongoing water quality monitoring in Nigeria in order to safeguard the general public's health. Similar findings were made when Ogunfowokan *et al.* (2013) examined the Ogun River's water quality and discovered high concentrations of chemical pollutants from industrial and agricultural processes [6, 8]. In Nigeria, the prevalence of waterborne diseases such as cholera, typhoid, and hepatitis A is a major public health concern. According to a study by Musa *et al.* (2013), outbreaks of these diseases are common in regions where access to clean water is limited, and contamination of water sources is widespread. The Federal University Lokoja community, like many other academic institutions in Nigeria, is at risk of exposure to these diseases due to its reliance on potentially contaminated water from the River Niger and other local sources [10, 13].

Checking quality of water with an emphasis on pathogen identification, water sources. In Lokoja and improving the water quality is the target of this paper. The water quality on campus has a direct impact on the health and happiness of the FUL community. Waterborne disease outbreaks among professors, staff, and students can result from contaminated water, particularly in high-density living and working environments. The FUL population is more susceptible to health concerns associated with water due to the university's reliance on water from the Rivers Niger and Benue as well as the absence of routine water quality monitoring. By giving a thorough evaluation of the water quality in Lokoja and concentrating on the water sources utilized by Federal University Lokoja, this study aims to address these issues. The study advances knowledge of the health dangers associated with contaminated water and provide useful suggestions for enhancing water management and safety on campus and in the larger Lokoja community [6, 12].

Methodology

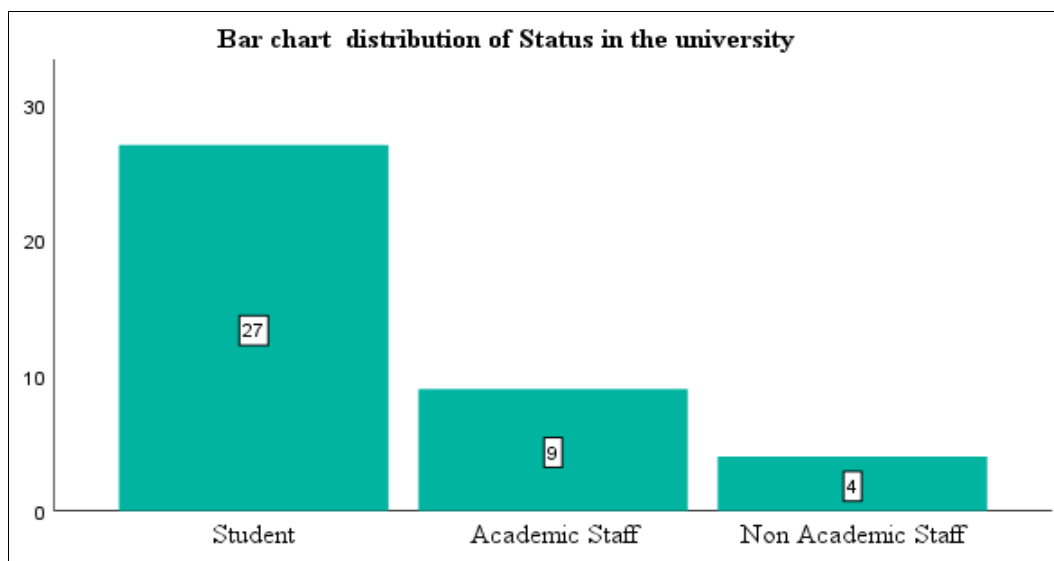
This study employs descriptive techniques to assess water quality in Lokoja and its impact on the Federal University Lokoja (FUL) community. The primary water bodies to be investigated includes, sachet water, boreholes and wells within the Federal University Lokoja. A structured questionnaire will be distributed to students, staff, and faculty to gather information on water usage patterns, health issues, and awareness of water safety. The survey also seek to identify any health problems linked to water consumption, such as gastrointestinal illnesses or waterborne diseases.

Analysis/Material Demograh Analysis



The Pie-chart distribution shows that female students participated more in the sample of data collection 52.5%

while male students accounts for 47.5%. It shows a gender balance and with slight pre-dominance of female students.



The bar chart illustrates the distribution of respondents by status within the university. Students constitute the largest group, accounting for 27 respondents, followed by academic staff with 9 respondents. Non-academic staff represent the

smallest category, with a total of 4 respondents. This distribution indicates that the sample is predominantly made up of students, which is reflective of the broader population composition within the university setting.

Objective 1

Assessment of industrial chemical pollution of natural water in Lokoja. To evaluate the quality of water in federal university Lokoja

Adequacy of water quality								
Primary source of drinking water	Strongly Agreed		Agreed		Disagreed		Strongly Disagreed	
	F	%	F	%	F	%	F	%
Sachet water	1	10	2	20	5	50	2	20
Borehole	1	20	2	40	2	40	0	0
Bottled water	3	33.3	3	33.3	1	11.1	2	22.2
Tap water	2	33.3	2	33.3	1	16.7	1	16.7
others	3	30	3	30	1	10	3	30

The cross-tabulation reveals notable variation in water quality satisfaction across drinking water sources. Sachet water users recorded the highest dissatisfaction rate, with 70% disagreeing on its adequacy, despite being a widely consumed source. Borehole users showed a more balanced response, with 60% agreement and 40% disagreement. Bottled and tap water users reported the most favorable

assessments, with 66.6% in each category expressing satisfaction with their water source. These findings highlight significant disparities in perceived water quality across sources within the institution, with sachet water emerging as the most concerning, pointing to the need for improved water safety standards and quality monitoring.

Observed changes in water quality over time				
Perceived impact of waste disposal practices	Yes		No	
	F	%	F	%
Strongly Agree	3	60	2	40
Agree	8	80	2	20
Disagree	5	31.25	11	68.75
Strongly Disagree	6	66.7	3	33.3

The cross-tabulation of observed changes in water quality over time against perceived impact of waste disposal practices reveals a meaningful association between the two variables. Among respondents who agreed, 80% confirmed that waste disposal practices have adversely affected water quality, while 60% of those who strongly agreed shared this view. Conversely, 68.75% of those who disagreed perceived

no significant impact of waste disposal on water quality. Overall, the distribution suggests a clear association between poor waste disposal practices and declining water quality, with the majority of respondents acknowledging waste disposal as a contributing factor to deteriorating water conditions within the study area.

Safety of available water sources								
Impact of industrial activities on water pollution	Strongly Agree		Agree		Disagree		Strongly Disagree	
	F	%	F	%	F	%	F	%
Strongly Agree	1	11.1	4	44.4	5	55.6	2	22.2
Agree	4	26.7	4	26.7	2	13.3	3	20
Strongly Disagree	3	37.5	1	12.5	1	12.5	3	37.5
Disagree	1	12.5	2	25	1	12.5	5	62.5

The cross tabulation indicates a noticeable association between impact of industries activities and water safety. Higher proportion of respondents agree that industries activities contribute to water pollution and also expressed regards water safety. This implies industrial activities is considered as significant factors that leads to water pollution.

Objective 2

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.228 ^a	3	.746
Likelihood Ratio	1.248	3	.742
Linear-by-Linear Association	.126	1	.723

Hypothesis statement

H₀: There is no significant relationship between water quality and illness due to water consumption

H₁: There is a significant relationship between water quality and illness due to water consumption

Test Statistic

Pearson chi-square test
 $X^2(3)=1.228$

Level of Significance

$\alpha = 0.05$

Decision rule

Reject H₀ if p-value is < 0.05 otherwise do not reject H₀

Conclusion

Since P-value is 0.746 >0.05 we conclude statistically that there is no significant relationship between water quality and illness experienced due to water consumption among people in FUL. This implies illness may not be strongly associated with water quality.

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.489 ^a	4	.975
Likelihood Ratio	.492	4	.974
Linear-by-Linear Association	.258	1	.612

Hypothesis statement

H₀: There is no significant relationship between source of drinking water and illness due to water consumption

H₁: There is significant relationship between source of drinking water and illness due to water consumption

Test Statistic

Pearson chi-square test
 $X^2(3)=0.489$

Level of Significance

$\alpha = 0.05$

Decision rule

Reject H₀ if p-value is < 0.05 otherwise do not reject H₀

Conclusion

Since P-value is 0.975 >0.05 we conclude statistically that there is no significant relationship between source of drinking water and illness due to water consumption among people in FUL. This implies illness may not be strongly associated with sources of water drinking.

Discussion/Recommendation

The Pie-chart distribution shows that female students participated more in the sample of data collection 52.5% while male students accounts for 47.5%. It shows a gender balance and with slight pre-dominance of female students. The bar chart illustrates the distribution of respondents by status within the university. Students constitute the largest group, accounting for 27 respondents, followed by academic staff with 9 respondents. Non-academic staff represent the smallest category, with a total of 4 respondents. This distribution indicates that the sample is predominantly made up of students, which is reflective of the broader population composition within the university setting. Findings highlight significant disparities in perceived water quality across sources within the institution, with sachet water emerging as the most concerning, pointing to the need for improved water safety standards and quality monitoring. Overall, the distribution suggests a clear association between poor waste disposal practices and declining water quality, with the majority of respondents acknowledging waste disposal as a contributing factor to deteriorating water conditions within the study area. This implies that industrial activities is considered as significant factors that leads to water pollution.

Conclusion

In conclusion, statistically there is no significant relationship between water quality and illness experienced due to water consumption among people in FUL. This implies illness may not be strongly associated with water quality. Also since P-value is 0.975 >0.05 study as well concluded that there is no significant relationship between source of drinking water and illness due to water consumption among people in FUL. This implies illness may not be strongly associated with sources of water drinking but it can be other natural phenomenon such as Lokoja temperature, food, life style etc.

Weakness and Future Research

This study is restricted to department of statistics federal university Lokoja. Increasing the scope and frame to extend to other institutions in Nigeria can be a full study.

Authors Contributions

All authors contributed immensely in the aspect of technical writing.

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Ethics

This is the original manuscript; there will be no expectation of any ethical problems.

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