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The Effect Of Water Quality Based on TSS (Total *Suspended Solid*), Nitrate (N) and pH Values on The Public Health Degree of Kediri City

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ABSTRACT
Poor water quality can have a significant impact on public health degrees. TSS (*Total Suspended Solid*), Nitrate (N) and pH parameters are important indicators in determining water quality. This study aims to analyze the effect of water quality based on TSS, Nitrate and pH values on the degree of public health in Kediri City. This study uses an observational quantitative research design with *a cross sectional* approach. The sample of this study amounted to 100 respondents with *a cluster random sampling* technique covering 3 sub-districts in Kediri City. The data analysis method uses *a linear regression* statistical test that looks at the correlation between TSS, Nitrate and pH values on health degrees based on the water quality of the community in Kediri City. Water samples were taken from several river points in Kediri City and analyzed in the PERSADA laboratory. TSS value data is measured using gravimetric method, Nitrate value data is measured using Spectrophotometric, while pH value is measured using pH meter. The results showed that the average TSS value ± 29.6 mg/L (Quality Standard Value according to SNI 6989.3: 2019 is > 50 mg/L), average Nitrate (N) value is 1.24 mg/L (Quality Standard Value according to SNI 6989.79-2011. is 1.6 mg/L) and average pH value ± 7.39 (Quality Standard Value according to SNI 6989.11-2019 is 6-9). For the average value of health degrees based on the water quality of the people of Kediri city, the average ± 30.3 (Max. score of 40). From the results of statistical analysis using *linear regression* The effect of TSS, Nitrate and pH values on health based on the water quality of the Kediri city community, data were obtained on TSS p value = 0.02, Nitrate p value = 0.876 and pH p value = 0.655 (sig. ≤ 0.05). So it can be concluded that the TSS value has a significant effect on the health status of the people of Kediri city. Meanwhile, the value of Nitrate and pH of water has no effect on the health degree of the people of Kediri city. The results of the study show that the values of TSS, Nitrate and pH of water in the city of Kediri still meet the set Quality Standards. The TSS value has an effect on the public health of the city of Kediri. However, the value of Nitrate and pH of water does not affect the health degree of the community in the city of Kediri. High TSS values, high nitrate values and unstable pH correlate with increased cases of water quality-related diseases, such as diarrhea and skin diseases.

Keywords : Public Health Degree, Water Quality, pH (Acidity Degree), Nitrate (N), TSS (Total Suspended Solid)

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INTRODUCTION

Rivers are one of the natural resources that have a vital role in supporting human life, both as a source of clean water, irrigation, fisheries, and other domestic activities. However, increasing human activities around watersheds (watersheds) have led to the degradation of water quality due to pollution from domestic, agricultural, and industrial wastes (Wijayaa and Potalangi, 2024). The expansion of cities and the use of land for industry can be influenced by the high population. Domestic and non-domestic waste production is increasing in line with the growth of settlements and industries (Mela Melisa, Winardi and Desmaiani, 2024). The availability of water resources in quantity and quality is very important to support environmental sustainability and public health. Water sources come from aquifers, springs, rivers, swamps, lakes, lakes, lakes, reservoirs and estuaries (Princesses and Saves, 2024). Water plays an important role in every aspect of human life. Good water quality is essential to improve the quality of life and health. Sewage discharge from domestic sources, agricultural runoff, aquaculture waste, and tourism industry waste have damaged water sources such as rivers and lakes. The discharge of domestic and agricultural sewage around water bodies has resulted in eutrophication and led to uncontrolled growth of plants and algae. This phenomenon damages freshwater ecosystems, including aquatic life (Made, Sukmawati and Rusni, 2019; Kemala *et al.*, 2023)

In Kediri City, there are several industries that can cause a decrease in river water quality. Industries in the city of Kediri include sugar factories, snail processing factories, tofu factories and dense community settlements in city districts, Islamic boarding schools and Mojoroto districts are sources of water pollution in the city of Kediri. The several rivers that pass through the city of Kediri include the Kresek River, the Parung River, the Brantas River and many others are rivers that are water reservoirs from several industries and residential waste. Water quality monitoring involves collecting and evaluating water samples to determine the chemical, physical, and biological quality of water bodies and the causes of changes in water quality in the Kediri City DLHKP, 2025.

Water quality measurement can be seen from several parameters, including Total suspended solids (TSS), Nitrate content and water pH. Total suspended solids (TSS) is a term used to describe the amount of matter or particles suspended in water. TSS reduces the penetration of sunlight into the water, increases the turbidity of the water, and interferes with the growth of organisms in it. To reduce its negative effects, abnormal water quality should be corrected immediately. If the concentration of total suspended solids (TSS) is too high, light cannot enter the water, stopping photosynthesis (Muhaimin, Meliyani and Kurnia, 2024). Meanwhile, nitrates function as an indicator of river water quality because its presence in excessive amounts indicates pollution from human activities such as industrial and agricultural waste runoff, which can accelerate eutrophication and lower dissolved oxygen levels. High nitrate levels also make the water undrinkable and can poison warm-blooded animals, drastically altering aquatic ecosystems (Syeed *et al.*, 2023; Widiyanto, Nuryanto and Suparmin, 2025). Water pH plays an important role in river water quality as an indicator of acidity or alkaline that affects the survival of aquatic biota as well as chemical and biological stability in river ecosystems. pH values that are outside the ideal range (generally 6.5-8.5) can be caused by pollution, such as organic and inorganic wastes, that interfere with the life of organisms and can trigger changes in other water quality parameters (Vikahadi *et al.*, 2023).

This study aims to analyze the effect of water quality based on TSS, Nitrate and pH values on the degree of public health in Kediri City.

METHOD

This study uses an observational quantitative research design with *a cross sectional approach*. This research was carried out in Kediri City which includes 3 sub-districts, namely Islamic Boarding

School District, Kota District and Mojoroto District which was conducted from July 2, 2025 to August 31, 2025. The population in this study is the people of Kediri city who live on the banks of the river and have a poor water quality index. The sampling technique used *a cluster random sampling* technique, by taking a sample of 100 respondents divided from 3 sub-districts. The independent variables in this study were the total value of suspended solids (TSS), Nitrate (N) levels, and water pH measured from river water samples close to residential communities that experienced health status disturbances. The determination of river water sampling points is carried out by considering the location of the inlet or potential point of waste sources entering the main river. The technique used to take samples is grab sample, which is the taking of water in a short period of time. Water samples were taken at 10 points of each river. Meanwhile, the dependent variable in this study is the degree of public health. Public Health status data was obtained by distributing questionnaires to people living on the banks of the river. Operational definition of each variable. Independent Variable Total suspended solids (TSS) is a term used to describe the amount of matter or particles suspended in water. TSS reduces the penetration of sunlight into the water, increases the turbidity of the water, and interferes with the growth of organisms in it (Muhaimin, Meliyani and Kurnia, 2024). Meanwhile, nitrates function as an indicator of river water quality because its presence in excessive amounts indicates pollution from human activities such as industrial and agricultural waste runoff, which can accelerate eutrophication and lower dissolved oxygen levels. High nitrate levels also make the water undrinkable and can poison warm-blooded animals, drastically altering aquatic ecosystems (Syeed *et al.*, 2023; Widiyanto, Nuryanto and Suparmin, 2025). Water pH plays an important role in river water quality as an indicator of acidity or alkaline that affects the survival of aquatic biota as well as chemical and biological stability in river ecosystems. pH values that are outside the ideal range (generally 6.5-8.5) can be caused by pollution, such as organic and inorganic wastes, that interfere with the life of organisms and can trigger changes in other water quality parameters (Vikahadi *et al.*, 2023). The Operational Definition of the dependent variable, namely the Public Health Framework is a description or health condition that occurs in general in the city of Kediri, which is determined by indicators such as the number of illnesses, which are influenced by environmental factors, namely poor water quality (Kurnianto *et al.*, 2024). The instruments used to measure water quality are TSS, Nitrate and pH values of water. TTS value data is measured using the gravimetric method , while Nitrate levels are measured using Sprektrophotometric (Kemala *et al.*, 2023) and The pH value of the water is measured using a pH meter (Saalidong BM *et al.*, 2022). Meanwhile, the instrument to find out the degree of health uses a questionnaire (Vikahadi *et al.*, 2023). The data was analyzed using *a linear regression statistical test* that looked at the correlation between the values of TSS, Nitrate and pH of water to the degree of public health in Kediri City. Water samples were taken from several points in Kediri City and analyzed for TSS, Nitrate and pH values in the PERSADA laboratory using standard Quality Values. The TSS Quality Standard Value according to SNI 6989.3: 2019 is > 50 mg/L), Nitrate Quality Standard Value according to SNI 6989.79-2011. is 1.6 mg/L) and the pH Quality Standard Value of water according to SNI 6989.11-2019 is 6-9). Meanwhile, the Public Health degree uses interval data from the total number of questionnaire scores with a minimum score of 20 and a maximum score of 40. To protect respondents from exploration in the study, the ethical principles used in this study, including *informed consent,* anonymity, and confidentiality, have been carefully handled during the research process. A research ethics approval letter has been obtained from the Research Ethics Committee at STRADA University Indonesia, No.: 0823420/EC/KEPK/I/06/2025, on June 28, 2025.

RESULTS

1. Sample Characteristics

The characteristics of the samples in this study are divided into 2, namely samples from river water taken from 10 points including the Kresek River, Tawang River, Sulter Al-Irsyad, Blabak River, Parung River, Bahudendo River, Open Channel, Kedak River, Brantas River, and Gayam Bridge River. The characteristics of the sample from the Kediri city community are as follows:

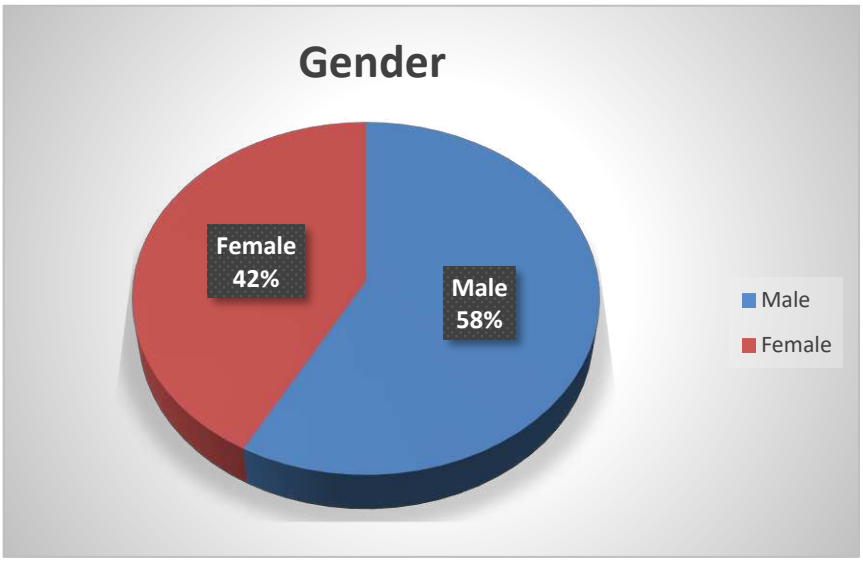

Diagram 1. Characteristics of respondents by gender

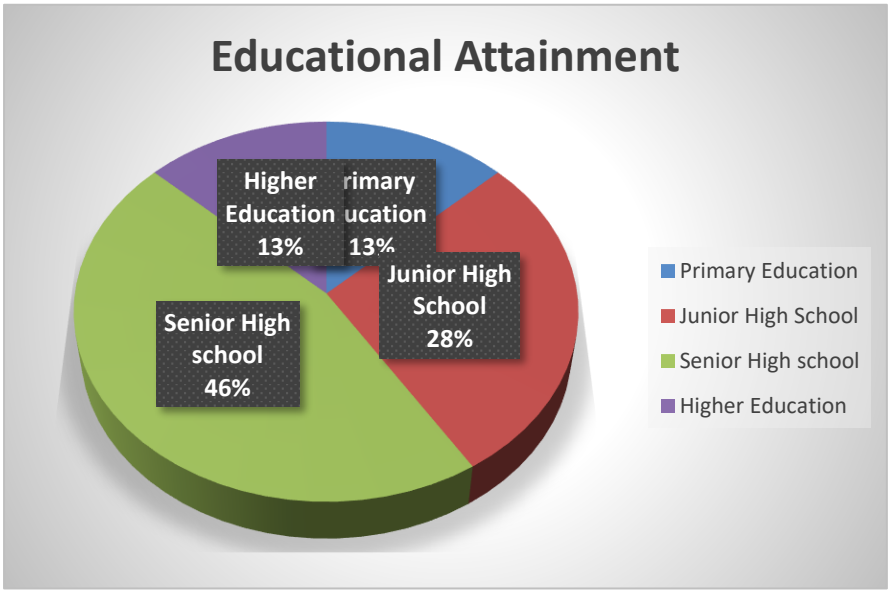

Diagram 2. Characteristics of respondents by Education

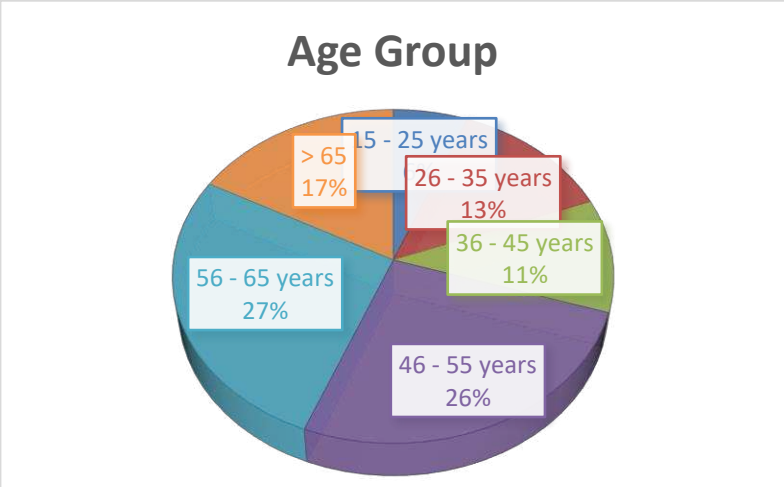

Diagram 3. Characteristics of respondents by age

2. Bivariate Analysis

The results showed that the average TSS value ± 29.6 mg/L, SD ± 25.56 (Quality Standard Value according to SNI 6989.3: 2019 is > 50 mg/L), Average Nitrate (N) value 1.24 mg/L, SD±0.85 (Quality Standard Value according to SNI 6989.79-2011 is 1.6 mg/L) and average pH value ± 7.39, SD ± 0.3 (Quality Standard Value according to SNI 6989.11-2019 is 6-9). For the average value of health degrees based on the water quality of the people of Kediri city, the average ± 30.3, SD ± 4.74 (Max. score of 40). From the results of statistical analysis using *linear regression* The effect of TSS, Nitrate and pH values on health degrees based on the water quality of the Kediri city community, data were obtained on TSS p value = 0.02, Nitrate p value = 0.876 and pH p value = 0.655 (sig. ≤ 0.05). So it can be concluded that the TSS value has a significant effect on the health status of the people of Kediri. Meanwhile, the value of Nitrate and pH of water has no effect on the health status of the people of Kediri city.

Table 1. Descriptive Analysis of TSS, Nitrate, Water pH and Public Health Degree

Table

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
TSS	100	90.00	1.70	91.70	2962.30	29.6230	2.55658	25.56579	653.609
Nitrat	100	3.37	.13	3.50	124.36	1.2436	.08545	.85448	.730
pH	100	.92	6.90	7.82	739.45	7.3945	.03091	.30912	.096
DKAIR	100	20.00	20.00	40.00	3032.00	30.3200	.47437	4.74369	22.503
Valid N (listwise)	100								

2. Bivariate Analysis of TSS Value on Public Health Degree

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.630	1	120.630	5.610	.020[b]
	Residual	2107.130	98	21.501		
	Total	2227.760	99			

a. Dependent Variable: DKAIR

b. Predictors: (Constant), TSS

Table 3. Bivariate Analysis of Nitrate Levels on Public Health Degrees

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.553	1	.553	.024	.876[b]
	Residual	2227.207	98	22.727		
	Total	2227.760	99			

a. Dependent Variable: DKAIR

b. Predictors: (Constant), Nitrat

Table 4. Bivariate Analysis of Water pH on Public Health Degree

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.555	1	4.555	.201	.655[b]
	Residual	2223.205	98	22.686		
	Total	2227.760	99			

a. Dependent Variable: DKAIR

b. Predictors: (Constant), pH

3. Multivariate analysis

The results of the multivariate analysis test using linear regression obtained a p value of 0.118 (sig. ≤ 0.05). So that there is no effect together between TSS values, Nitrate levels and water pH on the Public Health Degree of Kediri city. From the results of the average value of TSS, Nitra and pH of water are all in the normal category in accordance with the standard quality standard value. Meanwhile, the results of the Kediri City Public Health degree questionnaire score with a score of 30 out of a minimum score of 20 and a maximum score of 40. So it can be said that the degree of Public Health in the city of Kediri is in the medium category.

Table 5. Multivariate Analysis of TSS Values, Nitrate and Water pH Levels on the Public Health Degree of Kediri City

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	131.709	3	43.903	2.011	.118[b]
	Residual	2096.051	96	21.834		
	Total	2227.760	99			

a. Dependent Variable: DKAIR

b. Predictors: (Constant), pH, Nitrat, TSS

DISCUSSION

Testing the quality of river water in the city of Kediri based on chemical parameters aims to ensure that river water in the city of Kediri is suitable for use as raw water, in accordance with the quality standards stipulated in the Regulation of the Minister of Health of the Republic of Indonesia Number 02 of 2023. The chemical parameters tested included pH, nitrates, nitrites (NO_2), chromium

valence 6 (Cr^{6+}), iron (Fe), and manganese (Mn). However, in this study, only 3 parameters were used, namely TSS, Nitrate and pH. Based on the data obtained from the results of research taken from 10 river points and open channels including the Kresek River, Parung River, Brantas River, Ngadisimo Psasar River, Veteran Road Open Channel, Tawang River, Al-Irsyad Salter, Blabak River, Bahudendo River and Parung River in the city of Kediri. The average value for TSS ± 29.6 mg/L, SD ± 25.56 (Quality Standard Value according to SNI 6989.3:2019 is > 50 mg/L). This shows that the value of Total suspended solids (TSS) is still within the normal limit, which is less than 50 mg/L. The TSS value shows that the river water in the city of Kediri still has the amount of matter or particles suspended in the water within normal limits so that it allows the growth of organisms in it.

The high content of Total Suspended Solids (TSS) or suspended solids in river water can have a negative impact on human health, especially if the water is used for daily needs without adequate treatment. Journals show that increased TSS in river water contributes to deteriorating water quality and can lead to diseases, such as skin irritation, diarrhea due to bacterial contamination, and even more serious illness if the water also contains other pathogens. In addition, TSS can also affect aquatic ecosystems, which indirectly impacts human health through the loss of food sources and ecosystem changes.

Meanwhile, the results of the Nitrate level test showed average value of Nitrate (N) 1.24 mg/L, SD±0.85 (Quality Standard Value according to SNI 6989.79-2011 is 1.6 mg/L) from 10 sampling points. Nitrate levels in river water It serves as an indicator of river water quality because its presence in excessive amounts indicates pollution from human activities such as industrial and agricultural waste runoff, which can accelerate eutrophication and lower dissolved oxygen levels. High nitrate levels also make the water undrinkable and can poison warm-blooded animals, drastically altering aquatic ecosystems (Syeed *et al.*, 2023; Widiyanto, Nuryanto and Suparmin, 2025). Excessive exposure to nitrates in river water can lead to health problems, especially in infants and children, such as methemoglobinemia (*Blue Baby Syndrome*) because it interferes with the ability of red blood cells to transport oxygen, and has the potential to increase the risk of neural tube defects in the fetus as well as some types of cancer. Based on non-carcinogenic risk analysis, the severity of the risk increases with age, with infants and children having the highest potential risk when nitrate levels exceed safe limits set by regulators such as the USEPA (Sailaukhanuly *et al.*, 2024).

The condition of nitrate levels in a number of rivers and open channels in the city of Kediri is still within normal limits that do not exceed the standard quality values. So that it does not harm the public health of the city of Kediri. However, efforts still need to be made so that river water is free from polluted materials that can cause health problems.

Test results on the pH of river water and open channels at 10 points show the results The average pH value ± 7.39, SD ± 0.3 (Quality Standard Value according to SNI 6989.11-2019 is 6-9). From the results of the pH test, the condition of river water and open channels in the city of Kediri is still within normal limits. Water pH plays an important role in river water quality as an indicator of acidity or alkaline that affects the survival of aquatic biota as well as chemical and biological stability in river ecosystems. pH values that are outside the ideal range (generally 6.5-8.5) can be caused by pollution, such as organic and inorganic wastes, that interfere with the life of organisms and can trigger changes in other water quality parameters (Vikahadi *et al.*, 2023).

The results of the measurement of the degree of public health of the city of Kediri who live on the banks of the river from 100 respondents were obtained an average value of health degree based on the water quality of the people of Kediri city on average ± 30.3 (Min. score of 20 and Max. score of 40). So that the degree of Public Health of the city of Kediri is obtained based on water quality in the medium category. From the results of the research questionnaire, it was found that less than 5%

of people experienced health problems due to poor water quality, including diarrhea, skin pain (itching) and dysentery.

The results of the test The linear regression statistical analysis in bivariate analysis obtained TSS value data with a p value of = 0.02, Nitrate content with a p value of = 0.876 and a pH value with a p value of = 0.655 (sig. ≤ 0.05). So it can be concluded that the TSS value has a significant effect on the health status of the people of Kediri city. Meanwhile, the value of Nitrate and pH of water has no effect on the health status of the people of Kediri city. From the results of the multivatiat test, a p value of ≤ 0.118 (sig. ≤ 0.05) was obtained. So that with the joint test of TTS, the Nitrate and pH levels of the water have no effect on the Public Health Degree of the city of Kediri.

Statistical analysis shows that TSS, nitrate, and pH have an impact on health. This is because total suspended solids (TSS), nitrate, and pH are key water quality parameters that directly affect public health and aquatic ecosystems. All three are indicators of pollution that can cause disease if the water is consumed or used for daily needs. High TSS causes high turbidity. This blocks sunlight from entering the water, which reduces the productivity of aquatic organisms and disrupts the ecosystem. TSS also becomes a place for pathogenic microorganisms (bacteria/viruses) to attach. Water with high TSS is usually cloudy and unfit for drinking. High turbidity protects pathogens from disinfectants (such as chlorine), making it easier for bacteria that cause diarrhea and other intestinal diseases to survive and infect humans. (Shed, 2023; Sailaukhanuly *et al.*, 2024)

Consuming water with high nitrate levels is very dangerous, especially for infants. Nitrate in the body turns into nitrite, which binds to hemoglobin and reduces the blood's ability to carry oxygen, causing methemoglobinemia or "blue baby syndrome." In the long term, nitrate can increase the risk of cancer, such as colorectal cancer. Water with a low pH (acidic) can corrode pipes, produce an unpleasant taste, and trigger digestive problems and skin irritation. Water with a high pH (alkaline) can reduce the effectiveness of disinfection, risking the persistence of pathogenic bacteria in drinking water. These three factors collectively determine whether water is safe to use, regardless of its quality (Moon *et al.*, 2024; Sebaran *et al.*, 2024) . (Moon *et al.*, 2024; Sebaran *et al.*, 2024)

Although there are many factories and several *home industry* businesses in the city of Kediri, Types of companies that can have an impact on the quality of river water in Kediri City include: tofu industry, Santren sugar factory, household waste. They still pay attention to the disposal of waste from the rest of the industry. Waste before being discharged into the river has been treated at WWTP (Wastewater Treatment Plant) in each factory or home industry in the city of Kediri. This cannot be separated from the control carried out by the Kediri City Environment, Hygiene and Parks Service (DLHKP).

A Wastewater Treatment Plant (WWTP) is an integrated system designed to clean domestic, commercial, and industrial wastewater from contaminants (chemicals, organics, heavy metals, and pathogens) before it is discharged into the environment. These facilities aim to protect human health, prevent water pollution, and support environmental sustainability (Pramaningsih *Et Al.*, 2023; Wijayanto, Adeko And Gazali, 2025). Efforts made by the Kediri city government in increasing the water quality index by requiring every new housing development permit to use communal WWTP. Communal WWTP means a Wastewater Treatment Plant (WWTP) that is designed to serve several households, buildings, or areas jointly or centrally, so that domestic liquid waste from activities such as baths, kitchens, and toilets can be treated collectively and safer before being discharged into the environment. This system is an important sanitation solution to prevent environmental pollution and diseases caused by waste. In addition, the Kediri city government also requires all companies or *Home Industry* in the city of Kediri to treat its wastewater before it is discharged into environmental

media (rivers, open channels, etc.). Kediri city government policy to require all companies to build IPAL in accordance with regulations the Minister of Forestry Environment (LKH) no. 22 of 2021 (Shed, 2023; Stuart and Stuart, 2024). In order to prevent water pollution caused by domestic waste, the Kediri city government also built SANIMAS (Community-Based Sanitation), a national program that aims to provide and manage wastewater and sanitation facilities and infrastructure for the community, especially in low-income residential areas, slums, and urban areas. This program involves community empowerment in the planning, construction, and maintenance of sanitation facilities to improve access to proper sanitation, environmental cleanliness, and public health in a sustainable manner.

CONCLUSION

The study confirms that water quality parameters in Kediri City's rivers—TSS (average 29.6 mg/L, below SNI standard of 50 mg/L), Nitrate N (1.24 mg/L, below 1.6 mg/L), and pH (7.39, within 6-9)—remain within acceptable limits, supporting a medium public health degree (average score 30.3/40). Bivariate analysis reveals a significant individual effect of TSS (p=0.02) on health outcomes, potentially linked to elevated turbidity and pathogen carriage causing diarrhea and skin issues, while Nitrate (p=0.876) and pH (p=0.655) show no influence; however, multivariate regression (p=0.118) indicates no combined effect, challenging the initial hypothesis of synergistic impacts from all parameters.

These findings underscore TSS as the primary concern amid effective local interventions like communal WWTPs and SANIMAS, which maintain overall safety. Future research should test hypotheses on TSS-pathogen interactions via longitudinal sampling and microbial analysis; readers and policymakers are recommended to prioritize TSS monitoring, enforce stricter industrial sedimentation controls, and expand community education on water treatment to prevent health risks.

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