Analysis of the Biological Quality of Clean Water in the Taha Qur'an Education Park

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Abstract: Clean water is a source of basic needs for all forms of life. Water quality must be ensured before use, and water sources must be monitored regularly. The use of unclean water is one of the causes of skin diseases. Various age groups can be affected by skin diseases, especially the age group of children, who are still vulnerable. The purpose of this study was to determine the quality of clean water in the Taha Qur'an Education Park, which was reviewed biologically. This type of research is Descriptive Qualitative. The population in this study were all the water taps in the Taha Qur'an Education Park. The selection of all samples as a population was due to the fact that there were only two water taps at the Taha Quranic Education Park. Based on the results of biological quality tests, including Coliform tests and *Escherichia coli* tests obtained in water, it is known that the results of the coliform test obtained in sample A were 10 MPN / 100ml and in sample B 168MPN / 100 ml, and the results of *Escherichia coli* in sample A were 15,000 MPN / 100ml and in Sample B 5,000 MPN / 100ml. The water used by the students is still considered unfit for consumption due to the presence of coliform and *Escherichia coli* bacteria, which can cause disease in humans. Treatment is needed to reduce the bacterial content in the sanitation facilities at the Taha Quranic Education Park.

Keywords: Clean Water; Coliform; *Escherichia Coli*.

Introduction

Water is an environmental medium that is inseparable from human life. However, with the advancement of technology, water pollution has become increasingly widespread, resulting in a decline in water quality. A healthy and unpolluted environment can be seen, among other things, in the quality of the water used by humans as a basic support for their daily activities [1].

Water is a primary means of improving public health, as it is a medium for transmitting various diseases. Clean water is clear, colorless, fresh, and odorless. By providing clean water and meeting daily needs, communities have undertaken a self-funded effort to dig wells. Access to clean water is essential for daily life. Water, land, and people are inseparable [2]. Humans are one of the living creatures that have the greatest need for clean water. They require water for drinking, cooking, washing, and other daily activities [3]. The water they use can come from surface water or groundwater. Surface water refers to water that pools on the surface of the ground, such as in reservoirs and rivers, whereas groundwater sources encompass water from drilled wells, dug wells, and other sources [4]. When using water for consumption and household purposes, the water used must be clean. The quality of the clean water used meets health requirements and is free from contamination. If groundwater and surface water are contaminated, germs will automatically spread to the water source used for household purposes [5].

One of the determining factors in human health is environmental cleanliness. Water plays a significant role in human life. Poor water quality also affects the health of the surrounding environment, negatively impacting the ecosystem and other living organisms. The clean water sources are generally found in layers of soil or rock beneath the surface [4]. Groundwater plays a crucial role as the primary source of water for meeting basic human needs [6].

The primary source of groundwater is rainwater, which infiltrates the soil. Groundwater has several disadvantages compared to other water sources, as it contains high concentrations of minerals. These minerals, including magnesium, calcium, and iron, contribute to hardness [7]. The primary challenge facing water resources is the inability of water quantities to meet increasing demand, as well as the declining quality of water for domestic use over time. Industrial, domestic, and other activities, such as agriculture, have a negative impact on water resources [8].

Water quality can be analyzed through physical, chemical, and biological methods. Biological parameters assess water quality by examining the presence of microorganisms such as coliforms and *Escherichia coli*. Coliform bacteria are a group of intestinal bacteria that live in the human digestive tract [9]. Coliform bacteria are naturally present in the environment, including soil, plants, and the digestive tracts of warm-blooded animals. The presence of coliforms in water often indicates contamination from sources that can carry dangerous pathogens such as *Escherichia coli* [10].

Using water that does not meet standards can cause health problems. These health problems can include both infectious and non-infectious diseases. Infectious diseases spread directly through water are called waterborne diseases. Non-infectious diseases caused by water

consumption occur when the water is contaminated with hazardous or toxic substances [11]. Clean water should not contain excessive amounts of chemicals. Clean water that meets health requirements must be free from pollutants and must meet quality standards [12].

In Islam, water quality is highly emphasized, particularly in relation to the concept of purity and purification (thaharah). Water is considered pure if its natural properties (color, odor, and taste) are not altered by impurities or other substances. Water containing E. coli bacteria should not be used for ablution if the contamination changes any of the water's three properties: color, taste, or odor. E. coli is an indicator of fecal contamination or human/animal waste, which is classified as impure in Islamic jurisprudence.

Taha Quranic Education Park is one of the Quranic Education Parks located in Sanggar District, Bima Regency. The number of students at Taha Quranic Education Park is 111. To improve the quality of teaching and learning activities at Taha Quranic Education Park, access to clean water is a crucial factor in supporting various activities within the Quranic Education Park. Water use within the Quranic Education Park includes bathing, washing, toileting, ablution, and other activities.

Research Methods

The type of Research used is descriptive Qualitative, where biological water quality testing is carried out, including coliform tests and *Escherichia coli* tests on tap water used by students and teachers. The research data will be presented. This Research was conducted in June 2025. The sampling location was carried out in the Taha Qur'an Education Park in Bima Park and then analyzed at the Environmental Service of Dompu Regency. The population in this study were all the water taps in the Taha Qur'an Education Park. The selection of all samples as a population was due to the fact that there were only two water taps at the Taha Quranic Education Park. The sample in this study was a 3-3-tap sampling technique. The tools and materials used in sampling include sterile sample bottles, a medical mask, a label, a bolus point, a sample box containing an ice pack, latex, and alcohol [13].

The test conducted in this study employed the most probable number method, which involves testing procedures, calculations, and reporting of total coliform and *Escherichia coli* test results in water. The coliform test consists of a dilution, a presumptive test, and a confirmatory test, while the *Escherichia coli* test consists of a dilution and an *Escherichia coli* test [14].

The dilution stage begins with preparing 9 test tubes and labeling each tabbing with the signs $10^{-}1$, 10^{-2}, 10^{-3}, filling each test tube with 9 ml of sterile distilled water that has been measured using a measuring cup, adding 1 ml of sample each 1 ml using a dropper pipette into the tube that has been filled with sterile distilled water in the 10^{-1} dilution tube, then shaking to mix homogeneously, adding 1 ml of sample from the 10^{-2} dilution, then shaking to mix homogeneously, adding 1 ml of sample from the 10^{-2} dilution into the 10^{-3} dilution tube, then homogenizing, treatment in points 3-5 is carried out 3 times in other reactions [15].

The predictive test is carried out by fixing the mouth of the LBDS media tube on a Bunsen flame, then adding 5 ml each from the $10^{-}1$ dilution tube into 3 LBDS media tubes, and re-fixing the test tube and closing it with cotton. Fixing the mouth of the LBSS media tube, then adding 1 ml each from the 10^{-2} dilution tube to 3 LB (Lactose Broth) media, and re-fixing the test tube and closing it with cotton. Fixing the mouth of the LBSS media tube then adding 0.5 ml each from the 10^{-3} dilution tube into 3 LBSS media, and re-fixing the test tube and closing it with cotton, Homogenizing slowly in all tubes so that the sample spreads evenly throughout the media, Incubating all tubes at 37ºC for 24-48, Observing the presence of air bubbles in the Durham tube and recording the code A positive tube emits gas and observes the color change that occurs, a positive reaction occurs if the medium changes from green to yellow [16].

The confirmation test is carried out by taking water samples from positive LBDS and LBSS tubes, which are indicated by the presence of bubbles in the Durham tube and a change in the color of the media, then inserting 2 drops into the 2% BGLB tube, incubating the BGLB media at 37 ºC for 24-48 hours. The presence of gas in the BGLB confirms the presence of E. coli in the water sample, and records the number of tubes that show a positive confirmation test. Next, a complementary/perfection test is carried out by transferring the EMBA from the test tube to a petri dish aseptically. Sterilize the ose wire by heating it until it glows over a flame until the base of the ose wire tip. Open the cotton plug, then heat the mouth of the tube over a flame while moving it left and right twice. Take a small amount of culture from the 2% BGLB media in the tube by the corner of the wire that has been incandescent. When taking it, it is recommended to attach the hot ose wire to the edge of the tube so that it is not too hot. Take a petri dish containing EMBA media that has hardened or solidified. Scratch the culture on the ose wire into the dish containing EMBA media on the top, bottom, right, left, and middle. Label it, and incubate all petri dishes at 37°C for 24-48 hours. The presence of shiny black streaks (metallic red black colonies) on EMBA agar media or metallic green with black dots on EMBA media colonies confirms the presence of *Escherichia coli* in the water sample [16].

After all the tests have been carried out, the final step is to calculate the number of coliforms in the water sample. The number of coliforms in the water sample is calculated using the following formula [17]:

$$\text{CFU Formula} = \frac{\text{Number of Colonies}}{\text{Number of Petri}}$$

Results and Discussion

Taha Quran Education Park is one of the educational parks in Bima Regency. Open since 2022, the park currently has 111 students and 10 teachers. The park also features a dormitory, although it is currently not in use.

This study was conducted to analyze the water quality at the Quran Taha Education Park with biological parameters. The source of clean water at the Quran Taha Education Park comes from dug well water and is distributed through a pipe network and is used directly without going through a previous treatment process. Before sampling the tap water, sterilization is carried out at the

mouth of the tap to prevent contamination. Sampling must pay attention to the proper use of the Operational Unit, sampling that is not carried out according to the rules is feared to produce contaminated samples that affect the testing process and cause the results of the examination or test to be invalid [18].

The Result of the examination of Coliform bacteria and *Escherichia coli* can be see in the following table.

Table 1. Result of Biological Quality of Clean Water Parameters of Total Coliform

Sample	Total Coliform CFU/100 Ml	PERMENKES No 2 Year 2023	Result
A	10	0 CFU/100 ml	Not Eligible
B	168		Not Eligible

Table 2. Result of Biological Quality of Clean Water Parameters of *Escherichia coli*

Sample	Eschericia Coli CFU/100 Ml	PERMENKES No 2 Year 2023	Result
A	15,000	0 CFU/100 ml	Not Eligible
B	5,000		Not Eligible

Based on the results table presented above, it can be seen that several samples do not meet the Environmental Health Quality Standard, as specified in PERMENKES Number 2 Year 2023, namely 0 CFU/100ml.

Biological Quality of Clean Water: Parameters of Total Coliform

Based on the analysis results, the first sample of raw water was recorded at 10/100 ml, and the second sample at 168/100 ml.

Coliform bacteria contamination in water can originate from various sources, such as contaminated raw materials, inadequate distribution, or unhygienic water storage. Coliform bacteria are a group of microorganisms often used as indicators of pollution, as their presence can indicate whether a water source has been contaminated by pathogens. Practically, pathogen monitoring can be done by testing for the presence of pollution indicator organisms, such as coliform bacteria [19]. These bacteria originate from the same sources as pathogens and are generally more numerous than the more dangerous pathogens. Furthermore, the handling of coliform bacteria in the environment, wastewater treatment plants, and water treatment plants shares many similarities with the handling of other pathogens. Therefore, testing for the presence of coliform bacteria is a rational method to indicate the presence of other pathogenic bacteria in the environment [20].

Clean water examination with biological parameters in the Male Dormitory at the Abu Hurairah Islamic Boarding School in Mataram was also carried out and obtained total Coliform results in Sample A of 18 MPN / 100ML, sample B of 46 MPN / 100ML, sample C of 230 MPN / 200 mL and sample B of 0 MPN / 100ml. The high Coliform count in this study was attributed to the entry of household waste, which is the primary source of biological pollution. The waste comes from the kitchen, bathroom and human waste. Waste management that is not properly managed can lead to environmental pollution, which can have a detrimental impact on human health [21].

The types of coliform bacteria that can cause diarrhea are divided into two groups: fecal coliforms and non-fecal coliforms. This group of bacteria includes *Escherichia coli*, which originates from animal or human feces. Therefore, the presence of *Escherichia coli* in water indicates that the water is contaminated with human feces. The non-fecal coliform group includes enterobacteraerogenesis, which is found in dead animals or plants [22].

Coliforms are a group of microorganisms found in the digestive tracts of humans and animals. Coliform bacteria are used as indicators because they can provide clues as to whether a water source has been contaminated by pathogenic bacteria. The presence of these bacteria in water indicates that the water has been contaminated by feces containing intestinal pathogens, making it unsafe for consumption. Criteria for clean water include being tasteless, odorless, and colorless, as well as being free from chemical contaminants such as heavy metals and microbiological contamination. Furthermore, clean water must also be free from coliform contamination [23].

Coliform bacteria are one of the indicators of poor water and sanitation conditions, as well as inadequate food processing hygiene. Coliform bacteria are bacteria that are mostly found in animal and human feces, and are included in the Enterobacteriaceae family, classified as aerobic, rod-shaped, gram-negative bacteria, and are able to ferment lactose by producing acid and gas at a temperature of 35 °C in 48 hours [24].

Biological Quality of Clean Water: Parameters of *Escherichia coli*

Analyzing *Escherichia coli* (*E. coli*) in clean water quality is crucial for assessing the safety and cleanliness of water sources. *Escherichia coli* is a bacterium commonly found in the intestines of humans and animals, and its presence in clean water often indicates fecal contamination that can carry dangerous pathogens [25].

The primary concern is the adverse impact of poor water quality on human health. Water can be a medium for the spread of certain diseases, such as diarrhea, because it is an ideal place for the life of pathogenic bacteria, including *Escherichia coli*. Based on the results of the *Escherichia coli* examination, the count was 15,000 CFU/100 mL in

sample A and 5,000 CFU/100 mL in sample B. E. coli can live in open soil, and when pollution occurs (usually organic pollution characterized by high BOD), the soil becomes a good medium for this bacterium, which causes an increase in the concentration of *Escherichia coli* in the soil. When it rains, these bacteria are carried by groundwater into rivers, resulting in high concentrations of *Escherichia coli* being detected in both groundwater and rivers, which indicates soil contamination. The level of contamination is also influenced by seasonal factors and the intensity of waste from land-based activities [26].

Fecal *E. coli* bacteria enter the water through river flow and rainwater runoff, causing bacterial abundance to increase during rainy seasons. This condition is caused by the concentration of organic matter (N and P), changes in salinity and temperature, and increased light intensity. E. coli can grow well at temperatures between 8°C and 46°C, with an optimum temperature below 37°C. Although coli bacteria examination results cannot directly indicate the presence of pathogenic bacteria, the presence of coli bacteria in water can be used as an indicator of the presence of pathogenic organisms [27].

Based on the results of a study on the microbiological quality of water in Beringinharjo Traditional market, microbiological parameter tests showed that seven samples tested positive for Escerichia Coli and coliform, exceeding quality standards. The presence of wet waste accumulated on the ground surface and animal waste can penetrate the soil and then flow with the groundwater. Observations revealed numerous piles of garbage and numerous gutters and drainage channels, which could potentially lead to seepage into the well [28].

Another study examining clean water quality using biological parameters was also conducted in the South-Central Timor Regency. The results showed that the *Escherichia coli* and total coliform content in raw water in the Tondano River watershed were below the 5000 quality standard. In the first sample, *Escherichia coli* was recorded at 13/100 ml, with total coliform at 14/100 ml; in the second sample, *Escherichia coli* was 1.8/100 ml, with total coliform at 340/100 ml; and in the third sample, *Escherichia coli* was 0/100 ml, with total coliform at 40/100 ml. These values are still below the quality standards stipulated in Government Regulation No. 82 of 2001 concerning water quality treatment and water pollution control. For clean water, which must meet the quality standard 0 in accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 492 of 2010 concerning drinking water quality, the first sample showed an E. coli content of 13/100 ml and a total coliform content exceeding the quality standard. This was caused by the direct discharge of household waste into the Tondano Watershed area [29].

Escherichia coli was initially isolated from feces. The high level of E. coli contamination in clean water sourced from dug wells can be influenced by several factors, including the distance between the dug well and the septic tank. A septic tank that is too close, less than 10 meters, can result in high levels of E. coli contamination. Bacteriological contamination from the pollutant source to the dug well water source can move vertically or horizontally. The movement of E. coli bacteria, along with the vertical and horizontal flow of water, allows them to enter the soil pores, ultimately contaminating the dug well water [30].

Wells must be located higher than sources of pollution, such as toilets, livestock pens, garbage dumps, and so on, and must be at least 15 meters from the source of pollution. The construction of dug wells can be made of permanent bricks and some can also be made of concrete with a well diameter of approximately one meter and a well depth of between 7-10 meters. Limited land area results in the distance between the septic tank and dug well being close and does not meet requirements. Maintenance of sanitation facilities such as wells and pipes is carried out at least once a year. The choice of clean water facilities is adjusted to the source of clean water used [31].

Consuming water that does not meet quality requirements can cause health problems. Infectious and non-infectious diseases can occur when consuming water that does not meet the required standards. *Escherichia coli* bacteria are used as indicators of hygiene and sanitation in food and drinking water of poor quality. *Escherichia coli* belongs to the Coliform group of bacteria, which are rod-shaped, facultative anaerobic, and Gram-negative bacteria, and are part of the natural flora in the mammalian intestine. They consist of pathogenic *Escherichia coli*, which naturally live in the digestive tracts of humans and animals, and pathogenic strains of *Escherichia coli* that cause diarrhoea, infections, and poisoning. Clean water in the Quran, as mentioned in Taha Park, is used for ablution. The practice of ablution involves several actions that increase the risk of exposure due to water contaminated with *Escherichia coli*. Actions in the practice of ablution that can increase contamination are Gargling (madhmadhah): This is the most direct way bacteria can enter the digestive system, Washing the nose (istinsyaq): Bacteria can enter the respiratory tract or be swallowed through this action, Skin/Eye Contact: Although the risk of systemic infection through healthy skin is low, contaminated water can cause irritation or infection if there is an open wound or contact with the eyes. [32].

Conclusion

Based on the research conducted, it can be concluded that the biological Quality of the Clean water in the Taha Qur'an Education Park does not meet the Environmental Health Quality Standard, as per PERMENKES No. 2 year 2023. The set quality standards are 0 CFU/100 ml for both parameters, namely, total coliforms and *Escherichia coli*. Several samples, such as sample A and B in the total Coliform test, did not meet the Quality Standards because there were still coliform bacteria in sample A of 10 CFU/100ml and Sample B of 168 CFU/100ml, while in the *Escherichia coli* test, samples A and B contained Very High *Escherichia coli* bacteria, namely 15,000 CFU/100ml. Based on the results, the research provides advice to management at Taha Quran Education Park to regularly check and maintain the source of clean water and to treat the water by adding chlorine as a disinfectant to kill bacteria. In this way, the quality of clean water will meet the requirements and prevent queues, ensuring that people are not affected by diseases caused by microbial contamination.

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