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Clean water self-sufficiency and well water filtration method education for health workers in gowa regency

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ABSTRACT

The quality of well water in Jenemadingi hamlet does not meet health standards. As a result, cases of diarrhea and stunting are also high. The purpose of this community service is to provide training in water purification techniques. This educational method is carried out in five stages: the socialisation stage and the implementation stage. This activity comprises three sessions: the first stage, which includes a pre-test administered through a questionnaire, utilising lecture, question-and-answer, and discussion methods; the post-test and evaluation of post-test results; the technology implementation stage; the monitoring and evaluation stage; and the program sustainability stage. The results of the community service activity indicate that the socialization of clean water and sanitation education is beneficial for the community, as the community's knowledge has significantly improved. The average score increased from 20.22 in the pre-test to 23.18 in the post-test, with a p-value of 0.001, indicating a significant difference. These results confirm the effectiveness of the clean water and sanitation education program.

Keywords: Cadres; Borehole Water; Clean Water; Filtration.

INTRODUCTION

The use of clean water can meet individual needs, thereby maintaining health and preventing disease with ease. A common source of clean water found in both rural and urban areas, currently utilised by the community, is the dug well. Groundwater from drilled or dug wells originates from soil layers relatively close to the surface, making it susceptible to contamination from seepage of human and animal waste, as well as domestic household use [1] [2]. Construction requirements for dug well placement must be met to ensure that the groundwater extracted can provide clean water that meets established water quality standards. Groundwater boreholes are created by drilling non-solid soil using large borehole equipment. The structure of these boreholes is highly dependent on aquifer conditions and water quality, resulting in different types of structures. The depth of water wells typically ranges from 60 meters to 200 meters, primarily intended for office buildings or residential areas. Human activities in daily life can also cause water quality to deteriorate, making the water unusable as expected. Such water conditions are referred to as contaminated water. Water contamination occurs due to the introduction of foreign substances such as domestic waste [3] [4] [5].

Groundwater obtained from boreholes contains dissolved iron in the form of ferrous iron (Fe2+). When exposed to air (oxygen), Fe2+ oxidises to ferrihydrite (Fe3+), which can precipitate and turn yellowish-brown. This phenomenon can severely stain porcelain utensils and laundry; therefore, it is dangerous when used for cooking or drinking purposes. Typically, at such depths, water quality is often suitable for household use. Several conditions must be met, including clear and non-turbid water, colourless and tasteless; a neutral pH level; freedom from harmful chemicals; a low hardness level; and the absence of pathogenic bacteria, such as Escherichia coli [6] [7] [8].

Gowa Regency is one of the regencies in the province of South Sulawesi. It is bordered to the north by Maros Regency and Bone Regency, to the east by Sinjai Regency and Bantaeng Regency, to the south by Takalar Regency and Jeneponto Regency, and to the west by Makassar City and Takalar Regency. In 2020, it had an area of 1,983.32 km² and a population of 952,896, with a population density of 480 people per km². Kampili Village consists of 4 hamlets, one of which is Je, Nemadingin Hamlet, located east of Kampili Village.

Clean water is one of the necessities for human life. The community of Jenemadingi Village utilises dug wells as a source of clean water for consumption (without prior treatment) [9]. The use of clean water in daily life includes activities such as bathing, washing clothes, kitchen activities, and bathroom/toilet use, as well as serving as the primary source of drinking water [10]. Based on the results of observations conducted by students participating in the Field Learning Experience (PBL 1 FKM UMI) in Jenemadingi Village, the pH level was found to be 6.19, sulfate (SO_4) 385.47, and organic matter ($KMnO_4$) 0.10 mg/l (quality standard for organic matter: 10 mg/l).

The results of the water quality examination of dug wells in Jenemadingi Village showed a sulfate (SO_4) concentration of 385.47 mg/l. This sulfate concentration exceeds the quality standards for clean water (271 mg/L) and drinking water (250 mg/L). The iron content of the dug well water was measured at 0–1.10 mg/l. The iron content of the dug well was 0–0.17 mg/l. The study's results at the exact location revealed that 45.7% of the 10 dug wells had iron levels exceeding the quality standards for clean water, and 35.5% of the 10 dug wells had microbiological levels that did not meet health standards. The conclusion is that the quality of clean water in Jenemadingi hamlet is unhealthy and does not meet health standards. Regarding the existing conditions of the partner, there is a need

for training in the utilization of innovative water purification technology in the village. The partner profile comprises environmental health cadres established in 2023, consisting of 15 members who are community members empowered in the field of health. The task of these cadres is to assist health center staff in monitoring environmental health issues in the working area of Jenemadingi Village, Gowa Regency.

METHODS

The stages of community service include:
Socialization/activity survey stage
The forms of surveys conducted include:

a. Community water quality survey (water sample collection and examination in the laboratory)
b. Survey of potential water sources in terms of water discharge, adequacy of water quantity/discharge, especially in the dry season.

Figure 1: Discussion between partners and PKM Dikti students

Training stages

Lecture method

In the Lecture Method, materials related to clean water quality and the use of pomegranate plants are presented. 10–15 people attend this Lecture Method.

Demonstration Plot Method

In the Demonstration Method, guidance is provided on how to clarify turbid water. We also offer guidance on its use and maintenance, ensuring the community can utilise and maintain it with full awareness.

Technology Implementation Phase

Implementation of appropriate technology

a. Implementation of appropriate technology for well water using filtration methods.
b. Measurement of the physical and chemical quality of well water before and after the implementation of filtration methods
c. Education on maintenance techniques for well water that has undergone filtration

RESULT

Table 1. Education on the Effects of Well Water Quality on Health in Jenemadingi

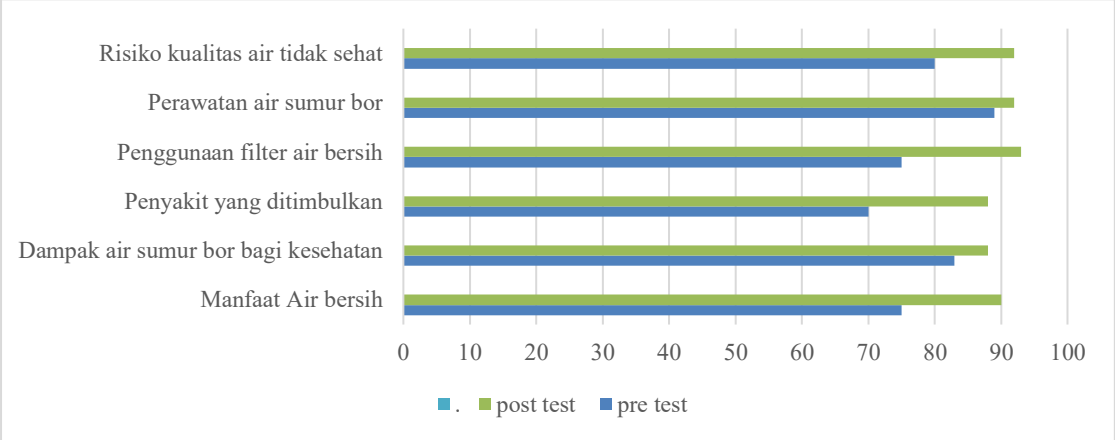
Result	Lowest value	Highest value	Maximum value	Mean rate	Standar deviasi	P-value
Pre test	20	24	28	20,22	3,28	0,001
Post test	28	26	28	23,18	5,48	

Table 1 shows the results of the well water sanitation education program for the community. This program was measured through pre-tests and post-tests conducted before and after the education was implemented. The pre-test results showed the lowest score of 20 and the highest score of 28, with an average of 20,22.

Table 2: Measurement of clean water quality

	Before treatment (NTU	After treatment (NTU)
Well 1	225	155
Well 2	255	175
Well 3	235	196
Weel 4	198	175
Weel 5	189	154

Based on the data in Table 2, it is evident that the water quality of well 1, before treatment (225 NTU), improved to 155 NTU after treatment. For well 2, the initial value (before treatment) was 255 NTU, and it decreased to 175 NTU after treatment. For Well 3, the turbidity before treatment was 235 NTU, and after treatment it was 196 NTU. For Well 4, the turbidity before treatment was 198 NTU, and after treatment it was 175 NTU. For Well 5, the turbidity before treatment was 189 NTU, and after treatment it was 154 NTU.



Based on Graph 1 related to clean water socialization, the results include: the benefits of clean water from the pre-test (77%) and posttest (90%), the impact of healthy water on health from the pre-test (82%) and posttest (89%), and diseases caused by clean water from the pre-test (70%) and posttest (89%). Use of well water filters in the pre-test (73%) and posttest (93%), maintenance of healthy water in the pre-test (89%) and posttest (92%), and risks of unhealthy water quality in the pre-test (80%) and posttest (92%).

DISCUSSION

The implementation of the Community Service Program (PKM) took place on Tuesday, July 8, 2025, at the Kampili Village Office, Pallangga Sub-district, Gowa District, one of the villages under the guidance of the University of Muslim Indonesia. This training and educational outreach activity was attended by 15 participants, who are health and environmental cadres. The results of this activity showed enthusiastic responses from participants eager to learn about clean water management using clean water filtration methods. This was evident from several participants who asked questions about the process, the tools used, and the ratio of materials employed. During the implementation of the Community Partnership Program (PKM), the UMI PKM team carried out a community service program in the form of training/mentoring on clean water filtration. Among the team's achievements were: The residents of Kampili Village gained knowledge on proper water management. The implementation of the PKM activity in the form of training on water purification techniques for community partners in Kampili Village, Palangga District, Gowa Regency, has been published on the online media platform Fajar.

Figure 2 Socialization and Education Activities on Water Purification Techniques and the Use of Guava Plants in the Prevention of Diarrhea and Stunting

In this activity, partners actively participate and support the entire series of PKM activities. For each dissemination and demonstration plot activity, partners prepare a location for implementing PKM activities. The partner also prepares the location and introduces appropriate technology for water purification techniques, which requires the partner's participation in a series of activities, especially in the educational sessions [11] [12] [13].

In this study, an analysis of iron (Fe) content was conducted on the sample before undergoing aeration treatment. This was done to determine the extent of the reduction that occurred. The initial iron (Fe) level was found to be 2.3 mg/l, making the water quality unfit for consumption and failing to meet the requirements of Ministry of Health Regulation No. 416/MENKES/PER/Lx/1990, which stipulates a limit of 1.0 mg/l. The pre-test standard deviation was 3.27, indicating variation in values among participants. The issue of limited water sources in certain areas has caused serious health problems for the people living there. Therefore, it is very important to ensure the availability and management of clean water to support the community's livelihood [14].

The quality and quantity of clean drinking water affect people's standard of living; therefore, access to fresh drinking water should be a human right that is fairly distributed throughout society [15]. Water treatment measures are necessary to meet the community's demand for drinkable water. Surface water consists of rainwater that does not seep into the ground; it can be further categorised as coming from rivers, lakes, or swamps. River surface water is one category that is often used as a raw material source, provided its quality remains good and it still meets health standards [16] [17] [18].

The health education activity began with the distribution of pretest evaluation materials to the residents in attendance [19]. The purpose of the pretest was to measure the participants' initial level of knowledge before they received the educational materials. After the residents completed the pretest, the education team continued by providing education using the lecture method. This method was chosen to provide participants with direct and systematic information regarding water well sanitation education for the community. After the education session was completed, the residents were then given a post-test containing a questionnaire. This posttest served to measure the residents' understanding after participating in the education session, allowing for a comparison of the results between the pre-test and post-test to assess the changes in knowledge that occurred.

CONCLUSION

The clean water and sanitation education outreach activity was beneficial for the community, as their knowledge increased significantly. The average score increased from 20.22 on the pre-test to 23.18 on the post-test, with a p-value of 0.001 indicating a significant difference. These results confirm the effectiveness of the clean water and sanitation education program.

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