



RESEARCH PAPER

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Assessing public awareness and knowledge of drinking water safety in Carmen, Cagayan De Oro City, Philippines

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ABSTRACT

This study evaluates public awareness and knowledge of drinking water safety in Carmen, Cagayan de Oro City, Philippines. A survey conducted among 20 residents revealed that while most respondents trust the safety of their drinking water, awareness of water quality factors is low. Only 40% of respondents paid attention to local water quality. Satisfaction levels were high: 40% very satisfied, 55% somewhat satisfied, and 5% not happy with their drinking water. Many respondents expressed confidence in the safety of their drinking water and had few concerns. However, knowledge about factors affecting water quality was limited, with respondents identifying only 4.15 out of 20 factors on average. The top recognized factors included the treatment process (65%), color (60%), raw water type (60%), odor (50%), and taste (40%). Less recognized factors were total hardness, disinfection byproducts, inorganic matter, pH, and organic matter.

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INTRODUCTION

Access to safe and readily available water is crucial for public health, encompassing uses such as drinking, domestic activities, food production, and recreation. The primary aim of providing safe drinking water is to reduce human exposure to chemical and physical hazards found in polluted water, as well as to eliminate waterborne infections. Consequently, national and municipal authorities, alongside public water system administrators, must adhere to strict regulations and consistently monitor water supply systems to safeguard public health.

Water quality is a dynamic phenomenon, frequently altered by both anthropogenic and natural events, with human activities having the most significant impact. Population growth, urbanization, and industrialization have all led to increased waste production, which in turn has extensively polluted recipient aquatic bodies. Domestic and industrial discharges, along with agricultural runoff, introduce a variety of contaminants, including raw sewage, detergents, fertilizers, heavy metals, chemical compounds, oils, and solid waste. These physical, chemical, and biological pollutants each have adverse effects on human health and the economy.

Human beings rely more heavily on safe, clean water than any other species. As such, authorities worldwide have established maximum allowable limits for known pollutants and water quality parameters to ensure access to safe drinking water. Water treatment and disinfection techniques are implemented to maintain the water's purity and safety.

The World Health Organization's criteria for drinking water quality also address the public's perception and acceptance of drinking water. Public attitudes toward drinking water safety and contamination incidents must not be overlooked. Raising environmental awareness is a key element in promoting public participation in environmental affairs. Numerous studies have shown that the success of pollution prevention efforts relies significantly on enhancing

environmental consciousness among the general public. Educating people about the importance of clean drinking water is essential for encouraging the use of household water treatment systems, enabling informed decisions about water sources, and minimizing the risk of unintentional contamination at home. Despite water suppliers implementing treatment systems, poor maintenance of water distribution networks remains a widespread issue in many regions. Even in highly urbanized cities like Cagayan de Oro, complaints about dirty water due to damaged or leaking pipelines are common. This indicates that a sustainable water management system requires not only robust infrastructure but also an engaged citizenry. Public actions significantly impact water quality, water demand, and the political will to develop and enforce critical water policies and infrastructure. The success of public environmental participation is dependent on an adequate understanding of environmental issues (Hoedjes, 2014; Mihaly, 2009).

Building an engaged citizenry is a vital component in transitioning to more sustainable water management practices (Marlow *et al.*, 2013; Vorosmarty *et al.*, 2010; Zhang *et al.*, 2012; Vairavamoorthy *et al.*, 2015). Water-related challenges demand a holistic approach that includes cognitive engagement (knowledge and understanding), emotional engagement (concern and supportive attitudes), and behavioral engagement (adoption of civic and household practices that promote sustainable water management) (Dean *et al.*, 2016). Engaged individuals comprehend, value, and actively support essential improvements in technology, investment, and legislation related to sustainable water management.

Research has shown that simply providing clean drinking water is not enough (Wang *et al.*, 2018). Public perceptions of drinking water safety and contamination events must be taken into account. According to Doria (2010), the general public is an important factor in water management. According to the International Water Association (IWA), standards should be focused on human health

protection and consumer acceptability (IWA, 2004). Public acceptability of drinking water also forms part of the World Health Organization's guidelines for drinking water quality (WHO, 2011). Thus, public perceptions of drinking water safety and contamination incidents should not be discounted (Mahler *et al.*, 2015; Means, 2002).

Therefore, this study aims to evaluate public awareness in Barangay Carmen, Cagayan de Oro City, about safe drinking water quality characteristics. The findings will be instrumental in guiding community information campaigns and potentially integrating relevant topics into formal science education in schools.

MATERIALS AND METHODS

To assess public awareness and knowledge regarding drinking water safety, a survey was conducted in Barangay Carmen, Cagayan de Oro City. Barangay Carmen, with a population of 77,756 according to the 2020 Census, accounts for 10.65%

of the total population of Cagayan de Oro City. The barangay boasts a dynamic economy with a blend of small and large commercial enterprises. Many residents are employed in sectors such as tourism, agriculture, and manufacturing. The area is well connected by various public transportation options, including jeepneys, tricycles, and taxis, ensuring ease of mobility.

The survey aimed to determine the level of public awareness about the significance of drinking water safety and to gather information related to water safety. It was administered to 20 residents, representing 20 households in Carmen. The questionnaire, adapted from the study by Wang *et al.* (2018), consisted of six main questions. Respondents were also asked to provide demographic information, including age, sex, and educational background. To maintain confidentiality, participants were issued a confidentiality agreement. The survey questionnaire is depicted in Fig. 1.

Drinking Water Safety Awareness Survey	
This survey questionnaire is designed to evaluate the public awareness on drinking water safety and water safety-related knowledge.	
Confidentiality Agreement The researcher agrees to keep all the research information shared with confidentiality by not discussing or sharing the personal information of the respondents in any form or format with anyone other than the Researcher. Ronnie L. Besagas Researcher	
Name: _____	
Address: _____	
Demographic Information	
Age (year)	☐ 21 – 30 ☐ 51 – 65 ☐ 41 – 50 ☐ above 65 ☐ 31 – 40
Sex	☐ Male ☐ Female
Highest Educational Degree Earned	☐ Elementary ☐ High School ☐ Bachelor's Degree ☐ Master's Degree ☐ Doctorate Degree ☐ Post Doctorate
Survey Questions 1. What kind of water do you use as the main source of your drinking water? (Choose one) ☐ Tap water ☐ Bottled water ☐ Well water ☐ Spring water ☐ Others (specify) _____	
2. Do you pay attention to local drinking water quality? (Choose one) ☐ Special attention ☐ Comparatively high attention ☐ No concerned ☐ No answer	
3. Are you satisfied with your drinking water quality? (Choose one) ☐ Very satisfied ☐ Relatively satisfied ☐ Dissatisfied ☐ No answer	
4. Do you trust the safety of your drinking water? (Choose one) ☐ Confident ☐ Relatively satisfied ☐ Dissatisfied ☐ No answer	
5. Do you have any problems with your tap water quality? (Choose one) ☐ Never had problems ☐ Had problems once or twice a year ☐ Had problems frequently ☐ No answer	
6. What factors can affect the quality of tap water? _____ _____	

Fig. 1. Drinking water safety awareness survey questionnaire

RESULTS AND DISCUSSION

Demographic information of the respondents

Twenty residents from each household in Carmen, Cagayan de Oro City, were polled to determine their level of awareness and knowledge about water safety. Fig. 2 depicts the respondents' demographic information. The majority of respondents, 35% and 30%, are between the ages of 31–40 and 41–50, respectively, with the remainder, 15%, falling between the ages of 51–65. The respondents have high school and college educational levels (bachelor's degree) and are predominantly female (70%).

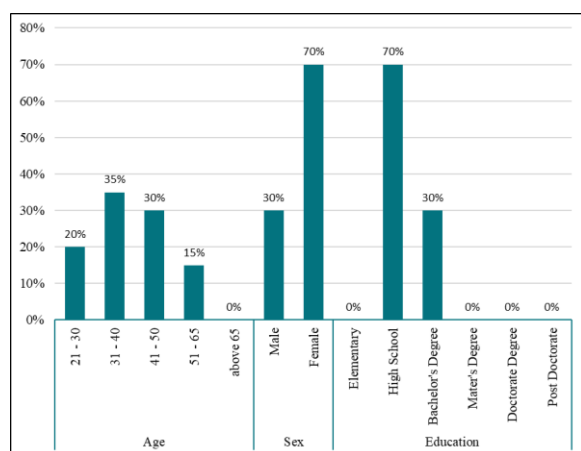


Fig. 2. The demographic information of the respondents

Water safety awareness

Fig. 3 shows the results of a survey on public awareness of drinking water safety. The most common source of drinking water indicated by respondents was tap water (65%), followed by bottled water (35%). Only a few people choose bottled water as their primary source of drinking water. Research shows that when people are unhappy with their tap water, they often buy bottled water (Van Der Linden, 2015; Hyun and Tae, 2015).

With regards to the attention the public gives to local water quality, the survey revealed that 40% of respondents paid attention to local water quality, 30% paid comparatively high attention, and 20% were not concerned about local drinking water quality. The degree of public satisfaction with drinking water is quite high. Forty percent of those polled said they are

very satisfied with the quality of their drinking water, while 5% said they are dissatisfied. Similar findings can be observed in terms of public trust in the safety of drinking water. The majority of the respondents said that they trust the safety of their drinking water, with 30% being confident and 65% being relatively confident. Satisfaction and trust in drinking water quality can be related mostly to respondents' perceptions of water quality. Water quality is perceived by the public in terms of aesthetic features such as turbidity, rust color, or an unpleasant taste or odor (Wang *et al.*, 2018).

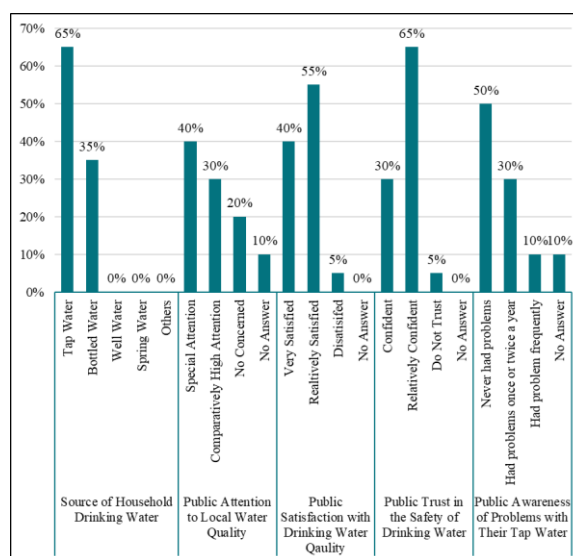


Fig. 3. Public awareness about water safety

If the general public knew more about how water is treated and how important all of the parameters of water quality are, their level of satisfaction and trust in the quality of drinking water might change.

Undesirable aesthetic qualities of water, such as unpleasant taste, smell, or appearance, are the usual problems people encounter in their drinking water for reasons that they are noticeable. As shown in the survey results, 50% of the respondents said that they had no issues or problems with their tap water, 30% said they had encountered problems once or twice a year, 10% had problems frequently, and 10% had no answer. However, many water quality problems are imperceptible to our senses, and because many people are unfamiliar with the many water quality indicators for drinking water, they may not bother to

inquire about them. This could explain why the majority of respondents reported having no or few concerns with their tap water.

Factors affecting drinking water quality

The results of a public knowledge survey about the different factors affecting drinking water quality are displayed in Fig. 4. The top five factors that were identified by the respondents are the treatment process (65%), color (60%), type of raw water (60%), odor (50%), and taste (40%).

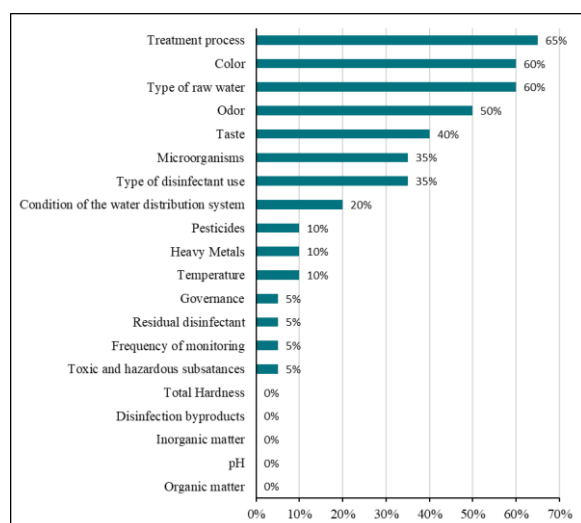


Fig. 4. Public awareness on the different factors affecting water quality

As expected, included in the top 5 factors are color, odor, and taste, which are related to the sensory properties of drinking water. The bottom five factors are total hardness, disinfection byproducts, inorganic matter, pH, and organic matter, which no single respondent has identified as factors that affect the quality of drinking water. These five parameters at the bottom are indicators of water quality that are imperceptible to the human senses. On the other hand, despite the fact that governance appears to be a practical and obvious choice as the foundation of a good water management system, only 5% of respondents identified it as a factor affecting water quality. In this survey, respondents identified an average of 4.15 factors, with a standard deviation of 1.95. In other words, this poll demonstrates a low level of public water-related knowledge, with respondents identifying an average of 4.15 ± 1.95 factors out of 20.

These findings serve as the basis for information and education campaigns aimed at content areas where water-related knowledge is lacking. Numerous aspects of water-related knowledge are almost certainly connected with general literacy. Thus, this highlights the need for formal education, particularly in science education, and nonformal education such as information obtained from the media, government, social media, and other sources to enhance water-related knowledge and, ultimately, water literacy of the public. Publicizing the government's drinking water quality report on television, in print, or online could improve public satisfaction, awareness, and understanding of the science underlying safe and high-quality drinking water.

CONCLUSION

The population being surveyed for water safety awareness and water-related knowledge has a low level of awareness of the various factors that influence water quality. The public is only aware of factors that are perceptible to the senses, while they have little to no knowledge of factors that are imperceptible to the senses. This highlights the need to promote public awareness of drinking water quality and knowledge of drinking water safety through formal education or informal education, such as information gathered from the media, the government, social media, and other sources.

RECOMMENDATIONS

Proactive actions can be expedited if there is an active involvement of the public. For this to happen, people must be well informed and knowledgeable enough of what does it mean to have a quality and safe drinking water. An awareness and educational campaign that promote environmental and health awareness among people can be conducted.

Science teachers can use the findings of this research in the delivery of their teaching-learning process and strengthen the integration of ecological resource management, conservation, and protection in the academic curricula. This will also make students understand how science works and appreciate science as

a way of knowing. In such way students may be motivated to engage in science and consider pursuing a career in science.

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