



Evaluating residents' health awareness about drinking water in Al-Baha region, Saudi Arabia

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ABSTRACT:

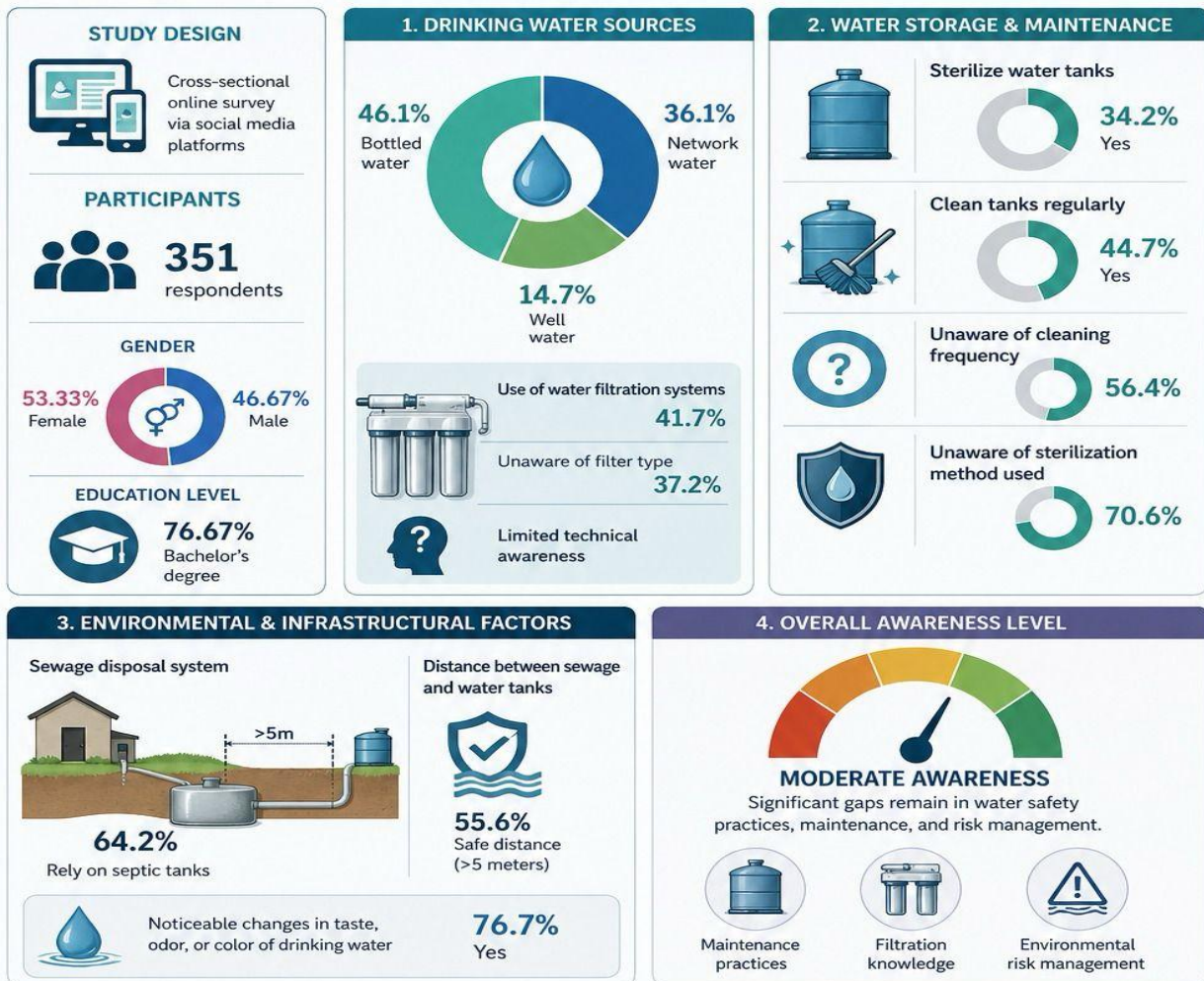
This study was conducted to assess the level of health awareness regarding drinking water among residents of the Al-Baha region in Saudi Arabia. A cross-sectional design was employed, and data were collected through an online questionnaire distributed via social media platforms. A total of 351 participants responded and were included in the final analysis. The demographic characteristics of the participants showed a relatively balanced gender distribution, with females representing 53.33% and males 46.67%. The majority of respondents held a bachelor's degree (76.67%), indicating a generally well-educated population. With regard to drinking water sources, bottled water was the most commonly used (46.1%), followed by network water (36.1%) and well water (14.7%). Despite this, only 41.7% of participants reported using water filtration systems, while a considerable proportion (37.2%) were unaware of the type of filter used, reflecting limited technical awareness. In terms of water storage practices, only 34.2% of respondents reported sterilizing their water tanks, and 44.7% indicated that they cleaned them regularly. Notably, more than half of the participants (56.4%) were unaware of the frequency of tank cleaning, and 70.6% did not know the type of sterilization method used. These findings suggest significant gaps in proper water maintenance practices. Environmental and infrastructural factors also revealed potential risks. A large proportion of participants (64.2%) relied on septic tanks for sewage disposal, and although 55.6% reported a safe distance (more than 5 meters) between sewage and water tanks, others reported shorter distances that may increase the risk of contamination. Importantly, a high percentage of participants (76.7%) reported noticeable changes in the taste, odor, or color of their drinking water, which may indicate possible water quality issues. Overall, the findings demonstrate moderate awareness among residents; however, several critical gaps remain in water safety practices, particularly in tank maintenance, filtration knowledge, and environmental risk management. These results underscore the need for targeted public health interventions and awareness campaigns to improve safe water consumption and storage practices.



Health Awareness and Practices Regarding Drinking Water Among Residents of Al-Baha Region, Saudi Arabia



BACKGROUND: Safe drinking water is essential for health. This study assessed the level of health awareness and practices related to drinking water sources, treatment, storage, and environmental risks among residents of the Al-Baha region.



KEY TAKEAWAY

While residents demonstrate moderate awareness regarding drinking water, critical gaps exist in tank maintenance, filtration knowledge, and environmental risk management, which may compromise water safety.

RECOMMENDATIONS

- Implement targeted public health education campaigns on safe water storage and treatment.
- Raise awareness about filtration systems and maintenance.
- Promote regular tank cleaning and proper sterilization methods.
- Strengthen environmental monitoring and regulations to minimize contamination risks.

Graphical Abstract: Bridging the Gap Between Awareness and Practice: Drinking Water Safety in Al-Baha Region, Saudi Arabia



1- Introduction

Access to safe and clean drinking water is widely recognized as a fundamental pillar of public health and a key determinant of human well-being. Safe water is essential not only for hydration but also for maintaining hygiene and preventing the transmission of infectious diseases. Despite significant global progress in water supply systems, unsafe drinking water continues to pose a serious public health challenge. It is estimated that approximately 1.7 billion people worldwide still rely on drinking water sources contaminated with fecal matter, exposing them to a high risk of waterborne diseases (WHO, 2023). Such contamination is strongly associated with illnesses including diarrhea, cholera, dysentery, and typhoid, which remain major contributors to morbidity and mortality, particularly in developing regions. As illustrated in **Figure 1**, ensuring the safety of drinking water extends beyond the provision of improved water sources to include maintaining water quality throughout the entire supply chain, from source to point of use. Although access to

basic drinking water services has improved globally, nearly one-quarter of the world's population still lacks access to safely managed drinking water (WHO, 2024). These disparities highlight the ongoing challenges related to infrastructure, environmental conditions, and population growth, which continue to affect water quality and accessibility. Public awareness and individual behavior play a critical role in preserving water safety at the household level. Even when water is adequately treated at centralized facilities, it can become contaminated during distribution, storage, or handling. Improper storage practices, lack of regular cleaning of water tanks, and insufficient disinfection measures can facilitate microbial growth and recontamination. It has been reported that inadequate water, sanitation, and hygiene (WASH) practices contribute to approximately 1.4 million deaths annually worldwide (Prüss-Ustün et al., 2019). These findings emphasize that behavioral factors and awareness are essential components in reducing water-related health risks.

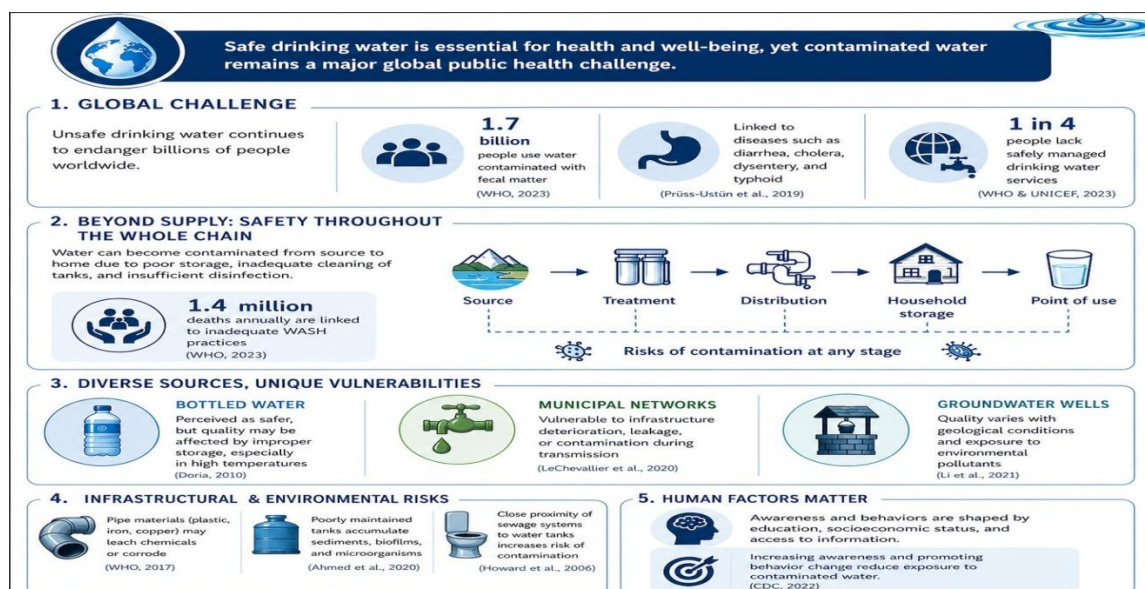


Figure 1. Conceptual framework illustrating global challenges, contamination pathways, and key determinants of drinking water safety, including environmental, infrastructural, and behavioral factors (Source: Original data obtained from current study).

In many regions, including Saudi Arabia, drinking water is obtained from a variety of sources such as bottled water, municipal distribution networks, and groundwater wells. Each of these sources presents

unique characteristics and potential vulnerabilities. Bottled water is often perceived as a safer option; however, its quality may be compromised by improper storage conditions, particularly under high temperatures



. Municipal water systems rely on extensive distribution networks that may be affected by infrastructure deterioration, leakage, or contamination during transmission (Mallick et al., 2021). Groundwater sources are also subject to variability in quality depending on geological composition and environmental exposure to pollutants . In addition to water sources, infrastructure-related and environmental factors play a crucial role in determining water safety. The materials used in water distribution systems, such as plastic, iron, or copper pipes, can influence water quality through chemical leaching or corrosion processes (Zhu et al., 2024). Furthermore, the condition and maintenance of water storage systems, particularly underground and overhead tanks, are critical in preventing contamination. Poorly maintained tanks can accumulate sediments, biofilms, and microorganisms, significantly compromising water quality . Environmental factors, particularly the proximity of sewage systems to water storage facilities, represent another important source of risk. In areas where septic tanks are commonly used, insufficient separation distances between sewage and drinking water tanks can increase the likelihood of contamination, especially in the presence of high groundwater levels or flooding (UNICEF & World Health Organization, 2023a). Inadequate wastewater management has been widely identified as a major contributor to water pollution and associated health hazards . Despite the importance of these factors, public knowledge and awareness regarding safe drinking water practices remain variable and, in many cases, insufficient. Educational level, socioeconomic status, and access to health information significantly influence individuals' understanding of water safety and their adoption of appropriate practices. Previous studies have shown that improving community awareness and promoting behavioral change are among the most effective strategies for reducing exposure to contaminated water and improving health outcomes (CDC, 2022).

The Al-Baha region in Saudi Arabia represents a unique setting where multiple water sources and diverse household practices coexist. However, there is a lack of comprehensive data assessing residents' awareness, attitudes, and behaviors related to drinking water safety in this region. This gap limits the ability of policymakers and public health authorities to design

targeted interventions and implement effective strategies to improve water quality and reduce health risks (Ministry of Environment, Water and Agriculture, 2023). Therefore, this study aims to evaluate the level of health awareness among residents of the Al-Baha region with respect to drinking water. The study focuses on key aspects including sources of drinking water, knowledge and use of filtration systems, water storage and maintenance practices, and environmental factors that may influence water quality. By providing a detailed assessment of these components, this research seeks to support the development of evidence-based public health interventions aimed at improving drinking water safety and protecting community health (Centers for Disease Control and Prevention, 2022a).

2. Materials and Methods

2.1 Study Design

This study adopted a cross-sectional research design to systematically evaluate the level of awareness, attitudes, and practices of residents regarding drinking water in the Al-Baha region. A cross-sectional approach is widely used in public health research to assess population characteristics, behaviors, and exposures at a single point in time, providing a reliable snapshot of prevailing conditions (Levin, 2006). This design is particularly appropriate for studies examining knowledge and practices related to environmental health issues, such as water safety.

2.2 Data Collection

Data were collected using a structured, self-administered questionnaire developed specifically for this study. The questionnaire was designed and distributed through the Google Forms platform, which facilitates efficient data collection, management, and accessibility. Online surveys are increasingly recognized as effective tools for collecting data from large and geographically dispersed populations (Evans & Mathur, 2018).

The survey link was disseminated through various social media platforms to maximize outreach among residents of the Al-Baha region. Participation was voluntary, and informed consent was implied through the completion of the questionnaire. All responses were collected anonymously to ensure confidentiality and to reduce social desirability and reporting bias, which are common concerns in self-reported data (Tourangeau R



et al., 2000). The data collection process was carried out during the summer of 2025, providing a contemporary assessment of the residents' awareness and practices regarding drinking water safety.

2.3 Study Population

The study population consisted of residents of the Al-Baha region who had access to the online questionnaire during the data collection period. A total of 351 participants completed the survey and were included in the final analysis. The sample included both male and female respondents and encompassed a range of educational levels and living conditions. Such diversity enhances the external validity and representativeness of the findings within the study context (Setia MS, 2016).

2.4 Questionnaire Content

The questionnaire was carefully structured to capture comprehensive information regarding drinking water awareness and practices. It consisted of multiple sections covering the following domains:

- **Sociodemographic characteristics:** including gender and level of education, to examine their potential influence on water-related behaviors.
- **Source of drinking water:** identifying primary water sources such as bottled water, municipal supply, or alternative sources.
- **Water filtration practices:** assessing the use, types, and maintenance of household water filtration systems.
- **Water storage practices:** evaluating storage methods, including the types of containers and materials used.
- **Maintenance and sanitation practices:** examining the frequency and procedures for cleaning and disinfecting water storage tanks.
- **Environmental factors:** including sewage systems, proximity to contamination sources, and perceived risks to water quality.
- **Sensory characteristics:** assessing participants' perceptions of taste, odor, and color, which may reflect water quality and influence consumption behavior.

The questionnaire primarily consisted of close-ended questions to facilitate quantitative analysis and improve reliability and consistency in responses (World Health Organization, 2017).

2.5 Statistical Analysis

The collected data were coded, verified, and entered into the Statistical Package for the Social Sciences (SPSS), version 20, for analysis. Data cleaning procedures were performed to ensure accuracy and completeness prior to analysis. Descriptive statistical methods were applied, including frequencies and percentages for categorical variables, to summarize the data and present the distribution of responses in a clear and interpretable format. Descriptive analysis is a fundamental approach in cross-sectional studies to provide an overview of population characteristics and behavioral patterns (World Health Organization, 2017).

3. Results

This study was conducted on random residents in Al-Baha region, Saudi Arabia, to evaluate their health views on drinking water that they consumed through an electronic questionnaire.

The demographic characteristics of the study participants, along with their reported practices and conditions related to drinking water in the Al-Baha region, are illustrated in Figures 2. With respect to gender distribution, the study sample consisted of a slightly higher proportion of females compared to males. Specifically, females accounted for 53.33% ($n = 192$) of the participants, whereas males represented 46.67% ($n = 168$), as shown in Figure 2. This reflects a relatively balanced representation of both sexes, with a modest predominance of female respondents. Regarding educational attainment, the majority of participants held a bachelor's degree, comprising 76.67% ($n = 276$) of the sample. A smaller proportion had attained postgraduate qualifications, with 3.06% ($n = 11$) holding a master's degree and only 0.83% ($n = 3$) holding a doctoral degree. Additionally, 19.44% ($n = 70$) reported other educational backgrounds. As illustrated in Figure 2, these findings indicate that the sample was predominantly composed of individuals with undergraduate-level education.

In terms of housing status, most participants reported owning their residences, representing 63.33% ($n = 228$).



of the sample. Meanwhile, 33.61% ($n = 121$) lived in rented accommodations, and a small minority (3.06%, $n = 11$) indicated other housing arrangements. As depicted in Figure 2, this suggests that a considerable proportion of respondents have direct control over their domestic water systems and infrastructure.

Concerning sources of drinking water, bottled water was the most commonly reported source, used by 46.1% ($n = 166$) of participants. This was followed by water supplied through the public distribution network (36.1%, $n = 130$). A smaller proportion relied on well water (14.7%, $n = 53$), while 3.1% ($n = 11$) reported alternative sources. These patterns, shown in Figure 2, reflect a notable reliance on commercially packaged water.

With regard to water filtration practices, 41.7% ($n = 150$) of participants reported using water filters in their households. In contrast, 21.1% ($n = 76$) indicated that they did not use any filtration systems, while 37.2% ($n = 134$) were uncertain about whether filtration systems were in use. As illustrated in Figure 2, this suggests limited awareness or engagement in household water treatment practices.

Among those who reported using filtration systems, the most commonly identified types included porcelain filters (7.8%, $n = 28$), cotton filters (7.5%, $n = 27$), and activated carbon filters (4.2%, $n = 15$), whereas gypsum filters were rarely reported (0.3%, $n = 1$). However, a substantial majority of participants (80.3%, $n = 289$) were unable to specify the type of filter used. This distribution, as presented in Figure 2, highlights a considerable knowledge gap regarding water filtration technologies.

Regarding the materials used in indoor water distribution networks, plastic pipes were the most frequently reported (36.1%, $n = 130$), followed by iron (7.8%, $n = 28$) and copper (2.2%, $n = 8$). Notably, more

than half of the participants (53.9%, $n = 194$) were unaware of the materials used in their household systems. As shown in Figure 3, this reflects limited awareness of infrastructure-related aspects of water supply. In terms of water tank maintenance, only 34.2% ($n = 123$) of participants reported that their upper and lower water tanks were regularly sterilized. In contrast, 41.7% ($n = 150$) indicated that sterilization was not performed, and 24.2% ($n = 87$) were unsure. Among those who reported sterilization, chlorine was the most commonly used disinfectant (24.7%, $n = 89$), followed by ozone (4.7%, $n = 17$), while a large proportion (70.6%, $n = 254$) were unaware of the type of sterilizing agent used. These findings are further illustrated in Figure 3. Similarly, regarding cleaning practices, 44.7% ($n = 161$) of participants reported that their water tanks were cleaned periodically, whereas 31.1% ($n = 112$) indicated that no cleaning was performed, and 24.2% ($n = 87$) were uncertain. Among those who reported cleaning, only 4.2% ($n = 15$) indicated weekly cleaning, 15.8% ($n = 57$) reported monthly cleaning, and 23.6% ($n = 85$) reported annual cleaning. More than half of the respondents (56.4%, $n = 203$) were unaware of the cleaning frequency. As depicted in Figure 2, this indicates inconsistent maintenance practices. Finally, regarding the depth of underground water storage tanks, approximately 24.2% ($n = 87$) reported a depth of 3 meters, while 22.8% ($n = 82$) indicated depths of 4 meters and an equal proportion reported 5 meters. The remaining 30.3% ($n = 109$) reported other depths. As illustrated in Figure 2, this variation reflects differences in construction practices and household infrastructure.

Overall, the findings illustrated in Figures 2 and 3 reveal varying levels of awareness and practices related to drinking water safety among residents of the Al-Baha region, with notable gaps in knowledge regarding filtration systems, infrastructure materials, and maintenance procedures

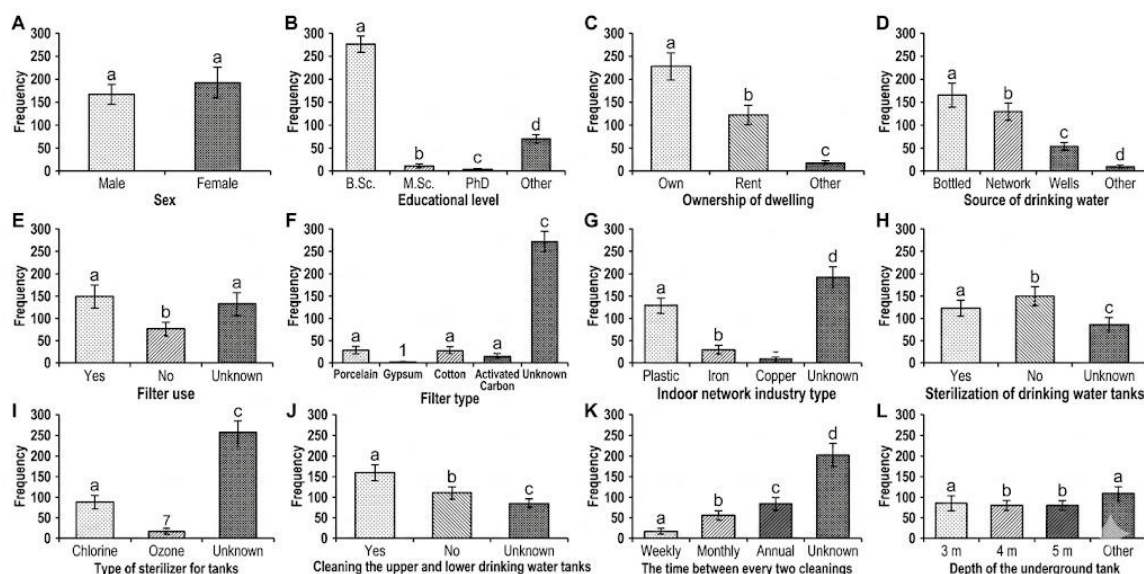


Figure 2: Comprehensive statistical analysis of drinking water-related issues in the Al-Baha region (N = 360). Bars represent frequency, with error bars denoting Standard Deviation (SD). Lowercase letters (a, b, c, d) indicate statistically significant differences within each category ($p < 0.05$) derived from post-hoc analysis.

Additional findings regarding environmental conditions and perceived drinking water quality among participants are illustrated in Figure 3.

With respect to wastewater management systems, the majority of participants (64.2%, $n = 231$) reported relying on septic tanks as their primary sewage disposal method. In contrast, 21.9% ($n = 79$) were connected to centralized sewerage systems, while 13.9% ($n = 50$) were uncertain about the type of system used. This distribution suggests a predominant dependence on decentralized wastewater management systems within the study area. Regarding the spatial relationship between septic tanks and drinking water storage systems, more than half of the participants (55.6%, $n = 200$) indicated that the distance exceeded 5 meters. However, a considerable proportion reported shorter distances, including 22.2% ($n = 80$) at approximately 5 meters, 15.8% ($n = 57$) at 2 meters, and 6.4% ($n = 23$) at less than 1 meter. As shown in Figure 3, these findings raise potential concerns about the risk of contamination, particularly in cases where the separation distance is minimal. In terms of environmental risks, 65.6% ($n = 236$) of participants reported no occurrence of septic tank overflow or elevated groundwater levels in their area. Nevertheless, 18.3% ($n = 66$) indicated the presence of such issues, while 16.1% ($n = 58$) were uncertain. These responses,

as illustrated in Figure 3, suggest that a notable portion of the population may be exposed to environmental conditions that could compromise water safety. When assessing the occurrence of waterborne disease outbreaks, the majority of respondents (73.6%, $n = 265$) reported no history of epidemics associated with drinking water. However, 7.2% ($n = 26$) indicated that such incidents had occurred, while 19.2% ($n = 69$) were unsure. Although the reported prevalence of outbreaks appears relatively low, the proportion of uncertain responses highlights a potential lack of awareness regarding public health events.

Finally, participants' perceptions of the sensory characteristics of drinking water revealed that a substantial majority (76.7%, $n = 276$) reported the presence of noticeable attributes such as taste, odor, or color. In contrast, only 14.4% ($n = 52$) indicated the absence of such characteristics, while 8.9% ($n = 32$) were uncertain. As depicted in Figure 3, these findings may reflect underlying issues related to water quality and could influence public perception and consumption behavior. Overall, the results illustrated in Figure 3 indicate that environmental conditions, infrastructure factors, and sensory perceptions of water quality vary considerably among participants, with potential implications for both public health and water safety practices in the region.

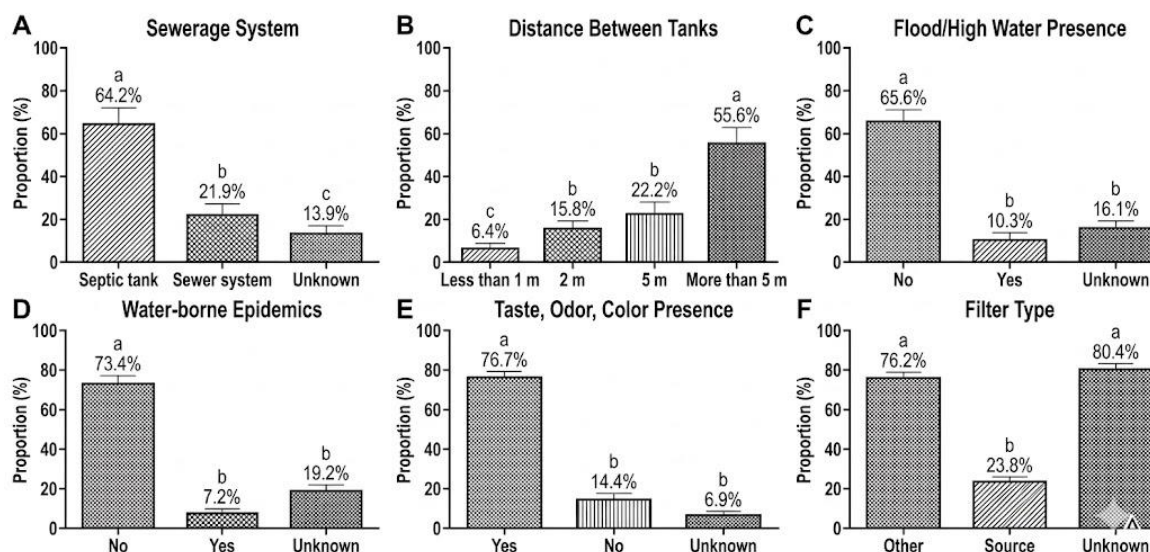


Figure 3: Analysis of environmental and structural factors associated with drinking water safety and potential health risks in the Al-Baha region.

4- Dissection

The findings of the present study provide important insights into drinking water awareness and practices among residents of the Al-Baha region, revealing a multidimensional gap between knowledge, perception, and behavior. Although the overall level of awareness appears moderate, several critical deficiencies persist in practical implementation, technical understanding, and environmental risk management. These findings are consistent with recent literature emphasizing that access to water alone does not guarantee safety, as household-level practices and awareness play a decisive role in determining water quality at the point of use (World Health Organization, 2023b).

One of the most prominent findings in this study is the high reliance on bottled water as the primary source of drinking water. This observation aligns with recent national data indicating that a substantial proportion of the Saudi population depends on bottled water for daily consumption (General Authority for Statistics, 2024). This preference reflects a widespread perception that bottled water is safer than municipal or groundwater sources. However, previous research suggests that such perceptions may not always be scientifically justified, as bottled water quality can be affected by storage conditions, prolonged exposure to heat, and

transportation factors. More recent assessments have reinforced that bottled water safety is context-dependent and not inherently superior to treated municipal supplies. Therefore, reliance on bottled water may represent a behavioral response driven by perceived risk rather than informed awareness. Despite the relatively high educational attainment among participants, the study reveals a substantial deficiency in technical knowledge related to water filtration systems. A considerable proportion of respondents were either unaware of the existence of filtration systems in their households or unable to identify their types. The general awareness of health-related practices does not necessarily translate into accurate technical knowledge or effective behavior. This disconnect suggests that formal education alone is insufficient to ensure functional environmental health literacy. Instead, targeted educational interventions are required to enhance understanding of water treatment technologies, their maintenance, and their limitations (Doria, 2010). The study also highlights significant gaps in water storage and maintenance practices, which are critical determinants of water safety. A large proportion of participants reported irregular or absent cleaning and sterilization of water tanks, while many were unaware of the methods used. These findings are particularly concerning in light of recent research demonstrating that water quality can



deteriorate significantly during distribution and storage due to microbial regrowth, sediment accumulation, and biofilm formation. Similarly, earlier studies have emphasized that inadequate maintenance of storage systems is a major contributor to secondary contamination, even when the source water is initially safe (LeChevallier et al., 1996). These results collectively underscore the importance of routine maintenance practices as a fundamental component of household water safety. Another important observation is the limited awareness of infrastructure-related factors, including the materials used in water distribution systems. More than half of the participants were unable to identify the types of pipes used in their homes. This lack of knowledge is significant, as recent studies have highlighted the influence of infrastructure on water quality through processes such as corrosion, leaching, and chemical interactions (WHO, 2017). In Saudi Arabia, where desalinated water is often transported over long distances, interactions between water and distribution materials can alter its chemical characteristics before reaching consumers. The absence of public awareness regarding these factors suggests the need for more comprehensive educational strategies that incorporate both behavioral and technical aspects of water safety. Environmental conditions identified in this study further emphasize potential risks to drinking water safety. The high reliance on septic tanks as a primary sewage disposal method raises concerns about groundwater contamination, particularly when separation distances between sewage systems and water storage facilities are inadequate. Although some participants reported maintaining recommended distances, others indicated shorter distances that may increase contamination risk. This finding is consistent with previous studies demonstrating that groundwater quality in Saudi Arabia is vulnerable to contamination from wastewater infiltration and environmental factors (Foster & Chilton, 2003). Such risks are particularly relevant in areas with decentralized sanitation systems, where monitoring and regulatory enforcement may be limited. An additional key finding is the high proportion

of participants reporting noticeable changes in the sensory characteristics of drinking water, including taste, odor, and color. These characteristics are widely recognized as indicators of potential water quality issues and play an important role in shaping consumer perception and behavior (WHO, 2022). However, the coexistence of these observations with limited awareness of waterborne disease risks suggests a gap in risk interpretation. In other words, individuals may detect changes in water quality but lack the knowledge required to associate these changes with potential health hazards. This disconnect highlights the need for targeted public health interventions aimed at improving both awareness and risk perception.

The findings of this study also reflect broader trends in public attitudes toward water security in Saudi Arabia. Recent reports have indicated increasing public confidence in national water systems due to technological advancements and large-scale infrastructure investments (Levin, 2006). While such confidence is important, it may inadvertently contribute to reduced vigilance at the household level, where individual practices remain critical for maintaining water safety. This paradox, along with the broader conceptual framework of the study's implications, underscores the necessity of balancing institutional trust with personal responsibility in water management (Figure 4). From a methodological perspective, the use of a cross-sectional design and self-reported data introduces certain limitations, including potential reporting bias and variability in respondents' knowledge levels. The relatively high proportion of "uncertain" responses observed across multiple variables reflects a broader issue of limited awareness and engagement with household water management practices (Tourangeau et al., 2000), a challenge further highlighted in the integrated insights of the proposed framework (Figure 4). Nevertheless, these findings provide valuable insights into community-level behaviors and highlight areas requiring targeted intervention.

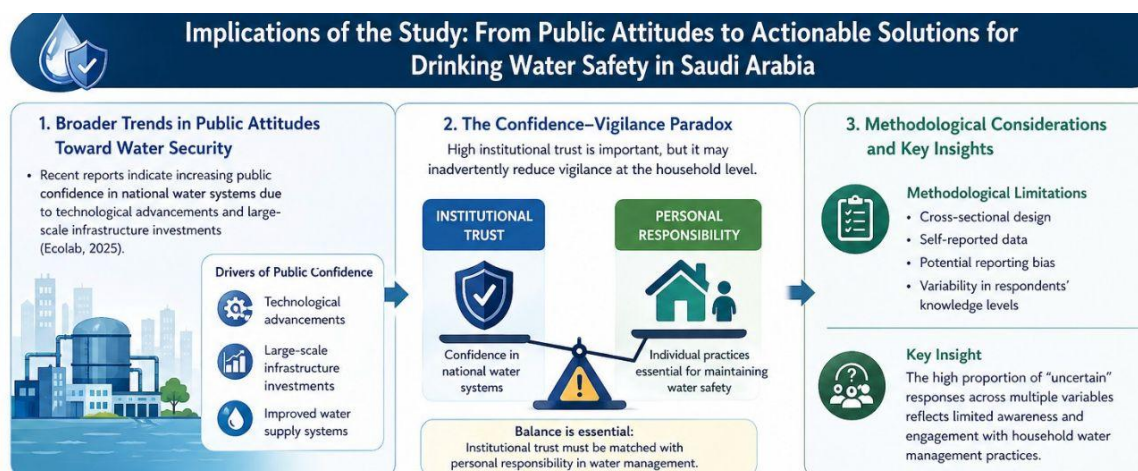


Figure 4: Conceptual framework of the study implications: Integrating public attitudes, the confidence–vigilance paradox, and methodological insights for drinking water safety in Saudi Arabia (Source: Original data obtained from current study).

5- Conclusion

In conclusion, although residents of the Al-Baha region demonstrate a moderate level of awareness regarding drinking water safety, substantial gaps remain in practical implementation, technical knowledge, and environmental risk management. Addressing these gaps requires a comprehensive approach that integrates education, infrastructure improvement, and regulatory oversight. Such efforts are essential to ensure the safety of drinking water and to reduce potential health risks associated with contamination at the household level.

6- Recommendations

Following the results obtained in this study, the following measures are recommended to enhance drinking water safety and public health in the Al-Baha region:

- **Implementation of Mandatory Tank Maintenance Protocols:** Given that a high percentage of residents (56.4%) were unaware of tank cleaning frequencies, local authorities should establish mandatory guidelines for the periodic cleaning and sterilization of household water storage tanks (at least twice a year) to prevent microbial regrowth.
- **Standardization of Household Filtration Guidance:** Since 80.3% of participants could not identify the type of filter they use, public health departments should provide clear,

technical guides to help residents select and maintain appropriate filtration systems (e.g., activated carbon or ceramic filters) based on the specific water quality challenges in the Al-Baha region.

- **Infrastructure Material Awareness & Auditing:** With more than 50% of respondents unaware of the materials used in their indoor water networks, it is recommended that new construction projects undergo strict auditing to ensure the use of high-quality, corrosion-resistant materials (such as high-grade plastic or copper) that comply with international safety standards.
- **Environmental Risk Mitigation & Setback Distances:** Considering the reliance on septic tanks (64.2%) and the reported proximity to water tanks, environmental agencies must enforce stricter regulations regarding the minimum safety distance between sewage systems and water storage facilities to minimize the risk of cross-contamination, especially in high-risk zones.
- **Targeted Public Health Literacy Campaigns:** The findings suggest a "confidence–vigilance paradox." Therefore, awareness campaigns should move beyond general information and focus on practical "how-to" knowledge regarding sensory monitoring (detecting



changes in taste, odor, or color) and emergency procedures during waterborne epidemic alerts.

- Establishment of a Local Water Quality Monitoring Program: To bridge the gap between perceived safety and actual quality, a community-based monitoring program should be initiated, allowing residents to easily submit water samples from their household tanks for low-cost or subsidized laboratory testing.

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Conflicts of Interest

The author declares the absence of any conflicts of interest.

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Data Availability

The datasets supporting the findings of this study are available from the corresponding author upon reasonable request.

References

1. Centers for Disease Control and Prevention. (2022a). *Global water, sanitation, and hygiene (WASH)*. <https://www.cdc.gov/healthywater/global/index.html>
2. Centers for Disease Control and Prevention. (2022b). *Global water, sanitation, and hygiene (WASH)*. <https://www.cdc.gov/healthywater/global/index.html>
3. Doria, M. F. (2010). Bottled water versus tap water: Understanding consumers' preferences. *Water Policy*, 12(2), 1–13. <https://doi.org/10.2166/wp.2010.137>
4. Evans, J. R., & Mathur, A. (2018). The value of online surveys. *Internet Research*, 28(4), 854–887. <https://doi.org/10.1108/IntR-03-2018-0089>
5. Foster, S. S. D., & Chilton, J. (2003). Groundwater: The processes and global significance of aquifer degradation. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 358(1440), 1957–1972. <https://doi.org/10.1098/rstb.2003.1380>
6. General Authority for Statistics. (2024). *Statistical yearbook of Saudi Arabia 2024*. <https://www.stats.gov.sa>
7. Howard, G., Pedley, S., Barrett, M., Nalubega, M., & Johal, K. (2003). Risk factors contributing to microbiological contamination of shallow groundwater in Kampala, Uganda. *Water Research*, 37(14), 3421–3429. [https://doi.org/10.1016/S0043-1354\(03\)00235-5](https://doi.org/10.1016/S0043-1354(03)00235-5)
8. LeChevallier, M. W., Welch, N. J., & Smith, D. B. (1996). Full-scale studies of factors related to coliform regrowth in drinking water distribution systems. *Applied and Environmental Microbiology*, 62(7), 2201–2211.
9. Levin, K. A. (2006). Study design III: Cross-sectional studies. *Evidence-Based Dentistry*, 7(1), 24–25. <https://doi.org/10.1038/sj.ebd.6400375>
10. Mallick, J., Singh, C. K., AlMesfer, M. K., Singh, V. P., & Alsubih, M. (2021). Groundwater quality studies in the Kingdom of Saudi Arabia: Prevalent research and management dimensions. *Water*, 13(9), 1266. <https://doi.org/10.3390/w13091266>
11. Prüss-Ustün, A., Wolf, J., Bartram, J., Clasen, T., Cumming, O., Freeman, M. C., Gordon, B., Hunter, P. R., Johnston, R. B., & Neira, M. (2019). Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: An updated analysis with a focus on low- and middle-income countries. *International Journal of Hygiene and Environmental Health*, 222(5), 765–777. <https://doi.org/10.1016/j.ijheh.2019.05.004>
12. Setia, M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian Journal of Dermatology*, 61(3), 261–264. <https://doi.org/10.4103/0019-5154.182410>



13. Tourangeau, R., Rips, L. J., & Rasinski, K. (2000). *The psychology of survey response*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511819322>
14. UNICEF, & World Health Organization. (2023). *Progress on household drinking water, sanitation and hygiene 2000–2022: Special focus on gender*. <https://washdata.org/reports>
15. World Health Organization. (2017). *Sanitation and health*. <https://www.who.int/news-room/fact-sheets/detail/sanitation>
16. World Health Organization. (2022). *Guidelines for drinking-water quality: Fourth edition incorporating the first and second addenda*. <https://www.who.int/publications/i/item/9789240045064>
17. World Health Organization. (2023a). *Drinking-water*. <https://www.who.int/news-room/fact-sheets/detail/drinking-water>
18. World Health Organization. (2023b). *Sanitation and health*. <https://www.who.int/news-room/fact-sheets/detail/sanitation>
19. Zhu, X., Huo, Y., Leung, A. Y. F., Zayed, T., & Tsang, D. C. W. (2024). Corrosion of pipes for conveying drinking water: Mechanisms and controlling strategies. *HKIE Transactions*, 31(1), 1–22. <https://doi.org/10.33430/V31N1THIE-2022-0045>