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Adoption of practices related to the safe handling of drinking water by women in Punjab

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Abstract

Prior research has shown that most people rely solely on physical characteristics of water. They are also ignorant about the recommended practices to ensure the potability of water. Thus, the present study was conducted with the objective to assess the adoption of recommended practices related to the safe handling of water by women along with the reasons for adoption or non-adoption. Data were taken from 200 rural women of the Ludhiana district by a self-structured interview schedule. The practices of safe handling of water were divided into three practices i.e. quality testing, purification, and safe storage of water. Results reveaed that only 19 percent of respondents regularly tested the quality of their household water once in six months. Nearly all of the respondents had not tested the TDS and pH level of their water due to a lack of knowledge. Seventy percent of respondents reported purifying their water before consuming. People need to be aware of the significance of water TDS level for installing RO purifiers because the use of an RO purifier emerged to be the commonly adopted method of water purification. Boiling was second most common practice of water purification but the chlorination method was unknown to the respondents. Users of plastic water storage containers madeup 77.5 percent of the sample mainly due to ignorance of the ill effects of plastic on health(44%). Lack of information among the respondents was the main barrier to majority of the advised practices being adopted. Thus, there is a need to educate people and it can be done by using a variety of extension strategies, including interpersonal, ICT-based, etc. Additionally, the reasons for the adoption and non-adoption of recommended practices discussed in this study may be useful to future researchers and extension agents in their efforts to increase the adoption of these practices.

Keywords: Adoption, safe handling of water, water quality testing, water purification, water storage

Introduction

Safe drinking water, which is considered to be a basic amenity, has become a luxury in many households as about 844 million people in the world struggle to get potable water. The populations of the United States, Brazil, Japan, Germany, France, and Italy grouped together are smaller than this (The world counts, 2023) [9]. A report prepared by WaterAid in 2016 has ranked India on top for being the world's worst country for having more people without access to clean water. According to the 2018 Water Index report by NITI Aayog, nearly 600 million Indians are facing high to extreme water stress and the number of people dying because of inadequate access to safe drinking water is about two lakhs per year (Kancharla, 2019) [3]. Past studies have revealed that most of the people in Punjab do not know the potable qualities of water according to BIS (Bureau of Indian Standards) specifications. They check the quality of water just by seeing the physical appearance i.e. taste, color, and smell of water. They are also ignorant about the recommended methods of purification and storage of drinking water. Thus, the present study was conducted to know the adoption of these practices with the objectives given below:

1. To assess the women's adoption of practices related to the safe handling of drinking water.
2. To identify the reasons for adoption or non-adoption of the recommended practices by women.

Methodology

The study was conducted in the Ludhiana district of Punjab, India following an exploratory research design. Four blocks, representing the rural population of Ludhiana, were selected purposively with the lowest water table. Further, two villages from each block were selected and 200 rural women from these villages were interviewed through the snow-ball sampling technique.

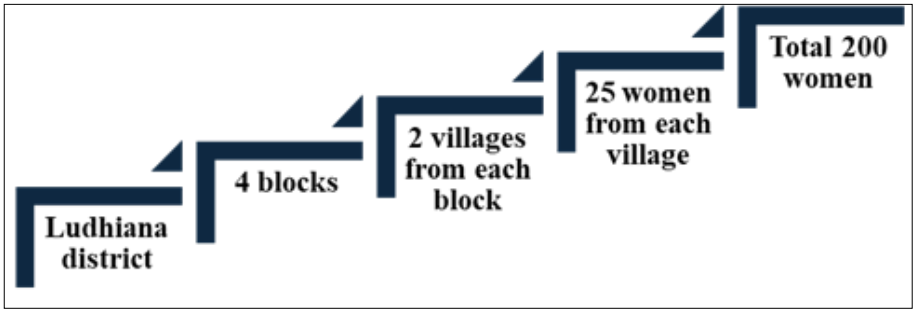

Fig 1: Sampling procedure of the study

Responses of the selected respondents regarding the adoption of water-handling practices were procured through a self-structured interview schedule. Reasons for adoption/non-adoption of selected practices were explored through open-ended questions. Data were analyzed using frequency and percentage. The practices of safe handling of drinking water were studied in three heads. These three major practices and their sub-practices are listed as follows:

Sr. No.	Major practice	Sub-practices
2.	Quality testing of water	▪ Testing the quality of drinking water ▪ Regular quality testing of water once in six months ▪ Checking the TDS level of drinking water ▪ Checking the pH level of drinking water ▪ Use of bacteriological water testing kit developed by Punjab Agricultural University, Ludhiana
3.	Purification of water	▪ Purify water before drinking ▪ Boil water for purification ▪ Use of chlorine for purification of water ▪ Use of recommended dose of chlorine for purification of water ▪ Keeping water container covered after adding chlorine ▪ Observing the waiting period of half an hour before the use of chlorine-treated water ▪ Consuming chlorine-treated water within 24 hours ▪ Avoiding the use of RO purifier when water TDS level is <500 ppm
4.	Safe storage of drinking water	▪ Avoiding the use of plastic containers for storing drinking water ▪ Use of water storage container with a narrow opening ▪ Daily cleaning of water storage container

Result and Discussion

Results on the adoption of safe water handling practices along with the reasons for their adoption/non-adoption are presented in the following three heads:

- Practices related to quality testing of water
- Practices related to the purification of water
- Practices related to the safe storage of drinking water

Practices related to quality testing of water

Testing the quality of drinking water is important to find out if there are any contaminants in the water that can cause various health problems. This practice included five sub-practices and respondents' responses for each sub-practice is presented in Table 1.

Water quality can be tested from laboratories or through portable testing kits. In the present study, the highest percentage of the respondents (65.5%) had got their household water tested. Out of them, only 14 percent expressed that the reason of water testing is to ensure the good quality of water. Whereas, 29.5 percent respondents stated that their household water is regularly tested by the filter company employees and water works employees (2%). The rest of the adopters of this practice had checked the quality of their household water only once. Results further showed that about one-third of those surveyed had not adopted this practice. Lack of knowledge was the major reason for non-adoption (13%). A negligible percentage of the respondents (1%) mentioned that they do not know the procedure of testing water.

Only nineteen percent of the respondents were found to test their household water once in six months to ensure good quality of drinking water (2%) and during the service of a water filter (16%). A large majority of the respondents (81%) had not adopted this practice. The major reasons behind their non-adoption were no knowledge of recommended time interval for testing of water (43%) and considering one-time testing of water as enough (2.5%). Further, the TDS (Total Dissolved Solids) test of water was done by merely 2.5 percent of respondents at the time of installation (1.5%) and service of the water filter (1%). More than ninety-seven percent of the respondents who had not adopted this practice were ignorant about the TDS test. Moreover, not even a single respondent had checked the pH level of their household water due to a lack of knowledge about the pH test (98.5%) and its importance for drinking water (1.5%).

Table 1: Adoption of practices related to quality testing of water along with the reasons for their adoption/non-adoption (n=200)

Practices of quality testing of water	Adopters	Non-adopters	Reasons			
			For adoption	f (%)	For non-adoption	f (%)
Testing the quality of drinking water	131 (65.5)	69 (34.5)	Ensure good quality of water	28 (14.0)	Lack of knowledge	26 (13.0)
			Regular testing of water by		Testing is not required since	
			▪ Water filter company's employee	59 (29.5)	▪ Water is clean	21 (10.5)
			▪ Water works employees	4 (2.0)	▪ Use water filter	12 (6.0)
			Water was tested once		▪ Use boiled water	1 (0.5)
			▪ When the water filter was installed	20 (10.0)	No knowledge about the best method	2 (1.0)
			▪ When the bore well was constructed	14 (7.0)	Water testing from the laboratory is costly and time-consuming	7 (3.5)
			▪ By RAWE students	2 (1.0)		
			▪ By health department officials	4 (2.0)		
Regular quality testing of water once in six months	38 (19.0)	162 (81.0)	During water filter service	32 (16.0)	Lack of knowledge about appropriate time interval for water testing	86 (43.0)
			Water testing by waterworks employee	2 (1.0)	One time testing of water is sufficient	53 (26.5)
			Ensure good quality of drinking water for better health	4 (2.0)	Once a year testing of water is recommended by filter company's employees	13 (6.5)
					Regular water testing is not needed since use a water filter	7 (3.5)
					Required only if there is a change in the physical characteristics of water	5 (2.5)
					Not willing to visit the laboratory as frequently	2 (1.0)
Checking the TDS level of drinking water	5 (2.5)	195 (97.5)	At the time of filter installation	3 (1.5)	No knowledge about the TDS test	195 (97.5)
			At the time of filter service	2 (1.0)		
Checking the pH level of drinking water	-	200 (100)	-	-	No knowledge about the pH test	197 (98.5)
					No knowledge of the significance of pH testing of drinking water	3 (1.5)
Use of bacteriological water testing kit of P.A.U.	-	200 (100)	-	-	No knowledge about the kit	200 (100)

*Multiple responses

To test bacterial contamination in water, Punjab Agricultural University has developed a portable water testing kit that is easy to use. However, the findings revealed that none of the respondents had ever used the bacteriological water testing kit developed by P.A.U. as they were not aware of it.

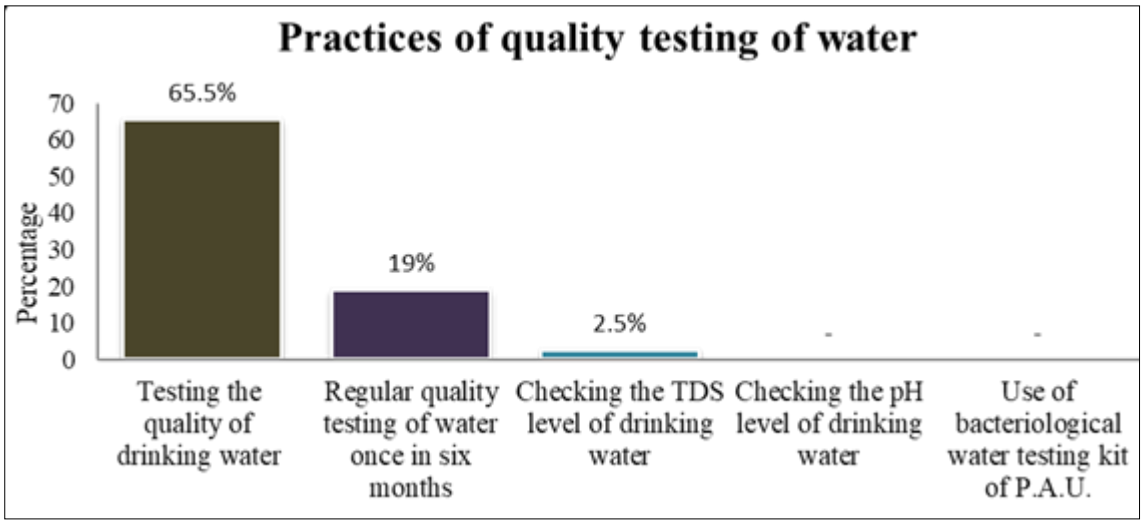

Fig 2: Adoption of practices related to quality testing of water

Practices related to the purification of water

Once the water is found to be non-potable, it is important to purify it before drinking. Household water treatment procedures can drastically enhance the microbial quality of drinking water and help to prevent infections. Various methods of water purification are being used worldwide like boiling, chlorination, filtration, etc. In the present study, respondents were enquired about the method of water purification used by them and the results are elicited in table 2.

Before purification, it is important to test the quality of water to find out if the water needs to be purified or not. But in most of the houses, the water was treated without being tested. Out of seventy percent of respondents, who were purifying water, the majority (54.5%) were of the view that RO water is best for drinking thus they were using an RO purifier. While shedding light on the reasons for non-adoption, most of the respondents said that water needs to be purified only in the case of illness (14%). Similar results were found by Myint *et al*. (2015) [6] where nearly a quarter of households in Myanmar did not use any method for purification of drinking water. However, more than half of the respondents (54.8%) in the study of Sridhar *et al*. (2020) [8] were not purifying their household water due to a lack of education and awareness. Similarly, Kuberan *et al*. (2015) [4] documented that forty-five percent of the respondents from Thandalam village of Chennai were not following any water purification procedure and half of them believed that the water they were receiving is clean and thus need not to be treated further.

Table 2: Adoption of practices related to water purification along with the reasons for their adoption/non-adoption (n=200)

Practices of water purification	Adopters	Non-adopters	Reasons			
			For adoption	f (%)	For non-adoption	f (%)
Purify water before drinking	140 (70.0)	60 (30.0)	RO water is safe for consumption	109 (54.5)	Not needed since water is clean	12 (6.0)
			Tap water is unsafe for consumption	32 (16.0)	Time-consuming process	4 (2.0)
			Habitual of using RO water from public tap	4 (2.0)	Water purification is needed only	
			Boiled water is safe for kids	4 (2.0)	▪ In rainy season	3 (1.5)
					▪ In case of illness	28 (14.0)
					Cannot bear the cost of water filter	7 (3.5)
					Aftertaste of purified water is unpleasant	6 (3.0)
Boil water for purification	16 (8.0)	184 (92.0)	Best and convenient method for the purification of water	12 (6.0)	Not needed since water is clean	12 (6.0)
			Boiled water is safe for kids	4 (2.0)	Use RO water	134 (67.0)
					Dislike the aftertaste of boiled water	6 (3.0)
					Required only in the rainy season	3 (1.5)
					Time consuming method	4 (2.0)
					Necessary only during illness	28 (14.0)
Use of chlorine for purification of water	1 (0.5)	199 (99.5)	Used it during the peak of COVID-19	1 (0.5)	No knowledge about chlorination method	194 (97.0)
					Not needed since water is clean	3 (1.5)
					Use RO filter	2 (1.0)
Use of recommended dose of chlorine for purification of drinking water	-	200 (100)	-	-	Not using chlorine for water purification	199 (99.5)
					Lack knowledge on recommended dose of chlorine for water purification	1 (0.5)
Keeping water container covered after adding chlorine	1 (0.5)	199 (99.5)	For proper disinfection of water	1 (0.5)	Not using chlorine for water purification	199 (99.5)
Observing the waiting period of half an hour before the use of chlorine-treated water	-	200 (100)	-	-	Not using chlorine for water purification	199 (99.5)
					Ten minutes contact time is enough	1 (0.5)
Consuming chlorine-treated water within 24 hours	1 (0.5)	199 (99.5)	Habitual of storing water only for 24 hours	1 (0.5)	Not using chlorine for water purification	199 (99.5)
Avoiding the use of an RO purifier when the TDS level of water is <500 ppm	-	200 (100)	-	-	Unaware of the relevance of water TDS for using an RO filter	200 (100)

*Multiple responses

Despite the fact that a large percentage of the respondents were purifying water before drinking, barely eight percent of respondents were practicing the boiling method for water purification. Considering it the best method of water purification (6%) and safe for kids (2%) were major reasons for the adoption of this practice. The majority of the ninety-two percent respondents justified the non-adoption of boiling method with the reason that they use an RO filter (67%). However, different results were speculated by Myint *et al*. (2015) [6], Pradhan *et al*. (2018) [7], and Sridhar *et al*. (2020) [8] as the percentage of the respondents who reported boiling their drinking water in all three studies was 33.3 percent, 28.4per cent and 44.4 percent, respectively.

Liquid chlorine or sodium hypochlorite is also used for water purification. It was noticed that a large majority of the respondents (99.5%) were not using chlorine for water purification and those 0.5 percent respondents who were practicing this method had no knowledge about the waiting period and recommended dose of chlorine for water purification, however, they were keeping the chlorinated water covered. When the respondents were asked about the reasons for the non-adoption of chlorine, the majority of them revealed that they have no knowledge about the chlorination method (97%). It was also observed that a negligible percentage of the respondents (0.5%) started using chlorine for water purification during the time of COVID-19. The study conducted by Myint *et al*. (2015) [6] had comparable outcomes with just 2.5 percent of the respondents from Myanmar being users of chlorine for water disinfection. However, Sridhar *et al*. (2020) [8] reported that 16.6 percent of the total respondents were adopters of the chlorination methodin Northwestern Nigeria.

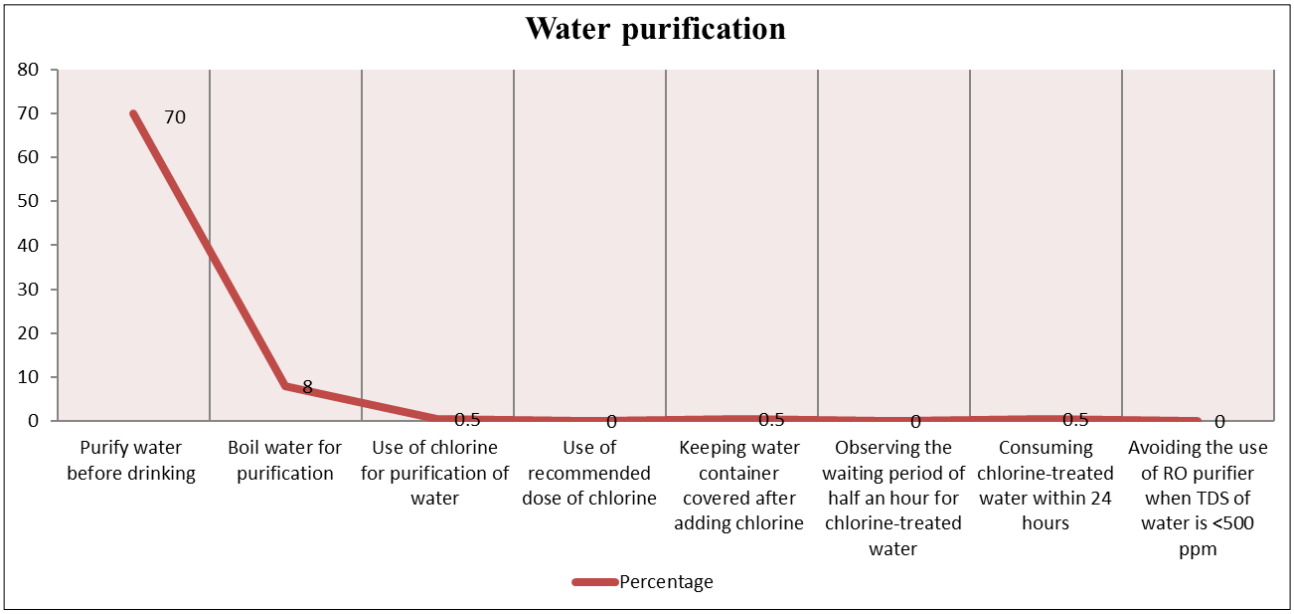

Fig 3: Adoption of practices related to water purification

Another widely used method for water purification is the use of an RO purifier. However, they are required only in the areas with high TDS levels i.e. more than 500 ppm (parts per million) because they make the heavy water drinkable by reducing its TDS level. However, no a single respondents' use of RO purifiers was influenced by the TDS content of their household water. The main barrier to the adoption of this practice was a lack of knowledge about the significance of the TDS level of water for using an RO filter.

Practices related to the safe storage of drinking water

Clean and pure water is also subject to contamination if not stored or handled properly. By safe storage, it is meant that once the water has been purified, it is stored in such a way as to prevent re-contamination. According to CAWST (2009) [1], safe storage means keeping the treated water away from contamination and using a clean and covered container. The container should prevent hands, cups, and dippers from touching the water so that the water does not get contaminated. The adoption status of three practices associated with the safe storage of drinking water along with the reasons is presented in Table 3.

Plastic containers are commonly used to store water be it a plastic bottle, water cooler, jugs, etc. However, the harmful chemicals, from which the plastic is made, can leach into the water. Thus the consumption of this water can lead to many health problems. Hardly twenty-three percent of respondents were not using a plastic container for storing drinking water. They provided an explanation, saying plastic is harmful to health (6.5%), and storing water in an earthen (13.5%) and copper (3%) container is good for health. The highest percentage of the respondents (77.5%) were using plastic containers for storing drinking water due to ignorance of the ill effects of plastic on health (44%). The remaining reasons supporting the use of plastic storage containers were easy handling and inexpensive of plastic containers (17%), the habit of using plastic contained (7.5%), use of good quality plastic (6%), and unawareness of the alternatives to plastic containers (4%). Contrasting results i.e. 88 percent of plastic users were observed in the study of Makoko *et al*. (2021) [5]. However, the users of plastic containers as discovered by Myint *et al*. (2015) [6] and Sridhar *et al*. (2020) [8] were nearly forty-five percent in their respective studies.

Table 3: Adoption of practices related to safe storage of drinking water along with the reasons for their adoption/non-adoption (n=200)

Practices of safe storage of drinking water	Adopters	Non-adopters	Reasons			
			For adoption	f (%)	For non-adoption	f (%)
Avoiding the use of plastic containers for storing drinking water	45 (22.5)	155 (77.5)	Plastic is harmful to health	13 (6.5)	No knowledge about the ill effects of storing water in a plastic container	88 (44.0)
			Use of earthen container is safe for water storage	27 (13.5)	Habitual of using plastic contained	15 (7.5)
			Use of copper container is safe for water storage	6 (3.0)	Easy to handle and inexpensive	34 (17.0)
					Use good quality plastic	12 (6.0)
					No knowledge about the substitute for plastic containers	8 (4.0)
Use of water storage container with a narrow opening	159 (79.5)	41 (20.5)	Easy to use	67 (33.5)	Difficult to clean	18 (9.0)
			Protect water from dust and contamination	48 (24.0)	Smell in a closed container	12 (6.0)
			Habitual of using a narrow container	46 (23.0)	Easy to use a wide container	13 (6.5)
Daily cleaning of water storage container	166 (83.0)	34 (17.0)	Inhibit germ growth	102 (51.0)	Cleaning of drinking water storage container is required	
			Habitual of daily cleaning	65 (32.5)	▪ Once or twice a week	27 (13.5)
			Clean daily in summer season	1 (0.5)	▪ Once or twice a month	6 (3.0)
					▪ When season change	1 (0.5)

*Multiple responses

A container with a wider opening also makes water susceptible to contamination. It was noticed that more than seventy-nine percent of respondents were using water storage containers with a narrow opening for storing drinking water. The highest percentage of the adopters (33.5%) gave the reason that narrow-mouthed containers are easy to use and children can easily take out water from them. About 20 percent of the respondents were not using narrow-mouth containers and nine percent of them said that it is difficult to clean them from the inside. Contrasting results were witnessed in the study conducted by Pradhan *et al*. (2018) [7] with the majority of respondents in Busta using containers with a wide openings like buckets, drums, etc. Moreover, Holt (2009) [2] and Kuberan *et al*. (2015) [4] also uncovered varying results with the percentage of respondents using narrow-mouthed containers being merely 49 percent and 21 percent, respectively.

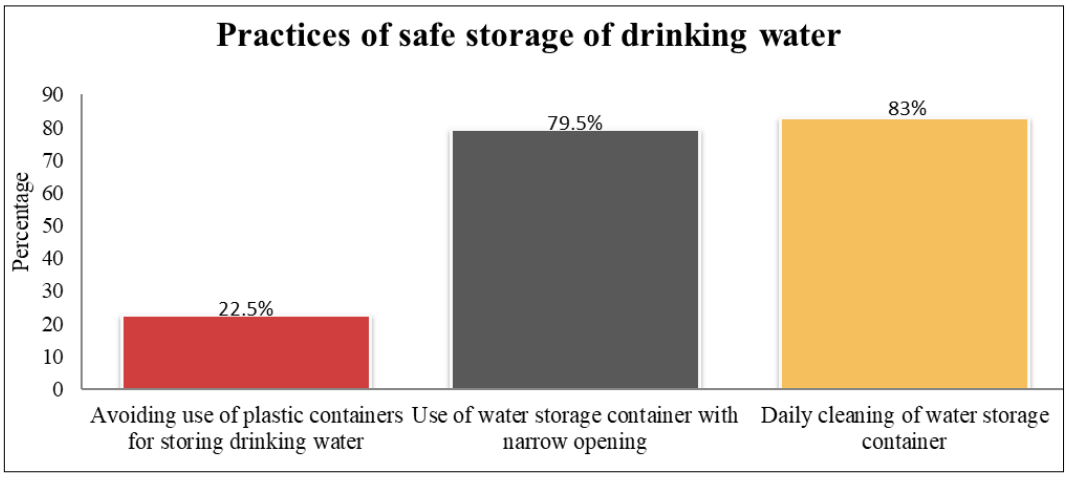

Fig 4: Adoption of practices related to safe storage of drinking water

Furthermore, frequent cleaning of water containers is also essential to mitigate bacterial recontamination of water. It is a commonly adopted practice by almost all the respondents. Eighty-three percent of respondents were cleaning their drinking water storage container daily considering its importance. However, there were 17 percent of respondents, who were not cleaning their drinking water storage container daily because they think that once or twice a week (13.5%), once or twice a month (3%) and seasonal (0.5%) cleaning of drinking water storage container is sufficient. Equivalent results were obtained by Kuberan *et al*. (2015) [4] and Sridhar *et al*. (2020) [8] since the majority of the respondents in both studies reported daily cleaning of their drinking water storage container. However, fifteen percent of the respondents in the study of Sridhar *et al*. (2020) [8] specified that they clean their water containers every week.

Conclusion

The research findings highlighted that the respondents who did not regularly check the quality of their household water lacked knowledge of the various methods of testing water as well as the recommended intervals between tests. Consequently, there is a need to make people aware of the various water tests and their importance. Furthermore, the

significance of water TDS level for installing RO purifiers should be made clear to the people because the use of an RO purifier emerged to be the commonly adopted method of water purification without considering the prerequisites for installing it. The main justification given by the majority of people utilizing plastic containers to store drinking water was that they were unaware of the negative repercussions of doing so. They should therefore be introduced to alternative storage options that are more manageable, less expensive, and safe for use. This can be achieved by utilizing various extension methods, such as lectures, demonstrations, and the usage of educational materials like pamphlets and videos, etc.

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Conflict of interest
This is to declare that there is no conflict of interest among researcher.

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