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Original article

Consumers' Preferences for Drinking Water in Istanbul City

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Abstract

Water is an indispensable resource for living things to survive. In addition to its direct consumption, water is also used in the preparation of foods necessary for eating and drinking. Therefore, it is extremely important that the water used is drinkable, healthy and safe. The aim of this study is to determine the place of network water as drinking water in consumer preferences. In accordance this purpose, an online questionnaire was prepared with 274 participants from different age groups, including students from Yıldız Technical University (YTU) Department of Environmental Engineering and their relatives and neighbours, including different ages and occupational groups. With this questionnaire, the factors affecting their water preferences and water usage profiles were determined. As a result of the survey, 54.1% of the participants use carboy water, 33.8% use pet bottle water, 12.1% use network water. The criteria that consumers pay attention to in their water preferences are taste, smell, color, cleanliness and the amount of mineral substances in the water, respectively. The reasons for preferring the carboy water, which is preferred by the majority, are that they find the carboy water cleaner and safer and that it tastes better. On the other hand, participants who preferred tap water stated that 33.3% of them preferred this water because its clean and reliable properties, 33.3% of it was affordable and 22.2% of it was easily accessible. When the degree of trust in the network water was questioned, 12.2% of the participants said that they found the network water safe, 40.5% did not find it safe and 47.3% said they were not sure. In addition, when the participants ranked carboy water, pet bottle water and network water according to the degree of reliability, the network water was found to be reliable with a large rate of 89.2%. 35.1% of the respondents stated that they would prefer to drink tap water if the Water Administration periodically discloses their water quality reports and indicates that the network water is clean enough.

Keywords: Network water, Water usage profile, Mineral matter, Reliability degree.

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INTRODUCTION

Drinking water quality is dependent on several pollutants which could be arising at the source, due to storage and handling practices or during transportation. The challenge of polluted water is even big in urban settings that are often characterized by exponential population growth, increased industrialization, urbanization, polulation growth and poor sanitary facilities (Ondieki et al., 2022). Consumption is increasing day by day because of developing world conditions and rapidly increasing population. A large part of this consumption is water. Because water is an indispensable basic need for human life. At this point, safe and healthy water is of great importance.

The sanitary security of drinking water is related to human health closely, but drinking water quality assessment mainly focused on relatively restricted time span so limited types of indicators (Xia et al., 2022). Water resources are one of the most important factors that determine the quality of drinking water (Usman et al., 2016), Poor practices and hygiene in water treatment level disruptions also cause contamination (Gizachew et al., 2020). For the human body to maintain its vitality and fulfill its vital functions, the most important substance it needs after oxygen is water (Bayhan and Hancer, 1987). The human body is mostly made up of water. The rate of water in our body changes throughout our lifespan. While 75% of the body weight of a newborn baby consists of water, this ratio is 70% in children, 60% in adults and 50% in the elderly. An adult human needs 2-3 liters of water a day, some of which is met from food. This; It carries oxygen and nutrients to the cells, prevents constipation, works the digestive system, supports the joints, balances the body temperature, ensures the removal of toxic substances accumulated in the body, ensures the absorption of minerals, vitamins, and other nutrients, and provides blood circulation. For these reasons, enough water should be drunk for health.

Water, one of the indispensable elements of human life, is a limited and irreplaceable resource. Despite the rapidly increasing world population and industrial production, the constant water resources lead to the pollution and consumption of these existing resources (Ceber et al., 2015). At this point, providing clean water to consumers and sustainability are very important. The more important the amount of drinking water is, the more important is the quality of the water (Yilmaz et al., 2014). Network water, also known as tap water, is generally used for domestic purposes such as drinking, cooking, cleaning, preparation of foodstuffs, regardless of its origin, in its original form or purified, either from its source or from a distribution network, and for Human Consumption. These are waters that comply with the parameter values specified in the Regulation and are not offered for sale for commercial purposes. Water of unknown origin should never be consumed. Municipalities are responsible for the cleanliness and reliability of the network water in our country. The Ministry of Health regularly analyzes and controls whether these waters are clean, healthy and safe. Carboy water, on the other hand, is water that is purified by various companies and produced from recycled polycarbonate material and presented to the consumer in 19-liter large bottles. Pet bottle waters are waters that are purified by various

companies and produced from polyethylene terephthalate (PET) and filled into smaller bottles compared to carboys.

Even though the network water is improved, usable and easy to access, the demand for carboy and pet bottle water has increased considerably in recent years (Kanat, 2017). This is because the reliance on network water is very low. When the studies conducted in Turkey and around the world are examined, it has been understood that the taste of the water, its cleanliness, concerns about its health effects, and factors such as the quality of the water affect the choice of the water consumed (Ayse et al., 2020). Understanding the preferences and expectations of the society about drinking and consumption water is very important for clean, reliable, and quality water consumption. In this study, it is aimed to understand the perspective of people on network water, to determine their water preferences and their expectations from a drinking water.

Water is an indispensable resource in human life. It is an indispensable and basic ingredient at every point of daily consumption. Water is used in everything that is consumed, from tea to coffee, to washing the materials to be used in the meal to be cooked. For this reason, it is very important for consumers that the water consumed is healthy, high quality and reliable. In addition, it should be hygienic because it is consumed directly without undergoing any processing.

Today, the most easily accessible water source for consumers is network water. It is the responsibility of local governments to ensure that tap water is clean, healthy, and reliable. Delivering clean, healthy and safe water to the community is a public service (Tekbas and Ogur, 2009). However, because consumers do not trust these institutions enough, there is a prejudice against network water. For this reason, consumers use demijohn (carboy) water, pet bottle water or purification devices that they connect to their homes as an alternative to this water. While choosing these alternatives, they consider the criteria of hygiene, taste, mineral content, price and ease of transportation.

According to the results of some studies, the population that prefers network water as drinking water is very few and the reason for preference is that it is easily accessible. In addition, it has been observed that in places where consumers use tea, coffee, food by boiling water, they use network water more. Because consumers think that water becomes more hygienic when boiled (Kanat, 2017; Ayse et al., 2020).

When another study is examined, it has been determined that consumers get their drinking water from carboys with 38%, from purified water with a ratio of 36%, from municipal network water with 13% and from spring waters such as wells and fountains with 13% (Uzundumlu et al., 2020). Network water is not only cheap and easily accessible, but also environmentally friendly. Because no plastic waste is produced. In this respect, it can be considered as zero waste.

MATERIALS and METHODS

This work was applied to people from different segments, especially from Yildiz Technical University (YTU) Department of Environmental Engineering students and their relatives and neighbours, between March and April 2022, using the online questionnaire method. In the study, students from different departments, people in different occupational groups, and different age groups were included. The study population consisted of 274 people in total. The questionnaire, which was prepared after a detailed literature review, consisted of 40 questions. In the first 5 questions, it is aimed to understand the sociodemographic status of the people with questions about age, gender, occupation, income status and where and with whom they live. In the following questions, it is aimed to understand the drinking water preferences and the point of view on the network water.

RESULTS and DISCUSSION

When the participants were asked which water they prefer in their daily lives in the survey, 54.1% stated that they use carboy water, 33.8% pet bottle water, 12.1% tap water. How many people prefer which water is shown in Table 1.

Table 1. Water preference – Number of people

Water preference	**%**
Carboy water	54,1
Pet bottled water	33,8
Main water	12,1

In the continuation of the survey, it is aimed to understand which criteria the participants pay attention to in their water preferences. Everyone has chosen more than one criterion. As a result, 87.8% of the participants marked the criteria for taste, 67.6% for smell, 48.6% for color, 67.6% for cleanliness, 29.7% for the amount of mineral substances contained in the water. In Table 2, the details of the criteria that the participants pay attention to according to the type of water they prefer are given.

Table 2. Criteria that consumers pay attention to according to their water preferences

	Carboy water	**Pet bottle water**	**Main water**
	%	**%**	**%**
Taste	87,5	92	77,8
Smell	70	68	55,6
Colour	52,5	40	55,6
Cleanliness	75	56	66,7
Mineral substance content	45	12	11,1

When Table 2 is examined; The priority criteria of the participants who preferred carboy water and plastic bottles were taste, cleanliness and smell, respectively. From this, it is understood that consumers find the taste of carboy and pet bottle water better than the network water. The priorities of the participants who preferred tap water were taste and cleanliness.

In the next question, the participants were asked why they preferred the water. 35.1% of the respondswere clean and reliable, 29.7% a better taste, 17.6% were easily accessible, 12.2% were affordable, and 5.4% had no odor. reported that they turned to the type of water they preferred for reasons. Which type of water the participants prefer and for what reason is given in detail in Table 3.

Table 3. Reasons for preference according to the water preferences of the participants

	Carboy water	**Pet bottle water**	**Main water**
	%	**%**	**%**
Easy Accessibility	12,5	24	22,2
Clean And Reliable	45	20	33,3
Better TASTE	25	44	11,1
Affordable Cost	7,5	12	33,3
No Odor	10	0	0

When Table 3 is examined in detail, the majority of the participants (45%) who prefer carboy water stated that they prefer this water because it is clean and safe. In addition, 25% of the participants consume carboy water because it tastes better. However, 12.5% of the consumers of carboy water stated that they preferred this water because of its easy accessibility, 10% because it had no odor and 7.5% because it was affordable.

A significant portion of the participants (44%) who consume pet bottle water in their daily lives prefer this water because it tastes better. In addition, 24% of them consume pet bottle water because it is easily accessible. In addition, 20% of the participants who chose plastic bottled water stated that they preferred this water because it was clean and reliable, and 12% because it was affordable.

33.3% of the participants who consume network water use network water because it is clean and reliable, and 33.3% of them use network water because it is affordable. 22.2% of them consume tap water in their daily lives because it is easily accessible and 11.1% has a better taste.

When these data are examined, it is understood that the most important factor in consumers' choice of carboy and pet bottle water is that they think that these waters are cleaner and safer than network water. However, consumers prefer these waters to network water because of the better taste of these waters. In addition, it is understood that consumers prefer pet bottle water because of the easy accessibility provided by the fact that pet bottled water is in smaller bottles compared to carboy water,

and the ease of transportation. The reasons for the preference of the participants who preferred the mains (tap) water were to a large extent that it was affordable and clean and reliable.

12.2% of the respondents said that they found the network water safe, 40.5% said they did not find it safe, and 47.3% said they were not sure. When asked whether they would prefer to drink tap water if the water administration periodically announced the water quality reports and stated that the water was clean enough, 35.1% answered yes and 64.9% answered no. The vast majority of the participants (85.1%) think that there are harmful microorganisms in the network water, and 14.9% think that there is no. Regarding the presence of harmful chemicals in the network water, 74.3% of the participants think that there are harmful chemicals and 25.7% think that there are no chemicals.

In the next survey question, the participants were asked about their confidence in public institutions such as İSKİ that the network water was purified sufficiently. 24.3% of the participants stated that they trust, 35.2% do not trust, and 40.5% are undecided on this issue. If it is reported by an impartial research institution (such as reputable universities, etc.) that tap water meets the standards, 62.2% of the participants think that they will find it safe, 12.2% will not find it safe, and 25.8% are not sure.

32.4% of the participants think that network water may have mud, foreign body, etc. that will discourage people from using the water. 55.4% of the participants stated that they boiled the network water before using it, 12.2% stated that they waited and rested the water before using it, and 4.1% purified it and used it. 27% of the respondents stated that they use tap water directly without applying any process. On the other hand, 1.3% do not use the network water at all.

24.3% of the participants stated that they use a water purifier at home. When it is questioned how often the filter maintenance of the purification device is performed, 16.7% of the participants who use the device have filter maintenance done once every three months, 50% once every six months, and 33.3% once a year. 90.5% of users said that if the device is not well taken care of, there will be a problem, 1.4% said there will not have a problem, and 8.1% are undecided. The respondents were also asked whether the quality of the water treated with the device was sufficient. 28.4% of the participants stated that it was sufficient, 41.9% stated that it would not be enough and that it would not be as high quality as bottled water, 29.7% were not sure.

Then, the participants were asked why they did not use tap water. 25.6% of them do not trust the water quality, 23% of them do not use tap water because of bad taste and unhygienic, 17.6% of them do not use tap water because it smells of chlorine. On the other hand, 10.8% do not use the network water because they think that the water resources are dirty and cannot be treated well.

Table 4. Reasons of the participants not to prefer tap water

	%
Unhygienic	23
Don't rely on water quality	25,6
Smell of chlorine	17,6
Bad taste	23
Not good quality treatment	10,8

68.9% of the participants used tea, coffee, cooking, etc., where water is boiled. In some cases, they use network water, 27% carboy water and 4.1% pet bottle water. In the continuation of the survey, tea, coffee, cooking, etc. It was questioned why the participants who used tap water in such cases preferred this water. A significant part of the participants (65.3%) use tap water in their tea, coffee and meals due to the disappearance of the hygiene problem, 14.3% not feeling the bad taste and 4.1% due to the disappearance of the chlorine taste. In addition, 16.3% of the respondents stated that they use the network water in these situations due to the economic reasons provided by the easy availability of network water. As it can be understood from here, the participants find the network water more usable when it is boiled.

Table 5. Tea, coffee, food, etc. reasons to prefer tap water

	%
No Bad Taste	14,3
Economic Reasons	16,3
Going The Taste of Chlorine	4,1
No Hygiene Problem	65,3

In the continuation of the survey, questions were asked about the participants' perspective and satisfaction with carboy and plastic bottled water. When asked how satisfied they are with the taste of carboy and plastic bottled water, 33.8% of the participants gave the answer very much, 64.8% medium, 1.4% less. Afterwards, 32.4% of the respondents stated that they found carboy water reliable, 2.7% did not find it reliable and 64.9% were not sure. When the participants were asked their opinions about whether the standards are fully complied with in carboy and plastic bottle water, 28.4% said that they were complied with, 32.4% said they were not, and 39.2% were not sure. In addition to these, it was also investigated how often users who use carboy water change their carboy pump. As a result, it was concluded that 17.8% of the users changed the pump monthly, 11.1% changed it annually, 28.9% did not change it at all, and 42.2% changed it when they felt that the pump was dirty. Regarding the reliability of pet bottled water, 41.9% of the participants stated that they found it reliable, 9.5% did not

find it reliable, and 48.6% were not sure. In addition, the participants were also asked whether they paid attention to the water content such as pH, mineral amount, bottling date, spring while consuming carboy and pet bottle water. As a result, 62.2% of the participants stated that they paid attention, while 37.8% stated that they did not pay attention. Details of these mentioned data are shown in Table 6 in detail.

Table 6. Confidence levels of the participants in bottled water

	Carboy water	**Pet bottle water**
	%	**%**
Reliable	32,4	41,9
Not reliable	2,7	9,5
I am not sure	64,9	48,6

In the next question, it was investigated how many days of the year the participants found the tap water drinkable. 66.2% of the participants are less than one month, 9.5% one month, 13.5% one – three months, 2.7% three – six months, 8.1% six months month – one year. Afterwards, 81.1% of the participants stated that they tasted excessive chlorination in the tap water, and 18.9% stated that they tasted like algae or fish. In the question of how many days of the year they felt this smell and taste, 37.8% of the participants answered less than a month, 10.8% for a month, 12.2% for one – three months, 5.4% for three – six months. month, 33.8% answered six months – one year. In addition, 39.2% of the respondents stated that this smell and taste is a hygienic problem in the water, while 60.8% stated that it is not a hygienic problem, but they do not trust it enough to consume it.

Table 7. The period during which the network water is considered drinkable and the unpleasant taste is felt

	Duration when network water is drinkable	**Duration during undesired taste and odor feeling in network water**
	%	**%**
Less Than 1 Month	66,2	37,8
1 Month	9,5	10,8
1 - 3 Months	13,5	12,2
3 - 6 Months	2,7	5,4
6 Months - 1 Year	8,1	33,8

In a different question, the participants were asked whether they observed algae accumulation in their water jugs, and if so, how many times a year they encountered this problem. 93.2% of the respondents stated that they did not observe algae formation in their jugs. In addition, 4% of the participants said that they observe it once a year, 1.4% five times a year, and 1.4% seven times a year.

The monthly average water consumption of the respondents was determined as 58.9 L. The average monthly water consumption of the families was found to be 210 L. In addition, the participants were also asked about the monthly average consumption of mineral water or soda for themselves and their families. As a result, it was determined that the participants consumed 5.4 L of mineral water and their families consumed 16.1 L of mineral water or soda per month.

Finally, in the survey, the participants were asked to rank the network water, carboy water and pet bottle water in terms of reliability. According to the answers of the participants, the network water was found to be reliable in the last place with a large rate of 89.2%. While PET bottle water was found to be reliable in the first place by 58.1% of the participants, carboy water was found to be reliable in the second place with 51.4%.

Table 8. Reliability ranking of water resources

	1.		**2.**		**3.**
	Number of people	**%**	**Number of people**	**%**	**%**
Bottled Water		39,2		51,4	9,5
Pet Bottled Water		58,1		40,5	1,3
Network water		2,7		8,1	89,2

According to the results of this study, only 12.2% of the participants trust the network water. This is a very low rate. However, 35.1% of the participants stated that they could use the network water if the Water Administration periodically announced the water quality reports and stated that the water was clean enough. In a similar study, only 30% stated that they trust tap water (Ciner, 2017). At the same time, if the network water standards are announced by an impartial research institution such as reputable universities, it is understood that more than half of the participants will find the network water safe and consume it. For this reason, if the municipalities that treat the network water and the Ministry of Health, which is responsible for its supervision, provide adequate hygiene and share this situation with the users, the trust and consumption of the network water will increase greatly.

As a result, three options were presented to the participants: carboy water, pet bottle water and mains (tap) water. When the survey results are examined, it is understood that more than half of the participants (54.1%) preferred carboy water. The most important reason for this is the thought that the taste of carboy water is better and its hygiene is more (Table 2). When similar studies are examined, it has been understood that the most important criteria that consumers pay attention to when making their water preferences are taste and hygiene (Ayse et al., 2020; Tekbas and Ogur, 2009; Uzundumlu et al., 2020; Uzundumlu et al., 2016).

Drinking water quality has been extensively studied in environments such as home and school. As a result of these investigations, it has been determined that there is very little research on drinking water quality in schools (campuses) The reason why these environments are important is that the effects of contamination from drinking water for children are greater than for adults (Morgan et al., 2021). However, network water can be considered as zero waste compared to carboy water. Because in its use, no plastic waste is generated, such as a carboy. However, microbiological and chemical changes occur in carboys and plastic bottles, which the participants find more hygienic, if they are not stored under appropriate conditions (contact with sunlight, etc.). In addition, it has been found in studies that carboy waters offered for consumption are microbiologically clean, but microbiological contamination increases depending on the consumption time, pump hygiene and usage conditions (Demirci et al., 2007). However, in this survey study, it was determined that 28.9% of those using carboy water never changed their carboy pump. Participants who use carboy water because they do not find the network water hygienic and safe, use microbiologically contaminated water under these conditions. Consumers should also be made aware of this issue.

In addition, the daily water consumption of the participants was also questioned in the study. In this direction, the monthly average water consumption of the participants was determined as 58.9 L. Based on a month and thirty days, the average daily water consumption is equivalent to 1960 mL. The European Food Safety Authority (EFSA) determined the amount of water that should be consumed daily in adults as 2500 mL for men and 2000 mL for women (EFSA, 2010). Therefore, it shows that the respondents consume approximately sufficient amount of water per day.

In addition to these, the reasons why the participants did not prefer tap water were respectively not trusting the water quality (25.6%), unhygienic (23%), bad taste (23%), chlorine smell (17.6%) and not being treated in good quality (10.8%) was determined. In this case, the municipalities responsible for treating the water should improve the water quality. The Ministry of Health, which is responsible for inspecting the treated water by the municipalities, should share the analysis reports and the appropriateness of the water with the society.

CONCLUSION

As a result, network water can be considered as environmentally friendly and zero waste, as it is both cost-effective and easily accessible, and does not generate plastic waste such as carboys or plastic bottles. Because it is zero waste, it is more beneficial for the environment than bottled water. No packaged commercial water can replace the network water that reaches the user from the source. Because network water is inspected by municipalities and public institutions such as the Ministry of Health and is offered to consumers under the assurance of these institutions. However, with this study, it has been understood that consumers do not trust the network water and they have many hesitations.

Therefore, if these institutions report that the network water is safe and healthy and the consumer is informed, the consumption of network water will increase and it will be used as drinking water.

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