Improving public perception of tap water in Antalya city, Turkey

Evrim Celik and Habib Muhammetoglu

ABSTRACT

Groundwater is the main source of drinking water for the City of Antalya, Turkey. The groundwater is naturally very hard, but is otherwise of good quality, although the public usually exaggerates the health effects of hardness. However, some pollutants enter the distribution network during maintenance operations and water cut-off. Deterioration of water quality is also reported in areas within Antalya that have old distribution networks. Some members of the public are suspicious of the water quality because they do not receive regular information about the quality of their drinking water. As a result, most residents do not drink water from the public supply. Instead, they use other sources such as bottled water or small home treatment systems. A questionnaire was prepared to elicit public opinion about tap water quality problems and possible solutions. The results of the questionnaire provided important ideas for improving the acceptance by the public of tap water as a drinking source at low cost. These ideas include organizing public awareness campaigns, informing the public about the results of potable water quality monitoring, using drain valves after maintenance, and renewing old parts of the distribution network.

Key words | Antalya, drinking water, hardness, public awareness, questionnaire, social factors

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INTRODUCTION

Antalya city is located on the Turkish Mediterranean coast and has around 1 million residents, making it one of the most crowded cities in Turkey. The municipality of Antalya is responsible for distribution, maintenance and monitoring of the city's drinking water. Groundwater is the main source of drinking water. The quality of groundwater from wells and springs is good except that it is very hard, owing to a calcium carbonate ($CaCO_3$) content of 200 to $300\,mg\,l^{-1}$. Unfortunately, residents of the city generally believe that hard water is a serious threat to their health.

The water distribution network includes some cast iron pipes which are over five decades old in some areas and contribute to the deterioration of water quality. The quality of water shows noticeable changes after each maintenance operation because of the soil and other contaminants such as coliform bacteria and sometimes pathogens that are

introduced to the network. Drain valves are seldom used to discharge drainage water after maintenance operations because most drain valves lie within crowded residential areas where it is difficult to discharge water. The water supply has experienced frequent cuts in the past, forcing many apartments to install local storage tanks to maintain a constant supply. Storage tanks use pumps to lift water to the higher floors when the pressure in the distribution network is reduced. Now, most of these tanks are out of service but those that are still in operation are not maintained or cleaned with sufficient frequency. A recent survey in Istanbul, Turkey, has shown that 98% of these tanks contain serious pollutants (ISKI 2003) that include organics, nutrients and coliform bacteria.

Antalya municipality produces short brochures that assure the tap water is safe for drinking. However, most of

the city residents believe that the tap water has some type of quality problem. Therefore, they do not use tap water for drinking and other purposes such as cooking and tea and coffee making. Instead, they use bottled water, or home treatment units such as ion exchange, activated carbon, ultraviolet and reverse osmosis. Maintenance of home treatment units is usually neglected for many years.

Antalya lacked a centralized wastewater collection, treatment and disposal system until recently. Septic tanks were the only systems used for wastewater collection and treatment. An integrated water and wastewater project was started in 1996 to protect groundwater beneath the city. The project involved collection, treatment and disposal of the wastewater from the crowded part of Antalya. A long and deep sea outfall system was built for disposal of treated wastewater. The project was recently completed with a total cost of over US$200 million. Completion of this expensive project did not change public opinion about using tap water for drinking, since hardness and palatability of tap water seem to be their concerns.

Public participation and involvement in public projects is often neglected in Turkey until late in the implementation stages of projects. Public input at this stage is usually through the environmental impact assessment (EIA) process that involves only a limited number of people who are informed about the project. This is an inefficient way to encourage public participation and it should be changed to better inform the public at large about projects during all stages including very early stages. The purpose of this study is to show the benefits of public participation to improve the acceptance of tap water as a drinking source in Antalya City.

METHODS

A questionnaire was prepared to investigate the public's opinion on drinking water problems and possible solutions. Issues investigated included opinions on: the quality of water in the distribution network; acceptance of tap water for drinking and other uses; the reasons for rejecting tap water for drinking; the use of and confidence in small home treatment units and bottled water; the cleaning of the local storage tanks; measurement and analyses of water quality

by an organization independent of the municipality such as the university; informing the public about the results of the water quality sampling programme; water standards; and water prices.

The questionnaire was first presented directly to a control group during March and April 2004. Following this, changes were made to clarify parts of the questionnaire. A total of 800 questionnaires were distributed between May 2004 and February 2005. Most of the questionnaires were conducted face-to-face by students who were not specialists in water-related topics. The surveyed individuals were chosen randomly but included various levels of education, living standards, ages and gender. Participants were from areas that receive water from different wells and from areas that represent different conditions of the water distribution network such as different pipe ages, water pressures and frequency of water cut-off.

A total of 800 participants were interviewed including 489 males and 311 females. In terms of income levels, the participants include 339 who were relatively rich (income exceeding 830 US Dollars per month) and the remainder were relatively poor. Education classification included 496 participants who were relatively well educated (at least a two-year university certificate) while the remainder were below this level (225 of them completed high school and 76 of them completed primary school). The age distribution of the participants was: 371 between the age of 18 and 25, 316 between 26 and 44, 96 between 45 and 60, and 15 older than 60 years old.

RESULTS AND DISCUSSION

Questionnaire results were analysed using the Statistical Package for the Social Sciences, SPSS version 6.1.4 (SPSS 1985).

Direct results of the questionnaires

The results of the questionnaires showed that 50.3% of the public do not drink tap water. Reasons given for this response include 22.5% who cited hardness, 16.5% water taste, 13.9% pathogenic contamination, 12.2% unclean water and 7.4% turbid water. Solutions suggested by those

who reject tap water included 21.7% who want hardness to be removed, 18.8% who want the municipality to carry out regular intensive water quality analyses and publicize the results, 17.2% want water analysis done by an independent organization, and 8.8% who want the distribution system to be renewed.

People are usually concerned about the adverse health effects of poor quality tap water and have turned to bottled water and home treatment systems in order to ensure good quality drinking water (Gelt 1996). Similarly, in Antalya 44.1% of the public who reject tap water prefer large water bottles of around 20 litres. An additional 7.0% choose home treatment systems, 4.6% favour small water bottles and 1.3% prefer combinations of all these alternatives. However, users in many other countries are purchasing bottled water for convenience and not necessarily for health. It may be of interest to note that very recently water users in the San Francisco area have switched back from bottled water to tap water because of concerns about safety and contamination of bottled water as well as the use of oil to make the bottles and the disposal of the bottles. The mayor of San Francisco City and County issued Executive Directive 07-07 dated 21 June 2007 to limit the use of bottled water to combat global warming and reduce environmental pollution (City and County of San Francisco 2007).

Hard water causes some consumer problems such as soap scum formation, white mineral deposits on dishes, and reduced efficiency of water heaters (Davis & Cornwell 1998). There is no evidence that drinking hard water adversely affects human health (Fabrizi 2005). In fact, drinking hard water has been shown to have advantages including reduced risk of cardiovascular diseases (Dezuane 1997) and stronger teeth and bones (Gelt 1996). However, in Antalya, 40.9% of the population thinks that drinking hard water is very harmful to health and an additional 37.7% of the population thinks that hard water is slightly harmful to health. Only 14.5% of people think that hard water does not have any adverse health impacts.

Among the questionnaire participants, 56.5% do not trust the quality of tap water, 18.0% trust the quality of tap water, and 24.1% hesitate about the quality of tap water. The quality of bottled waters is not trusted by 21.6% of the people, 38.4% trust bottled waters, and 37.8% of the people hesitate about the quality of bottled waters. Large bottled

water is not trusted by 23.4% of people questioned, 35.3% trust large bottled waters, and 38.6% hesitate about large bottled waters. Home treatment systems are not trusted by 29.5%, 22.8% trust them while 32.9% hesitate about their quality. These results indicate that the majority of the public do not trust alternatives to tap water but they believe that they are healthier than tap water.

Consumption of bottled water in some countries has developed cult characteristics. This is partly due to successful marketing, but in most cases it is justified because of poor tap water quality coming from natural resources (Pilat 2002). Contrary to what many people believe, bottled water is not free of microorganisms. Most of these organisms come from the source water itself and do not pose problems for healthy individuals. Pathogens can be attributed to either the source or the bottling process. Source and/or bottling contamination appears to have been the case in those incidents in which overt disease has been reported (Rosenberg 2003). In Antalya, the fluoride content in all bottled waters is much less than the guideline of $1.5 \, \text{mg} \, \text{l}^{-1}$ stated by the World Health Organization in their drinking water standards (WHO 2004). This guideline value may vary by climate and local circumstances.

In Antalya, most apartments have local storage tanks because of low pressure and frequent cuts in water services in the past. Now, however, the pressure of the water distribution system is enough to lift water to the upper floors of most apartment buildings and cuts in water service are less frequent. Therefore, most local storage tanks are bypassed although some of them are still in use. Among those in use survey participants indicated that only 6.4% are cleaned regularly, 5.4% are rarely cleaned, 17.3% did not know if their storage tanks were cleaned or not, and 4.0% never cleaned their storage tanks. If the Antalya municipality established a team to clean and disinfect the local storage tanks at considerable cost, 27.3% of the questionnaire participants would call this team to clean their tanks.

Among questionnaire participants, 92.7% wanted to know the results of water quality analyses conducted by the Antalya municipality in their residential areas. Only 6.5% of the participants were not interested in the results of the water quality analyses. Media used to report the analyses include: brochures, favoured by 30.0% of the respondents, television by 21.0%, newspapers by 21.0%, Internet by

20.0%, and radio by 5.0%. Also, among questionnaire participants, 85.7% wanted to receive information about tap water standards, tap water quality, tap water analyses, bottled-water quality and home treatment systems. Only 12.5% of them did not want to get information about these subjects.

Indirect results of the questionnaire

Questionnaire results showed that more than 50% of the people do not drink tap water. This percentage increases with the increase of educational and income levels. Also, this percentage is higher among females than males.

Nearly 60% of the people who participated in the questionnaire were not satisfied with the quality of tap water. This percentage is larger among people with more education and income. Also, males were more satisfied than females with the quality of tap water and young people were more satisfied with the quality of tap water than old people. Confidence in both small and large bottled water was lower among participants with more education and income.

The results of the questionnaire showed that the greater the educational level and income, the larger the percentage of the people who wanted to know about the results of the water quality analyses in their residential areas. In addition, the percentage of the females who wanted to know about the results of the water quality analyses in their residential areas was larger than the males.

Improving the acceptance of tap water

Investigating public opinion in Antalya resulted in qualitative and quantitative evaluation of drinking water problems and solutions. The public indicated clearly the reasons for rejecting tap water for drinking and some possible solutions. Hardness was the most important reason for objecting to tap water because more than 40% of the people believe that hard water is very harmful to health. This incorrect belief could be changed by organizing public awareness campaigns. The results of these campaigns are expected to be successful in changing opinion because more than 85% of the participants would like to receive information about potable water quality, standards, bottled water and home treatment systems. The results of the questionnaire also pointed out that the target group should include females and males, rich and poor, young and old persons or essentially all classifications of the public. Brochures, TV, newspapers, Internet and radio can be used for this purpose with good potential for success as indicated by the results of the questionnaire.

The public are anxious to know about the results of water quality analyses in their residential areas. More than 90% of the participants showed they are willing to receive such information. Thus, the municipality should regularly inform the public about these results. In addition, a proportion of the public indicated that they would have more confidence in the accuracy of the information if an independent organization such as the university in Antalya checked the results of analyses.

Participants indicated that the water becomes polluted shortly after each maintenance operation. Therefore, the municipality should find a way to discharge the drainage water from the drain valves after each maintenance operation. Water supply interruptions should be minimized as much as possible. Local storage tanks should be bypassed in the areas with enough water pressure and regular water supply. However, participants indicated their interest in using a specialized municipality team to clean their local storage tanks. Such a team should be made available by the municipality as is done in other big cities in Turkey such as Istanbul. Finally, the old parts of the water mains should be renewed to prevent the deterioration of water quality.

CONCLUSIONS

Most of the public in Antalya city do not use tap water for drinking purposes. The results of a questionnaire showed that exaggerated opinions about the adverse health impacts of hard water are the main reason for rejection of tap water. Other reasons include lack of information about the quality of water in the distribution network, lack of confidence in this information, and observations about turbid water following each maintenance operation. The majority of the public indicated a strong desire to receive information about water quality, water standards and other water issues. Consequently, public awareness campaigns should be very effective in changing incorrect beliefs of the public.

Questionnaire results showed that other water management actions should be taken to convince the public to use tap water for potable purposes. Examples include using drain valves to discharge water after maintenance, regular and intensive monitoring of water quality in the residential areas, and informing the public about water analysis results through brochures, TV, newspapers, Internet and radio. Public perception of tap water would also be improved by action on water rates, regulation of the use of home devices and storage. The results of this research study show that public participation is an effective and inexpensive method to improve public perception of tap water as a drinking source in Antalya city.

ACKNOWLEDGEMENTS

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