

Use and Quality of Bottled Water in Bahawalpur City, Pakistan: An Overview

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Abstract: As a basic need of human life, the place of safe potable water cannot be ignored elsewhere. Therefore, the main objective of the current study was to take an overview of the main source of water, expenditure on water purchasing and use quality of bottled water in Bahawalpur city. Primary data were gathered through a structured questionnaire during a field survey in selected five residential areas as sample sites i.e. Model town A, Model town B, Shahdrah, Satellite town, and Islami colony, while the secondary data were collected from PCRWR and a few web sources. Data were gathered from 150 respondents (30 from each study site) and analyzed in SPSS 17 software by applying descriptive statistics (frequencies and percentages) to get a generalized picture regarding the main source of water, use and quality of bottled water in the study area. Findings make it clear that majority of the respondents were fetching water from government filtration plants following the electric pumps. Moreover, various local water companies (e.g. Pineo, Piyas, Aquafina, Kinley, Al-Shiffa, Life Water) were also supplying water in the study area. Particularly, the use and demand for bottled water are increasing day by day as people have serious concerns on quality related issues of water. Bottled water was available in different quantities from 0.5 liters to 19 liters with respective prices that were purchased from various departmental and medical stores or via home delivery service. But the quality of the bottled water was not satisfactory and up to the standards. The PCRWR laboratory analysis of bottled water samples show significant variations and alarmingly different brands i.e. Blue water, Kalash pure water and Pan Pura were found chemically and microbiologically unfit for drinking purposes. So, it is suggested that regular monitoring and quality control steps by local government in the private sector would ensure the effective and secure potable water deliverance.

Keywords: Water use, water purchasing, bottled water, PCRWR, Bahawalpur.

Introduction

Water is considered as nature's best gift for mankind and its importance cannot be ignored, neither can it be replaced by any other substance. Today, for determining the quality of our lives, water is a key component. Currently, Pakistan is among those countries where increasing population growth rate is putting stress on water resources. The accessibility of water has dropped from 5,600 cubic meters per capita in 1952 to 1,200 cubic meters in 2003, and if prompt action wouldn't be taken, it is predicted to reduce as much as 700 cubic meters in 2025 (Khan and Javed, 2007; Pak-SCEA, 2006). In contrast with an increasing population from 34 million in 1951 to a projected population of 267 million in 2025, water availability is decreasing at an alarming rate (Pak-EPA, 2005). The key water-related issues in Pakistan are scarcity and unavailability of clean drinking water. In Pakistan, about 38.5 million individuals have no approach to fresh and secure drinking water and its deficit is multiplying rapidly (Rasheed, 2015). According to the World Health Organization (WHO), regarding drinking water quality issue, Pakistan stands at number 80 among 122 countries, where the bulk of water

supply is polluted with bacteria and arsenic (Aslam, 2017). The mega city Karachi is also facing a serious problem of water scarcity especially in its slum areas (Alamgir et al., 2015). It is required that a balance is maintained between the equal availability of water to all people, as a basic human need and for food production or other beneficial use (Savenije and Zaag, 2002).

Bottled water is one of the few sources of safe drinking water in developing countries; it has become an evolving worldwide enterprise and bottled water use keeps on enhancing quickly in the world, especially in those countries, where fresh drinking tap water is usable at a nominal price or free of cost (Rosemann, 2005; Wilk, 2006; Yilkal et al., 2019). The global bottled water industry comprises annually about 89 billion liters with a predicted value of \$22 billion and about 75% industry is handled by local traders. Moreover, worldwide, the sales of bottled water are increasing 10% per annum. As far as the quality of drinking bottled water is concerned, it is normal but it may undergo the same pollution danger as tap water. Therefore, bottled water quality has regularly been examined in Europe, both by autonomous labs and by

enterprises' owned resources. But in developing countries (e.g. Ethiopia, Pakistan, etc.), for human use, bottled water quality is not subjugated to any rigorous quality control standards (Ferrier, 2001; Gleick, 2004; Yilkal et al., 2019).

In Pakistan, with a rapidly surging population and growing urbanization, the need for fresh drinking water is enhancing on a daily basis as citizens prefer to drink bottled water. Particularly, the urban dwellers are very keen and have sufficient knowledge about contagious drinking water and as a result, the sale of bottled water is on the rise. The demand for bottled waters of various brands has increased in the past few years. Bottled water plants have been set up in different parts of the country, which indicates the increase in demand. Thus, Pakistan Standards and Quality Control Authority (PSQCA) has made it obligatory for the enterprises to attain proper permission from the authority prior to the beginning of functions (Awais, 2017). Therefore, the main objective of the current study was to take an overview of the main source of water, expenditure on water purchasing and use and quality of bottled water in Bahawalpur City.

Material and Methods

Study Area

Bahawalpur city is located in southern Punjab's semi-arid climatic zone. Bahawalpur located within 27°-80' to 29°-50' N latitudes and within 70°-54' to 72°-50' E longitudes. The position of the area also contributes to enhancing the environmental problem of water quality and availability in the area, as it is counted as an arid and semi-arid hot region. People are facing problems in getting a sufficient amount of safe drinking water, especially in summer when the groundwater table lowers down greatly.

Data Collection, Sampling and Sample Sites

The data for the current study depend both on primary and secondary data sources. Primary data is gathered in the field during a survey through a structured questionnaire. Mostly the questionnaire contains the questions related to the bottled water use, their quality, impact on health and others, while the secondary data of main bottled water companies' brands and general quality were collected from quarterly reports of Pakistan Council of Research in Water Resources (PCRWR) and few web sources. Five residential areas have been selected as sample sites in Bahawalpur city to collect data i.e. Model town A, Model town B, Shahdrah, Satellite town and Islamic colony (Fig 2). Data were gathered from 150 respondents as samples (30 from each study site) by filling the questionnaire after briefly explaining purpose of the study. During 1950s, the construction of Model town A started to facilitate high-class people. Model town A is a defense housing area under the control of the cantonment board

of Bahawalpur. Model town B is the area of middle-class people and adjacent to the old walled city. Shahdrah is a slum area close to a developed area of Model town C, where houses are small in size, the population is thick and the streets are narrow. Satellite town is another residential area, which had been designed to facilitate all types of classes. The town is divided into different blocks for different classes. Islami colony is another slum area, where people of the poor class are in the majority. Streets are narrow and the sewerage system is not good.

Data Analysis

The analysis of the data was performed by applying descriptive statistics (frequencies and percentages) through SPSS 17 software to get a generalized picture regarding the main source of water, expenditure on water purchasing and using good quality of bottled water in the study area. Map of the study area was prepared using ArcGIS 10.3 software.

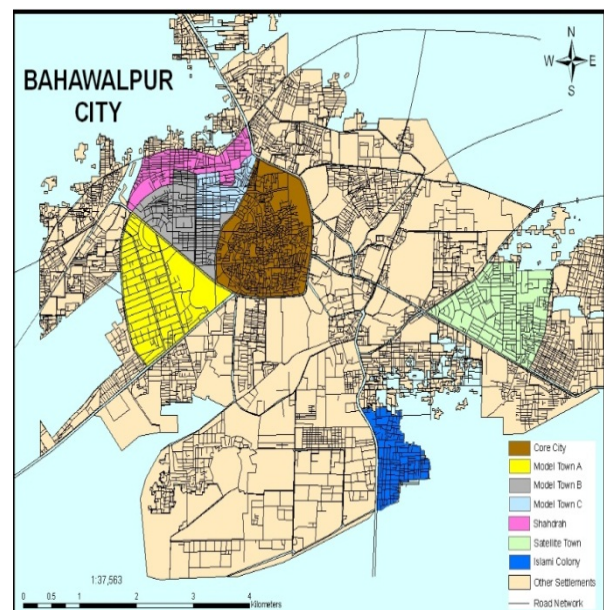


Fig. 1 Sample study sites in Bahawalpur city.

Results and Discussion

Major Source of Drinking Water

A drinking water source is one of the main indicators of water quality. Generally, groundwater is the main source of water used for domestic and other purpose in Bahawalpur, as it is evident throughout Pakistan (WWF, 2007). Figure 2 illustrates that 42.4% of respondents used Government filtration plants for drinking purpose following electric pumps with a share of 25.7%. Electric pumps are installed in almost every house, except some houses in Model Town A and Shahdrah, where municipal water supply still exists. Only 4.8% of respondents were using municipal supply as the main water source. Many people during the survey told us that in the past they had municipal supply, but now the water has just vanished from the

pipes due to inconsistent supply operation and deteriorating supply lines. Earlier a study conducted in Bahawalpur City had exposed that merely 10-15% of residents were using public water distribution network that served just 3% urban area (Safdar et al., 2014). Many people also complain that the quality or timing of the municipal water supply is not good. In another study, it is found that most of the residents of the city have complaints with Tehsil Municipal Administration (TMA) of Bahawalpur city about the water quality, that it is contaminated, sedimented and of diluted color (Mohsin et al., 2013). Alarmingly, about 96.1% of households were consuming unsafe water for drinking, leaving themselves greatly exposed to waterborne diseases (MICS, 2008). A recent study explored that the water used for drinking purpose is contaminated with 60% each of arsenic and iron in Bahawalpur (Hagras, 2013). In the study area, few houses reported using municipal water for watering lawn only. During the survey, it was also observed that private companies were supplying water in sampling sites too (e.g., Satellite Town). Moreover, 3.2% persons admitted that they have the private supply or often use bottled water in their homes. Residents were not satisfied with the water quality of government filtration plants as the installed filters are not changed according to the standards and with the quality of groundwater available in the city. About 17.6% of respondents told that they have installed small home-based water filter plants to improve the quality of water and the rest of 5.2% were using other sources of drinking water (e.g. hand pumps etc).

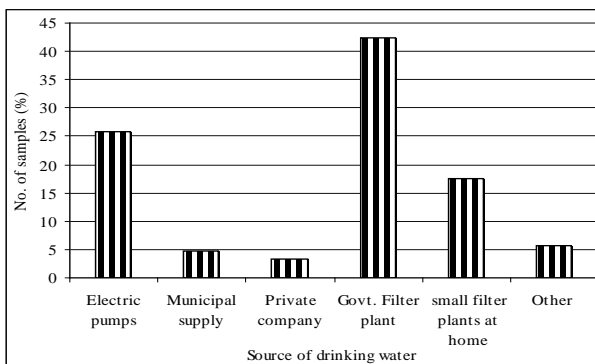


Fig. 2 Drinking water sources in the study area.

Expenditures on Water Purchasing

The role of local government is central on improving the quality and supply of water in the city, if such negligence stays, then this problem will become a long-lasting issue in future. It is not possible for every family to purchase water for drinking purpose on a daily basis. If we consider 2-liter water as a minimum drinking requirement for every human being in a day, then the estimated expenditure varies with the size of the family, especially in the summer season. Keeping the lower price of 5.26/liter (calculated from the average current prices of bottled and private water supply) for calculation or results are as follows;

Table 1. Estimated expenditure on purchasing water according to family size

Size of family	%age in the sample population	Est. the average demand for water (liters)/month	Est. expenditure (PKR) on purchasing water from private company/month
1-3	10.4	120	632
4-6	40	300	1,578
7-9	32.8	480	2,524
10-12	11.2	660	3,471
12+	5.6	840	4,418

Source: Field survey (2018) Note: Est. =Estimated

Table 1 clearly defines that family size consisting of 4 to 6 members has large population proportion in all groups, while estimated monthly expenditure for water is based on the minimum required demand. Fluctuations may occur with changing seasons and requirements. If the quality of water is not monitored and any plan is not initiated immediately, then water may be included as an essential item of our grocery. On the other hand, income is not increasing according to the demands and this gap between income and expenditure can put stress on the family in order to meet water demands along with other basic commodities.

Table 2. Sources of drinking water in relation to monthly income.

Income (PKR)	Source of drinking water					
	Electric pumps (%)	Filtration Plant (%)	Private Company (%)	Municipal supply (%)	Electric pumps +small water filters at home	Others (%)
>10,000	4	6.4	-	0.8	0.8	-
10,000-19,999	8	13.6	-	0.8	1.6	-
20,000-29,999	4	5.6	0.8	-	1.6	-
30,000-39,999	2.4	4.8	0.8	-	0.8	1.6
40,000-49,999	3.2	3.2	-	0.8	2.4	0.8
50,000-59,999	1.6	3.2	-	1.6	3.2	-
60,000-69,999	-	-	1.6	0.8	3.2	1.6
<70,000	2.4	5.6	-	-	4	2.4

Source: Field survey (2018)

The thought of expanding money to cure water-borne health problems compels people to spend a large proportion of their income on safe potable water purchasing. Many companies take advantage of this problem in the lower-middle class and sell their substandard water at cheap prices. Results show that the use of filtration plant was more common in an income group having a monthly income of less than PKR 20,000, although its use exists in almost every income group (Table 2). While its major use was observed in income groups having an income less than PKR 40,000 per month. Similarly, the use of electric pumps for drinking purpose was more common in an income group having a less than PKR 20,000 monthly. Income group of PKR 60,000-69,999 purchase more bottled water than any other income group. To avoid fatigue and tiredness of fetching water from filtration plants, many people have installed small water

filtration plants in their homes. Income groups ranging between PKR 30,000-70,000 were having the facility of filtration plants more than any other income group. Previously, a study conducted in Bahawalpur city found that a large proportion of 86% respondents was ready to pay monthly charges of water supply between the ranges of PKR 100 to 600 (Safdar et al., 2014). A study conducted in Parral, Mexico also indicates that households are willing to pay more from their income for safe and consistent drinking water services (Vasquez et al., 2009).

Use, Purchase and Supply of Bottled Water in Bahawalpur

The Pakistani bottled water market contains two main sections i.e. retail and wholesale. The retail market comprises of different quantities of PET bottles i.e. 0.5, 1.5, 3.1, 5.0, 6.0, 16, and 19 liters respectively. Whereas, the wholesale market provides delivery services mainly to household and office consumption in 2, 3, 5 and 19-gallon cans (Awais, 2017). Likewise, in the study area, the cost of bottles varied in different quantities from 0.5 liters to 19 liters. The highest price and demand of different quantity bottles were recorded by multinational Nestle Company (0.5 liters of PKR 40 and 19 liters of PKR 250) followed by local companies Kinley, Piyas, Pineo and Aquafina respectively (Table 3). It is also interesting to mention that the prices of bottled water vary in different shops with a difference of some rupees and as the quantity increases the prices normally decrease. Further, it is noticed that the most selling quantity PET of various companies was 5/6 liters frequently consumed by families on a daily basis, while the World Health Organization (WHO) also stated that the usage of bottled water in Pakistan is five liters per person as compared to three liters in Bangladesh (Aslam, 2017).

Table 3. Cost of bottled water in the study area (PKR).

Bottle company	Price of 0.5 liter	Price of 1.5 liters	Price of 5/6 liters	Price of 19 liters
Nestle	40	55	160 (5 liter)	250
Piyas	30	50	100 (6 liter)	200
Kinley	30	50	90 (6 liter)	-
Pineo	30	50	90 (6 liter)	150
Aquafina	30	50	90 (6 liter)	-

Source: Field survey (2018)

In the study area, there is a remarkable increase recorded in the use of bottled water and purchasing water from private companies. Although it burdened the economy of large families, for healthy lifestyle people have compromised their additional needs over purchasing water. Field survey shows the real picture of bottled water supply in the study area (Table 4). Results show that almost 1,075 houses that were surveyed purchased the water from various private water supplying companies (Pineo, Piyas, Aquafina, Kinley, ARWA, Al-Shiffa, Life Water). The most commonly selling brands were of 6 liters, 12 or 15 liters and 19 liters quantity which are sold through departmental stores or by delivering at homes out daily

and weekly basis. Consumers have to pay some security fee before they start exchanging their empty canes with filled ones. A big list of bottled water suppliers has been prepared during the survey, but on the basis of their ratio of sale, some companies have been shortlisted (Table 4). Private companies are less in number, which provide home delivery of water, because it requires storage place and transportation. In the context of bottled water usage, numerous factors are also mentionable including demographic factors (e.g. age, income, and occupation) and the source of known water quality. Although, comparative results of various bottled water labels show notable variations, but the trends appear to deviate regionally and according to country level (Alfadul and Khan, 2011; Doria, 2006; Abrahams et al., 2000).

Table 4. Private water supply companies in the study area

Name of Brand	No. of houses to be supplied	Price of 6 liters (PKR)	Price of 12/15 liters (PKR)	Price of 19 liters (PKR)
Pineo	300	90	-	200
Piyas	150	100	145 (12)	210
Aquafina	15	100	150 (15)	-
Kinley	10	90	-	-
ARWA	200	90	140 (12)	-
Al-Shiffa	200	-	-	150
Life Water	200	-	-	150

Source: Field survey (2018)

Among various water supplying companies, Pineo and Piyas are local companies, covering a large number of houses to supply water. Information about these companies was collected from houses as well as shops during the field survey. Although, importance of quality of water increases the use of bottled water in the study area, but this trend brought many substandard companies in the field.

Quality of Bottled Water

Despite these things, bottled water usage is becoming popular in the study area, as it is witnessed throughout the country but the quality of bottled water is not satisfactory. The PCRWR asserted that residents were compelled to purchase bottled water because of the poor drinking water quality, which had led to the expansion of bottled water enterprise in recent years. Earlier, the government assigned PCRWR the task to monitor the mineral and bottled water of various brands on a quarterly basis. Therefore, a large number of collected samples of many water bottle supplying companies were tested in PCRWR laboratory and found unfit either chemically or biologically (Shahid, 2018).

In the study area, bottled water samples of six different water supplying companies from two different quarterly periods (July-September 2017 and April-June 2018) were collected and tested for analysis. The PCRWR laboratory analysis of samples shows significant variations in chemical and microbiological parameters (Table 5). During the period of July-September 2017, Pineo, Blue Water, Pan Pura, and

Aspen Aqua were found chemically and to some extent microbiologically unfit for drinking purposes. Whereas during the period of April-June 2018, Blue water, Kalash pure water, and Pan Pura were found unsafe chemically and microbiologically.

Table 5. Quality of bottled water in Bahawalpur city

Brand Name	July-September 2017	April-June 2018
Pineo	Chemically unsafe microbiological safe	Chemically microbiological safe
Blue water	Chemically unsafe microbiological unsafe	Chemically unsafe microbiological
Kalash pure water	Chemically microbiological safe	Chemically unsafe microbiological safe
ARWA	Chemically unsafe microbiological safe	Chemically microbiological safe
Pan Pura	Chemically unsafe microbiological safe	Chemically unsafe microbiological safe
Aspen Aqua	Chemically microbiological unsafe	Chemically microbiological safe

Source: PCRWR laboratory analysis.

While in a study conducted in Lahore city, Pakistan, it is concluded that among total 24 collected samples of various brands of bottled water, 8.3% were found contaminated with bacteria (Yousaf and Chaudhry, 2013). Another analytical study made sample comparison with permissible limits of PSQCA and discovered that 17 brands of bottled water were not safe and contaminated microbiologically. These included Pineo, Niamat, Al-Khair, Aqua National, Zindagi Plus, Days Pure, Al-Haider Pure, Blu, Super Natural, Isberg, Jumeirah, Paradise, Afra and others (Ghani, 2015).

Similarly, in a report of 11 brands of water supplying companies including Livon, New Premier, Douro, Natural Pure Water, Vey, Doab, Al-Shalal, etc that the water was found dangerous for human use due to microbiological and chemical contaminants (The Dawn, 2017). Recently, it is found in a council's quarterly published monitoring report (October to December 2017) that 131 samples of bottled and mineral water were taken from Islamabad, Rawalpindi, Lahore, Quetta, Karachi, Peshawar, Multan, Tandojam, Sialkot and Bahawalpur. The comparative findings of these samples with the PSQCA standards had exposed that 12 brands were not found safe for human use due to chemical and microbiological pollution. These included SN Pure Drinking Water, Orion, I Pure, Snow Dip, Abe-Khyber, Fino, Oasis Plus, Aqua National and Life Water, etc (The Dawn, 2018). Thus, keeping this worse and alarming situation and projected risks for people's health, an official of PSQCA said that sound water policy is being formulated to ascertain the quality of drinking water, as rapid growth of private water filtration plants has been observed (Gulf News, 2017).

Conclusion

Accessing safe drinking water now is one of the important priorities of people in developing countries.

The findings of the present study manifest that safe drinking water accessibility and its use are becoming an important issue in Bahawalpur city. People are now more aware of the quality related aspects of the water. Overall, the quality of groundwater is not fit for human use in the city. Residents are fetching water from government filtration plants or installing electric pumps and home-based water filtration plants as the main sources of drinking water. Moreover, they were spending considerable income on buying water from private companies according to their family size and per month consumption. Besides, the expenditures were also made for purchasing bottled water from mushrooming private bottled water supply companies. But the cost and quality of this bottled water is not satisfactory and up to the mark as indicated by the PCRWR. The chemical and microbiological quality of water from various companies was substandard and not according to the criteria set by PSQCA.

Although, the use and purchase of these bottled water are growing on daily basis throughout the country yet people prefer them as safe potable water. But the quality issue is creating several health risks for the consumers. Basically, it has been the sole responsibility of local government to provide safe drinking water and consider it as a basic public right. However, due to lack of strict imposition of laws and ambiguous legislative framework, it is very difficult to manage the public and private partnerships for effective, secure and healthy supply of quality potable water to the people. Regular monitoring and quality control steps by the government in the private sector can ensure their right track and can control monopoly on public goods.

References

- Abrahams, N., Hubbell, B., Jordan, J. (2000). Joint production and averting expenditure measures of willingness to pay: Do water expenditures really measure avoidance costs? *American Journal of Agricultural Economics*, **82**(2), 427-437.
- Aslam, H. (2017). Bottled water business flourishes as demand for clean drinking water increases. Available: <https://propakistani.pk/2017/11/08/bottled-water-business-flourishes-demand-clean-drinking-water-increases>.
- Alamgir, A., Khan, M. A., Hany, O., Shaukat, S. S., Mehmood, K., Ahmed, A., Ali, S., Riaz, K., Abidi, H., Ahmed, S., Ghori, M. (2015). Public health quality of drinking water supply in Orangi town, Karachi, Pakistan. *Bulletin of Environment, Pharmacology and Life Sciences*, **4**(11), 88-94.
- Alfadul, S. M., Khan, M. A. (2011). Water quality of bottled water in the Kingdom of Saudi Arabia: A comparative study with Riyadh municipal and Zamzam water. *Journal of Environmental Science and Health, Part A. Toxic/Hazardous Substances*

- and *Environmental Engineering*, **46** (13), 1519-1528. DOI: 10.1080/10934529.2011.609109.
- Awais, M. (2017). List of bottled mineral water companies (brands) in Pakistan. Available: <https://content.pk/pakistan/list-of-bottled-mineral-water-companies-brands-in-pakistan>.
- Doria, M. F. (2006). Bottled water versus tap water: understanding consumers' Preferences. *Journal of Water and Health*, **4**(2), 271-276.
- Ferrier, C. (2001). Bottled water: understanding a social phenomenon. *Ambio.*, **30**, 118-119.
- Ghani, A. (2015). 17 Bottled water brands unsafe for drinking. Available: <https://nation.com.pk/17-Jul-2015/17-bottled-water-brands-unsafe-for-drinking>.
- Gleick, P. H. (2004). The myth and reality of bottled water. In: *The world's water 2004-2005: The biennial report on freshwater resources*, Part 8, Island Press.
- Gulf News. (2017) Demand for bottled water increasing in Pakistan: Majority of water supply is contaminated with arsenic and various bacteria. Available: <http://gulfnnews.com/news/asia/pakistan/demand-for-bottled-water-increasing-in-pakistan-1.2123416>.
- Hagras, M. A. (2013). Water quality assessment and hydrochemical characteristics of groundwater in Punjab, Pakistan. *IJRRAS*, **16** (2), 254-262.
- Khan, F. J., Javed, Y. (2007). Delivering access to safe drinking water and adequate sanitation in Pakistan. Seminar presentation, Available: www.pide.org.pk/pdf/Seminar/Seminar78dp.
- MICS. (2008). Multiple indicator cluster survey (MICS) 2008-2009 Punjab. Available: pspu.punjab.gov.pk/system/files/01-MICS%202007-0Provincial%20Report_0.pdf.
- Mohsin, M., Safdar, S., Asghar, F., Jamal, F. (2013). Assessment of drinking water quality and its impact on residents health in Bahawalpur city. *International Journal of Humanities and Social Science*, **3**(15), 114-128.
- Pak-EPA. (2005). State of the environment report. Available: <http://environment.gov.pk/state-of-environment-report>
- Pak-SCEA. (2006). Pakistan strategic country environmental assessment. South Asia environment and social development unit, the World Bank, available: <http://environment.gov.pk/new-pdf/PK-SCEA-FText-Oct-2006.pdf>.
- Rasheed, S. A. (2015). Provision of safe drinking water: A new challenge for Pakistan. Available: <https://nation.com.pk/13-Jun-2015/provision-of-safe-drinking-water-a-new-challenge-for-pakistan> (March 27, 2018).
- Rosemann, N. (2005). Drinking water crisis in Pakistan and the issue of bottled water: The case of Nestlé's 'Pure Life'. Swiss Coalition of Development Organizations Swissaid, Catholic Lenten Fund.
- Safdar, S., Mohsin, M., Khan, A. A. (2014). Sustainable management of water supply in Bahawalpur city, Pakistan. *European Academic Research*, **1**(12), 5824-5850.
- Savenije, H., Zaag, P. V. D. (2002). Water as an economic good and demand management paradigms with pitfalls. *Water International*, **27** (1), 98-104.
- Shahid, J. (2018). PCRWR declares nine bottled water brands unsafe. Available: <https://www.dawn.com/news/1438192>.
- The Dawn. (2018). Twelve bottled water brands declared unsafe. Available: <https://www.dawn.com/news/1388920>.
- The Dawn. (2017). Eleven mineral, bottled water brands unsafe for consumption. Available: <https://www.dawn.com/news/1350881>.
- Vasquez, W. F., Mozumder, P., Hernandez-Arce, J., Berrens, R. P. (2009). Willingness to pay for safe drinking water: Evidence from Parral, Mexico. *Journal of Environmental Management*, **90**, 3391-3400.
- Wilk, R. (2006). Bottled water, the pure commodity in the age of branding. *Journal of Consumer Culture*, **6** (3), 303-325. DOI: 10.1177/1469540506068681
- World Development Report. (2006). *Water for Development*. Washington, DC: The World Bank.
- WWF. (2007). Pakistan's water at risk- water and health related issues in Pakistan and key recommendations, Freshwater and Toxics Programme. World Wildlife Fund (WWF). Available: <http://www.wfpak.org/pdf/water-report.pdf>.
- Yilkal, E., Zewge, F., Chandravanshi, B. S. (2019). Assessment of the quality of bottled water marketed in Addis Ababa, Ethiopia. *Bulletin of the Chemical Society of Ethiopia*, **33**(1), 21-41. DOI: <https://dx.doi.org/10.4314/bcse.v33i1.3>
- Yousaf, S., Chaudhry, M. A. (2013). Microbiological quality of bottled water available in Lahore city. *Journal of Pakistan Medical Studies*, **3**(2), 110-112.