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Short Report

Purview: Quality of Drinking Water in Rawalpindi and Islamabad

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Introduction

Pakistan is facing acute water shortage due to climatic changes since last many years, not only for drinking purposes, but also for agriculture and industries.[1] Safe drinking water is essential for human health. The supplies of potable water are not only scarce but also gets contaminated before consumption and people are concerned about the un-safe drinking water in most parts of the country. Pakistan is among those few developing countries where access to safe drinking water falls far below satisfactory levels.[2] While figures vary significantly, a recent independent study reports that not more than 25% of the population has sustainable access to quality drinking water.[3] The quality of drinking water in the capital is expected to be better as compared to other cities; however, the same situation exists in Rawalpindi/Islamabad. Although the capital of Pakistan is having a relatively less polluted environment as compared to other bigger and older cities like Lahore, Karachi, Faisalabad as well as rural areas.

During the year 2016, the Environmental Health & Microbiology Laboratories of National Institute of Health Islamabad received 753 water samples for physico-chemical and bacteriological analysis. The present study deliberates upon the water quality in the Rawalpindi/Islamabad and adjoining areas.[4]

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Authors Contribution

JAN & NJ conceptualized the project. JAN, NB & AK did the data collection. NB & MI performed literature search. FH, MS, NJ & MI did the statistical analysis. SB, TRS & FH did the data collection. Drafting, revision and writing of manuscript was done by NB, FR & MS.

Methods and Results

A prospective study, using consecutive sampling for period from January to December 2016.

The Environmental Health & Microbiology, Public Health Laboratories Division at National Institute of Health received 753 drinking water samples during 2016 from general public for microbiological and chemical analysis. All samples were assigned a code, containing the information of respondents and their area to avoid any overlapping in sampling. Only one sample form for each site was selected for the study. The sample pool contained 76.22% (n=574) water samples from Islamabad, 7.83% (n=59) from Rawalpindi, while 15.93% (n=120) samples were from the peripheral/adjoining areas of the twin cities. The sterilized glass bottles were provided for sampling by the laboratory, and 750 ml water was collected for each sample, 250 ml for microbiological analysis, while the remaining 500 ml was used for physico-chemical study.

Fifteen parameters were tested according to the standard method procedure printed on the kits. Temperature and pH were recorded, chlorine, (free and total) was analyzed by using LaMotte test kit. Taste, odour, and colour were tested in situ and Nitrate-nitrogen was determined by diazotization/ coupling. Total hardness, chloride conductivity, total dissolved solids, turbidity, zinc, iron were tested in the laboratory. Total Coliform count (multiple tube method, MPN technique) and Faecal Coliform (presence/absence) were also tested.

The results of analysis were compiled according to the WHO guidelines for quality of drinking water,[5] and the comment was made on the quality of sample as “satisfactory” or “unsatisfactory” on basis of different parameters processed for physico-chemical characters including pH, turbidity,

Table 1: WHO reference values of physico-chemical parameters.

Parameter	*Reference Value*	*Parameter*	*Reference Value*
Colour	Colourless/Clear	Conductivity	<2000 µS
Odour	Odourless	Total Dissolved Solids	<1000 mg/L
Sediments	Nil	Chloride	<250 mg/L
pH	6.5-8.5	Chlorine	<0.3 mg/L
Nitrite-NO_2	<0.1 mg/L	Iron	<0.3 mg/L
Nitrate-NO_3	<10.0 mg/L	Zinc	<5 mg/L
Fluoride	<1.5 mg/L	Arsenic	<0.05 mg/L
Turbidity	<5.0 NTU	Sulphate (SO_4)	<400 mg/L
Hardness as Ca CO_3	<500 mg/L		

Table 2: Quality of drinking water obtained from different sources.

Source	*n*	*Physico-chemical analysis*		*Microbial Contamination*	
		Satisfactory (%)	*Un- Satisfactory (%)*	*Satisfactory*	*Un- Satisfactory (%)*
Bore	507	394 (77.7)	113 (22.28)	300	207 (40.82)
Tap	53	43 (81.0)	10 (18.86)	32	21 (39.42)
Filter	49	45 (92.0)	4 (8.16)	37	12 (24.48)
Others	144	110 (76.0)	34 (23.61)	69	75 (52.08)
Total	753	592 (79.0)	161 (21.38)	438	315 (41.83)

hardness, conductivity, Chlorine, total dissolved solids (TDS), iron, zinc and chloride content multiple tube method was used for microbiological analysis. All the Physico-chemical and Microbiological results were interpreted according to WHO guidelines for the Drinking water quality standards. The reference values for the physico-chemical parameters are given in Table-1.

Data were subjected to chi-square test, using SPSS-20.00, with the significance level of 0.05.

A total of 753 water samples were tested for Physico-chemical and microbiological parameters during 2016, 21.38% (n=161) samples were Physico- chemically unsatisfactory, 41.83% (n=315) were not safe to drink microbiologically and 44.75% samples were unsatisfactory, both physico-chemicaly and microbiologically (Table-2).

Comparison of the results using the chi-square test (SPSS ver 20.00), revealed no significant differences (p =0.12) on the basis of physico-chemical analysis, while significant variation was observed in case of microbiology results (p =0.01).

Few samples from tap (18.86%) were unfit physico-chemically as only turbidity was not within the normal range. On the whole, 39.42% samples were unfit for human consumption due to the presence of coliforms, faecal coliforms and *E. coli.* Samples from filter water 8.16% were unfit physico-chemically; again only turbidity was the affected parameter. Taking into consideration the presence of coliforms and faecal coliforms, 24.48% samples were unfit for human consumption.

The bacteriological quality of the water samples from all sources, except for bore water, was poor as compared to physico-chemical parameters to climatic changes especially during the rains & flood season and presence of coliforms, faecal coliforms and *E. coli*. bacteria in contaminated samples. The value of three parameters TDS, Turbidity and Nitrate were increased in rainy season while the other parameters remained the same. The bacterial contamination and the presence of TDS, turbidity in these samples was important.

Comments

The quality of drinking water was significantly unsatisfactory microbiologically due to the presence of faecal coliforms. A significant number of samples from bore were unfit physico-chemically (22.28%) as three parameters, turbidity, conductivity and TDS were not within the normal range.

Sampling from other sources revealed 23.61% samples were unfit physico-chemically. Four physico-chemical parameters: pH, turbidity, conductivity and TDS were not within the normal range. Taken together, 52.08% samples were unfit for human consumption due to the presence of coliforms, faecal coliforms and *E. coli*. bacteria.

Indicators of water quality are important in devising strategies to prevent long term deleterious effects on human health.[6] The data generated from the study under discussion warrants the need to adapt both short term and long term management.

Impact from water safety plans (WSPs), has been documented,[7,8] however, it requires extensive surveillance data or expensive studies which may not be economically supportive in developing countries, as they often require a long time to be noticeable and are relatively complicated to measure.

Major outcome of WSPs are the intermediates change resulting in impacts such as water supply and health improvements, and have been documented by various studies.[9,10] Our study has reported microbial contamination of more than 40% even in the bore water, with 39.42% in the tap water being supplied through the municipal water supplies (Table-2). This study is providing baseline data for the capital of Pakistan, a developing country, which is to serve as the starting point towards implementation of the WSPs in Pakistan.

Conflict of interest: None declared.

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