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COMPARSION OF PHYSICAL AND CHEMICAL QUALITY OF WATER AVAILABLE FROM WATER WORKS AND RO SYSTEM OF RURAL AND URBAN AREA IN FARIDKOT DISTRICT IN PUNJAB

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ABSTRACT

Introduction: Waterborne diseases are still a burden on the economy of developing countries due to lack of awareness of among populations.

Methodology: The present cross-sectional study was conducted in urban area (Faridkot block) and rural area (villages under community health centre, Bajakhana) of district Faridkot, Punjab. The total of 80 water samples, 40 each from urban and rural areas were studied. The further distribution was 30 from Water Works, 10 from R.O system. The total of 3 Water Works and 13 RO systems were located in urban area. While the total of 53 Water Works and 53 RO systems were located under rural area. Finally, a list of 10 R.O systems and 10 samples each from 3 Water Works was prepared from urban and rural area by Simple random sampling. Results: Water available from water works in the urban area showed higher value of turbidity, pH, total dissolved solids, alkalinity and total hardness (p value <0.005) as compared to rural area. In case of water filtered by RO system, turbidity, alkalinity and total hardness were more in case of rural water.

Conclusion: Results of present study concluded that RO treated water had better quality as compared to water available from water works both at rural and urban level.

Keywords: Total dissolved solids; Turbidity; Drinking water; Faridkot; Punjab

INTRODUCTION

Drinking water is one of the basic needs of life and essential for survival. Still more than one billion people all over the world do not have ready access to an adequate and safe water supply and more than 800 million of those unsaved live in rural areas. In India, ground water is being used as raw water for 85% public water supply.[1] Around 37.7 million Indians are affected by waterborne diseases annually, 1.5 million children are estimated to die of diarrhoea alone and 73 million working days are lost due to waterborne disease each year. The resulting economic burden is estimated at $600 million a year. While 'traditional diseases' such as diarrhoea continue to take a heavy toll, 66 million Indians are at risk due to excess fluoride and 10 million due to excess arsenic in groundwater. In all, 1,95,813 habitations in the country are affected by poor water quality.[2] The present study was planned and carried out to assess the physical and chemical quality standards of water in different rural and urban areas of Faridkot district, Punjab. The study aimed to highlight the difference in quality of water standards available from water works and RO system in urban and rural area.

MATERIALS AND METHODS

The present cross-sectional study was conducted in urban area (Faridkot block) and rural area (villages under community health centre, Bajakhana) of district Faridkot, Punjab. The samples were tested in District Public Health Laboratory. The study was continued till completion of 80 samples from June to September 2014. A pilot study was conducted for a period of 15 days in May 2014 to assess the

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Table 1: Physical and chemical parameters with their permissible limits

Physical parame-ters	Test results	Permissi-ble Limit	Maximum Permissi-ble Limit
Colour (Hazen units, max.)		5	25
Taste and Odour (Qualitative)		UNOBJEC-TIONABLE	
pH value		6.5 TO 8.5	NO RELAXA-TION
Total Dissolved Solids(mg/Ltr)		500	2000
Alkalinity (mg/Ltr)		200	600
Total Hardness		300	600
Calcium (as Ca) mg/Ltr		75	200
Chlorides(as Cl) mg/Ltr		250	1000
Flouride (as F) mg/Ltr		1.00	1.50
Iron (as Fe) mg/Ltr		0.3	1.00
Turbidity (NTU,max)		5	10

feasibility of the study by using predesigned proforma. Based on the observation, certain minor modifications were done and the proforma was used. District Sub-Divisional Engineer of the Water Supply and Sanitation Department, Faridkot was personally approached and explained about the purpose of the study. Written Permission of sub-divisional engineer was obtained and the staff was instructed to cooperate and provide all assistance to the author and also supply list of water sources. A list of total number of water sources in Faridkot District, which includes Water Works and R.O Systems was obtained from the Water Supply and Sanitation Department, Faridkot. The total of 80 water samples, 40 each from urban and rural areas was studied. The further distribution was 30 from Water Works, 10 from R.O system. The total of 3 Water Works and 13 RO systems were located in urban area. While the total of 53 Water Works and 53 RO systems were located under rural area. Finally, a list of 10 R.O systems and 10 samples each from 3 Water Works was prepared from urban and rural area by Simple random sampling. Table 1 shows the proforma including physical and chemical parameters with their permissible limits. Data was collected, compiled and analyzed by using SPSS-16 and t-test was used to e statistical analysis and p value<0.05 was considered as significant value.

RESULTS

The comparsion of chemical and physical parameters of R.O system (table 2) in urban and rural area of Faridkot district showed that the turbidity of rural area was more, 0.424 as compared to 0.182 of urban area. The pH of rural and urban area was almost same, 6.80 as compared to 6.75 of urban area. The total dissolved solids of urban area was more, 70.1 as compared to 68.3, alkalinity of rural area was more, 40.8 as compared to 24.8 and hardness of rural area was more, 39.6 as compared to 25.8. Regarding mineral content, calcium of urban area was more, 13.6 as compared to 12.8 of rural area, chlorides of rural area was more, 25.6 as compared to 16.5 of rural area, fluoride of urban area was more, 0.50 as compared to 0.15, iron level and residual free chlorine of rural and urban area was almost same. Physical parameters i.e. color, taste and odour were found same in urban and rural area. The colour was colourless, taste and odour was ordinary.

The comparsion of chemical and physical parameters of water works (table 3) in urban and rural area of faridkot district showed that turbidity of urban area was more, 1.39 as compared to 1.09 of urban area, pH of urban area was more, 8.02 as compared to 7.71 of rural area, total dissolved solids of urban area was more, 3.52 as compared to 1.94 and the alkalinity of urban area was more, 118 as compared to 93.6.The hardness of urban area was more, 128 as compared to 102. The calcium of rural area was more, 34.3 as compared to 31.7 of rural area. The chlorides of rural area were more, 82.9 as compared to 81.7 of rural area. The fluoride of urban area was almost same, 0.916 as compared to 0.950. The iron of urban area was more, 0.106 as compared to 0.010 in rural area . The residual free chlorine of rural area was more, 0.126 as compared to 0.066 in urban area. The colour was colourless in

Table 2: Comparsion of R.O system of rural and urban area

S. No	Parameters	Urban			Rural			
Chemical Parameters								
		Mean	SD	Range	Mean	SD	Range	P-value
1.	Turbidity	0.1820	0.05350	2.48	0.4240	0.2200	0.76	0.036
2.	pH value	6.7500	.42492	1.00	6.8000	.25820	0.5	0.555
3.	Total Dissolved Solids	70.1000	2.5808E1	81.00	68.3000	2.7616E1	72.00	0.841
4.	Alkalinity	24.8000	5.00666	12.00	40.8000	10.16311	30.00	0.001
5.	Total Hardness	25.8000	8.13497	22.00	39.6000	7.76316	22.00	0.000
6.	Calcium	13.6000	1.83787	6.00	12.8000	2.34758	6.00	0.309
7.	Chlorides	16.5000	2.17307	8.00	25.6000	19.22498	64.00	0.169
8.	Flourides	0.500	.07071	0.2	0.1500	.07071	0.2	0.002
9.	Iron	0.0000	0.00000	0.00	0.0000	0.00000	0.00	-
10.	Residual Free Chlorine	0.0000	0.00000	0.00	0.0000	0.00000	0.00	-
Physical parameters								
1.	Colour	Colourless			Colourless			
2.	Taste And Odour	Ordinary			Ordinary			

P value < .05 and alpha error 5%

both urban and rural area .The taste and odour was ordinary in both urban and rural area.

DISCUSSION

Access to clean drinking water presents a monumental challenge that is well documented for the developing world but is a rising problem for more established regions. Lack of clean water is responsible for more deaths in the world than war. About 1 out of every 6 people living today do not have adequate access to water, and more than double that number lack basic sanitation, for which water is needed. In some countries, half the population does not have access to safe drinking water, and hence, is afflicted with poor health. [3]

Turbidity is a measure of the cloudiness of water. The higher the turbidity, the harder it is to see through the water. Drinking water should have a turbidity of ≤ 5 NTU (Davis, 2002). Turbidity becomes visible at approximately 5 NTU, and water with any visible turbidity may be rejected in favor of a clearer, possibly more contaminated source.[4] In the present study, the turbidity of rural area was more, 0.424 as compared to 0.182 of urban area in case of RO water.

Careful attention to pH control is necessary at all stages of water treatment to ensure satisfactory water clarification and disinfection. For effective disinfection with chlorine, the pH should preferably be less than 8. The pH of the water entering the distribution system must be controlled to minimize the corrosion of water mains and pipes in household water systems. Failure to do so can result in the contamination of drinking-water and in adverse effects on its taste, odour, and appearance. The optimum pH will vary in different supplies according to the composition of the water and the nature of the construction materials used in the distribution system, but is often in the range 6.5–9.5. Extreme pH values can result from accidental spills, treatment breakdowns, and insufficiently cured cement mortar pipe linings.[5] In the present study pH of urban water was 6.75 of RO water, 8.02 of water works and of rural area was 6.8 of RO water and 7.7 of water works.

Total dissolved solids (TDS) is defined as all inorganic and organic substances contained in water that can pass through a 2 micron filter. In general, TDS is the sum of the cations and anions in water. TDS concentrations less than 500 mg/L should ensure safety from almost all inorganic constituents. Above 500 mg/L, the individual

Table 3: Comparsion of water works of rural and urban area

S. No	Chemical Parameters	Urban			Rural			
		Mean	SD	Range	Mean	SD	Range	P-Value
1.	Turbidity	1.3933	.30614	0.96	1.0967	.06348	0.18	0.000
2.	PH Value	8.0283	.32155	1.05	7.7127	.15863	0.55	0.000
3.	Total Dissolved Solids	3.5213e2	1.4948e2	550.00	1.9420e2	2.8979e1	106.00	0.000
4.	Alkalinity	118.2667	30.46188	94.00	93.6667	2.83249	10.00	0.000
5.	Total Hardness	128.6667	36.38618	114.00	102.0667	5.29107	24.00	0.000
6.	Calcium	31.7333	2.01603	6.00	34.3333	1.49328	4.00	0.000
7.	Chlorides	81.7667	14.33992	44.00	82.9667	7.73921	32.00	0.403
8.	Flourides	0.9167	0.31741	1.00	0.9500	0.15256	0.50	0.242
9.	Iron	0.1067	0.10483	0.60	0.0100	.03051	0.10	0.000
10.	Residual Free Chlorine	0.0667	0.04795	0.10	0.1267	.07397	0.20	0.000
Physical Parameters								
1.	Colour	Colourless			Colourless			
2.	Taste and Odour	Ordinary			Ordinary			

P value < .05 and alpha error 5%

constituents contributing to TDS should be identified, quantified, and evaluated.[6] In the present study TDS of urban water was 70.1 mg/litre of RO water, 3.52 mg/ litre of water works and of rural area was 68.3 mg/ litre of RO water and 1.94 mg/ litre of water works.

Alkalinity is primarily due to carbonate, bicarbonate and hydroxide contents. It is used in the interpretations and control of water and waste water processes.[1] In case of water works, urban water (118.26) was more alkaline as compared to rural water (93.6) and in case of RO water, rural water (40.8) was more alkaline as compared to urban water (24.8).

Hardness is defined as the sum of calcium and magnesium concentrations and is a measure of the capacity of water to precipitate soap.[1] In case of water works, urban water (128.66) was more alkaline as compared to rural water (102.06) and in case of RO water, rural water was more alkaline as compared to urban water.

The presence of chlorine residual in drinking water indicates that a sufficient amount of chlorine was added initially to the water to inactivate the bacteria and some viruses that cause diarrheal disease and the water is protected from recontamination during storage. The presence of free residual chlorine in drinking water is correlated with the absence of disease-causing organisms, and thus is a measure of the potability of water.[7]

Department of water supply and sanitation, Punjab in the year 2004 posed a rural water supply and sanitation project costing Rs 1819.35 crore to the department of drinking water supply, ministry of rural development, Government of India for recommending the same to World Bank for providing financial assistance.[8]

Samra S et al in 2011 conducted a study to check the implementation of Punjab Rural Water Supply and Sanitation Project in rural Punjab, villages were selected from the Ludhiana district in central Punjab, approximately, 61% indicated that the quality had improved over the past five years, which may be partly due to the PRWSS program initiated in 2006. Nearly 63% of respondents reported that they had never treated their water and more than 50% mentioned that they never had access to materials for treating water.[9] The Water Supply & Sanitation (RWS) Division, Faridkot, in 2001, conducted a survey which stated that out of 171 villages, 160 villages have been provided with potable Water through 83 Schemes while the

remaining 11 Villages, 8 villages are Be-Charge and 3 Villages have been identified as problem villages. The sub- soil water was brackish due to excessive fluorides and have total dissolved solids more than permissible limits. Therefore 70 Rural water supply schemes were based on canal water and 13 schemes were based on tube wells.

Sharma N et al carried out a study and concluded that in Faridkot and Bathinda districts the TDS values in feed water vary from 656mg/l to 1650mg/l and in the treated water from 21mg/l to 84mg/l. About 87.57% to 97.01% of the TDS is removed by the RO systems. For Mansa the values of TDS vary from 1250mg/l to 3480mg/l in the feed water and from 56.1mg/l to 478mg/l in the treated water means about 62.36% to 96.49% of TDS is removed by RO systems. In case of Amritsar the values of TDS vary from 316mg/l to 890mg/l in the feed water and from 10mg/l to 126mg/l in the treated water that is about 76.31% to 97.48% of TDS is removed by RO systems.[12]

CONCLUSION

In the present study water available from water works in the urban area showed higher value of turbidity, pH, total dissolved solids, alkalinity and total hardness (p value <0.005) as compared to rural area. In case of water filtered by RO system, turbidity, alkalinity and total hardness were more in case of rural water. However, results of present study showed better quality of RO water as compared to water available from water works both at rural and urban level.

REFERENCES

1. Kumar M, Puri A. A review of permissible limits of drinking water Indian J Occup Environ Med 2012; 16(1): 40–44.

2. Drinking water quality in rural India: Issues and approaches. www.wateraid.org Last accessed as on 4-5-2015

3. Riley MR, Gerba CP, Elimec M. Biological approaches for addressing the grand challenge of providing access to clean drinking water J Biol Eng. 2011;5(2):1-10.

4. Myre E, Shaw R. The Turbidity Tube: Simple and Accurate Measurement of Turbidity in the Field. Community Planning and Analysis www.cee.mtu.edu/sustainable_engineering

5. Guidelines for drinking-water quality, 2nd ed. Vol. 2. Health criteria and other supporting information. World Health Organization, Geneva, 1996. http://www.who.int/water_sanitation_health/dwq/chemicals/en/pH.pdf

6. Total Dissolved Solids (TDS) http://www.uwyo.edu/uwe/pubs/b1183/_files/tds.pdf

7. Chlorine Residual Testing http://www.cdc.gov/safewater/publications_pages/chlorineresidual.pdf Last accessed as on 3-5-2015

8. Punjab Rural Water Supply and Sanitation Project Department of Water Supply and Sanitation, (Assissted By World Bank) www.pbdwss.gov.in

9. Samra S, Crowley J, Fawzi MS. The right to water in rural Punjab: Assessing equitable access to water through the Punjab rural water supply and sanitation project. Health and Human rights 2011:13(2):36-49.

10. The official Website of Faridkot Citizen Charter http://faridkot.gov.in/citizencharterfdk.html

11. Sharma N, Singh J and Kaur B. Performance Study of Some Reverse Osmosis Systems for Removal of Uranium and Total Dissolved Solids in Underground Waters of Punjab State, India. Journal of Advances in Physics 2014; 4(2):2347-3487.