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EXPLORATORY STUDY ON WATER QUALITY AND SANITARY PRACTICE IN RURAL AND URBAN COMMUNITIES OF SILIGURI, DARJEELING, WEST BENGAL

Kuntala Ray[1], Hironmoy Roy[2], Manasi Chakraborty[3], Romy Biswas[4]

ABSTRACT

Background: Contamination of drinking-water is a persistent problem in developing countries. ***Objectives:*** Present study was designed to compare the sanitary condition and accessibility of different sources of drinking water in rural and urban community of Siliguri and to assess the hygienic practices at water-consumption level and to investigate the biochemical and microbiological quality of water at source and at consumption level. ***Materials and methods*:** A community based cross-sectional descriptive study was conducted interviewing among 181 families in two villages and one urban ward using systematic sampling. Biochemical and microbiological testing of water was done in Public Health Laboratory of Siliguri Corporation. **Results:** Out of 137 drinking water sources visited, only 24.8% could attain the sanitary condition. More than 65% of families used to cover the vessels during their carriage and storage in both the areas but only 17.4% cleaned the storage vessels daily. Out of 181 household 37.8% neither boiled nor filtered water before consumption. 45.3% families habituated to sink the glass into storage container. Out of total water sample analysed, 50% of rural sources were contaminated with Coliform. **Conclusion**: This study emphasizes the need for awareness about water sanitation and multidisciplinary approach for access to safe water to all.

Key word: *Water quality, sanitary practice, accessibility*

INTRODUCTION

Growth in global population over the past century has put tremendous pressure on existing water resources. Only about 2.75 % of the total water available on the earth is fresh water, out of which a miniscule 0.68% is ground water and 0.01% is surface water [1]. Access to fresh water is no guarantee that it will be safe. At present, 1.1 billion people are consuming water that is not clean. In developing countries, 90 to 95 percent of all sewage and 70 percent of all industrial wastes are dumped untreated into surface waters [2]. In developing countries death related to the drinking of unsafe water, inadequate sanitation and associated poor hygiene contribute to loss of millions of young life. An important fact is that, on average, women in the developing world walk six kilometers each day to collect water in problematic areas. When supplies become contaminated or scarce, women must spend more time and energy finding and collecting water they regard as safe for household use especially for drinking [2]. Factors such as poor availability, affordability and accessibility may lead household to depend on less safe sources and reduce the volume of the water used for hygiene purpose [3].

1. Assistant Professor, 3. Prof. & Head, 4. Associate Professor, Department of Community Medicine, North Bengal Medical College & Hospital, West Bengal.
2. Assistant Professor, Department of Anatomy, North Bengal Medical College & Hospital, West Bengal.

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With the above context this study was undertaken in two villages and one urban ward under Siliguri subdivision in Darjeeling district of West Bengal, situated in foothill of Himalaya with very shallow river beds having seasonal flows and loose porous soils. This geological nature allows people to access water in shallow depth, which is very much unsafe to consume. The present study aimed to explore the real condition of drinking water quality and the usage pattern of these in study areas. So this endeavor definitely goes in support of the public health, where till date very little alike studies had ever been undertaken.

Objectives

The present study was carried out with the following objectives-:

1. To determine the accessibility of drinking water in rural and urban communities including sanitary condition of sources
2. To find-out the usage pattern at water-consumption level in the study area.
3. To assess the biochemical and microbiological quality of drinking water at source and at consumption level.

MATERIALS AND METHODS

A cross-sectional, community-based study was conducted for 10 months in two villages adjacent to the North Bengal Medical College under Matigara block and an urban ward under the Siliguri Municipal Corporation. All the households of 2 villages and 1 urban ward were taken as the study population. Considering the households having access to safe water in India was 88% [4], Confidence interval of 95%, 5% relative precision and assuming 10% non-response rate the sample size became 181. According to the list of households collected from the respective panchayat offices and Municipal Corporation in Siliguri subdivision, 120 households from rural area and 61 from urban area were taken using 'probability proportion to size' method. Thus, ultimately total 181 houses were selected by systematic random sampling.

Necessary permission for testing of water quality was taken from Siliguri Municipal Corporation. The respondent was one adult family member of each house, who was usually engaged in water collection, storage and usage. After obtaining informed consent, the respondent was interviewed using the pre-tested, pre-designed, semi-structured schedule by house to house visit. According to their response the major sources of water in that locality were identified and their sanitary conditions were judged with standard parameters. During those unannounced visits, water samples were collected from on an average 15% of the households from their drinking-water sources. Samples were collected with proper precautions as governed by the guidelines [5] of the World Health Organization for the quality of drinking- water in a sterile container provided from public health engineering laboratory of Fulbari water treatment-plant. Every bottle was marked with identification number, and submitted to the accredited public health laboratory within four hours of collection. The microbiological quality of water was quantitatively assessed through the enumeration of colony-forming units (CFUs) of *Escherichia coli*, which was used as an indicator organism for faecal contamination. The levels of dissolved iron and pH were also measured, providing biochemical quality. Other parameters could not be assessed for infrastructural/ financial limitation. Data was analysed by Epi-Info Soft-ware version 3.3.2 and SPSS 12.0 version for necessary statistical tests & sample size calculation.

RESULTS

Demographic and socioeconomic background of the study population: Approximately 57% families in rural area and 28% in urban area were found to posses BPL card. Respondents in the rural area were found to have a median of 4 years of school attendance with that of 7 yeas in urban communities. Most of the study population was Hindu (65%). About 60% families were nuclear type; with an average of 5-6 members. 53% of the families had at least one under-5 child. The houses were mainly mixed type (51%) in rural and pucca (69.8%) in urban communities. Types of drinking water sources- Majority of

rural families (59.1%) found to use tube wells as predominant source of drinking water, where only 40% were deep. In urban community community-based pipe-water systems were mostly used (75.4%). In urban locality shallow tube well were not used as source of drinking water. In rural community under study there was no facility for pipe water supply.

Sanitary condition of drinking water sources: In total 137 sources of drinking water were checked for sanitary condition. Only 24.8% drinking sources had fulfilled these criteria as per requirement. More than 60% sources had parapet and platform in both the locality. 86% corporation tap had drainage facility where as 50% dug well not found to have drainage facility. Dug well 39.5% in rural area and 50% in urban area were covered (Table -1).

Table- 1: Profile of drinking water sources in both urban and rural area

Criteria for sanitary source	Types of sources									
	Dug well (N=42)				Tube well (N= 66)				Corporation tap (N= 29)	
	Rural (n=38)		Urban (n=4)		Rural (n=55)		Urban (n=11)		Urban (n=29)	
Lining	38	100.0	4	100.0	N.A.		N.A.		N.A.	
Parapet	34	89.4	3	75.0	48	87.2	7	63.6	N/A	
Platform	32	84.2	3	75.0	50	90.9	8	72.7	24	82.7
Drain	22	57.9	2	50.0	36	65.4	8	72.7	25	86.2
Hand pump	8	21.1	1	25.0	55	100.0	11	100.0	N.A.	
Covering	15	39.5	2	50.0	N.A.		N.A.		N.A.	
Fencing	7	18.4	2	50.0	13	23.6	3	27.3	11	37.9
Distant to pollution source	22	57.9	3	75.0	31	56.4	8	72.7	21	72.4
No washing clothes/ Animal	25	65.8	3	75.0	46	83.6	9	81.8	21	72.4

N.A. indicates 'Not Applicable'

Table- 2: Distribution of different sources of drinking water according to location

Type of sources	Area							
	In house				Outside house			
	Rural (n=64)		Urban (n=28)		Rural (n=29)		Urban (n=16)	
	No.	%	No.	%	No.	%	No.	%
Well	25	39.1	4	14.3	13	44.8	0	0.0
Deep tube well	13	20.3	8	28.6	9	87.5	3	18.7
Shallow tube well	26	40.6	0	0.0	7	100.0	0	0.0
Corporation tap	0	0.0	16	57.1	0	0.0	13	81.3
Total	**64**	**100.0**	**28**	**100.0**	**29**	**100.0**	**16**	**100.0**

Accessibility of the drinking water sources: The sources those located inside the house premises or just adjacent to the boundary of the houses were considered as sources 'inside the house'. Out of total 137 sources 32.8% were out-side the house, from which at least 10-15 minutes was required to fetch water. This time increases during summer due to long queue (Table- 2). Only 13.3% sources were situated more than 1.6 km away from the dwelling.

User patterns of drinking water at consumption level: Among the 181 houses visited, 8 families from urban and 1 family from rural area were noted to be habituated to use the electrical water purifier system before consumption. In rest, more than 65% of families used to cover the vessels during their carriage and storage as practiced in both the urban and rural areas. In only 22% urban and 15% of rural families it was found to be in regular practice to clean the storage vessels daily.

More than 40% rural families did not found to bother to disinfect their drinking water, which was also quiet present in 26% urban families though, 85% of them had deep tube well. Only 8-9% families used to boil drinking water for the sake of their babies to prevent the incidences of diarrhoea (Table- 3).

Table- 3: Usage patterns of drinking water at consumption level (N=172)

Usage patterns		Area				Total	
		Rural		Urban			
		No.	%	No.	%	No.	%
Covering during carriage & storage	Yes	77	64.7	35	66.0	112	65.2
	No	42	35.3	18	34.0	60	34.9
Frequency of cleaning of storage container	Daily	18	15.1	12	22.6	30	17.4
	Weekly	69	58.0	26	49.1	95	55.2
	Fortnightly	32	26.9	15	28.3	47	27.3
Disinfection before consumption	Strain with cloth	22	18.5	8	15.1	30	16.6
	Alum	23	19.3	12	22.6	35	19.3
	Water filter	13	0.9	14	26.4	27	15.7
	Boiling	10	8.4	5	9.4	15	8.7
	Nothing	51	42.9	14	26.4	65	37.8
Mode of collection of water from the storage container	Sinking the container	60	50.4	18	34.0	78	45.3
	Long handled fixed mug	41	34.5	14	26.4	55	31.9
	Attached tap	07	5.9	12	22.6	19	11.0
	Directly	11	9.2	9	17.0	20	11.6
Total		**119**	**100**	**53**	**100**	**172**	**100**

Water quality - at source and consumption level: Water quality was assessed both at source i.e. from the collection site and at the consumption level i.e. drinking vessels. Surprisingly it was noted that more than 50% drinking-water sources in rural and 12.5% in urban communities were contaminated with Coliform. Similarly, Iron and pH level was beyond the acceptable limit in more than 60% supply sources in rural area. But as expected, the quality of water quiet noted to improve after the home-based water treatment, which reflected those 67% rural families and 90% urban families consume pathogen free drinking water (Table 4).

Table- 4: Water quality at supply sources and consumption level

Water Quality		At source				At consumption level			
		Rural (n=18)		Urban (n=8)		Rural (n=12)		Urban (n=10)	
Coliform	Present	9	50.0	1	12.5	4	33.0	1	10.0
	Absent	9	50.0	7	87.5	8	67.0	9	90.0
Iron	Within acceptable limit	7	38.9	6	75.0	7	58.6	9	90.0
	To be rejected	11	61.1	2	25.0	5	41.4	1	10.0
pH	Within acceptable limit	3	16.7	4	50.0	5	47.3	8	80.0
	To be rejected	15	83.3	4	50.0	7	52.7	2	20.0

Acceptable iron limit- 0.01-0.99mg/l ; Acceptable p H -7-8.5)

DISCUSSION

The present study has been undertaken in a time period of ten months in the year of 2009-10. It mainly attempted to explore a comparative picture of *'drinking-water quality and sanitary practices'* among the urban and rural people of the Siliguri subdivision in the Darjeeling district of West Bengal. At first, this study could highlight that, the ground water be the major sources for drinking water in rural area (59.1%) where as corporation tap was main sources in urban community (75.4%), which were quiet parallel with the infrastructure of water-supply in urban and rural community throughout all over the India. Except a few, almost every family had the source of drinking water 'inside their house', though maximum of them were

shallow in nature (60%). In other (24.8%) household women had to go outside everyday requiring 10 to 20 min to fetch water. This is quiet better than the scenario in Ujjain district of Madhya Pradesh, where 84% people was found to have no drinking water sources inside their house, for which they require almost 1.25 hours to collect water[6]. On the contrary, as reported by UNFPA, one-third of women in Egypt walk more than an hour a day for water; in other parts of Africa, the task consumes as much as eight hours [2]. It was unfortunate that, at those common sources of drinking water, the sanitary condition was found to be very poorly maintained, even somewhere highly contaminated with coliform, as reported after the laboratory examination of the samples. This might be due to their shallow depth (as in >95% dug wells), un-usage of any coverings, practice of cattle-cleaning, bathing, washing and persistent habits of the villagers for excreta disposal at near vicinity of the sources.

It is established fact that contamination could take place during the process of fetching water in container over the distance between home and supply sources as well as storing or using it at home [7]. This survey could explore that the practices to collect water was very much favourable to allow contamination and in most of the families (42%), they do nothing to disinfect water. Even most of the rural families hardly know the word disinfection. This indicates that there is lack of awareness about water sanitation. The study identifies that the problem of availability of safe drinking water sources in rural areas is more, but very few are aware of it probably due to ignorance towards water quality or may be lack of knowledge about water borne diseases. Evidences suggest that water quantity receives more attention than quality. Although quality is the utmost importance, but sufficient quantity helps to get rid of pathogens and maintain sanitation.

Additionally, the findings of different studies emphasize the importance of reducing the risk of contaminating drinking-water just before use. Hygienic measures, such as regular cleaning of drinking cup, could reduce this risk; moreover, residuals after chlorination could still be active in drinking vessel. But the scope of this project did not allow investigating the exact source of contamination at the point-of-consumption, specifically distinguishing between dirty hands and dirty cups as the cause of contamination or recontamination. Further research is required to search the alternative source of water and mobilize and educate the community towards water sanitation and protection of the existing sources. Through this study the respective administrative authorities were also could make aware about the overall scenario of sanitary conditions of the different water sources and health awareness programme can be undertaken in future days in joint collaboration with the departmental faculties and local administration.

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Background: With the rapid expansion of urban population, provision of safe water and basic sanitation is becoming a challenge; especially in slums. This is adversely affecting the health of the people living in such areas.Â Methods: A community-based, cross-sectional study was conducted among 796 slum households in Siliguri from January to March 2016 by interviewing one member from each household using a predesigned and pretested questionnaire based on the WHO/UNICEF Joint Monitoring Program Core questions on drinking water and sanitation for household surveys. Results: A majority 733 (92.1%) of slum households used an improved drinking water source; 565 (71%) used public tap. About two-thirds (65.7%) household used improved sanitation facilities. with water and sanitation facilities. Methods: A community-based, cross-sectional study was conducted among 796 slum households in Siliguri. from January to March 2016 by interviewing one member from each household using a predesigned and pretested questionnaire based on. the WHO/UNICEF Joint Monitoring Program Core questions on drinking water and sanitation for household surveys. Results: A majority.Â and sanitation practices in the slums of Siliguri. Although the. proportion of households with improved drinking water was.Â Drinking water and sanitation facilities in slums of Siliguri. Indian Journal of Public Health Â¦ Volume 61 Â¦ Issue 4 Â¦ October-December 2017. 252. Urban and rural areas in Nigeria,are experiencing water supply shortfall, attributed to increase in population among other factors (Adeboye and Alatise 2008). Rainwater collection can help meet the demands for water by rural communities (Pacey and Cullis, 1986) and provide supplement water for urban areas (Devi et al., 2012; Gould and Mcpherson, 1987).Â rural and urban communities of Siliguri, Darjeeling , West Bengal. Indian j Prev. Soc.Â Studies on the quality of rainwater at various land use locations and variations by interaction with domestic rainwater harvesting systemsâ€. Doctor of Philosophy Thesis submitted to Cochin University of Science and Technology. [30]. Tobin, E. A., Ediagbonya, T. F., Ehidiamen, G. and Asogun, D. A., (2013).