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Original Research Article

Community based cross sectional study to assess the drinking water handling practices and its association with water borne diseases at household level, in a tribal community

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ABSTRACT

Background: 71% of India resides in its villages. The living conditions in rural areas are poor, which make India's rural population more vulnerable to inaccessibility of safe drinking water and high risk of water borne diseases. Water safety in a community depends on a range of factors, from the quality of source water to storage and handling in the domestic setting. The present study was conducted to understand the knowledge and practices about hygiene of drinking water.
Methods: A community-based, cross-sectional observational study was conducted in Sakhawar a tribal village of Palghar district, Mumbai, Maharashtra, to study the water handling practices in households and its association with the prevalence of water borne diseases. One Pada was selected randomly for study. The duration of data collection was three months. All the houses in the Pada were included in the study.
Results: Of the 152 households included in the study, 47.4% did not use any method of water disinfection whereas 15% used boiling and 40% used chlorination as a method of water disinfection. Tap water was the commonest source of drinking water used by 52.6% of households. Only 7.9% subjects used ladle to draw stored water. The prevalence of water borne diseases was 81.57% and was significantly associated with distance of drinking water source from house, education status, family type, duration of water supply, knowledge of water disinfection methods and water disinfection practiced.
Conclusions: Health education, promotion and practice of hygienic water handling practices can significantly reduce water borne diseases morbidity.

Keywords: Water source, Water disinfection, Water handling practices, Water borne diseases

INTRODUCTION

Safe water is vital for survival and its lack can impact the health, food safety, and livelihoods. Our planet has ample fresh water to achieve a regular and clean water supply for all but bad economics and poor infrastructure can skew supply unfavourably. Water and sanitation are very important for the sustainable development.[1]

Every year millions of people including children die from diseases associated with inadequate water supply, poor sanitation and hygiene. Since 1990, Two and a half billion people have accessed to improved drinking water still 663 million people are without it. From 1990 to 2015, the proportion of the global population using an improved drinking water source increased from 76-91%. However, each day, nearly 1,000 children die due to

preventable water and sanitation-related diarrheal diseases.[2]

From 1992 to 2012 the overall proportion of Indian households with access to improved water sources increased from 68% to 90.6%. Yet, the same report showed that merely having improved water sources does not necessarily represent the water is safe to drink. Person's water handling practices plays role in access to quality of drinking water. However in developing countries like India, other factors like education, cultural beliefs and socio-economic status impact the water handling practices and the quality of drinking water.[3]

Sustainable development goal 6 aims to, achieve universal and equitable access to safe and affordable drinking water for all by 2030.[4] To achieve this goal, water handling practices plays very important role along with availability and quality of water source.

The objectives of the study were to assess the hygiene and drinking water handling practices at household level and its association with the prevalence of water borne diseases in individual families in last six months against the background of water handling practices prevalent in the area.

METHODS

A community-based, cross-sectional observational study was conducted in Sakhwar a tribal village of Palghar district, Mumbai which is in the rural field practice area of a tertiary health institute. This village was geographically divided into three Padas. One Pada was selected randomly for study purpose. The study was conducted from September 2015 to November 2015. All the houses in the village were included in the study (Sample size N=159). Those houses with family members not willing to participate in the study, closed houses and houses with language barrier as a communication problem were excluded from the study (n=152, seven households was excluded from the study while data collection.)

All the houses in the village were visited once. Written informed consent was taken after explaining the purpose of the study. The family member present at that time was interviewed using a semi- structured and pre-validated questionnaire. During the visit their practices regarding procurement, storage and consumption of water were observed by the interviewer. This was done by observing the source and storage of water as well as asking them to perform certain task (e.g. Can you give me a glass of water?) During this act their water handling practice was observed by the interviewer.

Statistical software used

IBM SPSS Version 21.0 and Microsoft Office Excel 2007.

Statistical analysis

Continuous data has been expressed as mean (Standard deviation) and median (Interquartile range). The categorical data is summarized as frequencies and percentages. The normality of the continuous data was tested by Shapiro-Wilk test. The continuous variables were analyzed by unpaired t test. Categorical data was analyzed using Chi square test and Fisher's exact test and expressed as frequencies. $P<0.05$ were accepted as indicative of statistical significance.

RESULTS

A total of 152 families were included in the study having a total of 682 family members. The literacy rate among subjects was 77.6% along with farming as most common occupation among them. The average number of members in each family was five with a mean family income of 3501.3 rupees. The average number of under-five children in each family was two; the socio-demographic profile of the participants is given in table (Table 1).

Table 1: Socio-demographic profile of the participant families.

Socio-demographic factors	Frequency	%
Education (n=152)		
Literate	118	77.6
Illiterate	34	22.4
Occupation (n=152)		
Farmer	68	44.7
Labourer	46	30.3
Service	14	9.2
Shopkeeper	14	9.2
Driver	10	6.6
Family type (n=152)		
Joint	88	57.9
Nuclear	56	36.8
Three Generation	8	5.3
Members of participant families (n=682)		
Adults and children above 5 years	450	66.0
Under 5 children	232	34.0

52.6% subjects have tap water source and 61.8% have 24hour water supply. All families covered stored water with a lid. Only 7.9% subjects used ladle to takeout water from storage vessel. 94.7% subjects used to wash hands before withdrawing water. 31.6% families used only water to wash hands. 52.6% households use at least one of the water disinfection methods. Chlorination of water was the method of choice in majority households. Children themselves draw water for drinking in 81.6% households, among those only 55.3% washed hands before withdrawing water. Only 30.3% households took extra care in purification of water during rainy season. Distance of water source from place of residence was

mentioned in terms of minutes of walking required to reach the source. The mean distance of water source from the house was 13.0 minutes. 37.5% subjects had knowledge of waterborne diseases (Table 2).

As seen in Table 3, the knowledge about water borne diseases as well as techniques of water disinfection was significantly associated with literacy as also the practice of disinfecting drinking water and taking extra care during monsoon (Table 3).

The prevalence of water borne diseases was found to be 81.57% and significantly associated with distance of drinking water source from house, education status, family type, duration of water supply, knowledge of water disinfection methods and water disinfection practiced (Table 4).

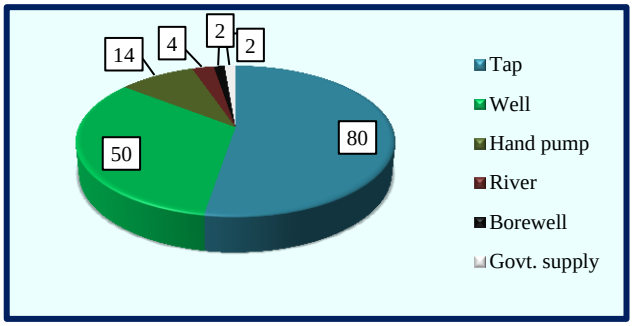

Figure 1: Drinking water supply to the households.

Table 2: Water source, storage and handling practices among the participant families.

	Frequency	%
Drinking water source		
Tap	80	52.6
Well	50	32.9
Hand pump	14	9.2
River	4	2.6
Bore well	2	1.3
Govt. supply	2	1.3
24 hrs water supply		
Yes	94	61.8
No	58	38.2
Water storage container material		
Steel	116	76.3
Others	36	23.7
Water drawing technique of stored water		
With ladle	12	7.9
Without ladle	140	92.1
Hand wash before drawing stored water from container		
Yes	144	94.7
No	8	5.3
Water disinfection done (n=152)		
Yes	80	52.6
No	72	47.4
Water treatment techniques used (n=80)		
Boiling	12	15
Chlorination	32	40
Filtration	6	7.5
Both boiling and chlorination	2	2.5
Boiling, chlorination and filtration	2	2.5
Straining with cloth	26	32.5
Children draw stored water		
Yes	124	81.6
No	28	18.4
Hands washed by children before drawing water (n=124)		
Yes	84	67.74
No	40	32.26
Extra care taken during rainy season		
Yes	46	30.3
No	106	69.7

Table 3: Education level of the participant families and practices related to water sanitation.

Practices		Education		P value
		Illiterate	Literate	
Drawing out stored water	With ladle	8 (6.8)	4 (11.8)	0.342
	Without ladle	110 (93.2)	30 (88.2)	
Hand wash before drawing out water	Yes	110 (93.2)	34 (100)	0.2
	No	8 (6.8)	0 (0)	
Knowledge of water disinfecting methods	Yes	16 (47.06)	77(65.25)	0.055*
	No	18 (52.94)	41 (34.74)	
Water disinfection done	Yes	56 (47.5)	24 (70.6)	0.017*
	No	62 (52.5)	10 (29.4)	
Knowledge of diseases caused due to water	Yes	37 (31.4)	20 (58.8)	0.004*
	No	81 (68.6)	14 (41.2)	
Extra care during rainy season	Yes	20 (16.9)	26 (76.5)	<0.0005*
	No	98 (83.1)	8 (23.5)	

* Significant at 0.05 level of significance. @Fisher Exact test used. Chi-square test used for the remaining.

Table 4: Factors affecting incidence of water related illness among family members.

Factors	Water related illness among family members in last 6 months		P value
	Yes	No	
Family income (mean (SD))	3562 (1796.6)	3305.6 (2485.0)	0.568#
Number of family members (mean (SD))	4.6 (1.7)	4.2 (2.6)	0.46#
Number of under- 5 children (mean (SD))	1.5 (1.2)	1.8 (1.4)	0.159#
Hand washing			
With soap	79 (81.4)	17 (18.6)	0.137
With water	32 (66.7)	16 (33.3)	
No hand washing	5 (71.4)	3 (28.6)	
Education			
Illiterate	20 (58.8)	14 (41.2)	0.006*
Literate	96 (81.4)	22 (18.6)	
Occupation			
Driver	6 (60)	4 (40)	0.009*@
Farmer	58 (85.3)	10 (14.7)	
Labourer	36 (78.3)	10 (21.7)	
Service	10 (71.4)	4 (28.6)	
Shopkeeper	6 (42.9)	8 (57.1)	
Family type			
Joint	76 (86.4)	12 (13.6)	<0.0005*
Nuclear	32 (57.1)	24 (42.9)	
Three generation	8 (100)	0 (0)	
Drinking water source			
Tap	66 (82.5)	14 (17.5)	0.137@
Well	34 (68)	16 (32)	
Hand pump	8 (57.1)	6 (42.9)	
River	4 (100)	0 (0)	
Bore well	2 (100)	0 (0)	
Govt. supply	2 (100)	0 (0)	
24 hrs water supply			
Yes	64 (68.1)	30 (31.9)	0.002*
No	52 (89.7)	6 (10.3)	
Water drawing technique of stored water			
With ladle	10 (83.3)	2 (16.7)	0.732@
Without ladle	106 (75.7)	34 (24.3)	

Continued.

Factors	Water related illness among family members in last 6 months		P value
	Yes	No	
Hand wash before drawing stored water from container			
Yes	110 (76.4)	34 (23.6)	1.000@
No	6 (75)	2 (25)	
Knowledge of water disinfection methods			
Yes	81 (85.7)	12 (14.3)	0.002*
No	44 (64.7)	15 (35.3)	
Water disinfection done			
Yes	52 (65)	28 (35)	0.001*
No	64 (88.9)	8 (11.1)	
Children draw stored water			
Yes	100 (80.6)	24 (19.4)	0.008*
No	16 (57.1)	12 (42.9)	
Knowledge of diseases caused due to water contamination			
Yes	40 (70.2)	17 (29.8)	0.168
No	76 (80)	19 (20)	
Extra care taken during rainy season			
Yes	36 (78.3)	10 (21.7)	0.71
No	80 (75.5)	26 (24.5)	

*Significant at 0.05 level of significance. @Fisher exact test used, #Unpaired t test used. Chi-square test used for the remaining.

DISCUSSION

Different studies conducted, in different parts of the country in the past on the subject of drinking water supply, its safety and water handling practices have shown varied results.

In the current study literacy rate was 77.6% and majority was farmer. Similarly in the study conducted by Bharti et al the most common occupation of head of household was farming (54.7%) followed by labor (30.8%), shop and service. However level of literacy was comparatively high with only 9.6% illiterate.[5]

Safe drinking water by using techniques of water purification helps to reduce waterborne diseases in a community. In the current study, only 15% of the families used boiling whereas 40% used chlorination as a method of disinfection of water. But 47.4% of the families did not use any method of water disinfection. High level of chlorination method in current study was due to their awareness and accessibility of chlorine solution from government supply. In India, approximately 72.7 per cent of the rural population does not use any method of water disinfection.[6] Bhattacharya et al. also found 72% of household don't follow any treatment and drink it as it is.[7] As per the WHO/UNICEF Joint Commission Report (2012), 67% of Indian households do not treat their drinking water.[8] In a survey conducted by Pachori it was found that 45.3% households used boiling method for purification of drinking water followed by 39.3% of them who treat drinking water by other methods and 15.3% households did not use any treatment for purification of water.[9] In disparity to the current study he found that boiling was more commonly used for purification of drinking water than straining through cloth.

According to National health profile 2017 (as per the census 2011), 43.5% of households in India are using tap water, 11.0% well water and 33.5% hand pump water for purpose of drinking. The corresponding figures in Maharashtra are 67.9%, 14.4% and 9.9% and in the current study are 52.6%, 32.9% and 9.2%.[10]

The practice of drawing water from its container has the risk of microbial contamination through potentially contaminated hands. In the study conducted by Bharti et al, around two third of informants (64.4%) did know about importance of ladle to draw water while ladle was actually being used in less than one third (30.5%) of households only.[5] Similarly, Bhattacharya et al. found only 38% of household used handled jug to take out drinking water from vessel.[7] However in the current study only 7.9% of the families used a ladle to draw water.

Bharti et al found that 64.3% of informants were aware that boiling or filtering water can prevent water borne diseases but it was being practiced in only 10% of households.[5] In this study 61.18% had knowledge of water disinfection methods but it was practiced in 52.63% of households.

In the study by Bharti et al one in every fourth household had history of diarrheal episodes in past 6 months among family members.[5] In current study the prevalence of water borne diseases was found to be 81.57% and was significantly associated with distance of drinking water source from house, education status, family type, duration

of water supply, knowledge of water disinfection methods and water disinfection practiced.

CONCLUSION

Socio demographic profile of community has an impact on water handling practices and also on prevalence of water borne diseases. Statistical data in the current study have shown that literacy plays a major role in safe drinking water handling practices. Also safe water handling practices have significant association with prevalence of water borne diseases. Water safety in a community depends on a range of factors, from the quality of source water to storage and handling in the domestic setting along with socio-demographic profile of community.

Recommendations

There should be focussed efforts on improving awareness about the water disinfection techniques and its association with reduced diarrhoeal morbidity. Only improving the availability and quality of water source will not have the desired impact if the water handling practices remain faulty. Multiple techniques of water purification method should be made easily accessible at local level, so that the people can choose from any of them based on the feasibility, acceptability, cultural norms, etc. The prevalence of water borne diseases in the study area was high which explain the need for the motivation and promotion of safe drinking water handling practices. Distance from water source from households should be reduced.

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