Drinking water in an urban area in South India – A community based cross sectional study.

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RESEARCH

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Abstract

Background
Globally, 1.1 billion people lack access to improved drinking water supply and drink water that is grossly contaminated. Hence, study of water treatment assumes utmost importance in order to ensure the safety of the water consumed especially in fast developing cities. This study would provide information of drinking water management practices in the study area. We studied the sources, the treatment and storage facilities of drinking water in households and assessed the free chlorine levels in the drinking water.

Method
This community based cross sectional study was conducted in Mangalore - a city of Karnataka State in South India. Using convenience sampling, 100 households were visited in the area of Boloor. Information was collected regarding demographic profile, household drinking water sources, treatment and storage practices followed by testing for free chlorine in the drinking water using O-Toluidine.

Results
Study population had high literacy rate and 83% had their main source of drinking water from municipality, 17% had private water source. Among these 6% households had bore wells, 10% had protected dug well. Overall 99% had improved source of drinking water. Sumps were present in 32% of the households. Of these 34.4 % cleaned it once a month. Boiling was found to be the preferred choice of water treatment; but 5% of the population (lower socio economic status) did not use any method to treat water in their households. Overall, 43% households drank water by pouring to glass from storage vessel, 34% dipped glass into vessel using hands, 23% had tap

system and 84.2% of the households cleaned their storage vessel daily. O-Toluidine test showed no free chlorine in drinking water in any of the homes.

Conclusion
Study population had access to improved water. However households lacked appropriate storage and handling practices of drinking water which needs to be evaluated further.

Background

Water is an elixir for mankind and its quality decides the health of the community. However about 1.1 billion people lack access to an improved drinking water supply globally and many more drink water that is grossly contaminated.[1] Lack of safe water perpetuates a cycle whereby poor populations become further disadvantaged, and poverty becomes entrenched.

Globally, about 4 billion cases of diarrhoea occur and about 1.8 million people die per year; the vast majority being children under 5 years of age, of which 88% is attributable to unsafe water. WHO estimates that 94% of diarrhoeal cases are preventable through interventions to increase the availability of clean water, and to improve sanitation and hygiene.[1]

Progress towards these interventions is indicated by the proportion of households reporting the use of improved water supplies, such as piped household connections or protected wells.[2]

However depending on the local geographic conditions especially in urban areas, a significant proportion of water from the sources may be contaminated.[3] Hence, water treatment assumes utmost importance in order to ensure the safety of the water consumed. At the community level, it is the responsibility of the municipalities to chlorinate the water being supplied to the households and public taps. Also it is up to the individual household to ensure that the drinking water they consume is adequately safe.

Thus understanding the quality of drinking water in urban areas and fast developing cities becomes primary concern. [4] This study was conducted to assess the drinking water management practices in households of urban area in Mangalore city which would give an insight into drinking water management practices in this area.

Method

This study was conducted in the households of Boloor which is an urban area in the Mangalore city; the chief port city of Karnataka State with population of 398,745. [5] The drinking water to households and public taps is supplied by the Mangalore City Corporation.

Using convenient sampling, 100 households were selected (25 households from each quarter of the area) and were visited for the data collection. Since random sampling was not possible for logistic reasons and availability of household members during the visits, convenience sampling was adopted after dividing the study area into 4 quarters. The households in which people were not willing to participate in the study and where residents were not present during the visits were excluded from the study. This study was carried out between January and February 2010.

Households were identified using the information obtained from the local authorities. The identified households were visited and the members of the household informed regarding the study, and its aims and objectives.

An informed consent was taken from the respondents willing to participate in the study. Information was collected regarding the socio economic status household drinking water sources, treatment methodology and storage practices by completing a pretested questionnaire by interview and observational technique. [6] After filling the questionnaire, the free chlorine in the drinking water of the households was determined by using O-Toluidine testing method, wherein a sample (about 8mL) of the drinking water of the household was collected in a test tube and two drops of O- Toluidine reagent was added to it .The colour change, if any, was noted and quantity of free chlorine assessed using the Lovibond's comparator. The collected data was coded and entered into SPSS version11.5 for analysis.

Results

Among the households interviewed in this study, majority of the residents were Hindus (71%), followed by Christians (27%) and Muslims (2%). The study area had a literacy rate of 98% and 63% of the households were nuclear families, 34% were joint families and 3% extended families. The socio economic grading of the households in the study area was as follows - Upper 15%, Upper Middle 26%, Lower middle 32%, Upper lower 17% and Lower10%.[6]

The sources of water supply for the households in the study area are shown in Table 1. The majority (83%) of the households were depending on the municipality water supply. The remaining 17% households had a private source of water (among Upper and upper middle socio economic status).

About 32% of the households surveyed, used sumps (the underground tank or reservoir to store water from bore wells, municipal supply etc). [7] Among those households using sump, a mere 34.4 % cleaned it once in a month.

Table 2 shows the alternate sources of drinking water in the study area. Protected dug well was the preferred alternate source of drinking water for about 75% households, followed by municipality water supply and unprotected dug well and tankers. The majority of households belonging to Upper, Upper Middle and Middle used protected dug well as alternate source of water.

As Table 3 shows, 74% of the houses boiled water, 7% used water purifier, 4% used both methods, 4% used water filter and 6% of the households boil water and then filtered it using a water filter. Five percent of the population does not use any method to treat water in their households. These households were from lower socio economic status.

It was found that 67% of the houses surveyed stored drinking water in a different well maintained vessel, 25% stored it in the same vessel they boiled the water in. Majority of them were using well maintained vessel. Figure 1 shows that, in 43% of the households, people drank water by pouring it to a glass from the storage vessel, 34% dipped a glass into the vessel using their hands and 23% of the people had a tap from which the water was taken for drinking. It was also found that the people who did not use water treatment methods in their households had an incident of water borne disease in their house.

The free chlorine test conducted using O-Toluidine reagent in the 100 households did not yield any positive result, showing that there was no free chlorine in the drinking water among any of the households tested.

Discussion

This study assessed the sources and the safety of the water consumed by the population. Similar to this study, a study done by JMP (Joint monitoring Programme WHO) showed that 87% of the world's population used drinking water from improved sources. [2]

The National Family Health Survey-3/NFHS-3 showed that 88% of the population of India had access to an improved water source, of drinking water.[8] These findings, like other studies at the national level; [9] relates with the overall household situation of the quality of drinking water. Household survey conducted by Abdul Shaban et al [10] showed that a majority of households, as high as 92%, in major cities in India depended on the municipal water supply for their daily needs. Of this 92% of the population, 9.5% were dependent on community taps. Similarly, our study showed that about 83% of the houses in Boloor had their main source of drinking water as the municipality water supply. The remaining 17% of the households had a private source of water. The water sources were adequate across all socio economic strata.

The result is comparable with the international and national values denoting the adequacy of the safety of the source of water. [11, 12]

Despite the presence of adequate sources of water for the households, the growth of the city can be a factor which may worsen the condition similar to cities like Mumbai in India. [11] The study area is also expanding in a similar way. [5]

The study done by JMP showed that 67% of the households surveyed in India did not follow any water treatment practices, 9% of the households boiled the water, 2% used bleaching powder/ chlorine and 17%, strained the water through the cloth. [2] National Family Health Survey-3/NFHS-3 [8] showed that 45% of the people in Karnataka state do not treat drinking water prior to consumption. Our study found that 5% of the population did not use any method to treat water in their households. All these belonged to lower socio economic status and it could lead to higher chances of water borne diseases among them. The results are much higher than the national and state values which are highly commendable. [9, 10]

The lack of free Chlorine in the wells of households studied in our study, points towards the chances of future contamination of the drinking water. This could be an alarm for the authorities to ensure the presence of residual chlorine in the wells.

So, the source alone is not sufficient to provide safe and healthy water supply to the houses in an urban area. This should be supported by the treatment practices and storage practices of drinking water.

Conclusion

The households in the study area had access to improved water sources. But the treatment and storage practices for the drinking water were not satisfactory especially in lower socio economic strata. Absence of free chlorine also suggests the need for the attention of the concerned authorities. This field study reflects the quality of the drinking water in the urban area in one of the chief cities in India and calls for the similar evaluation in other cities.

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Figures and Tables

Figure 1 . Practices of removing water from storage vessel for drinking purposes among households in Boloor
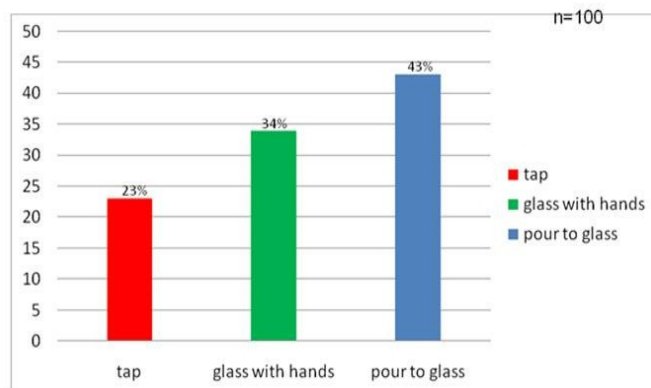

Table 3: Water treatment methods used among the households in Boloor (n=100)

Method of treatment of drinking water	Number of households (No.)	Percentage (%)
Nothing	05	05
Boiling	74	74
Water filter	04	04
Water purifier	07	07
Boiling + water filter	06	06
Boiling + water purifier	04	04

Table 1: Main sources of drinking water among the households surveyed in Boloor (n=100)

Source of drinking water	Number of households (No.)	Percentage (%)
Municipality water into the household	74	74
Public tap	09	09
Bore well	06	06
Protected dug well	10	10
Unprotected dug well	01	01

Table 2: Alternate sources of drinking water among the households in Boloor (n=31)

Alternate sources of drinking water	Number of households (No.)	Percentage (%)
Municipality water into the household	04	12.9
Public tap	01	03.2
Protected dug well	23	74.2
Unprotected dug well	02	06.5
Tankers	01	03.2

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