

Access to Safe Drinking Water and Availability of Environmental Sanitation Facilities among Dukem Town Households in Ethiopia

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KEYWORDS Water. Sanitation. Households. Ethiopia. Assess. Acceptability. Underserved population. Improvement. Toilet

ABSTRACT The objective of this study was to assess the accessibility of water and environmental sanitation amongst households of Dukem town in Ethiopia. This was a cross-sectional study conducted among 391 households. Almost all the households had access to improved sources of drinking water. Majority of the households had access to water within a distance of upto 200 metres or less and had access to water within a time of 30 minutes or less. More than two-thirds of households had improved toilets (flush/pour-flush toilet, ventilated improved pit (VIP) latrine and traditional pit latrine). It is important to make water available by supplying with private or yard tap connections for underserved population and improved basic sanitation by promoting Total Sanitation Approach which aims to achieve universal access and use of toilets and the elimination of open defecation in the communities.

INTRODUCTION

Access to water supply and sanitation is a fundamental need and a human right. It is vital for the dignity and health of all people. According to the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Joint Monitoring Programme for water supply and sanitation estimates that 1.1 billion people live without improved water sources, while over half of the developing world population (representing 2.6 billion people) lack access to improved sanitation (WHO and UNICEF 2000; Waddington et al. 2009). Globally, an estimated 24% of the disease burden (healthy life years lost) and an estimated 23% of all deaths (premature mortality) was attributable to environmental factors (Prüss-Üstün and Corvalán 2006). Among children between 0 and 14 years of age, the proportion of deaths attributed to the environment was as high as 36%. Diseases with the largest absolute burden attributable to modifiable environmental factors included: diarrhoeal diseases; lower respiratory tract infections; 'other' unintentional injuries; and malaria. Infectious

waterborne diseases such as diarrhoea, typhoid and cholera are leading causes of death and illness in the developing world (Ministry of Health 2011). An estimated 94% of the diarrhoeal burden of disease is attributable to the environment, and associated with risk factors such as unsafe drinking-water and poor sanitation and hygiene (Prüss-Üstün and Corvalán 2006). Water, sanitation and good hygiene practices have the potential to prevent at least 9.1% of the global disease burden and 6.3% of all deaths (Prüss-Üstün et al. 2008).

One of the targets of Millennium Development Goal (MDG) 7, which is concerned mainly with environmental sustainability, is to halve the number of people who do not have sustainable access to safe drinking-water and basic sanitation by 2015. This target requires coverage of 75% of the population by improved water sources. In the area of sanitation, the target is 66% coverage by improved services by 2015 (World Health Organization Regional Office for Africa 2006). Sub-Saharan Africa represents about 11 per cent of the world population, but almost a third of all people live without access to safe drinking water (UNICEF 2006) or 37% of people not using an improved source of drinking-water live in Sub-Saharan Africa (WHO and UNICEF 2010). Among the largest disparities in safe water and basic sanitation are those between urban and rural populations. Globally, access to

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improved drinking-water sources is 95 per cent in urban areas, compared with 73 per cent in rural areas. There is great difference in urban-rural divide in drinking water in sub-Saharan Africa, where 81 per cent of people in urban areas are served, compared with 41 per cent in rural areas (UNICEF 2006).

In Ethiopia, the provision of safe and adequate water supply for the population has far reaching effects on health, productivity and quality of life, as well as on the socio-economic development. Lack of clean/potable water supply and sanitation services in the country has been a serious problem and statistics show that more than 60% of health related deaths are caused by water-borne diseases (Government of Ethiopia 2007). It is estimated that diarrhoea contributes 20% of the cause-specific proportions for under-5 mortality (World Health Organization Regional Office for Africa 2004). Diarrhoeal diseases caused by improper management of water and sanitation are among the major causes of infant and child morbidity and mortality (Ministry of Water Resources 2004).

Objectives

The increased magnitude of environmental health problems in urban settings of the country demands community-based studies that will facilitate a better understanding of the issues and influence policy and decision-making at the community, town, regional state and national level. Therefore, this study aimed to assess the accessibility of safe drinking water and availability of environmental sanitation facilities among Dukem town households in Ethiopia.

METHODS

Study Design and Setting

This was a descriptive, cross-sectional study conducted among households of Dukem town. Dukem Town of Finfinne is surrounding special zone of Oromia region in Ethiopia between 3rd October to 25th October 2011. Finfinne surrounding special zone is one of the 18 zones in Oromia Regional State located in the central part of the region at 37 kilometres away from Addis Ababa. Dukem Town is administratively divided into 4 *Kebeles*. The town has a population of more than 24000 (Dukem Town Health Office 2010). Regis-

tered number of households of the town during the time of the research was 3,845.

Sampling Methods

Stratified random sampling method was used to select the samples. Firstly, four *kebeles* were considered as strata and then from each strata number of households were selected using simple random sampling techniques. The lists of registered households of the town were obtained from registration performed by health extension workers in each *kebele* and used for the selection of households. A number was assigned to each head of household name on the list, and then using a table of random numbers the households were selected from the registered list.

Sample Size

The sample size was determined using the single population proportion formula.

$$n = Z^2 P(1-P)/d^2 \dots\dots\dots (1)$$

Where

n = Sample size of households.

P = Proportion of households using improved water and sanitation. The value of P is based on the data of the coverage of environmental sanitation with main component of national latrine coverage (basic sanitation) for Ethiopia which was 60%.

d = Degree of accuracy required (sampling error) is 5% that is, d = 0.05.

Z = Standard score for 95% confidence level is 1.96.

Substituting the above values in the equation (1), the calculated sample size for the study was 369. To minimize errors arising from the likelihood of non-response rate, ten percent of the sample size was added to the calculated sample. Thus, based on the above assumptions, the total sample size "n" was determined to be 406 households.

Inclusion and Exclusion Criteria

Inclusion sampling criteria for this study was being a household living in a registered housing unit of Dukem town. Exclusion sampling criteria for the research were: (i) being institutions (such as offices, hotels, etc.) other than households; and (ii) households that were not registered in the *kebeles* of the town.

Ethical Considerations

Ethical clearance was obtained from Research and Ethics Committee of the Department of Health Studies at University of South Africa (UNISA). Institutional consent was obtained from concerned institutions after communicating with formal letter written by UNISA Regional Centre. Permission for data collection from Dukem town was sought from Oromia Regional State Health Bureau. Informed consent was voluntarily sought from all the study participants. Participation in the study was voluntary. The rights of the households not to participate were respected at anytime if they refused to participate or if they choose to withdraw from their participation during the interview and observation without any prejudice. Participants were informed that the collected data from the households to be kept strictly confidential.

Data Collection

Data were collected using a structured questionnaire. Two types of structured data collection methods were used in the study. Face-to-face interview was carried out with respondents by asking questions about water and environmental sanitation of the households. Also information on the sanitary facilities and environmental sanitation conditions of the households were also collected using observational method. A pre-coded and structured data collection instrument containing interview and observational questions was developed which was adapted from UNICEF's (2006) "*core questions on drinking-water and sanitation for household surveys*".

The interview schedule questions of the data collection instrument were constructed containing a list of issues pertaining to household environmental sanitation-specific issues such as domestic water, basic sanitation (toilet facilities), as well as socio-economic and demographic characteristics were also included. The observational questions of the data collection instrument focused on domestic water storage containers, toilet facilities, and cleanliness of latrines.

The data collection instrument was originally prepared in English prior to use in the study. The interview was conducted in the local language and for this purpose the data collection instrument was translated into Afan Oromo and Amharic. The average time taken to complete all

the household data collection instruments per a household was found to be 32 minutes. The data collection instrument was pre-tested among 41 households in the study area of the population of Dukem town to assess the suitability of the data collection instrument with regards to duration, language appropriateness, content validity, and question clarity.

The data collection team was composed of the researcher and with 11 trained field workers who were grouped into four teams per the four *kebeles* to gather the data from 406 sampled households. The data collectors and the field assistant were trained for one day on theoretical and practical session to familiarize them with the study objectives and in data collection and interview/observation methodology. The training was conducted at Dukem Town Health Office. During the training, the data collectors were provided with a clear explanation of the study with guiding notes, its purpose, tasks to be accomplished, the sampling method, interviewing techniques, content of the data collection instrument, data quality, and ethical conduct of human research. The data collection of the research was daily coordinated and monitored by the researcher. The researcher was responsible for organizing and facilitating of the data collection, recruitment of data collectors and monitoring and checking of the data quality on daily basis.

Data Analysis

Data capturing was done using Excel spreadsheet and imported to SPSS 18.0.1 window version for analysis. The analysis results of participants' demographics and baseline outcome variables were summarized using descriptive summary measures: expressed as mean for continuous variables and percent for categorical variables. Chi-square test was carried out to find association between two categorical variables. P-values less than 0.05 were considered statistically significant.

RESULTS

From a total of 406 households sampled in Dukem town, 391 households participated in this study, giving a response rate of 96.3%. Table 1 summarises socio-demographic information of the households. Less than half (43.5%) were from Dukem 01 *kebele* and followed by Tedicha *kebele* (23.8%). The average age of the

participants was 35.2 years. About two-thirds (64.2%) were between the ages of 18 and 37 years. Majority of the households were headed by men (74.4%). Regarding marital status of the head of the household, 69.6% were married. According to the results, quarter (24.6%) of the head of households could not read and write (illiterate). The mean family size of the households was 4.2. Half of the households (49.9%) had members between four and six. With respect to type of job of the heads of households, 24.3% were farmers followed by traders (19.4%), and 17.9% were unskilled labourers. More than half (57%) of the houses were privately owned. More than three-quarters (78.7%) of the households had family monthly income of ETB 1000 or less.

Table 1: Socio-economic and demographic characteristics of the head of households and respondents of Dukem town, Ethiopia

Characteristics	Frequency	Percentage
<i>Age of the Respondent</i>		
18 – 27 years	134	34.3
28 – 37 years	117	29.9
38 – 47 years	71	18.2
48 – 57 years	34	8.7
58 years or order	35	9.0
<i>Gender of Head of the Household</i>		
Male	291	74.4
Female	100	25.6
<i>Gender of respondents</i>		
Male	142	36.3
Female	249	63.7
<i>Total Number of Persons in Households</i>		
1 – 3	152	38.9
4 – 6	195	49.9
>7	44	11.3
<i>Education Level of the Head of Household</i>		
Literate (formal schooling)	205	52.4
Illiterate	96	24.6
Read and write	90	23
<i>Main Job of the Head of Household</i>		
Farmer	95	24.3
Trader	76	19.4
Unskilled worker	70	17.9
Private sector employed	56	14.3
Civil servant	24	6.1
Non-government organization employed	24	6.1
Other	46	11.4
<i>Household's Monthly Income in ETB</i>		
<500 ETB*	162	41.4
501-1000 ETB	146	37.3
>1,000 ETB	46	11.8
Unspecified**	37	9.5
<i>Type of House Ownership</i>		
Private owned	223	57.0
Rented	168	43.0

*1 US Dollar equals 17.1019 on October 15, 2011(Commercial Bank of Ethiopia 2007).

**Include those unemployed and those who do not know their incomes

Table 2 classifies the type of water sources into different categories. More than a third of the households used private piped water inside the compound (38.9%) and more than a quarter (28.6%) bought water from neighbourhood private piped tap.

Table 2: Households sources of drinking water in Dukem town, Ethiopia (n=391)

Source of drinking water	Frequency	Percentage
<i>Improved Source</i>		
<i>Private Piped</i>		
Private piped water inside the house	14	3.6
Private piped water inside the compound	152	38.9
<i>Communal Piped</i>		
Shared neighbourhood piped water	14	3.6
Buy water from neighbourhood private piped tap	112	28.6
Public tap/standpipe	88	22.5
<i>Protected Well/Spring</i>		
Protected dug well	3	0.8
Protected spring	2	0.5
<i>Unimproved Source</i>		
Surface water (pond or river)	6	1.5

Table 3: Access to water source and consumption of water by households in Dukem town, Ethiopia (n=391)

Category	Frequency	Percentage
<i>Time to Obtain Drinking Water (Round Trip)</i>		
Water on premises	161	41.2
Less than 30 minutes	161	41.2
More than 30 minutes	69	17.6
<i>Distance of Water Source from Dwelling</i>		
Water on premises	161	41.2
≤ 200 metres	167	42.7
> 200 metres	63	16
<i>Persons Who Collects Drinking Water for Households</i>		
Adult woman (age >15)	323	82.6
Adult man (age >15)	48	12.3
Female child (under age 15)	13	3.3
Male child (under age 15)	3	0.8
Other	4	1.0
<i>Daily Water Consumption in Litres</i>		
<i>Water Consumption From Minimum Recommended 20 LCD</i>		
≤20	328	83.9
>20	63	16.1
<i>Water Consumption From Mean</i>		
<i>Daily Amount of 15 LCD</i>		
≤15	218	55.8
>15	173	44.2

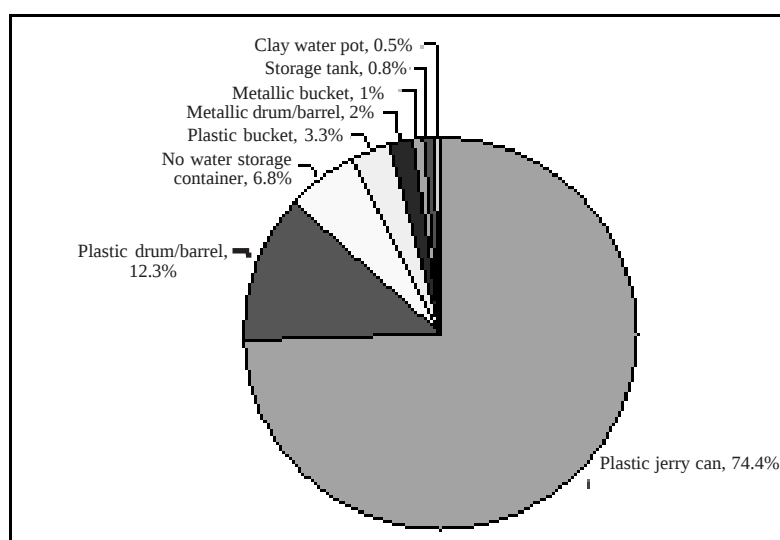


Fig. 1. Patterns of storage of water by the dwellers in Dukem town, Ethiopia

With respect to distance of water source from dwelling, Table 3 shows that majority (83.9%) of the households had access to water within a distance of upto 200 metre or less. Also, an overwhelming majority (82.4%) of households had access to water within a time of 30 minutes or less. In the majority of households (82.6%) an adult woman usually collected drinking water from water sources. Regarding consumption of water, majority of the households (83.9%) had used less than 20 litres per capita per day and 55.8% households had used less than 15 litres per capita per day. Data collectors observed whether the household water container was covered or not. The result showed that most households (93.2%) had covered their stored water and about three-quarters (74.4%) of households had used plastic jerry can container (Fig. 1).

Table 4 shows the availability of toilet facility and pattern of disposal of children's stool among the households of Dukem town in Ethiopia. More than two-thirds (70.1%) of households had improved private toilets (flush/pour-flush toilet, ventilated improved pit (VIP) latrine and traditional pit latrine). Among the households that had their own private latrines, 21.9% were shared. From households that had children of under 3 years of age, about three-quarters (74.2%) of them used potty followed by diaper/cloth (12.4%). The result indicated that 85% of the latrines were kept clean.

Table 4: Type of toilet facilities used and stool disposal pattern of children younger than three years by households in Dukem town, Ethiopia

Type of toilet facilities (n=391)	Frequency	Percentage
<i>Improved</i>		
Flush/pour-flush toilet	9	2.3
Ventilated improved pit latrine	50	12.8
Traditional pit latrine	215	55.0
<i>Unimproved</i>		
Communal latrine	50	12.8
Public toilet	33	8.4
Field or anywhere	34	8.7
<i>Whether Households Share Private Toilet With Other Households?</i>		
Yes	60	21.9
No	214	78.1
<i>Where Usually Young Children (0-3 Years) Pass Stool?</i>		
Used potty	72	74.2
Used latrine	2	2.1
Used diapers/cloth	12	12.4
Went in house yard/compound	6	6.2
Went outside the premises	2	2.1
Don't know	3	3.1
Total	97	100
<i>Households Usually Dispose the Young Children (0-3) Faeces</i>		
Dropped into toilet facility	81	83.5
Uncontained		
Thrown away to drainage system	3	3.1
Disposed into solid waste	3	3.1
Disposed in yard/compound	2	2.1
Disposed outside premises	6	6.2
Did nothing/left it there	1	1.0
Other	1	1.0
<i>Latrine Was Clean</i>		
Yes	303	84.9
No	54	15.1

The results indicated that there was a statistically significant association between private house ownership and private piped water availability ($p < 0.05$). However, there was no significant relationship between family size and availability of private piped water at $p < 0.05$. Also, availability of private toilet was significantly associated with private house ownership ($p < 0.05$). In addition, there was a statistically significant relationship between family size and availability of private toilet facility ($p < 0.05$) (Data not shown).

DISCUSSION

This study investigated access pattern of water and environmental sanitation among households in Dukem town in Ethiopia. The study found that almost all the households had access to improved water supply and quite a large proportion of households had unimproved toilet facility.

The present study found that 42.5% of the households had access to their own private piped water inside their house or in their compound. This can be compared to global situations in which in developing countries an average of 73% of the urban population uses piped water from a household connection and in urban areas of Sub-Saharan Africa 35% of urban dwellers use water piped to the household (WHO and UNICEF 2010). A study conducted in 2003 by Jyotsna Jalan and Martin Ravallion reported that, overall, in households with piped drinking water, the prevalence and duration of diarrhoeal disease among children was significantly lower. The benefits of a piped water system appear to be further increased when the tap is located within the house, as opposed to a communal tap shared by several households (Bachhuber et al. 2008). Piped systems, especially with household connections, provide greater convenience and are thus preferred by people in most communities. However, making large quantities of safe water readily accessible to all households is often not easily realizable (UNICEF 1999).

Summing up with other improved sources of drinking water, almost all the households (98.5%) had access to improved sources of drinking water, which was high coverage because of reasonable access to municipal piped water connections. This coverage was high as compared to study conducted in Ethiopian DHS survey of

2005 in which national access to improved water is 61%, national access to urban improved water is 94% and national access to urban piped water is 90% (Central Statistical Agency and ORC Macro 2006).

Ensuring access to water supply systems can greatly reduce the time women spend collecting water, allowing more time to care for young children and more time for income generating activities (Environmental Health Project 2004). In many communities, household water is managed exclusively by women. Women and girls are generally the ones who obtain water for the home, transport it, store it and then use it for various household purposes (UNICEF 2008). In this study, females carried 85.9% of the water from water sources. This finding indicates that the task of water collection is considered a task for women and girls. In terms of uneven distribution of the burden of collecting water, this compares unfavourably to the data for all developing countries, which shows an average of 64% (WE Consult Lda and UNICEF Mozambique 2009). Despite the fact that most of the hardship associated with water hauling affects females in the studied households, but the accessibility to an improved source of drinking water within reasonable time and distance to fetch drinking water in the majority of households could reduce the burden of hardship and the time spent for collecting water by women.

With respect to distance of water source from dwelling, 83.9% of the households had access to water within a distance of upto 200 metre or less. A study conducted in Kisumu city (Kenya) showed that 77.1% of the households access water within a distance of upto 200 metre or less (Wagah et al. 2010).

The result of the present study indicated that majority of the households had used less than 20 litres per capita per day. The finding was lower than the WHO and UNICEF's Joint Monitoring Programme (JMP) recommendations which describe reasonable access as being '*the availability of at least 20 litres per person per day from a source within one kilometre of the user's dwelling*' (WHO and UNICEF 2000). According to "Universal Access Programme" (UAP) of Government of Ethiopia (2007), the programme has the objective to enable residents of towns to reliably get access to 20 litres of water per day within half a kilometre distance from their residences.

One of the essential parts in the safe water chain is the possession and use of a clean/safe dipper that allows the water from a safe source to be transferred to a vessel for drinking (Environmental Health Project 2004). The study found that most of the households (73.4%) mentioned to use pouring for drawing water from a container. The use of pouring for drawing water from a container is a safe method in domestic water management.

The study indicated that two-third (70.1%) of the surveyed households had used improved private toilets. Other studies showed that community coverage of improved sanitation at the 75% level to be associated with improved health and less than 75 percent still places those with improved sanitation in their homes at risk because of the poor environmental conditions surrounding them (Bateman et al. 1995; Bateman et al. 1993). Improved hygiene and sanitation when practiced by more than 80% of the population is known to radically reduce diarrhoeal disease and worm infestations (Ministry of Health 2006).

The study showed that 21.9% of the private toilets of the surveyed households were shared. The shared status of a toilet facility can be less hygienic than facilities used by a single household (WHO and UNICEF 2006).

To improve the hygiene situation of a household, a toilet facility must be kept clean and well maintained (Environmental Health Project 2004). Information on cleanliness of toilets was also gathered by observing the toilets in the households. Hygienic (clean latrine) was defined as latrine which is not full, do not have faecal matter on the latrine floor and wall, no or few flies in or near the latrine and does not smell bad. Data collectors assessed and visually checked based on this definition as to whether the toilets were clean or not. The result indicated that 85% of the latrines were kept clean. A high level of coverage with hygienic latrines appears to have health advantages.

LIMITATIONS

The households that were included in the study were from one town only (Dukem) and other towns in Ethiopia were not incorporated in this study. Research results therefore are limited to this particular town and cannot be generalized to other towns in Ethiopia. The study was limited to the problems related to domestic envi-

ronmental sanitation condition at household level and did not include data collection from the local institutions such as the municipality, the town's health office, the health centre and other relevant institutions at different levels such as community, municipal, regional or national level.

CONCLUSION

The majority of households had access to an improved source of drinking water within reasonable time and distance. But access to private piped water was low. The large proportion of households had improved private toilets; however, the majority of the facilities were traditional type of pit latrine.

RECOMMENDATIONS

The following recommendations were made based on the findings of this study:

- Water supplies should be as close to the point of use as possible to maximize the health benefit. Thus, it is important to make improved water available, preferably by increasing the coverage and accessibility of improved piped water supply with private or yard tap connections for underserved population.
- Increased emphasis on improved basic sanitation and reducing environmental contamination should be made by promoting Total Sanitation Approach which aims to achieve universal access and use of toilets and the elimination of open defecation in the communities.

ACKNOWLEDGEMENTS

The authors thank those participants who voluntarily participated in this study.

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