MERIT RESEARCH JOURNALS
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Merit Research Journal of Microbiology and Biological Sciences (ISSN: 2408-7076) Vol. 8(2) pp. 016-024, May, 2020
Available online http://www.meritresearchjournals.org/mbs/index.htm

Original Research Article

Assessment of Water Sanitation, Hygiene and Treatment at House Hold Level in Belela Town, Sidama Zone, Southern Ethiopia

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Abstract

Ethiopia has made remarkable progress towards water supply, sanitation and hygiene access in the past decade, but still significant challenges remains unaddressed which varies from place to place especially in Belela town which was not well studied. Therefore, the present study was designed to assess the status of water supply, sanitation and hygiene facilities in Belela town, southern Ethiopia. A community based cross sectional study was conducted. The study subjects were randomly selected 342 households by systematic random sampling. Data were collected through interview and observation checklist. Based on the key indicators addressed in this study, access to water, sanitation and hygiene is lower than that of required standard. The main water sources of the respondents of the study area of households were unprotected spring 120 (35.09%) followed by protected spring 89 (26.02%). The per capita water consumption for private pipe were 13 L and for of public were 6.67 liters' in addition to this the average water consumption per house hold per day for private pipe were 80 liters and for public were 40 liters per day. Training on hygiene and sanitation practice have been given to 99.12% of the families.The odd ratio indicates, there is a statistically significant association between safeness of water and diarrhea.As a result, from household respondents 58.6% of the diarrhea cases are under five children and the remaining 41.4% were adults. Health-workers and local stake holders must give special attention to improve the demand of the town, additional water, sanitation, and hygiene programs are required these conditions.

Keywords: Water sanitation, Hygiene, Treatment, Belela town, Household

INTRODUCTION

Water is essential for life and safe drinking water is a basic human right essential to all, and for sustainable development. It is known that water is our most precious resource, vital to our economy, our daily lives and to the health of our environment. Water and sanitation inadequacies hinder economic and social development; constitute a major impediment to poverty alleviation and in evitable lead to environmental degradation (Water, Sanitation, and World Health Organization, 2004).

It is common for many international organizations to use access to safe drinking water and hygienic sanitation facilities as a measure for progress in the fight against poverty, disease, and death. It is also considered to be a human right, not a privilege, for every man, woman, and child to have access to these services. Even though progress has been made in the last decade to provide safe drinking water and sanitation to people throughout the world, there are still billions of people that lack access to these services every day (UNICEF and WHO, 2012).

Globally a child dies of diarrheal disease every 30 seconds and for every child who dies of diarrheal disease, three more children die of other diseases passed along by unwashed hands, or made more deadly by chronic malnutrition resulting from constant bouts of diarrheal disease and intestinal parasites (Esrey et al., 1991). Thus every 7 seconds, child in the developing

world dies of water sanitation and hygiene (WASH)–related disease or WASH-related malnutrition. According to the world health organization (WHO) and the centers for disease control and prevention (CDC), 80 percent of all childhood diseases are WASH-related (Yardley, 2010). Again globally, an estimated 2,000 children under the age of five die every day from diarrheal diseases and of these some 1,800 deaths are linked to water, sanitation and hygiene (Prüss et al., 2002).

Ethiopia is on track to achieve the Millennium Development Goal target related to water, where 62 percent of the population should access improved sources of drinking water by 2015. According to the 2011 Demographic Health Survey (EDHS), more than half of the households (54%) have access to an improved source of drinking water, compared to 35% in 2005 and 25% only in 2000 (Prüss et al., 2002). Safe water is the door way to health and health is the pre-requisite for progress, social equity and human dignity (Water, Sanitation, and World Health Organization, 2004). Access to safe water alone does not reduce diarrheal diseases significantly. Even if the source is safe water, become contaminated during collection, transportation, storage and drawing in the home. Inadequate hygiene practices must be targeted as well when implementing water and sanitation projects, to decrease morbidity and mortality especially in rural area (Prüss et al., 2002).

Access to safe water, adequate sanitation, and hygiene facilities can mitigate a person's risk of diarrheal disease (World Health Organization, Guidelines for Drinking-Water Quality, 2006). Theprovisionofsafe and adequate water supply, proper disposal of human excreta and refuse, the control of the safety of food, vegetables, and beverages from disease causing organisms or their poisonous products, and the control of lies, lice, mosquitoes, and so forth are human's first line of defense against disease (Teka, 1984).

As a result, three-fourths of the health problems in Ethiopia are due to communicable diseases attributable to unsafe (in adequate water supply, and unhygienic /unsanitary waste management particularly excreta) (Teka, 1984). Diarrheal diseases caused by improper management of water and sanitation are among the major causes of infant and child morbidity and mortality. Water and sanitation programs have a direct bearing on the prevalence of the diarrheal diseases in the population. Water and sanitation project, which are properly designed and implemented, have the potential of reducing diarrhea caused deaths by 55 percent (National water development report Ethiopia, 2004).

The combination of safe water supply, sanitation facilities and hygienic practices has demonstrated a potential in contributing to a remarkable reduction in mortality (Teka, 1984). In Ethiopia, over 60 percent of the communicable diseases due to poor environmental health conditions arising from unsafe and in adequate water supply and poor hygienic and sanitation practices. About 80 percent of the rural and 20 percent of urban population have no access to safe water, which is the least among the continent. Three-fourth of the health problems of children in the country are communicable diseases arising from the environment, especially water and sanitation (Amenu et al., 2012).

Although safe water supply services are available in most places, the national as well as the regional information on the water quality status and the house hold management of local water sources is not readily available. This research tries to identify house hold drinking water containers and the main contributing factors towards the contamination of drinking water and variation of water quality at the source and house hold level. The main aim this study is to investigate hygiene, sanitation and treatment practices of the community with respect to the quality of water from the source to home, in the study area.

MATERIALS AND METHODS

Study Design and Setting

A community based cross-sectional study design was used to assess Water supply, sanitation and hygiene status of households. The study was carried out in the Belelatown, Sidama zone, Southern Nation and Nationalities Peoples Regional States (SNNP) regionalstate, Ethiopia. The town is located 307 km from Addis Ababa (capital city of Ethiopia). The study population was all households in Belela town. The study units were randomly selected households from the two kebeles (Kebele 01 and 02). The study was conducted from Feburery to April 2019 using a pretested semistructured questioner supplemented by qualitative methods obtained by in-depth interview of the local water supply official and water quality technician and health extension workers of the town.

Sampling technique

To select a fairly representative sample of households, the sample size was distributed proportionally to each of the two kebeles based on the number of households they have. After assigning a number to each houses, each sample was selected by systematic random sampling to select study unit.

Exclusion criteria

The children below the seven ages was not recommended or interview for questionnaire. The kebeles out of our selection and the administrative bureaus are not included in our study.

Sample size determination

The sample size, in this case, refers to the number of house hold to be included in the survey. The sample size was determined using the single population proportion formula.The appropriate sample size for a population-based survey is determined largely by three factors: (i) The estimated prevalence of the variable of interest prevalence of water associated diseases due to consumption of unsafe water in this instance; (ii) The desired level of confidence and (iii) The acceptable margin of error. For a survey design based on a simple random sample, the sample size required can be calculated according to the following formula (the minimum sample size was determined by a single population proportion formula).

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

Where,

n = required sample size

Z = confidence level at 95% (standard value of 1.96)

P= estimated prevalence of water associated diseases in the study area the sample size was determined by simple proportion formula using 40% prevalence in Chencha town with a margin of error 0.05 and confidence level 95%.

To minimize errors arising from the likelihood of noncompliance, 10% was add to the normal sample

d= margin of error at 5% (standard value of 0.05),for population less than, 10,000, otherwise it was nf=ni/1+ni/N,

Where N, is the total population, so sample size would be ni=pt^2(1-p)/m^2, which is, 0.4*$(1.96)^2$(0.6)/$(0.05)^2$=369 households, 5% for contingency the final was 384 households. The final sample size:

nf =ni/1+ni/N, where ni=384,

N=3168, then

nf=342

Data analysis

After the data were collected and the responses coded, the data was entered into a computer and analyzed using SPSS version 20. In the analysis process, frequency distribution of variables was worked out in order to describe them. To ascertain the association between dependent and independent variables, adjusted odds ratio with 95% confidence interval will be calculated at 5% significance level.

Types of variables

Variables were classified in to two namely, demographic variables such as age, sex, education status, occupation status, ethnicity, religion, and family size, and environmental health variables such as water supply, hygiene, water treatment mode and sanitation.

Ethical considerations

Ethical clearance should have obtained from Arbamich University, College of Natural Sciences. Before starting data collection, brief explanation was given to the selected house hold community on the purpose of the study. Participant's confidentiality of information assumed by excluding names as identification in the question-naires.

RESULTS

Socio-demographic characteristics of respondents

The data reveals that the socio-demographic characteristics of total of (n=342) households were shown in table 1 below. The table presents, sex of respondents, age of respondents, marital status, educational background, religious status, occupation of households and number of family members of households (Table 1). The number of females 190(55.56%) of the household respondents in the study area exceeds that of males 152(44.44%). Regarding the age of household respondents, 145(42.39) were range between 31 and 45years of age and 103(30.12%) were between 16 and 30 years of age. Whereas, 86(25.15%) and 8(2.34%) were greater than 46 and less than 15 years of age respectively. Regarding the educational status of the respondents the results revealed that about 64(18.71%) were unable to read and write followed by 83(24.27%) of the household respondents were can read and write. The rest of the respondents 102(29.82%), 55(16.08%) and 38(11.12%) were grade 1-8, grade 9-12 and above grade 12, respectively. In terms of marital status 235(68.71%) were married, 48(14.04%) were widowed, 33(9.65%) were single and the rest 26(7.60%) was divorced. Regarding the religious status of the household respondents in the study area, 206(60.20%) were Protestants, 120(35.10%) were Orthodox, 14(4.10%) were Muslims and 2(0.60%) were followers of other religions. Concerning the occupation of household respondents 124(36.26%) of the respondents were unemployed, 94(27.48%) were daily laborers, 71(20.76%) were government employee, 45(13.16%) had business related occupation and 8(2.34%) of the participants were involved in other different occupations. In terms of the family number of the household respondents 175(51.17%) had a family size >4 families; whereas 92(26.90%) had a family size of <4 families (Table 1).

Table 1. Socio-demographic characteristics of households ofBelela Town, 2019, (n=342).

Variables	Responses	Frequency	Percent
Sex of respondents	Male	152	44.44
	Female	190	55.56
Age of respondents (in years)	<15	8	2.34
	16-30	103	30.12
	31-45	145	42.39
	>46	86	25.15
Educational background	Illiterate (can't read and write)	64	18.71
	Read and write	83	24.27
	Grade 1-8	102	29.82
	Grade 9-12	55	16.08
	Above grade 12	38	11.12
Marital status	Single	33	9.65
	Married	235	68.71
	Divorced	26	7.60
	Widowed	48	14.04
Religious	Orthodox	120	35.10
	Musilm	14	4.10
	Protestant	206	60.20
	Other	2	0.60
Occupation of households	Employee	71	20.76
	Unemployed	124	36.26
	Business related	45	13.16
	Daily laborer	94	27.48
	Others	8	2.34
Number of family members in household	<4 families	92	26.90
	4 families	75	21.93
	>4 families	175	51.17

Water handling practices related to water collection

The mainwater sources of the respondents of the study area of households were unprotected spring 120 (35.09%) followed by protected spring 89 (26.02%) and protected hand dug well 59 (17.25%). The majority of households 254 (74.27%) required greater or equal to 40 minutes to fetch drinking water. Of the total population of (342) the household participants, adult woman 156 (45.61%) followed by female under 15 years 125 (36.55%) were responsible for fetching of water for home use. The present study shown that the most commonly preferred type of water collection container was Jerrycan 213 (62.28%) followed by clay pot 108 (31.58%). From the total participants, the majority 227 (66.37%) and 233 (68.13%) were wash their hands and clean their container before collection of water respectively.The most common type of cleansing material to clean the water storage container was water with soap which was estimated to be 215 (62.87%) and followed by water without any detergent only 77 (22.51%) according to the respondents of the study area. In addition, majority 203 (59.36%) of the household respondents were cover the water collection container during transportation (Table 2). The per capita water consumption for private pipe were 13 L and for of public were 6.67 liters' in addition to this the average water consumption per house hold per day for private pipe were 80 liters and for public were 40 liters per day.

Water quality perception of households

Most of the 337 (98.54%) household respondents had the perception of the quality water. Consumers concerning their drinking water said aesthetic factors such as, test, odor and color were very important, likewise drinking water trustworthiness depends on the perception of consumer and the resulting complaints due to testes, odor, color or other particulate matter.Among the 342 household respondents about 208 (60.80%) believes that water quality is measured by color and other 128 (37.40%) believes in the taste. According to the survey, 28 (8.2%) of the respondents believe that the case for the turbidity of water is animals waste, 39 (11.4%) believes in human waste and 275 (80.4%) of the respondents believe in that flood is the main source for reducing the quality of water (Table 3).

Sanitation and hygiene

All most all 331 (96.70%) of household respondents had latrine facility, of which 201 (58.78%) was open pit

Table 2. Water source and water collection practices of households respondents of Belela Town, 2019 (n=342)

Characteristics		Frequency	Percent
Source of drinking water	Public pipe	31	9.06
	Protected dug well	59	17.25
	Unprotected dug well	26	7.61
	Protected spring	89	26.02
	Unprotected spring	120	35.09
	Private pipe	17	4.97
Time taken to obtain drinking water (round trip)	<40 min	88	25.73
	≥40 min	254	74.27
Person who collect drinking water	Adult woman	156	45.61
	Adult man	28	8.19
	Female (under 15 years)	125	36.55
	Male (under 15 years)	33	9.65
Drinking water collection and storage materials	Clay pot	108	31.58
	Plastic bucket	21	6.14
	Jerrycan	213	62.28
Do you wash your hand before water collection?	Yes	227	66.37
	No	115	33.63
Do you wash you collection container?	Yes	233	68.13
	No	109	31.87
Types of cleansing materials for clean water container	Only water	77	22.51
	Water with soap	215	62.87
	Water with ash and leaf	50	14.62
Do all the water collection and storage container have cover?	Yes	203	59.36
	No	139	40.64

Table 3. Water quality perception of household respondents of Belela Town, 2019 (n=342)

Characteristics	Variables	Frequency	Percent
Is there any aesthetic factor that affect the quality of drinking water?	Yes	337	98.54
	No	5	1.46
If there are aesthetic factors that affect the quality of water, what are these?	Taste	128	37.40
	Odor	4	1.10
	Color	208	60.80
	Particulate matter	2	0.7
Do you know the sources of aesthetic factors?	Yes	328	95.91
	No	14	4.09
What are the sources of aesthetic factors?	Animal waste	28	8.2
	Human waste	39	11.4
	Floods	275	80.4

followed by 131 (38.30%) pit latrine without slab. Out of the household respondents, 206 (60.23%)of the latrines have hand washing facility around the latrine. Majority 291 (85.09%) of the household respondents has a trend of washing their hands after they visit the latrine. Training on hygiene and sanitation practice have been given to 339 (99.12%) of the families. Regarding the training on hygiene and sanitation of household respondents, 332 (97.07%) received on personal hygiene, 321 (93.86%) on water handling, 245 (71.67%) latrine construction and 215 (62.87%) on environmental hygiene received the training (Table 4).

Treatment measures used by household respondents

Among the total population, 285 (83.33%) of the household respondents heard about water treatment measures. In the present study the most dominant water treatment method used in the study area was using chemical disinfection 116 (33.92%) followed by boiling 83 (24.27%) and sedimentation 62 (18.14%) of the household respondents respectively (Table 5).

Table 4. Sanitation and hygiene facilities of household respondents in Belela Town (n=342).

Variable		Frequency	Percent
Does your household have latrine?	Yes	331	96.7
	No	11	3.3
What type of latrine do you have?	Pit latrine without slab	131	38.30
	Open latrine	201	58.78
	Flash toilet	10	2.92
Is there hand washing facility around latrine?	Yes	206	60.23
	No	136	39.77
Does the family washing hands after toilet?	Yes	291	85.09
	No	51	14.91
Have you received training on hygiene and sanitation?	Yes	339	99.12
	No	3	0.88
What sort of training you received on hygiene and sanitation?	Latrine construction	245	71.67
	Water handling	321	93.86
	On personal hygiene	332	97.07
	Environmental hygiene	215	62.87

Table 5. Methods water treatment practiced and awareness of household of Belela Town (n=342)

Variables		Frequency	Percent
Do you know about water treatment?	Yes	285	83.33
	No	57	16.67
Which methods of household water treatment you use?	Cloth filtration	40	11.70
	Sand filtration	32	9.37
	Sedimentation	62	18.14
	Chemical disinfection	116	33.92
	Boiling	83	24.27
	Other	9	2.63

Table 6. The association between the perception of respondents on unsafe and safeness of water with diarrhea.

Water supply	Diarrhea				Total
	Yes		No		
	O	E	O	E	
Safe	114	103.78	90	100.21	204
Unsafe	60	70.21	78	67.78	138
Total	174		168		342

Perception of respondents on unsafe and safeness of water with diarrheal disease

The safeness of water measured based on accessibility, affordability and relevance, which is depends on the distance to fetch water time it takes in case of public pipe users, cost of water and quality of water. Ho (null hypothesis): the safeness of water cannot determine the prevalence diarrhea. Ha (alternative hypothesis): the safeness of water determines the prevalence of diarrhea. Chi-square test for that whether the water supply is associated with diarrhea (Table 6).

Chi-square (x^2) = $\sum(O-E)^2/E$, X^2 Cal = 5.066, then Chi square tabulated at confident interval 95%, p- value < 0.001, α= 0.05 and at degree of freedom (1)= 3.84 so, the statically decision:the null hypothesis is rejected. Therefore, there is a statistically significant association between safeness of water and diarrhea. For the strength of the association, we should calculate Odd ratio (OR) = 1.64 and relative risk (RR) =1.27. $\frac{OR}{RR} = \frac{1.64}{1.27} = 1.3$, which is greater than 1, so the safeness of water and diarrhea have significantly association (Table 6).

The null hypothesis (Ho): is the educational status of respondents not affect the usage of Aqua tab.The alternative hypothesis (Ha): is the educational status of respondents affect the usage of Aqua tab. X^2 (Chi-square) = 2.76+1.45+0.105+0.0575=4.376. So, the X^2 value ofthe confidence interval (CI) 95%, degree of freedom (DF)=1, α =0.05 and P-value ≤0.001 is 3.84 (X^2-tabulated), then the null hypothesis is rejected, X^2(Chi-square) calculated > X^2(Chi-square) tabulated. Therefore, the educational status of the respondents has associated

Table 7. Testing the association between educational status of the respondents and usage of Aqua tab

Educational status of respondents	Aqua tab				Total
	Yes		No		
	O	E	O	E	
Illiterate	8	4.480	5	8.51	13
Literate	110	113.51	219	215.48	329
Total	118		224		342

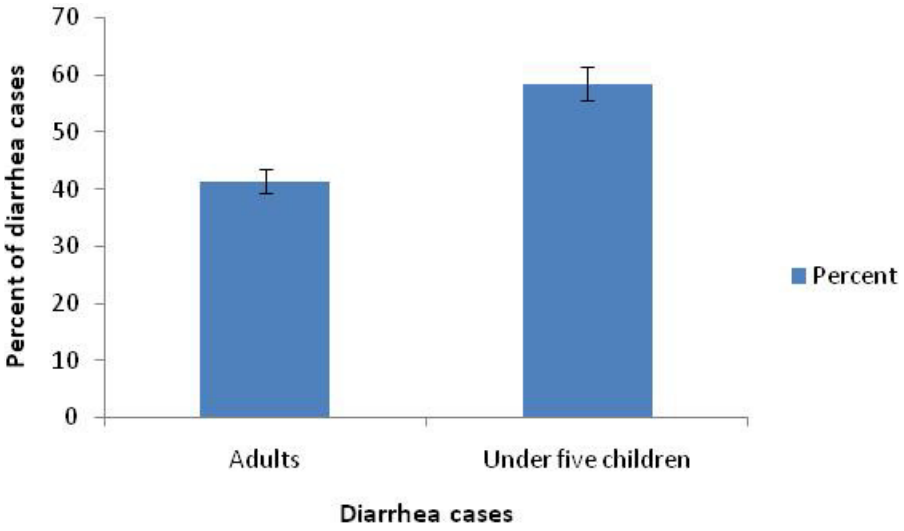

Figure 1. Disease related with drinking water in Belela Town, Sidama zone, Ethiopia.

with aquatab usage. The strength of association as follows;Odd ratio (OR)=3.18; Relative risk (RR) =1.81. Therefore $\frac{OR}{RR}$= $\frac{3.18}{1.81}$=1.76, which is, >1 so, the association between educational status and usage of Aquatab is significant (Table 7).

Morbidity or disease related with drinking water

There are so many diseases associated with drinking water in the world. In our survey diarrhea was prevalent, especially in under five children, who were more vulnerable to the disease. As a result, 58.6% of the diarrhea cases are under five children and the remaining 41.4% were adults. Figure 1

DISCUSSION

Increasing access to drinking water is one of the millennium development goals that Ethiopia and other nations worldwide have adopted (Crow, 2001). Ensuring adequate sanitation facilities are another millennium development goal that Ethiopia shares with other country. Water supply condition without sanitation and hygiene behavior looks nothing at the household level adequate sanitation facilities include an improved toilet and disposal that separates waste from human contact. According to study revealed, 96.7%of household have improved toilet which was better than 8% of that of the country (Demeke, 2009), the reason for this may be the participation of health extension workers on awareness giving service to the residents.

Ethiopia, 62% of women's are responsible for fetching water (Bhandari and Miriam, 2007), similarly in the study area 45.61% of adult womenand 36.55% of female under 15 years were in burden of fetching water from public pipes and other sources. This shows that the share of fetching water among the family members was considered as the major role of women and females than males. In the study area they travels about ≥40 minutes to fetch water from public pipes and other sources were 74.27% of the households,which contrasts that of the country, that is >30 minute about, 53% of the country. This shows that the public installations were fewer in number than users relatively.

Ninety-six point seven percent (96.7%) of the households have at least one type of latrine which was higher than the EDHS 2011 report, 68% (CSA, Ethiopia Demographic and Health Survey, 2011). Despite the progress seen in Ethiopia, 28% practice open defecation

(WHO Ethiopia, 2016). The most common type of latrine available to households was open latrine which was estimated to be 58.78% followed by a pit latrine without slab 38.30%. The coverage of household toilet facility was higher as compared to the national coverage (at which 84% of urban town has access to improved toilet facility) (WHO Ethiopia, 2015). Washing of hand with soap after visiting toilet has a paramount importance in decreasing of diarrheal and other parasitic diseases (Baye et al., 2012). The study showed 85.09% of the households with latrines washed their hands after defecation. The result was greater than the growth and transformation plan or health sector transformation plan of Ethiopia (77%).

Recently, the sanitation system of the town was improving but still much open defecation is observing everywhere" is the reply by one of the key informants. Most people used to urinate in the ditches and street flood canals instead of looking for toilets in their home.

According to (Admassu et al., 2003), only 13% of the households have pipes in premises, but in the study area, 9.06% of public pipe and 4.97% of private pipe have in premises. This shows that the water coverage in the area was lower than that of the standard. In the 2011 EDHS all households asked whether they treat their drinking water. An overwhelming majority, nine households in every ten do not treat their drinking water. According to our survey the water treatment methods used were cloth filtration (11.70%), sand filtration (9.37%), sedimentation (18.14%), chemical disinfection (33.92%) and boiling (24.27%). Boiling is better than that of the standard (2.6%) and also the using practice of chemical disinfection was better than that of the standards, finally the sedimentation water in the area was much greater than that of the standard (0.2%) according to 2011 EDHS. This shows that awareness of some of the households about water treatment was good compared to the standards.

The per capita water consumption in the study area is 13 liters for private pipe users and 6.67 liters for public pipe users, which shows that both of them are lower than the standard that of 15-20 litres per capita according to (Demeke, 2009). The reason for this was they do not aware about the function of water properly, in other words the sanitation and hygiene of the environment and their poor personal condition. Jerrycan (62.28%) was the most water collection container because of two reasons; firstly it reduces the burden of carrying water in the heavy container as it made from light plastic material. Secondly it minimizes possibilities of post contamination as water is used by tilting the jerrycan instead of dipping cups. Studies had shown that the level of contamination was high at the point of consumption than the point of collection (Haylamicheal and Moges, 2012), which may be attributed to the mode or drawing water from the containers. This was as a result of health extension workers in the study area.

Diarrheal disease was one of the problems faced in the study area. There were 58.6% of under five children and 41.4% adults of the respondents that had complaints of any type of diarrheal disease.

CONCLUSION

The study reveals issues related with water supply, sanitation behavior, water collecting materials and treatment modes in the study area. Indeed it gave a brief understanding about house hold water consumption, water quality of improved sources and it was tried to identify, the determinants of household reluctant to use improved water sources. Therefore,the study took 342 households to conduct survey in which the respondents were family members, excluding under 7 children. The major responsible bodies to collect water were women's and children, besides the work load of women doing the home activities. It was extension observed that the use of plastic pot, that is Jerrycan which reduces the heavy load and contamination. Because women's travels averagely 500 meter to collect water with load of heavy clay pots from public pipes, but it was better to replace by jerrycans.And also dropping the water from the jerrycanreduces the direct contact in between the storage and consuming material. The percapita water consumption has a negative relationship with the house hold size, besides that queering time negatively correlates with percapita consumption in public pipe users. Even if the water source was improved and the accessibility was better than that of the country, the daily consumption of their water using practice was low, that is only 13 liters and 6.67litresper person per day in private and public users respectively. And this was reason for the diarrheal diseases.

ACKNOWLEDGMENT

The researcher acknowledged all the study participants and data collectors for their willingness to participate in this study.

Authors' contribution

BWL developed the proposal and help the preparation of the manuscript. The author has read and approved the final version of the manuscript.

Funding: Not applicable.

Availability of data and materials: The primary data set collected from households and analyzed during the

current study is available from the corresponding author.

Ethics approval and consent to participate

The study procedure was reviewed and approved by the Arba Minch University college of natural sciences. All study participants were informed that they have the right not to participate in the study or stop the interview at any time they wish if that was their choice. Written consent was obtained from all participants before the interview. All information obtained in the study was kept confidential.

Consent for publication: Not applicable.

Competing interests: The authors declare that they have no competing interests

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