

household member on specific parameters. The presence of latrine, functionality, availability of water source, water cleanness and handling practices were evaluated. Personal and food hygiene of the family was practically assessed during the data collection time by trained investigators.

Data Analysis and Interpretation

Data were entered in CSPro 7.3 and transported to SPSS software, and descriptive statistics were presented using frequencies and percentages. Chi-square test was implemented to assess the association of the variables to the background of the participants. P value < 0.05 was considered significant. Weighting of the results was done as cluster sampling design was used.

Operational definitions

There were 11 knowledge and 8 practice questions. Those who respond correctly to the knowledge question were scored as 1 and for those responded incorrectly were given 0 point. Results were summed and converted to percent. Finally, those who scored less than 70% in the knowledge questions were considered as having poor knowledge and those who scored higher than 70% were considered as having good knowledge in sanitation and water treatment options. The same principle was applied to evaluate the level of practice of the participants.

Ethical consideration

Ethical approval was obtained from the Ministry of Health Research and Ethics Clearance Committee on 21/09/2020 and further permission was asked from the zonal and local administrators. The confidentiality of the patient's information was kept secured. The head of the family had signed a written informed consent and they had the right to withdraw from the research at any stage if they thought the questions are confidential.

Results

A total of 360 respondents were enrolled in the study dominated by females (75.3%). Almost all (99.0 %) of them were Muslim in religion and Tigre in ethnicity. About 40.8% were illiterate and 25.8% reached primary level of education. Most households (87.5%) own latrine and children (64.2%) usually collect water from the water source. Most of them were aged between 21 to 40 years' (58.5%) and 41 to 60 years (34.1%).

Majority of the households had one to two children and owns one to two living rooms in their house. As there is no piped tap water to the households, 58.4% of the households have access to water provided by municipality (public tap) in less than one kilometer distance. While, 24.7% travel a distance of 1-2 kilometers and 16.9% travel more than 3 kilometers for water access. (Table 1)

Table 1: Socio-demographic characteristics of respondents

Categories	Variables	Frequency (N)	Percent (%)
Sex	Male	89	24.7
	Female	271	75.3
Religion	Muslim	356	99
	Christian	4	1
Ethnicity	Tigre	356	98.7
	Tigrigna	3	0.8
	Saho	1	0.5
Marital status	Married	354	97.9
	Single	6	2.1
Level of education	Illiterate	149	40.8
	Primary and Junior	170	47.5
	Secondary and above	41	11.7
Age (years)	18-21	10	3
	21-60	337	92.6
	above 60	13	4.4
Number of rooms in the house	2-Jan	299	82.6
	3 and above	61	17.4
House with Tap water	Yes	1	0.3
	No	359	99.7
House with latrine	Yes	316	87.5
	No	44	12.5
Who collects water	Mother	93	26.7
	Father and Boys	127	33.9
	Girls	139	39.3
Distance to municipality water source (km)	< 1km	227	58.4
	1-2km	91	24.7
	3km and above	42	16.9
Total		360	100

Knowledge and practice of the community on sanitation, hygiene and water utilization

The community had good level of knowledge on most of the questions regarding sanitation and hygiene. Almost all respondents (98.5%) reported that diarrhea can be prevented and 37.5% answered that water which looked clean by their naked eye was clean and free of bacteria. Majority of them (91.2%) affirmed that defecation in toilet could help prevent diarrhea and regular hand washing is very important (99.8%).

The results showed that 88.3% of the communities in the city have some form of toilet in their compound. The commonly used types of toilets are direct pit (43.2%) and

pit latrine with slab (41.4%). From those who didn't own toilets, 14.2% would rather use neighbor's toilet than openly defecate. One tenth (9.2%) of the toilets were not functional and the main reason was that construction was not finished. Burying was the common (77.3%) method of liquid waste disposal in the community. Even though 98.2% of them were comfortable with their current sanitation situation, 52.8% had reported constraints to improve their sanitation in the community. Among the commonly mentioned constraints to improve their sanitation were shortage of material (34.1%), financial constrains (32.1%) and no space (15.8%). The study participants reported that the positive aspects of using toilet are improved hygiene (88.6 %) and improved health (84.9%). Almost all (99.4%) of the study participants used water for cleansing after defecation and half of them (49.4%) reported that open defecation had never practiced in their community. (Table: 2)

Table 2: knowledge and Practice of the community on sanitation and hygiene

Categories	Responses	Frequency (N)	Percent (%)
Do you have toilet on the compound?	Yes	319	88.3
	No	41	11.7
What kind of toilet do you have?	direct pit	161	43.2
	Pit latrine with slab	139	41.4
	Ventilated improved toilet	30	7.4
If you don't own toilet, where do you dispose human waste?	In the field	16	5.2
	Use neighbor's toilet	52	14.2
Are all toilets functional at the moment	Yes, all functional	317	88.9
	No functional toilet	35	9.2
Why are toilets not functional	Construction not finished	32	9.4
	Other technical problems	11	3.2
Are you comfortable with your current sanitation situation	Very comfortable	182	49.9
	Comfortable	169	48.2
	Uncomfortable	8	1.8
Are there constraints to improve your sanitation	Yes	184	52.8
	No	175	47
What are the main difficulties for improving sanitation	Financial constraints	116	32.1
	No space indoor/ outdoor	56	15.8
	No material available	118	34.1
	Lack of know-how	51	14.6
	Other reasons	63	20.2

What are the positive aspects of using own toilet	Improved health	306	84.9
	More privacy	275	73.7
	Improved hygiene	324	88.6
	Other reasons	186	51.6
Where do you usually defecate when at home	In own toilet	315	87.2
	In neighbor's toilet	36	9.5
	Open defecation	5	2.1
What do you use for cleaning after defecation	Water	358	99.4
	Toilet paper	2	0.6
Is open defecation practiced by household members	Often	15	5.6
	Sometimes	52	13.8
	Seldom	116	31.3
	Never	177	49.4
Total		360	100

Hand washing, comprehensive knowledge, practice and prevalence of diarrhea

According to the family heads report, two thirds of the household members wash their hand more than 5 times per day, and 31.9% wash 1-4 times per day as needed. And overwhelmingly, 91.9% of them claimed to use water and soap when washing hands. About 50.9% of all households washed their hands after defecating, while 71.3% washed before preparing food, 95.9% before eating and 87.5% after eating.

Almost all community had good level of comprehensive knowledge (99.4%) and practice of 93.0%. only 7.0% of them had poor practice on sanitation, hygiene and water treatment options. The self-reported prevalence of diarrhea during the last six months of 2020 in the community was 13% and 10.1% in < five years' children. And, 5.9% of respondents reported of diarrheal illness in their household in the past two weeks and, mostly (4.4%) reported single episode of diarrhea. (Table 3)

Household water use and treatment practice

The community's main sources of drinking water are well (61.7%), truck water supply (18.6%), and public tap (16.9%). They were asked whether they treat the fetched water regularly, and three quarters (76.6%) of the household confirmed that they treat their water at home, and the most common methods used was straining against cloth (48.9%), boiling (38.6%) and adding chlorine (31.7%). The common reasons mentioned for not treating water are lack of knowledge and materials. Sustainability of water access and amount is alarming as 47.1% households sometimes suffer shortages water for drinking. And, still some family members drink unsafe and untreated water (73.7%) when either in the field or away from home, and 23.0% when they are in a hurry.

Table 3: Hand washing, comprehensive knowledge and practice of respondents

Variables	Categories	Frequency (%)	Percent (%)
How often do you wash their hands	5 times of more a day	241	68.1
	1-4 times a day	119	31.9
When do you wash their hands	Before preparing food	261	71.3
	Before eating	348	95.9
What do you use for hand washing	After eating	321	87.5
	After defecation	188	50.9
	Water only	25	8.1
	Water and soap	335	91.9
Any family suffer from diarrhea in the last 6 months	Yes	45	13
	No	314	86.7
	Don't know	1	0.3
If yes, how many suffered during the last six months	1-2 incidents	43	12.4
	3-4 incidents	2	0.6
In the last 2 weeks, how many household members had Diarrhea?	1	12	4.4
	2	2	0.8
	3+	2	0.7
In last six months, do your household members < five years have Diarrhea?	Yes	26	10.1
	No	252	89.9
If yes, how many of your members < five year's suffered diarrhea in the last six months	1	19	5.9
	2	3	0.8
	3+	3	0.8
Comprehensive knowledge	Good knowledge	358	99.4
	Poor knowledge	2	0.6
Comprehensive practice	Good practice	338	93
	Poor practice	22	7
Total		360	100

Two third of the study participants were satisfied with the amount and quality of water they received. The main reasons for dissatisfaction mentioned are bad taste (11.8%), water turbidity (7.7%) and poor quality (3.0%). More than half (58.0%) of the households own water storage tank and they cleaned it using water and OMO (detergent) on weekly (67.6%) and monthly (24.1%) basis. (Table: 4)

Practical observation by investigators

The latrines were checked for functionality during the spot observation by trained investigators and, 90.7% were deemed functional. The latrine pit hole was left open during the observation period in almost all households (99.0%).

During the investigators visit, presence of soap in the toilet was seen in only 22.9% of the households. The investigators also approved that the mother's hand was clean in 77.3% and food was covered in 88.2% during their visit. Garbage container (disposal system) was present only in 43.7% of the households. And, in 5.7% of households', feces were observed around the household. (Table: 5)

Association of comprehensive knowledge and practice with their background

The comprehensive knowledge and practice of the respondents had showed significant association with their age, gender, marital status, level of education, distance to municipality water source and household size ($p < 0.001$).

Table 4: Household water use and treatment practice

Variables	Categories	Frequency (N)	Percent (%)
Do you treat your drinking water regularly	Yes	277	76.6
	No	79	22.4
	Don't know	4	0.9
Household not get enough water for drinking?	Yes	164	47.1
	No	196	52.9
Have you drunk unclean water in your home?	Yes	30	8.1
	No	315	88
	Don't know	12	3.2
How satisfied are you with the amount of water you receive?	Satisfied	235	66.2
	Neutral	78	20.7
	Dissatisfied	47	13.1
How satisfied are you with the water quality	Satisfied	243	66.9
	Acceptable	78	21.6
	Dissatisfied	39	11.3
How often do you wash the storage containers used for drinking water?	Daily	22	6.4
	Weekly	250	67.6
	Monthly	80	24.1
How do you wash the storage containers used for drinking water?	Water only	29	9.3
	Water and Clorox	11	2.9
	Water and OMO	306	84.4
Respondent drank unfiltered water when	In the field	138	38.4
	In a hurry to drink	88	23
	Away from village	123	35.3
The main sources of drinking water for members of your household	Public tap	61	16.9
	Well	222	61.7
	Tanker	84	23.3
	Others	103	28.6
How do you treat your drinking water	Strain by cloth	176	48.9
	Add Chlorine	114	31.7
	Boiling	139	38.6
	Others	21	5.9

Study participants with distance to municipality water source greater than three kilometers were having poor practice on sanitation, hygiene and water use compared to these with one-kilometer distance to the municipality water source ($p<0.001$). (Table 6)

Association of administrative areas to selected background of study participants

Study participants from administrative area of one and three have the highest good practice compared to the other administrative areas and the lowest practice on sanitation

Table 5: spot observation by investigators

No.	Variables	Yes N (%)	No N (%)
1	presence of latrine	322 (89.1)	38 (10.9)
2	Functional toilets	320 (90.7)	29 (9.3)
3	Pit covered	4 (1.0)	337 (99.0)
4	Containment system full	14 (4.8)	324 (95.2)
5	Presence of soap in toilet at time of visit	80 (22.9)	261(77.1)
6	Mother's hands are clean	285 (77.3)	75 (22.7)
7	View food is covered	319 (88.2)	40 (11.8)
8	Garbage pit present	165 (43.7)	195 (56.3)
9	Garbage present inside home	18 (5.4)	342 (94.6)
10	Feces observed in living area	17 (5.7)	343 (94.3)

Table 6: Association of comprehensive knowledge and practice with their background

Variables	Comprehensive knowledge			Comprehensive practice		
	Good N (%)	Poor N (%)	p value	Good N (%)	Poor N (%)	P value
Age (years)						
<21	10(100.0)	0(0.0)		9(90.5)	1(9.5)	
21-40	212(100.0)	0(0.0)	<0.001	204(96.3)	8(3.7)	<0.001
41-60	123(98.4)	2(1.6)		113(87.9)	12(12.1)	
>=60	13(100.0)	0(0.0)		12(89.1)	1(10.9)	
Gender						
Male	89(100.0)	0(0.0)	<0.001	83(92.6)	6(7.4)	0.009
Female	269(99.3)	2(0.7)		255(93.1)	16(6.9)	
Religion						
Muslim	354(99.4)	2(0.6)		335(93.1)	21(6.9)	
Christian	4(100.0)	0(0.0)	0.014	3(80.8)	1(19.2)	<0.001
Ethnicity						
Tigre	354(99.4)	2(0.6)		334(92.9)	22(7.1)	
Saho	1(100.0)	0(0.0)	0.019	1(100.0)	0(0.0)	<0.001
Tigrigna	3(100.0)	0(0.0)		3(100.0)	0(0.0)	
Marital status						
Married	352(99.4)	2(0.6)		332((92.8)	22(7.2)	
Single	6(100.0)	0(0.0)	<0.001	6(100.0)	0(0.0)	<0.001
Level of education						
Illiterate	147(98.7)	2(1.3)		139(90.8)	10(9.2)	
Primary	96(100.0)	0(0.0)		88(91.6)	8(8.4)	<0.001
Junior	74(100.0)	0(0.0)	<0.001	71(96.2)	3(3.8)	
Sec&above	41(100.0)	0(0.0)		40(97.5)	1(2.5)	
Distance to municipality water source						
<1km	225(99.1)	2(0.9)		217(96.0)	10(4.0)	
1-2km	91(100.0)	0(0.0)	<0.001	86(94.7)	5(5.3)	<0.001
>=3km	42(100.0)	0(0.0)		35(80.0)	7(20.0)	
Number of rooms in the house						

1	156(100.0)	0(0.0)		145(92.0)	11(8.0)	
2	141(98.6)	2(1.4)	<0.001	133(91.7)	10(8.3)	<0.001
3 & above	61(100.0)	0(0.0)		60(98.3)	1(1.7)	
Household size						
3-Jan	62(100.0)	0(0.0)		58(92.9)	4(7.1)	
7-Apr	212(99.1)	2(0.9)	<0.001	198(91.2)	16(8.8)	<0.001
8 & above	84(100.0)	0(0.0)		82(97.5)	2(2.5)	
Total	358(99.4)	2(0.6)		338(93.0)	22(7.0)	

Table 7: Association of administrative area to different background of study participants N=360

Variables	Administrative area						p value
	1	2	3	4	5	6	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
Comprehensive knowledge of respondents							
Good	61(98.4)	30(100.0)	90(100.0)	87(98.9)	30(100.0)	60(100.0)	
Poor	1(1.6)	0(0.0)	0(0.0)	1(1.1)	0(0.0)	0(0.0)	<0.001
Comprehensive practice of respondents							
Good	61(98.4)	23(76.7)	88(97.8)	84(95.5)	28(93.3)	54(90.0)	
Poor	1(1.6)	7(23.3)	2(2.2)	4(4.5)	2(6.7)	6(10.0)	<0.001
Did any member of your household suffer from diarrhea in the last six months							
Yes	4(6.5)	5(16.7)	22(24.4)	8(9.1)	2(6.7)	4(6.7)	
No	58(93.5)	25(83.3)	68(75.6)	79(89.8)	28(93.3)	56(93.3)	<0.001
Don't know	0(0.0)	0(0.0)	0(0.0)	1(1.1)	0(0.0)	0(0.0)	
House with latrine							
Yes	57(17.1)	25(13.8)	78(23.8)	79(25.9)	25(8.0)	52(11.3)	
No	5(10.6)	5(19.4)	12(25.7)	9(20.8)	5(11.3)	8(12.3)	<0.001
Distance from your home to municipality water source							
<1 km	54(24.3)	0(0.0)	70(3)	61(30.0)	0(0.0)	42(13.7)	
1-2km	8(8.5)	0(0.0)	20(21.6)	26(30.2)	30(34.2)	7(5.4)	<0.001
>=3km	0(0.0)	30(85.8)	0(0.0)	1(1.7)	0(0.0)	11(12.5)	
How often do your household members wash their hands in a day?							
< 5 times	32(26.6)	11(16.8)	38(31.3)	1(0.9)	7(6.2)	29(18.1)	
>=5 times	30(11.6)	19(13.5)	52(20.4)	87(36.7)	23(9.5)	31(8.4)	<0.001

and hygiene was reported in administrative area of two, ($p < 0.001$). The highest prevalence of diarrhea in the city was reported in administrative area of three and two respectively ($p < 0.001$). All study participants from administrative area of two went greater than three kilometer distance from their home to municipality water source ($p < 0.001$). Majority of the respondents in administrative area of four were practicing hand washing of greater than five times a day compared to the other administrative areas ($p < 0.001$). The level comprehensive knowledge, practice, prevalence of diarrhea, house with latrine, distance to municipality water source and hand washing practice of the participants showed significant association the administrative area in the city. (Table: 7)

Discussion

Three key hygiene practices of safe disposal of feces, hand washing with soap at critical times, and the treatment

and storage of drinking water are the most effective ways of reducing diarrheal disease. The objective of this study was to determine the community awareness and practice on sanitation, hygiene and water use, and to estimate the prevalence of diarrhea in the community. The study has demonstrated that three quarters of the respondents regularly treat their drinking water, and straining against cloth and boiling are the common ones. This result was higher to other studies that an estimated 33% of the households in these countries report treating their drinking water at home and boiling were the most dominant water treatment method (21%). [5] Other study also reported that household water treatment was practiced by 34% [6] and 18.3% [14] of the respondents and Chlorination was a major (20%) method of HWT [6]. This higher practice of water treatment could be mainly due to their higher level of knowledge on the methods and on the disease burden compared to the other studies.

This study revealed that the community has high level of knowledge and practice on sanitation, hygiene and water treatment options. This result was high compared to other studies that the overall mean knowledge of water safety, sanitation and hygiene was 78.1% [6]. And, in another study, good knowledge and practice on WASH were observed in 42.2% and 49.2% of the respondents, respectively [14]. This high level of knowledge and practice in the city could be mainly due to the continuous input of the Ministry of Health and the Eritrean Government in improving the life standards of the community in general and the proper utilization and usage of latrines and sanitation through the community lead total sanitation programs in increasing awareness and triggering processes. Based on the trained investigators practical observation of the communities during data collection, most of them had functional toilets and about one tenth use neighbor's toilet if they lack toilet. This result was similar (88.6%) [6] and higher (71%) to other studies [15]. This higher utilization of latrines in the community reflects the works done by the environmental health program of Ministry of Health in construction and proper utilization of latrines in the community to end open defecation in the country.

During the spot observation, feces were observed in the living area in only 5.7% of the households. This result was lower to other study from Ethiopia which reported 11.4% of the households practiced open-field defecation [6]. This lower practice of open defecation in the community also reveals their awareness and the increased utilization of latrines that enhances the motive to end open defecation in Eritrea to achieve the sustainable development goals. This study indicates that about half of households claimed they wash their hands after defecating and most of them use water and soap. Similarly, Ethiopian study showed that hand washing after using toilet was practiced by 67% of households. And, 48% wash their hands with soap and water [6]. Despite these results, although almost all reported that regular hand washing is very important, but during practical observation the narrative changes. Mothers' hands were not clean in 22.7% and only 22.9% of the households had soap at the toilet during the investigators visit, which was better than similar Ethiopian study (14.9%) [14]. This spectacle that the practice of hand washing with soap after defecation is questionable. And, the actual practice of proper hand washing in the community seems lower to the self-reported practice and could be one reason for the higher prevalence of diarrhea in the households.

This study depicted two third of the households wash the water storage containers used for drinking water on weekly basis and majority with water and OMO (detergent). This practice was higher to other study where 46% of households clean their water tanks [16]. This further mirrors the higher

awareness of the community on household water treatment techniques.

The trained investigators observation was crucial in assessing the gap on maintaining water safety personal sanitation and hygiene. And, despite the communities' relatively better knowledge about waterborne fecal-oral disease, the results showed discrepancies on actual practice. Absence of garbage container, unclean mother's hand, absence of soap at toilet, uncovered food and feces in the living area were the noted indicators of actual sanitation and hygiene practices in the community. Hence, empowering the community to increase their practice through behavior change and sustaining the current results would be crucial. Though the majority of participants were satisfied with the quantity and quality of water supplied; bad taste, poor quality and water turbidity were reported as major problem by one-third of them. Therefore, it is essential to introduce household piped water method or the household water treatment options should be enhanced.

The prevalence of diarrhea in the community in the last six months of 2020 and in children < five years' age was 13% and 10.1% respectively. This was similar to other study that the two-week prevalence of diarrhea in children under 5 years of age was 13.6% [6] and lower to other study that 19.1% households experience diarrhea symptoms in the last six months [15]. This lower prevalence in diarrhea in the community could be mainly due to that they had higher knowledge on sanitation, hygiene and higher percent of the community were using water treatment techniques in their house.

The introduction of Rota virus vaccine in the country could have also an impact on the lower prevalence of diarrhea in children < five years in the community. Based on the results of this research, the administrative area in the city showed significant association with their comprehensive practice, prevalence of diarrhea, distance to municipality water source and hand washing practice. Other studies showed that statistically significant differences were observed on the levels of knowledge and education [6].

Strength and limitation of the study

The self-reported practices of the respondents were verified by practical observation of the investigators, which increases the validity of the respondents. This research tries to answer all aspects (sanitation, hygiene and water use) which can cause diarrhea to increase the strength of the study. Further studies with larger sample size that includes the urban and rural communities from different zoba's and different ethnicities are necessary to have different responses. The study was no without limitations. It was conducted in one city which the results can't be used to generalize to the whole country. Since there was no similar study conducted before

in the country, it was difficult to associate the results with national previous studies.

Conclusions

The level of knowledge and practice of the community on sanitation, hygiene and household water treatment in Afabet city was very high and the utilization of toilets and household water treatment options was promising. The prevalence of diarrhea in the community was low and most of them were satisfied with the amount and quality of water they use. Open defecation was rarely used but personal and food hygiene was not such satisfactory in the community. The level comprehensive practice, prevalence of diarrhea, distance to municipality water source and hand washing practice of the participants showed significant association the administrative area in the city. Their knowledge and practice had also showed significant association with their age, gender, marital status, level of education and distance to municipality water source.

To end open defecation and meet the sustainable development goals, further monitoring and community control strategies for those who defecate in the fields and to sustain the high utilization of toilets are highly recommended. Awareness on personal, food and environmental hygiene and hand washing with soap at the critical times are vital and should be addressed to decrease the prevalence of diarrhea in the community. Introducing affordable and reliable household water treatment techniques and providing household pipe water are necessary to improve the living standards of the households.

List of abbreviations

- WHO - World Health Organization
- HWT- household water treatment
- KAP- knowledge, attitudes and practices
- WASH- water, sanitation and hygiene
- CSPRO - Census and Survey Processing System
- SPSS- Statistical Package for the Social Sciences

Declarations

Ethical approval and consent to participate

Ethical approval was obtained from the Ministry of Health Research Ethical and Clearance Review Committee of Eritrea and written informed consent was obtained from the study participants. Personal information of participants was kept secured.

Consent for publication

All authors have approved the manuscript for publication, but consent was not applicable

Availability of data and materials

The data sets used and supplementary materials are available and can be requested from the corresponding author if necessary.

Competing of interest

Authors declare that they didn't have any competing of interest to disclose.

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Author's contribution

The proposal was designed by BT, FK and HM. FK varnished the study design and methodology part. All authors have participated on supervision of the data collectors. FK designed the data entry tool and BT and MG participated on data entry. Data analysis was done by FK and the first draft of the manuscript was written by BT, MG and HB. All authors have contributed by analyzing, interpreting and writing the manuscript. The final form of the manuscript was shaped by all authors and they have read and approved the final manuscript.

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