Community Knowledge and Practice on Sanitation, Hygiene and Household Water Utilization in Afabet City, Northern Red Sea Zone of Eritrea: Cross Sectional Study

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Abstract

Background: Water and sanitation entitles the human right to affordable access and sanitation. The objective of this study was to determine the knowledge and practice on sanitation, hygiene and water utilization and to estimate the prevalence of diarrhea in Afabet city.

Methods: A descriptive community-based study with a multistage cluster sampling technique was used. Twelve clusters were selected from the city and 30 households were nominated from each cluster. Then, a total of 360 individuals were sampled and every family head was interviewed. A structured interviewer administered questionnaire and field observation was used from December 05-21, 2020. Cross tabulation and association of variables using chi-square test was used.

Results: A total of 360 respondents were enrolled with females (75.3%) and Muslim (99.0%) predominance. About 66.2% and 66.9% of them were satisfied with the amount and quality of water they received respectively. The prevalence of diarrhea in the community in the last six months of 2020 was 13.0%. The investigators practically approved that 90.7% of the communities revealed functional toilets, and feces were observed in 5.7% of the living area of the community. The community’s comprehensive knowledge and practice was 99.4% and 93.0% respectively, and showed significant association with their age, sex, marital status, level of education and distance to water source (p<0.001). Furthermore, their knowledge, practice, prevalence of diarrhea, presence of latrine, distance to water source and hand washing practice were significantly associated with the administrative area of study participants (p<0.001).

Conclusion: The community had good level of knowledge, practice and the prevalence of diarrhea was relatively low. Latrines were highly utilized but the usage of soap, personal and food hygiene was slightly low. Their practice, prevalence of diarrhea, distance to municipality water source and hand washing practice was associated to the administrative areas. Enhancing environmental sanitation, personal hygiene and provision of adequate and clean water are highly recommended.

Keywords: Practice, Sanitation, Hygiene, Prevalence, Diarrhea, Eritrea

Introduction

According to a World Health Organization (WHO) report, globally 2.3 billion people lack safe water at home and 844 million people do not have basic drinking water supplies [1]. Furthermore, 2.5 million people worldwide do not have access to any type of improved sanitation [2]. Unsafe drinking
water, along with poor sanitation and hygiene accounts for nearly 10% of the total burden of disease worldwide [3]. Safe, reliable and piped-in water is an essential goal, and treating water at the household or other point of consumption provides a means by which vulnerable populations can improve the quality of their own drinking water [4].

For populations without reliable access to safe drinking water, household water treatment (HWT) provides a means of improving water quality and preventing disease [5]. Information on knowledge, attitudes and practices (KAPs) in relation to water safety, sanitation and hygiene in peri-urban areas is essential to prevent water-borne diseases [6]. Many communicable diseases can be effectively managed by improving water, sanitation and hygiene (WASH) practices. Waterborne disease prevalence can be reduced through implementing the three key WASH practices: Safe disposal of feces and hand washing with soap at critical times can reduce prevalence of waterborne diseases by 30% and 40%, respectively [7].

The prevalence of diarrhea in developing countries has encouraged the development of low-cost, behavior-based interventions to interrupt diarrhea-causing pathogen transmission by improving water quality at the point-of-use and by washing hands using soap. Meta-analysis of efficacy studies indicate that household water treatment reduces diarrhea in children <5 years of age by 30–40% and hand washing with soap reduces diarrhea and acute respiratory infections by 31% and 24%, respectively [8]. In Sub-Saharan Africa, access to safe drinking water in peri-urban areas is inadequate and complicated by the influx of people from rural to urban areas, poverty, and poor sanitation and housing conditions [9].

According to UNICEF-WHO Joint Monitoring Programme data from 2015, only 16% of the population in Eritrea has access to basic sanitation facilities and 76% practice open defecation [10]. In highland areas of Eritrea, many people practice open-air defecation for different reasons [11]. In Eritrea, currently most of the urban population gets clean water and the use of latrine is promising. But, it is mainly different in the rural areas and their distribution may differ among the subzones, and their level of knowledge and practice is not well determined. To the knowledge of the researchers, there are no similar researches done before to identify this problem in the country in general and in the subzone in particular. Thus, to fill this gap, the objective of this study was to assess the level of knowledge and practice of the community in sanitation, hygiene and water utilization, and to determine the prevalence of diarrhea in Afabet city, Northern Red Sea Zone of Eritrea.

Methods

Study design and Sampling method

It was a descriptive cross-sectional community-based type of study. A multistage cluster sampling technique was implemented as a sampling method to select the study households. First, the city was stratified into six strata and from these strata 12 clusters were selected proportional to their size and 30 households were nominated from each cluster. Finally, a total of 360 individuals were sampled from the study area and every head of the selected family was interviewed for the questionnaire.

Study population and Site

The study was conducted in Afabet city, Northern Red Sea zone of Eritrea. Afabet sub zone and Afabet city have a population of 91,813 and 34,676 respectively [12]. All household heads from the selected study area and who were available during the data collection time were included in the study. Household heads that were unable to speak and with no legible respondent and those with mental retardation were excluded from the study.

Sample size determination

The sample size for this study was calculated based on various aspects including diarrhea prevalence, precision level and confidence interval. The diarrhea prevalence (p) in the community was not known to the researchers; hence, it was assumed that 50% of the households in the community were infected with diarrhea. Besides, the precision level (d) and the confidence level (z) were taken at 6.5% and 95% respectively. The initial sample size was obtained using the formula $n = \frac{Z^2*p*q}{d^2}$

Thus, with the assumption of the estimates mentioned above the initial sample size were 228. Considering 95% response rate(r), the final sample size (n) was: $n = \frac{n1}{r} = 228/0.95 = 239$

Considering a design effect of 1.5 the final sample size was 359. The cluster size was determined at 30 individuals and hence 12 (359/30 =11.9 ~12) clusters were selected. Therefore, a total of 360 individuals were sampled from the study area.

Data collection

Data were collected from December 05-21, 2020 using a structured interviewer administered questionnaire and field observation. The questionnaire had included the socio demographic characteristics of the study participants, questions which used to assess their awareness on general sanitation, hygiene, availability of water and household water treatment options and the prevalence of diarrhea in their community. The questionnaire was partly adopted from knowledge, attitude and practice study on sanitation, hygiene and solid waste management, private toilet survey 2014 in BO City [13] and finally modified and reformed to the context and objectives of this study. During data collection, field observation was done to validate the response of the
household member on specific parameters. The presence of latrine, functionality, availability of water source, water cleanliness 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)

| 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                        | 316           | 87.5        |
|                             | 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        |

Table 1: Socio-demographic characteristics of respondents

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        |

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 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        |
| 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? | Yes | 12           | 4.4         |
|                                                | No               | 2             | 0.8         |
| 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           | 93.1        |
|                                                | Poor practice    | 22            | 7           |
| Total                                          | 360             | 100          |

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        |
|                                                | Acceptable       | 78            | 21.6        |
|                                                | 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         |

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

**Table 5: spot observation by investigators**

| No. | Variables                        | Yes   | No   |
|-----|----------------------------------|-------|------|
| 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)     | <0.001  | 9(90.5)    | 1(9.5)     | <0.001  |
| 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             |            |            | <0.001  |            |            | 0.009   |
| Male               | 89(100.0)  | 0(0.0)     | <0.001  | 83(92.6)   | 6(7.4)     |          |
| 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          |            |            |          |            |            | <0.001  |
| Tigre              | 354(99.4)  | 2(0.6)     |          | 334(92.9)  | 22(7.1)    | <0.001  |
| 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     |            |            |          |            |            | <0.001  |
| 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 |            |            |          |            |            | <0.001  |
| 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 |            |            |          |            |            |         |

**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.
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.

| Variables                                                                 | Administrative area | 1     | 2     | 3     | 4     | 5     | 6     | p value |
|--------------------------------------------------------------------------|---------------------|-------|-------|-------|-------|-------|-------|---------|
|                                                                         | N (%)               | N (%) | N (%) | N (%) | N (%) | N (%) | N (%) |         |
| **Comprehensive knowledge of respondents**                               |                     |       |       |       |       |       |       |         |
| Good                                                                     | 211(92.0)           | 145(91.7) | 133(91.7) | 108(86.7) | 106(96.4) | 105(96.4) | <0.001  |
| Poor                                                                     | 16(8.0)             | 18(9.3)  | 5(3.3)  | 5(4.3)  | 4(3.6)  | 5(4.6)  |         |
| **Comprehensive practice of respondents**                                |                     |       |       |       |       |       |       |         |
| Good                                                                     | 185(97.8)           | 137(96.1) | 140(96.1) | 137(97.7) | 137(97.7) | 137(97.7) | <0.001  |
| Poor                                                                     | 6(2.2)              | 4(2.9)   | 5(3.3)  | 6(4.3)  | 6(3.6)  | 6(3.6)  |         |

| Did any member of your household suffer from diarrhea in the last six months? |                     |       |       |       |       |       |       |         |
|---------------------------------------------------------------------------|---------------------|-------|-------|-------|-------|-------|-------|---------|
| Yes                                                                       | 187(94.3)           | 133(91.7) | 140(96.1) | 137(97.7) | 137(97.7) | 137(97.7) | <0.001  |
| No                                                                        | 27(15.7)            | 15(9.3)   | 10(6.9)  | 6(4.3)  | 10(7.3)  | 16(13.0) |         |
| Don't know                                                                | 56(0.0)             | 2(0.0)    | 3(2.0)   | 1(1.1)  | 3(2.0)   | 3(2.0)   |         |

| House with latrine                                                        |                     |       |       |       |       |       |       |         |
|--------------------------------------------------------------------------|---------------------|-------|-------|-------|-------|-------|-------|---------|
| Yes                                                                       | 77(22.9)            | 70(20.0) | 54(21.7) | 57(26.1) | 60(23.8) | 62(26.4) | <0.001  |
| No                                                                        | 183(77.1)           | 268(80.0) | 191(78.3) | 149(74.9) | 147(76.2) | 138(73.6) |         |

| Distance from your home to municipality water source                      |                     |       |       |       |       |       |       |         |
|--------------------------------------------------------------------------|---------------------|-------|-------|-------|-------|-------|-------|---------|
| <1 km                                                                    | 143(47.7)           | 102(32.8) | 160(64.0) | 144(66.7) | 140(63.2) | 132(60.9) | <0.001  |
| 1-2km                                                                    | 109(35.6)           | 107(33.1) | 71(27.6)  | 78(35.0)  | 81(35.5)  | 82(37.3)  | <0.001  |
| >=3km                                                                    | 44(14.7)            | 16(4.9)   | 9(3.4)   | 6(3.0)   | 9(3.8)   | 12(5.8)   |         |

| How often do your household members wash their hands in a day?           |                     |       |       |       |       |       |       |         |
|--------------------------------------------------------------------------|---------------------|-------|-------|-------|-------|-------|-------|---------|
| < 5 times                                                                 | 105(37.2)           | 88(27.2) | 91(36.0) | 100(45.5) | 96(43.1) | 100(45.5) |         |
| >=5 times                                                                 | 155(62.8)           | 104(32.8) | 173(64.0) | 147(54.5) | 141(57.9) | 140(54.5) |         |

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

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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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