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RESEARCH PAPER

Food Safety, and Water Sanitation and Hygiene Among Food Insecure Households: The Case of *Woreda* 10 of Arada Sub-City, Addis Ababa, Ethiopia

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ABSTRACT:

PURPOSE: Appropriate knowledge, attitude and practices (KAP) of food safety and water sanitation and hygiene (WASH) enable households to prevent food- and water-borne illnesses, thereby contributing to a better food security status, for which access to safe food is an essential requisite. The objective of this study was to investigate the food insecurity status and KAP of food safety and WASH in randomly selected households in the study area.

DESIGN: A cross-sectional study on food security status, and KAP of food safety and WASH among households was conducted. Both qualitative and quantitative data were collected from a total of 351 randomly selected households found in *Woreda* 10. Data were analysed using STATA for Windows version 14.2. Household food insecurity access scale (HIFAS), food safety KAP and WASH KAP were analysed using descriptive statistics.

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FINDINGS: About 89% of households (n=351) had a low monthly income. HFIAS indicated that only 23% of the studied households were food secure; the rest were mildly (44.8%), moderately (25.4%), or severely (6.8%) food insecure. Average knowledge, attitude and practice in food safety were 57.1%, 86.6% and 37.6%, respectively. Study households had poor knowledge (20%) about the signs of safe water, and the reasons and prevention of diarrhoea, positive attitude towards measures in WASH (54%), and good WASH practices including waste management (63%).

VALUE: The findings of this study bring to the forefront the need to consider food and water safety issues in addressing food security in a country. As the ultimate goal of food security is to lead an active and healthy life, ensuring food and water safety in households, together with making nutritious food available, is, therefore, of great importance.

KEYWORDS: *Knowledge; attitude; practice; food safety; food security; WASH*

INTRODUCTION

According to the FAO's (1996) definition of food security, food safety is an essential requisite to lead a healthy and active life. Food safety is also getting more attention worldwide as there is a strong association between food and health. In fact, the Director General of the FAO declared that there could be no food security without food safety (FAO, 2019). Simultaneously, due to growth in the food trade across the globe, food safety has become a common issue among both developed and developing countries (Unnevehr, 2003).

Food safety addresses not only the production of safe food, but also safe consumption of food products (Kinsey, 2005). At the household level, food safety, in broader terms, comprises different aspects of food handling, preparation, storage, personal hygiene and water sanitation to prevent the occurrence of contaminating micro-organisms or other substances. Unsafe food causes diarrhoeal diseases that are the second leading cause of death in the world and kill close to half a million children under 5 years of age in Ethiopia each year (Melese *et al*., 2019).

Food production is primarily an agricultural practice. Food safety, however, is a public health issue. Food can be contaminated by disease-causing micro-organisms or their toxins at any point along the food chain due to improper practices, and may result in food-borne illnesses. However, most food-borne illnesses occur in homes (Redmond and Griffith, 2009).

Water, for drinking or household use, also plays an important role in the transmission of food-borne illnesses. Proper water sanitation prevents the contamination of water sources by faecal material, and adherence to good hygienic practices prevents the transfer of harmful microbes from contaminated water or environmental sources to food (UNICEF, 2016). Nevertheless, over a third of the world's population lives without basic sanitation facilities (WHO, 2014). The importance of water is not limited to public health, but also to general livelihoods and development, including agricultural production, industry and commerce and daily life. Therefore, the water supply and sanitation conditions affect food security and health (ACF, 2005).

In many parts of the world, due to absence of adequate sanitation systems, people practice open excretion that allows faecal waste to contaminate the environment (WHO/UNICEF, 2017). Many low and middle income countries fail to properly deliver sanitation services, and cities are confronted

with sanitation problems stemming therefrom (WHO, 2018). The aim of this study is, therefore, to assess the food safety and water sanitation and hygiene practices of low income households living in the densely populated *Woreda* (District) 10 of Arada sub-city, Addis Ababa, Ethiopia.

MATERIALS AND METHODS

Description of the Study Area

Addis Ababa is divided into 10 sub-cities, and Arada sub-city is situated in the north central part of the city (Figure 1). It is one of the early developed parts of Addis Ababa. According to data collected in 2003 (UN Habitat, n.d.), over 80% of households in Arada sub-city were slum households. The sub-city is divided in to 10 *Woredas*; a *Woreda* is the smallest administrative unit in the country.

Of the households in the *Woreda*, 10% had water piped into the dwelling and the rest used water piped into their yard or public tap water. Up to 48% of the households faced frequent water disruption, 8-60% of households had access to improved, affordable and sufficient water, only 20-25% had adequate sanitation. About 70% of toilet facilities were shared and, of these, 44% were shared with six or more households. About 32% of the toilets were connected to a sewage system (UN Habitat, n.d.). With no improvements in housing schemes in the sub-city, current WASH facilities may even worsen.

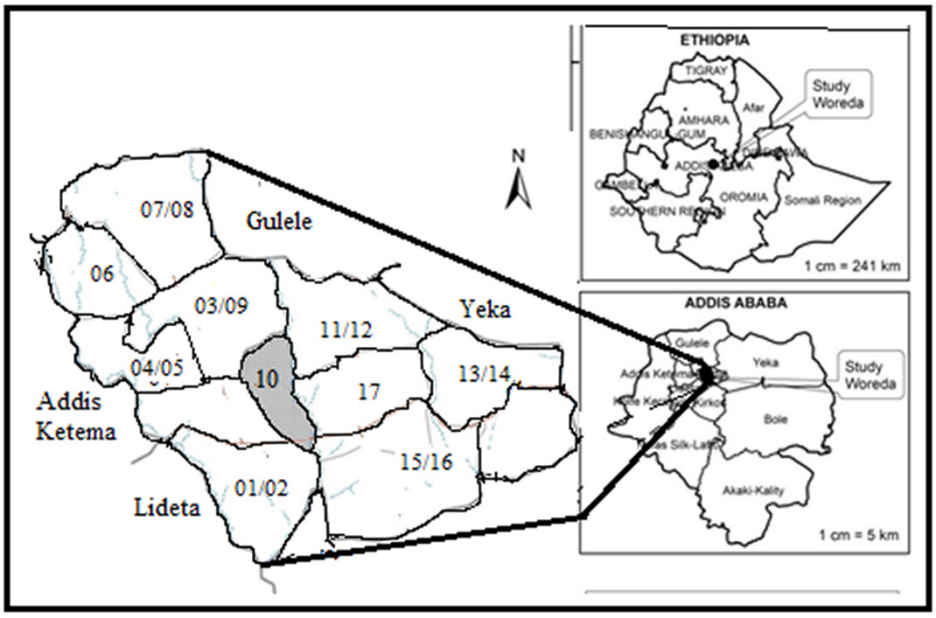

Figure 1: Map of *Arada* Sub-City Showing the Location of *Woreda* 10

Source: Arada sub-city land administration office 2005: Ethio-GIS II, 2015

A cross-sectional study was conducted on food security, and knowledge and practice of food safety and water sanitation among households in *Woreda* 10, Arada sub-city. Both qualitative and quantitative primary data were collected from respondents with varied characteristics and demographics. Secondary data were gathered from recorded documents from the administration office of *Woreda* 10. Environmental observations were made on sanitary conditions in the *Woreda*. The study was conducted from January to March 2019.

Sampling

The study area, *Woreda* 10, is located around Piazza and covers an area of 39.5 hectares. There were 2,885 households who were living in *Woreda* 10 during the study period, giving a density of 73 households/hectare. They consisted of 1,429 male-headed and 1,456 female headed households. *Woreda* 10 was purposively selected as it was one of the oldest settlements in the city and the sewerage system was outdated. The selected *Woreda* had six "*ketenas*" (neighbourhoods) and the samples were proportionally selected from all "*ketenas*" by random sampling. Households were randomly selected based on a census conducted to obtain the list of households.

Sample size was determined according to Yamane (1967) and a corrected sample size of 351 households was considered in this study.

A structured questionnaire was used to assess knowledge and practice on food safety (Macías and Glasauer, 2014) and WASH (WHO, 2018). The household food insecurity access scale (HFIAS) was measured according to Coates *et al*. (2007). The response rate of the study participants was 100%. Secondary data were collected from the Food Security Administration Office and Job Creation Office of *Woreda* 10.

The total KAP percentage among respondents was calculated as in Macías and Glasauer (2014):

$$\text{Percent of knowledge} = \frac{\text{Sum of correct responses given by all respondents}}{\text{Sum of all responses given by all respondents}} \times 100$$

Total positive attitude among respondents was calculated as:

$$\text{Percent of positive attitude} = \frac{\text{Sum of positive responses given by all respondents}}{\text{Sum of all responses given by all respondents}} \times 100$$

Similarly, appropriate practice was calculated as:

$$\text{Percent of practice} = \frac{\text{Sum of appropriate responses given by all respondents}}{\text{Sum of all responses given by all respondents}} \times 100$$

Data were analysed by using STATA for Windows version 14.2. HFIAS, food safety and WASH were analysed by descriptive statistics.

Ethical Consideration

Verbal informed consent was obtained from study households in *Woreda* 10, and interviews were only carried out with the full consent of the person being interviewed. Confidentiality regarding respondents' details and information obtained therefrom, as well as anonymity of the respondents, was maintained. Written consent was obtained from the *Woreda's* Food Security Office.

RESULTS AND DISCUSSIONS

Socio-Economic and Demographic Characteristics

The majority (65%) of the respondents were between 20 and 40 years old, and 73.5% were female. About 43% were either divorced or single, and about 70% of the households had two or fewer children while about 9% had five or more children. The majority of the children (80%) were under 18 years old. Around 45% of the respondents were daily labourers and about 21% could not read and write. About 76% of them had a monthly income of ETB 1500 or less (1 USD=ETB 32.60 during the study period) (Table 1).

Table 1: Socio-Economic and Demographic Status of the Respondents

		No.	%
Age	20-30	95	27.1
	31-40	135	38.5
	41-50	85	24.2
	>50	36	10.3
Sex	Male	93	26.5
	Female	258	73.5
Marital Status	Single	93	26.5
	Married	205	58.4
	Divorced	53	15.1
Number of children/household	Two and less	244	69.5
	Three and four	76	21.7
	Five and above	31	8.8
Children age group/household (years)	<5	208	33.12
	>5-10	118	18.79
	>10-18	179	28.50
	>18	123	19.59
	Total	628	100.00
Religion	Christian	257	73.4
	Muslim	75	21.4
	Others	18	5.1

(continued)

Table 1: Socio-Economic and Demographic Status of the Respondents *(continued)*

		No.	%
Occupation	Government	41	12.0
	Private	148	43.2
	Daily labourer	154	44.9
Education	Cannot read and write	73	20.9
	Can read and write	223	63.7
	>Diploma	54	15.4
Income (monthly)	500-1000	148	42.2
	1001-1500	117	33.3
	1501-2000	48	13.7
	>2000	38	10.8

Source: Constructed by authors from own data

Household Food Insecurity Access Scale (HFIAS)

Households in the study area experienced food insecurity in different forms. Less than a quarter of households either did not worry about sufficiency of food for the household in the previous 30 days or worried very rarely. A high proportion of households experienced food insecurity at different levels; some reduced the quality (70%) or quantity (48%) of food they ate because of lack of resources. Others (10%) experienced hunger from one to ten times in the previous 30 days because there was no food to eat (Table 2).

Table 2: Mean Values of Food Insecurity Experiences of Participant Households (351) in the Past Four Weeks

Household Food Insecurity Experience	Occurrence	Frequency		
		Rarely	Sometimes	Often
Anxiety and uncertainty	212 (60.4%)	212 (100%)	-	-
Reduced quality of food	245 (69.8%)	224 (91.4%)	17 (6.9%)	5 (2%)
Reduced quantity of food	168 (47.9%)	158 (94.1%)	10 (6%)	0
Hunger	34 (9.7%)	32 (94.1%)	2 (5.9%)	0

Rarely (1 or 2 times), sometimes (3 to 10 times), often (more than 10 times)
Source: Constructed by authors from own data

Households (23%) who were free from anxiety or uncertainty about food availability in the household or worried rarely in the previous 30 days were categorised as food secure (Table 3). About 45% of the households sometimes or often worried about the availability of sufficient food for the household and were considered as mildly food insecure. Households who frequently had to compromise with the quality of food they ate were considered as moderately food insecure (25%). The small proportion of households who compromised with the quantity of food they ate or

experienced hunger (7%), though rarely, were considered as severely food insecure. The level of food insecurity in our study was comparable to that reported from Damot Galle Woreda in Wolayta zone (Mota *et al*., 2019), much lower than that from Boset Woreda, Arsi zone (Moroda *et al*., 2018), but higher than that from Jima Zone (Hassen *et al*., 2016) and West Oromia (Garoma, 2020).

Table 3: Food Security Status of the Study Population (n=351)

Food Security Category	Frequency
Food secure	23%
Mildly food insecure	44.8%
Moderately food insecure	25.4%
Severely food insecure	6.8%

Source: Constructed by authors from own data

Food Safety Knowledge, Attitude and Practice

In most parts of Ethiopia, sauces are the major components of traditional meals. They are usually legume-based, vegetable-based or meat-based. If contaminated, they allow multiplication of various kinds of micro-organisms, including those that cause diseases, and, therefore, have to be stored at low temperatures to avoid microbial growth (Ashenafi, 1996 a, b; Moges and Ashenafi, 2000). Most micro-organisms that are common contaminants in kitchen environments can also spoil sauces that are kept at ambient temperatures for over 12 hours (Ashenafi, 1997). Uncleaned kitchen utensils and environment can be sources of contamination to cooked foods (Ashenafi, 1996a).

The food safety of households was measured with respect to knowledge of avoiding contamination, thorough cooking, cold storage of perishable foods and cleaning of raw fruit and vegetables. Attitude towards implementing food safety measures was assessed in terms of perception on susceptibility to and severity of food-borne diseases, perceived benefits of taking the appropriate safety steps, and perceived difficulty of implementing such measures. Food safety practice was assessed in terms of food handling, personal hygiene and household water sanitation and hygiene.

Knowledge of Food Safety Issues

Food Handling

This was assessed with regards to the separation of raw from cooked foods, thorough cooking, cold storage of perishable foods, and washing raw fruit and vegetables (Table 4). About 97% of respondents had very good knowledge of signs of thorough cooking and washing raw fruit and vegetables. Thorough cooking should go to the point of boiling and is essential to kill bacteria and ensure food safety (Ashenafi, 2012). Most respondents (76%) also had good knowledge of separating cooked foods from raw foods. Raw foods are usually contaminated with various groups of micro-organisms and are possible sources of contamination to cooked foods. Lower knowledge (33-63%) was noted on cooling of perishable and left-over foods. To avoid possible illnesses from left-over foods, they should be kept in a cold place and reheated during serving

(FSIS, 2012). Knowledge regarding personal hygiene was also notably low (32.3%), particularly in identifying the key moments of handwashing (16%). Good personal hygiene practices are essential to prepare safe food and food handlers should wash hands often to keep food safe (Voca, 2014).

Knowledge of treating unsafe water was also low (27%). The two dependable methods of choice to disinfect water before use are boiling or adding disinfectants, usually chlorine, in the right concentration (CDC, 2020).

The total knowledge of respondents regarding general food safety issues was 57%. This level was similar to that reported from Saudi Arabia (Ahmed *et al*., 2018) but much lower than that from Palestine (Zyoud *et al*., 2019). The low level of knowledge about food safety was indicative of lack of awareness in households to handle foods more safely (Shapiro *et al*., 2011).

Table 4: Food Safety Knowledge Among the Study Population (n=351)

Knowledge	
Food handling	
Reason for separation of raw and cooked foods	265 (75.5%)
Signs of thorough cooking	343 (97.7%)
Kinds of perishable foods to be stored in a cool place	221 (63%)
Reasons for avoiding eating left-overs not kept in a cool place	114 (32.5%)
Washing raw fruit and vegetables before eating	339 (96.6%)
Food handling Knowledge level	***73.1%***
Personal Hygiene	
Action for preventing food poisoning from germs from faeces	172 (48.9%)
Key moments for handwashing	55 (15.7%)
Personal hygiene knowledge level	***32.3%***
Water Sanitation	
Treating unsafe water	93 (26.5%)
Water Sanitation Knowledge level	***26.5%***
Total Food Safety Knowledge	**57.1%**

Source: Constructed by authors from own data

Attitude on Food Safety Issues

Food handling attitude was assessed with regards to perceived susceptibility to sickness from contaminated food, perceived severity of the sickness if it is contracted, perceived benefits of following food safety measures, perceived barriers that make implementing safety methods difficult, and perceived self-efficacy that builds confidence in oneself to implement the methods that make food safe (Table 5). These perceptions positively or adversely affect the implementation of one's knowledge into practice.

Over 90% of respondents showed a positive attitude towards following appropriate food handling practices and the importance of maintaining good personal hygiene, particularly appropriate handwashing. A smaller proportion (76%) of respondents had good attitude in household water sanitation issues. It was worth noting, however, that the majority of respondents were against boiling unsafe water before use mainly because they perceived that the taste of boiled water was not as acceptable and that boiling water required fuel (wood or charcoal), which they used sparingly. The total positive attitude among respondents could be considered as high (86.6%). This was much higher than the rate reported from Palestine (Zyoud *et al*., 2019), Debarq, Ethiopia (Dagne *et al*., 2019) or Saudi Arabia (Ahmed *et al*., 2018). This might be because access to food safety information through various means is easier in city centres.

Table 5: Food Safety Attitude Among the Study Households (N=351)

Attitude	
Food handling perceptions	Frequency
Susceptibility: Likely to get sick from eating contaminated food?	327 (93.2%)
Severity: Seriousness illness from eating contaminated food.	325 (92.6%)
Benefits: Good to cold store perishable foods, re-heat left-overs, clean wash fruit and vegetables	333 (94.9%)
Barriers: Not difficult to re-heat left-overs or clean wash fruit and vegetables, or store perishable food in cool place.	302 (86.1%)
Food handling attitude	***91.7%***
Personal Hygiene perceptions	
Susceptibility: Likely to get stomach ache or diarrhoea from not washing hands	317 (90.3%)
Severity: Serious to get diarrhoea from oneself not washing hands.	329 (93.7%)
Benefits: Good to wash hands before preparing food or before feeding a child/eating	337(96%)
Barriers: Not difficult to wash hands before preparing food or before feeding a child/ eating	319 (90.9%)
Self-efficacy: Confidence in washing hands properly?	319 (90.9%)
Personal hygiene attitude	***92.4%***
Water Sanitation perceptions	
Susceptibility: Likely that oneself or one's child to get diarrhoea from using unsafe water	317 (90.3%)
Severity: Serious to get sick from using unsafe water	317 (90.3%)
Benefits: Good to boil water before drinking or using it	315 (89.7%)
Barriers: Not difficult to boil water before drinking or using it	154 (44.1%)
Self-efficacy: Confidence in boiling water before drinking or using it	227 (65%)
Water sanitation attitude	***75.8%***
Total Positive Attitude in Food Safety	**86.6%**

Source: Constructed by authors from own data

Practice of Food Safety Issues

Food safety practice was evaluated with respect to actions taken to clean food utensils and kitchen surfaces, cold storing perishable foods, frequent and appropriate handwashing and appropriate storage of water, and disinfecting unsafe water (Table 6). Although most respondents had good knowledge of food handling and had a high positive attitude towards appropriate food handling, not all these were translated into practice.

Only about 45% of the respondents appropriately cleaned kitchen surfaces and utensils, and about 31% stored perishable fresh foods in cold places. Although over 90% of respondents had a positive attitude towards handwashing, only 36% practiced it. Appropriate handwashing requires washing one's hands with soap and water under running water. A relatively higher proportion of respondents (68%) cleaned their water storage containers using water and detergent, and smoked them using olive splinters. Although about 22% of respondents boiled unsafe water, none used bleach to achieve disinfection. It should, however, be noted that water after collection can be contaminated during storage in households: drinking water obtained from safe sources became contaminated during storage in the house (Jensen *et al*., 2002). Significant contamination after water collection from source was also reported (Wright *et al*., 2004). Another study showed that even the collected safe water was subjected to frequent and extensive faecal contamination in the household (Clasen and Bastable, 2003). For this reason, cleaning of storage containers matters was most important.

The total level of appropriate practice of food safety was 38%. Food safety practice observed in our study was much lower than that reported from Hanoi, Vietnam (Takanashi *et al*., 2009) and Palestine (Zyoud *et al*., 2019), but slightly higher that that reported from Egypt (Allah *et al*., 2017).

Table 6: Food Safety Practice Among the Study Households (n=351)

Practice	
Food Handling	Frequency
Appropriate cleaning of kitchen surfaces and utensils after preparing dinner	158 (45%)
Appropriate storing of perishable fresh foods	108 (30.8%)
Food handling practice level	***37.9%***
Personal Hygiene	
Appropriate handwashing	125 (35.6%)
Handwashing practice level	***35.6%***
Water Sanitation	
Appropriate storage of water	237 (67.5%)
Appropriate actions to make water safer to drink	39 (11.1%)
Water sanitation practice level	***39.3%***
Total Appropriate Practice in Food Safety	**37.6%**

Source: Constructed by authors from own data

Knowledge, Attitude and Practice of WASH

Globally, there are concerns regarding household sanitation and hygiene problems in rural or urban settings in developing countries (Sibiya and Gumbo, 2013). Such problems are responsible for a huge proportion of child mortality due to diarrhoea (WHO/UNICEF, 2009). Approximately 85% of cases of diarrhoea among children under five are due to unsafe water and sanitation (Liu *et al*., 2016). Prevention of diarrhoea requires access to safe drinking water, adequate sanitation, and promotion of good personal and environmental hygiene. WASH-related knowledge, attitudes and practices help to understand the behavioural determinants affecting appropriate WASH practices.

WASH Knowledge

Respondents' knowledge of signs of safe water was based on the absence of germs, turbidity, bad taste, or any smell (Table 7). Although 55% of respondents considered absence of germs as a major sign, the average knowledge of respondents on water safety was low (25%). Most claimed that water became unsafe due to turbidity, therefore basing judgement on visual parameters. This resulted in low average knowledge (10.5%) in identifying the signs of safe water. Similarly, respondents' knowledge of the causes of diarrhoea was only 14%. Of the six different steps needed to prevent diarrhoea, less than 40% of respondents identified any one of the steps, and total knowledge of prevention of diarrhoea was as low as 16.7%. Knowledge of how to prepare oral rehydration solution (ORS) was also only 12%. Mean knowledge of all WASH issues among the study households was only 20%. This proportion was comparable to the 22% mean knowledge reported from South India (Veerapu *et al*., 2016), but lower than the 42% reported from North Ethiopia (Berhe *et al*., 2020) and the 91% from Malaysia (Mohamed *et al*., 2016). The findings in this study indicated the need for sanitation and health education to achieve a functioning water and sanitation system (Duncker, 2001).

Table 7: WASH Knowledge Among the Study Population (n=351)

Knowledge	(%)
Signs of safe water	25%
Reasons for water not to be good	10.5%
Causes of diarrhoea	14.1%
Prevention of diarrhoea	16.7%
Method how to prepare ORS	12%
Total WASH Knowledge	***19.9%***

Source: Constructed by authors from own data

WASH Attitude

A positive attitude was noted among a large proportion of respondents who perceived that unsafe water could transmit diseases (70%), felt bad when someone littered waste from containers (89%),

or were willing to pay for garbage collection services (72%). However, a lower positive perception was observed regarding toilets (56%), shower cabins (35%), number of waste collectors (22%), and drainage systems (34%). The total positive attitude of respondents was 54% (Table 8). Positive attitude to WASH was lower (49%) in North Ethiopia (Berhe *et al*., 2020), and higher (59%) in South India (Veerapu *et al*., 2016) and 92% in Malaysia (Mohamed *et al*., 2016).

Table 8: WASH Attitude Among the Study Population (n=351)

Attitude	
Water can transmit diseases	70.4%
Satisfaction with privacy, safety and cleanliness of toilet	55.7%
Happy with water pressure, cabin design and privacy of shower provided on the plot	34.5%
Enough communal waste collectors in the neighbourhood	22.4%
Bad feeling about littering of waste out of containers	89.2%
Willing to pay for the garbage collection	71.5%
Happy with the drainage system	33.9%
Total WASH Positive Attitude	***53.9%***

Source: Constructed by authors from own data

WASH Practices

WASH practices were examined from the perspective of water availability for the household, diarrhoea incidence and treatment, open defecation and toilet usage, disposal of excreta, shower usage, and waste disposal. About 32% of respondents had children under 5 years of age in the family with diarrhoea in the previous 15 days (Table 9). Low appropriate practice among respondents was observed with regards to the removal of solid waste from the neighbourhood (25%) and emptying the household waste collection bin in communal waste collectors (47%). This implied that waste was not properly disposed of from inside homes and the neighbourhood, and could consequently result in contamination of the household surroundings. A large proportion of respondents (78%) observed that people of all age groups defecated in the open, therefore contaminating the environment with faeces. Faeces are a source of food-borne disease causing microbes that are picked up by insects and rodents (Ercumen *et al*., 2017). Both children's and adults' hands can be contaminated from soil that comes in contact with faeces (Gil *et al*., 2014). Unwashed hands, flies and rodents can bring disease-causing microbes to household kitchens. The microbes contaminate food and water and cause diarrhoea. Mean practice of respondents was 63%, therefore requiring urgent education on the safe handling of water from collection point to consumption (Macías and Glasauer, 2014).

Table 9: WASH Practice Among the Study Population (n=351)

Practice	Number (%)
Sometimes not enough water for the family	205 (58.4%)
<5 children in the family with diarrhoea during these last 15 days	112 (31.9%)
Visit clinic or give ORS when someone from family has diarrhoea	243 (69.2%)
Seen people of all age categories practicing open defecation	273 (77.8%)
<5 children who defecate on a potty	307 (87.5%)
Dispose excreta in toilets	325 (92.6%)
Take shower less than once per week	228 (65%)
Take showers inside home or toilet	275 (78.3%)
Solid waste taken away from the neighbourhood	88 (25.1%)
Garbage disposed of in a bin inside the house	225 (64.1%)
Empty bin in the communal waste collectors	165 (47%)
Total Appropriate WASH Practice	***63.4%***

Source: Constructed by authors from own data

Assessment of Food Safety and WASH Practices Through Visits

Regarding food safety status, it was observed in kitchens that utensils, such as plates, cooking pots, drinking glasses, wooden mixing sticks during cooking, or refrigerators were not properly cleaned. Fingerprints were clearly seen on glasses, supposedly cleaned sauce mixing sticks contained stew remnants, fat residues were noticed on washed plates and cooking pots. These problems arose from improper cleaning of utensils without detergents and not cleaning the inside of refrigerators regularly. Moreover, some households scrapped remaining pieces of food into uncovered garbage bins inside the house. A swarm of flies was observed around the bins as they were major breeding sites for flies. In households with refrigerators, perishable foods were not properly stored. Some households kept raw meat alongside fresh fruit and vegetables on the same shelf. Others stored raw meat on the top shelf and the cooked foods on the lower shelf. This kind of storage in refrigerators exposes cooked foods to contamination from raw meat. Raw foods should always be stored on the bottom shelf.

With respect to personal hygiene, while washing hands after visiting the toilet, some household members opened taps with possibly contaiminated hands, washed their hands with soap and running water, and closed the contaminated taps using their washed hand, thus re-contaminating their hands. The same unsafe practice was observed on others who poured water from jugs by themselves to wash hands.

In the case of WASH practices, about 53% of handwashing facilities were more than five metres away from latrines, soap and water was not available at 22% of these facilities, and water was available only in 25% of them during the time of the visit. Although half the respondents said that they boiled water to make it safer to drink, the researcher could not find a separate container to store boiled water at least for emergency use.

In households that used containers for storing drinking water at home, jugs were used to fetch water from the containers for cooking purposes. However, these jugs were not properly cleaned when immersed in storage containers to get water and, sometimes, were used for purposes other than cooking, such as for handwashing outdoors or for bathing inside the toilet area. Although respondents claimed that they stored water in regularly cleaned containers, water taken from storage containers was found to be unclean or turbid when poured into a glass. This was indicative of the fact that the water tanks were not cleaned regularly or thoroughly.

The majority of respondents said that the latrine on their plot was easy to clean. Observations confirmed that there was no sign of excreta on the latrines. However, there was a strong foul odour from urine possibly because users passed urine outside of the toilet hole.

With regard to showering practices, some households used a bucket and jug to carry water to the toilet for showering. The same containers were used for household activities without any form of disinfection, therefore making them vehicles of faecal contamination.

Some households threw away waste outside the house but within the compound. Discarded plastic bottles, fruit peel, and solid and liquid waste were seen around the fence of their compound.

Most improper practices arose from lack of knowledge on food and water safety. A functioning water and sanitation system should be supported by complementary sanitation and health education component (Duncker, 2001).

The public health significance of poor food safety and WASH lies in the fact that deaths due to diarrhoea from poor storage practices, insufficient cooking time, use of contaminated water to wash kitchen utensils, and poor hand hygiene, represent a considerable proportion of food-borne disease. Diarrhoeal disease transmission is mainly effected through the faecal-oral route consisting of contaminated food, water, hand and insect vectors. An individual is increasingly exposed to faecal pathogens by poor food safety and WASH practices.

CONCLUSIONS

This study showed that the majority of the study households were food insecure at different levels. Their food safety knowledge was only satisfactory but not translated into appropriate practice. Similarly, knowledge and practice on WASH status was markedly low. As the ultimate goal of food security is to lead an active and healthy life, ensuring food and water safety is of paramount importance. Therefore, the following recommendations are drawn from the study. Providing regular awareness training to households on food and water safety may improve the situation.

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