Household food security status and food safety knowledge, attitude and practice in Tehuledere Woreda, South Wollo, Ethiopia

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Abstract

A community based cross-sectional study was carried out in a rural and peri-urban kebeles in Tehuledere woreda between January24 and February 23, 2019 to assess the food security status of households and their food safety knowledge, attitude and practice (KAP). Food security status was assessed by Households Food Insecurity Access Scale (HFIAS, and household food safety KAP were assessed in terms of food handling, personal hygiene and water sanitation. A total of 245 households were selected randomly from the two kebeles. Data were collected by using structured questionnaires and analysed using descriptive statistics and t-test was used to assess significant differences between kebeles. HFIAS analysis indicated that only 18% of the households were food secure. Most of the sample households were mildly food insecure (54.4%) and a considerable proportion were moderately food insecure (27.8%). There were no severely food insecure households. Food safety knowledge and practice were generally unsatisfactory. Respondents, in general, showed low level of food safety knowledge (<50%) and poor level of food handling practices, although attitude towards safe handling of food was positive (>70%).

Keywords: Household food security, food safety knowledge, attitude, practice, Tehuledere, South Wollo, Ethiopia.

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1. Introduction

Food security is commonly understood as the state when all people at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO 2002). The ultimate goal of food security is to enable individuals to lead an active and healthy life. And an active and healthy life is possible when food is safe and nutritious. Therefore, FAO (2019) declared that there could be no food security without food safety. Food safety is a scientific discipline that describes the handling, preparation, and storage of food in ways that prevent food-borne illness (Oggiano 2015).

Contamination of food with diseases causing organisms causes food-borne illnesses, mainly diarrhoea, which, globally, affects 600 million people and cause more than 420,000 deaths each year (WHO 2015). Diarrheal diseases, among others, are responsible for causing malnutrition in children through reduction in food intake, decrease in absorption of nutrients, and increase in breaking down processes of nutrient reserves (NRC 1985). Diarrhoea and the resulting malnutrition mostly affect 150 million children under the age of five both in terms of mortality and stunting (WHO 2015).

Furthermore, food safety problems threaten the life of population groups with undeveloped, compromised or weakened immune systems, such as infants, pregnant women, AIDS or cancer patients, and the elderly (Krones and Hoegenauer 2012; FDA 2014). In addition to its negative impact on health, unsafe food can cause significant social and economic costs due to loss of income and reduced market access. According to the World Bank (Jaffee *et al.* 2019), the total cost of food-borne diseases in developing countries is about USD 110 billion per year (USD 95.2 billion for productivity losses and USD 15 billion for treating food-borne illnesses).

Household food insecurity and household food safety are inseparably intertwined in poor households. Infants and children have a higher risk than adults for being affected by diarrhoea due to their underdeveloped immune system, low production of stomach acid that kills ingested harmful bacteria lower body weight and lack of control over meal preparation (Ray, 2004).

Persistent diarrhoea results in malnutrition which, in turn, weakens the immune system and puts infants at high risk of diarrhoea with increased severity (Walsona and Berkley 2018). This is commonly known as the 'diarrhoea-malnutrition-diarrhoea' vicious cycle. This cycle is usually caused by lack of food safety practices as influenced by knowledge and attitudes of household food handling (Akabanda *et al*. 2017).

The food safety knowledge, attitudes and practices of food-handlers have been a focus of study in different countries around the world (WHO 2008). According to Sharif and Al-Malki (2010), the combination of knowledge, attitude and practice of food handlers, plays a dominant role in food safety at household level or larger food establishments. Recent statistics indicates that globally, nearly one in every 10 persons falls ill due to consumption of foods contaminated with food-borne microbes while 420 million people die annually due to illnesses, mainly diarrhoea, associated with unsafe foods (WHO 2016). Food-borne illnesses cause increased budgetary expenditures on health (Subbulakshm *et al*. 2012) and most are caused due to lack of basic food hygiene principles (Mendagudali *et al*. 2016; Tolulope*et al*. 2015).

Most food-borne disease outbreaks are linked to inappropriate food preparation by food handlers (Barrabeig *et al*. 2010; Beatty *et al*. 2009). Unfortunately, many food handlers are not aware of their roles in ensuring proper personal and environmental hygiene accompanied by the basic food hygienic practices when they buy, prepare and sell food (WHO 2015). The aim of this study was, thus, to assess the food security status and food safety KAP among rural households in Tehuledere Woreda, South Wollo.

2. Materials and Methods

2.1. Description of the Study Area

It is expected that urban areas have a better exposure to information regarding food safety. We were interested if this is actually true. And we wanted to see how the situation is in a close rural environment. This study was therefore carried out in Kebele 01 (peri-urban) and Kebele 026 (rural) in Tehuledere woreda of South Wollo Zone in Amhara National Regional

State (Fig. 1). The woreda has a total area of 44,030 hectares and is subdivided into nineteen rural and two small peri-urban kebeles. The Woreda's Agro-ecological Zones consist of 15% Dega (masl, above 2440) 72% woyina-dega (masl, 1830 – 2440) and 15% kola (below 1830). Its average annual rainfall is 1030 mm and has average temperatures of 9^0C–21^0C per annum (TWOA 2016).

The Woreda has 25,380 agricultural households consisting of 82.3% male- and 17.7% female-headed households. The average land holding per household is estimated at 0.5 ha. Tehuledere has two rainy seasons, the short rainy season (known as "belg") from February to end of May and the main rainy season or long rainy season (known as "Meher") from July to end of September. Farmers grow a variety of crops such as teff, sorghum, wheat, maize, barely, beans etc. The most important crop in the district is sorghum followed by teff and maize. The main pulses are chick peas, grass peas and haricot beans, sometimes inter-cropped with sorghum and maize. Vegetables and fruits are produced where farmers have access to small-scale irrigation, especially around Haik and Ardibo lakes. They also use rivers and water ponds for the same purpose. Another feature of the farming system in Tehuledere area is the increasing production of cash crops, such as khat, as one of the main sources of income for households.

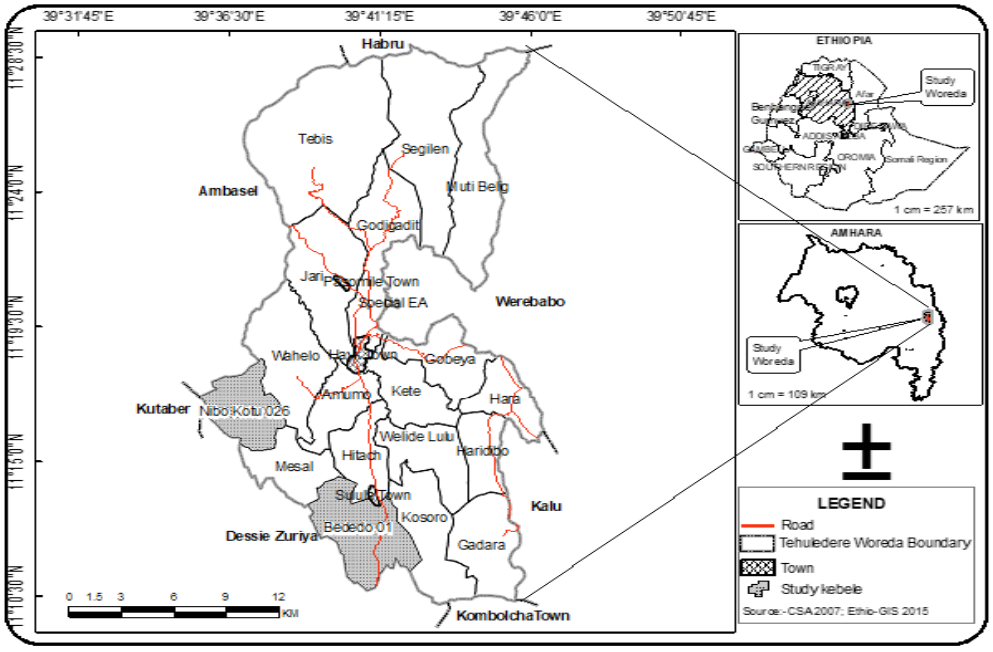

Figure 1. Map of study area (Ethio-GIS 2015).

2.2. Research Design

A community-based cross-sectional study design was used to collect data on HFIAS and investigate food safety KAP of mothers in the study households in both kebeles. Information, consisting of household socio-economic and demographic parameters, such as age, sex, educational level, monthly income, and occupation, was also collected. Representative sample size was determined as in Cochran (1963).

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where n_0 is the initial sample size, n is adjusted sample size and N is the population size.

$$n=382/1+ ((382-1)/625) =237$$

Finally, with 5% non-response rate, the size was 249 households. However, since the actual response rate was lower than 5%, a total sample of 245 of

randomly selected households (133 from Kebele 01 and 112 from Kebele 026) were considered for the study.

2.3. Household Survey

Ethical clearance to conduct the study was obtained from Centre for Food Security Studies, College of Development Studies, Addis Ababa University. Tehuledere Woreda administration and the health office were informed about the purpose of the study and permission to conduct the study in kebeles 01 and 026 was secured. Informed oral consent to participate in the study was obtained from respondents and all ethical procedures were followed throughout the study.

Household face-to-face interviews, employing structured questionnaires, were used to collect data on household socio-demographic characteristics, experience-based household food insecurity access (Coates *et al.* 2007), and KAP on food safety (Macías and Glasauer 2014)**.** The data was collected from January 24 to February 23, 2019.

The HFIA assessment consisted of nine questions that measured food insecurity experiences along with occurrence and frequency of occurrence of the experiences. Food insecurity experiences were expressed as worrying about having enough food, compromising quality or quantity of food because of lack of resources, or experiencing hunger. Each of the nine questions was asked with a recall period of four weeks. Occurrence parameters ranged from never having experienced food insecurity conditions to experiencing hunger. Frequency of occurrence was assessed as 'rarely' (one to three times), 'sometimes' (three to ten times) or 'often' (more than ten times) in the last four weeks.

Households that experienced none of the food insecurity conditions or experienced worrying only rarely were considered as food secure. Mildly-food-insecure households worried about not having enough food sometimes or often, and/or had to compromise quality of foods they ate but only rarely. Moderately food insecure households compromised quality of food more frequently and/or quantity of food rarely or sometimes. Severely food

insecure households cut back on meal size or number of meals often, and/or experienced hunger (Coates *et al*.2007).

KAP questionnaires were based on those recommended by FAO (Macías and Glasauer 2014). The questionnaires were translated into Amharic for simplicity of communication between the enumerator and respondents. The Kebele Health Extension Workers were oriented on issues related to data collection procedures and ethics. Questionnaires were pre-tested to check for item validity and reliability. All questionnaires were checked for completeness before releasing respondents at the end of the interview. In addition to collecting data using questionnaires, visits to households were made to observe the way raw or cooked foods and food utensils were stored, to water sources to assess environmental hygiene around the water wells, and to farms, where cash crops were produced, and how farmers handled fresh vegetable produce.

The Household Food Insecurity Access Scale (HFIAS) is an experience-based food insecurity scales. Experience of food insecurity (access) causes reactions and responses that can be captured by a set of nine questions that distinguish food insecure from food secure households across different cultural contexts. HFIAS measures the severity and prevalence of household food insecurity (access component) and detects changes in the food insecurity situation of a population over time Coates et al (2007).

Household Food Insecurity Access was determined by using the formula:

$$\frac{\text{Number of households with HFIA category}}{\text{Total number of households with a HFIA category}} \quad X\ 100$$

Household food safety KAP was assessed with respect to food handling, personal hygiene and water sanitation. Quantitative data, collected through questionnaires, were converted to percentages and used as indicators for level of knowledge, attitude and practice on food safety. The assessment was based on the FAO guidelines on food safety and nutrition-related KAP assessments (Macías and Glasauer 2014). The knowledge, attitude and practice of the population was calculated for each question by dividing the

total number of correct responses by the number of respondents who answered the particular question (Macías and Glasauer 2014). Respondents who did not answer the question, or for whom information was incomplete, were excluded.

Percentage of Average knowledge/attitude/practice among population =

$$\frac{\text{Sum of correct responses given by all respondents}}{\text{Total number of responses given by all respondents}} \text{ X } 100$$

The data was entered and analysed using Statistical Package for Social Sciences (SPSS v22). Descriptive analyses such as means, median and frequencies were used to analyse status of household socio-demographic variables.

3. Results and Discussion

3.1. Households' Socio-economic and Demographic Characteristics

In this study, only mothers were considered as they are more likely than other household members to properly answer questions regarding food safety KAP at household level (Table 1). The majority (>90%) of the mothers were young adults aged between 20 to 40 years, married and Muslim in religion. More than half of the households had between four to five children and over 20% had six or more than six children. Higher number of dependent children per household could expose families to, at least, mild or moderate levels of food insecurity when food availability is compromised. The majority (80%) of the respondents in both kebeles attended primary and secondary school education. Thus, the community in both kebeles seemed easily trainable on appropriate intervention methods in food safety by Health Extension Workers. According to Miller and Rodgers (2009), mother's education contributes to easy adoption of and adherence to new skills, beliefs and choices about sound health and nutritional practices. (Table 1).

Table 1. Socio-economic and demographic characteristics of respondents

Variables	Category	Kebele 01 No. (%)	Kebele 026 No. (%)
Age group (mother)	20-30	72 (54.2)	51 (45.9)
	31-40	61 (45.8)	55 (48.5)
	41-50	0 (0)	5 (4.5)
	Total	***133 (100)***	***112(100)***
Marital status	Married	119 (89.5)	103 (91.9)
	Divorced	11 (8.3)	8 (7.2)
	Widowed	3 (2.2)	0 (0)
	Widower	0 (0)	1 (0.9)
Number of children per household	Two	3 (2.3)	9 (8.0)
	Three	22 (16.5)	18 (16.1)
	Four	35 (26.3)	30 (26.8)
	Five	39 (29.3)	30 (26.8)
	Six	20 (15.0)	12 (10.7)
	>Six	14 (10.5)	13 (11.6)
Religion	Muslim	124 (93.2)	106 (94.6)
	Orthodox	9 (6.8)	6 (5.4)
Education (mothers)	Illiterate	24 (18.0)	8 (7.2)
	Read and write	36 (27.1)	31 (27.9)
	Grades 1-5	12 (9.0)	28 (25.2)
	Grades 6-8	50 (37.6)	38 (34.2)
	Grades 9-12	10 (7.5)	6 (5.4)
	College	1 (0.8)	0 (0)
Occupation	House wife	43 (32.3)	28 (25.2)
	Farmer	75 (56.4)	78(70.3)
	Gov't employee	1 (0.8)	0 (0)
	Merchant	11 (8.3)	5 (4.5)
	Daily labourer	3 (2.3)	0 (0)
Monthly household income (ETB)	500-1000	33 (24.8)	41 (36.6)
	1001-2000	43 (32.3)	43 (38.4)
	2001-3000	27 (20.3)	24 (21.4)
	3001-4000	14 (10.5)	4 (3.6)
	>4000	16 (12.0)	0 (0)

The majority of the mothers in both kebeles were farmers. A little over 95% of the respondents from Kebele 026 and 77% from Kebele 01 had monthly income of less than ETB 3000 (USD 1 = ETB 28). The general low income combined with larger family size per household would put the community in a marginal situation regarding food security. According to Miller and Rodgers (2009), higher household income directly increased the ability to get sufficient quantities of nutritious foods.

3.2. Households Food Insecurity Access Scale

Experiences of household food insecurity were expressed as: (i) anxiety and uncertainty about the household food supply; (ii) insufficient quality in terms of variety and preferences of the type of food; (iii) insufficient food intake in terms of reducing quantity of food and (iv) hunger manifested as absence of food of any kind in the household, going to sleep at night hungry, or going whole day and night without eating anything (Table 2). Food insecurity experiences occur either from lack of resources or absence of enough food in the household.

Table 2. Mean values of food insecurity experience among rural (133) and peri-urban (112) households in the past four weeks

Household food insecurity experience	**Location**	**Occurrence**	**Frequency (%)**		
		No. (%)	**Rarely***	**Sometimes**	**Often**
Anxiety and uncertainty	Rural	103 (77.4)	49 (47.6)	54 (52.4)	0 (0)
	Peri-urban	85 (75.9)	47 (55.3)	38 (44.7)	0 (0)
Reduced quality of food	Rural	100 (75.2)	48 (48)	52 (52)	0 (0)
	Peri-urban	85 (75.9)	46 (54.1)	39 (45.9)	0 (0)
Reduced quantity of food	Rural	7 (5.3)	7 (100)	0 (0)	0 (0)
	Peri-urban	23 (20.5)	15 (65.2)	8 (34.8)	0 (0)
Hunger	Rural	0 (0)	0 (0)	0 (0)	0 (0)
	Peri-urban	0 (0)	0 (0)	0 (0)	0 (0)

*Rarely (1 or 2 times); Sometimes (3 to 10 times); Often (more than 10 times)

Based on Household Food Insecurity Access Scale (HFIAS) (Coates *et al.* 2007), Food secure households did not worry about food shortage or worried only rarely (1 or 2 times) in the last four weeks. Mildly food insecure households sometimes (3 to 10 time) or often (more than 10 times)

experienced anxiety or uncertainty about possibilities of food shortage, or could not sometimes eat preferred foods, or rarely had to eat limited variety of foods or foods they did not like. Moderately food insecure households had to eat limited variety of foods and foods they did not like sometimes or ate smaller or fewer meals in a day rarely or sometimes. Severely food insecure households experienced hunger in one way or another. (Detailed data on HFIAS is presented in Annex 1). Households were, thus, classified into any one of the four food insecurity categories (Table 3). It was found that 17.9% of the households in both kebeles were food secure, 54.4% were mildly food-insecure and 27.8% moderately food insecure. There was, however, no severely food insecure household in both kebeles. This showed that over 80% of the study population was in a state of some degree of food insecurity. Considering the fact that the survey was conducted immediately after the harvest season, when food was relatively abundant, the level of food insecurity was indicative of what could happen in the months of food scarcity (July, August and September). There was no significant difference between the two kebeles in occurrence or frequency of occurrence of food insecurity experiences ($p>0.1$).

Food security categories of households consisted of food secure, mildly food insecure, moderately food insecure and severely food insecure households (Coates *et al.* 2007) (Table 3). There was no significant difference in levels of food insecurity between the two kebeles ($p>0.1$).

Table 3. HFIA prevalence (%) in the study kebeles

Category	K01	K026	Both
Food secure	17.8	18.0	17.9
Mildly food insecure	56.5	52.2	54.4
Moderately food insecure	25.7	29.9	27.8
Severely food insecure	0.0	0.0	0.0

3.3. Households Food Safety KAP

KAP assessments had been used to assess and understand various health related issues in Africa since the 1960s (Schopper *et al*. 1993). Although KAP methodologies are used to plan and manage programs or assess the

impact of interventions in different rural communities (Annika 2009), in this study, they were intended to assess the current status of food safety situations in the study area and to identify training gaps which could be filled up by health extension work. A KAP survey is not a stand-alone methodology but should be viewed as a pathway or guideline for clarifying human behaviour (Rahman *et al.* 2012). Thus, food safety assessment in the two kebeles was made in terms of mothers' KAP of food handling, personal hygiene and water sanitation among the study population, as these were the most important parameters that would help to avoid food-borne infections at household level.

3.3.1. Food handling knowledge

Contamination of food with microbes at household level and multiplication of disease-causing microbes during storage of food are basically determined by how food is handled. Cooking food to the right temperature and time combination, avoiding contact of cooked food with raw food and heating left-over food before consumption are some of the methods of proper food handling (Schmidt and Rodrick 2003).

Over 90% of respondents from both kebeles knew the correct food safety reason for separating raw and cooked food; but a small proportion (between 2% to 7%) gave explanations such as "I separate raw from cooked food because raw food imparts foul odour on cooked food", while the correct explanation was raw food could re-contaminate cooked food with disease-causing organisms. Foul odour cannot be a sign of food safety because most disease-causing microbes do not produce foul odour in food or most food spoilage microbes do not cause illnesses (Jarvie 2015).

Over 80% of the respondents from Kebele 01 and only 67% of those in Kebele 026 knew the correct signs of thorough cooking of sauces *('wett'* in Amharic). A considerable proportion (33%) of respondents from Kebele 026 believed that subjective feelings, such as taste, aroma or appearance, could indicate thorough cooking of sauces. Such subjective feelings might or might not correspond to the cooking temperature that eliminates microbes in cooked foods. However, cooking of sauces to the point of boiling is the most dependable sign as elimination of contaminating

disease-causing microbes can be guaranteed only by cooking to the right temperature and time combination (Schmidt and Rodrick2003). Food safety requires regular use of thermometers to check for attaining the temp./time combination that eliminates disease-causing microbes in foods.

Knowledge regarding cold storage of perishable foods was very low among respondents from both kebeles (20%). Of the list of five food items that should be stored at cold temperatures, over95% of the respondents could identify only one or two items. Modern appliances (cooling boxes or refrigerators) for cold storage are not available for most rural households in Ethiopia. However, training on devising cooling methods using locally available materials, at least, for a relatively shorter period of time, could be given by trained extension workers.

Foods which are made ready to serve but remain unconsumed during a particular meal are considered as left-over foods. They are kept and usually consumed during the next meal. Although over 90% of the respondents in both kebeles knew that left-over food, not kept in cool place, was unsafe for consumption, only less than 5% of them knew why the food became unsafe for consumption. Keeping left-over foods at ambient temperature for hours creates a favourable condition for the multiplication of contaminating microbes which may cause disease or spoil the food (Schmidt and Rodrick 2003).

Over 80% of respondents in both kebeles knew that fruits and vegetables should be washed before eating, although less than 20% thought that vigorously shaking off small solid particles from the vegetables and fruits was enough to make them clean for eating. Fruits and vegetables are naturally in close contact with soil, which contains abundant microbes. Microbes attach to surfaces of vegetables and fruits tightly and physical shaking cannot remove them from surfaces. Fruits and fresh vegetables, which are consumed raw, should be washed with water before serving.

Average knowledge of respondents was measured based on the ratio of total questions asked to all respondents to the total number of correct answers given by all respondents. Data obtained in this study, thus, showed that total

household food handling knowledge was 42.2% and 39.6% in kebeles 01 and 026, respectively. There was no significant difference in food handling knowledge between the two kebeles ($p>0.1$). This level of food safety knowledge is much lower than the 62% knowledge reported from Malaysia (Lee *et al.* 2017) but much higher than the 8.9% in Pakistan (Naeem *et al.* 2018). Also, kitchen utensils such as cutting boards, knives, and dishes, should be cleaned with hot water and soap after preparing each food item to prevent cross contamination (Medeiros *et al*. 2001).

Table 4. Household food handling knowledge in the study area

Variables and possible responses	**Respondents and response**	
	K01	**K026**
1. Reason for separation of raw and cooked foods		
• Raw foods of animal origin often contain germs	131(98.5)	102 (91.1)
• Other	2 (1.5)1	8(7.1)[1]
• Don't know	0 (0)	2 (1.8)
2. Signs of thorough cooking of soups and sauces for safety and readiness to be served		
• They are boiling/ well cooked	110 (82.7)	75 (67.0)
• Other	23 (17.3)2	37 (33.0)2
3. Kinds of perishable foods to be stored in refrigerator or in a cool place		
• Meat, offal	48 (36.1)	23 (20.5)
• Poultry	1 (0.8)	10 (8.9)
• Fish	3 (2.3)	2 (1.8)
• Milk/dairy products	0 (0)	0 (0)
• Cooked foods	80 (60.2)	72 (64.3)
• Don't know	1 (0.8)	5 (4.5)
4, Reasons for avoiding eating leftover food that was not kept in a cool place		
• Because that food is not safe anymore	123 (92.5)	112 (100)
• Germs multiply very quickly and can cause illness	4 (3.0)	0
• Higher temperatures make germs grow faster	6 (4.5)	0
5. Washing raw fruits and vegetables before eating		
• Wash them with clean water	118 (88.7)	92 (82.1)
• Other -	15 (11.3)[3]	20 (17.9)[3]

Note: [1]Raw foods impart bad odour to the cooked foods.

[2]We know it is thoroughly cooked by its taste, aroma and appearance.

[3]By vigorously shaking off solid particles.

3.3.2. Household's attitude to food handling

Respondents in the study area showed positive attitudes towards need for safe handling of food. Despite the relatively poor knowledge they had on proper food handling, their attitude was quite positive with values as high as 96.7% and 87% for kebele 01 and Kebele 026, respectively (Table 5). Generally, the respondents in both kebeles had very positive attitude to the need for food safety with no significant difference ($p>0.1$); but, unfortunately, this did not translate into strict hygienic practices by respondents (<30%) during handling of food products. A similar situation was also observed by Akabanda et al (2017) in Ghana.

Table 5. Respondents' Attitudes to Food Handling practices in the study area

Food handling attitude		Affirmative	Negative	Not sure
Perceived susceptibility				
Likelihood of getting sick from	K01	133 (100)	0	0
eating contaminated food?	K026	112 (100)	0	0
Perceived severity				
Seriousness of getting sick from	K01	133 (100)	0	0
eating contaminated food	K026	92 (82.1)	15 (13.3)[1]	5 (4.5)
Perceived benefits				
Good to keep meat, poultry,	K01	120 (90.2)	2 (1.5)[2]	11 (8.3)
fish, or cooked food in a cool	K026	81 (72.3)	4 (3.6)[2]	27 (24.1)
place.				
Good to re-heat left-over foods	K01	130 (97.7)	3 (2.3)[3]	0
before eating or serving them	K026	87 (77.7)	0	25 (22.3)
Good to wash fruits and	K01	132 (99.2)	1 (0.8)	0
vegetables with clean water	K026	98 (87.5)	5 (4.5)[4]	9 (8)
Perceived barriers				
Difficulty of re-heating	K01	3 (2.2)[5]	130 (97.7)	0
leftovers before eating or	K026		106 (94.6)	6 (5.4)
serving them				
Difficulty of washing fruits and	K01	2 (1.5)[6]	122 (91.7)	9 (6.8)
vegetables with clean water	K026		106 (94.6)	6 (5.4)

[1] We don't consider sickness from contaminated food to be serious.
[2] We believe keeping these foods in cold place changes their aroma and taste.
[3]I find cold food good for my gastritis.
[4] We think water washes the nutrients out from vegetables and fruits.
[5] We spend time working and, thus, we don't have time to reheat leftover food.
[6]We eat fruits and vegetables while harvesting them. We can't find water on the farm.

Although most rural and peri-urban households did not own refrigerators, keeping cooked foods in corners cooler than the ambient could help to delay growth of microbes in foods. Negative attitude, manifested by some respondents in our study, stemmed from different beliefs (Table 5). Few among them were that some considered sickness from contaminated food not to be serious; others did not store food in cooler places because "keeping foods in cold places would change the aroma of food"; or others did not wash vegetables because "water washes the nutrients out from vegetables and fruits". Such attitudes develop because of lack of basic and appropriate knowledge in household food handling and can be avoided through short trainings.

3.3.3. Household's food handling practices

Food handling practices were addressed in terms of cleaning of kitchen surfaces and utensils after preparing a meal and ways of storing perishable fresh foods. Average appropriate practice of respondents was expressed as the ratio of all practice questions asked to all respondents to the total number of appropriate practices by all respondents. Average appropriate practice in cleaning food contact surfaces and storing of perishable fresh foods in cool places was only 28% and 21% in kebeles 01 and 026, respectively (Table 6). There was no significant difference between the two kebeles in Average appropriate practice ($p>0.1$). From 24% to 37% of respondents in both kebeles used chemical detergent ('*Ajax'* soap) to clean utensils. This proportion was much lower than that observed in Hanoi (87%) and Vietnam (Takanashi *et al.* 2009), but much higher than the 0.3% observed by Naeem *et al.* (2018) in Lahore, Pakistan. Some traditional practices of storing some perishable foods as practiced by some respondents consisted of rubbing with salt and drying as slices. During cleaning utensil surfaces, respondents did not scrape excess food into rubbish bin. Traditionally, scraping food into rubbish bin is not only being disrespectful to food but is also a luxury in low-income households. In addition, a smaller proportion of respondents (<40%) used detergents to clean utensils in both kebeles. Detergents assist to loosen tightly-bound microbes to the utensil surfaces, thus making cleaning with water more efficient and effective. Regarding cold storage of perishable foods, only a small proportion (17%)

of the peri-urban dwellers kept perishable food in cool places. However, many respondents used indigenous practices to store meat for longer periods, such as slicing meat into thin longer pieces, salting them and hanging them to dry. Such practices significantly reduce water in stored foods which could, otherwise, serve for microbial growth.

Practice of covering food to protect it from contamination from environmental sources was also low in both kebeles (<40%) and still much lower proportion of respondents separated ready-to-eat foods from raw meat or poultry. Since these raw animal products are naturally heavily contaminated with various types of microbes, they can be sources of contamination to ready-to-eat foods, if not separated. The practice, thus, affects the safety of ready-to-eat foods as they are served without further heating. The need to create awareness among the rural community in appropriate practices of food handling is of paramount importance to guarantee food safety.

Table 6. Households Food Handling Practices in the study areas

	Kebele	
Food handling Practice	***K01***	***K026***
Usual cleaning of kitchen surfaces and utensils after preparing dinner		
¨ Scrape excess food into rubbish bin	-	-
¨ Wash with hot water	84 (63.2)	85(75.9)
¨ Wash with detergent	49 (36.8)	27(24.1)
Store perishable fresh foods such as raw meat, poultry and fish		
¨ In the refrigerator (below 5 °C)/cool box	22 (16.5)[1]	-
¨ Covered (protected from insects, rodents, pests and dust)	49 (36.8)	41 (36.6)
¨Separated from cooked or ready-to-eat foods	28 (21.1)	3 (2.8)
Other[1]	34 (25.6)	68 (60.7)

[1]If it is raw beef, mutton or goat meat, it is sliced into thin longer pieces and left to dry on rope. In the case of chicken, salt is rubbed into it and kept until it is cooked.

3.3.4. Households' knowledge of personal hygiene

Personal hygiene was assessed with regards to prevention of food-borne diseases from germs that originate from faeces and ways of hand washing

(Table 7). Average knowledge on these two aspects was very low in kebeles 01 and 026 (24% and 22%, respectively). Hand washing knowledge was much higher in Kebele 01 than that in Kebele 026, indicating that peri-urban dwellers are more aware of the need to washing hand after visiting the toilet. However, more people in Kebele 026 knew about the need to remove faeces from the home and surroundings than those in Kebele 01. Average knowledge in personal hygiene was not significantly different between the two kebeles ($p>0.1$). The personal hygiene knowledge values obtained from our study area were much lower than those observed in other countries (Lee et al, 2017; Akabanda et al, 2017) but higher than that in Darfur, Sudan (Mahamud, 2005). Of the six correct key moments of hand washing, the majority of our respondents knew only one (76% and 88% in kebeles 01 and 026, respectively).

Table 7. Households' Knowledge in Personal Hygiene in the study area

	Know	
	K01	**K026**
Wash hands		
• After going to the toilet/latrine	79 (59.4)	52 (46.4)
• After cleaning the baby's bottom/ changing a baby's nappy	0	12 (10.7)
o Before preparing/handling food	46 (34.6)	43 (38.4)
o Before feeding a child/eating	0	2 (1.8)
• After handling raw food	0	0
• After handling garbage	8 (6.0)	3 (2.7)
• Other	0	0
• No answer	0	0
• *Knew only one answer*	101 (76.9)	99 (88.4)
• *Knew two answers*	19 (14.3)	10 (8.9)
• *Knew three answers*	13 (9.8)	3 (2.7)
Remove faeces from the home and surroundings	13 (9.8)	32 (28.8)

3.3.5. Households' attitude to personal hygiene

Respondents from both kebeles had a high level of positive attitude (over 80%) about personal hygiene when assessed in terms of importance of hand washing to avoid disease and its usefulness before preparing food or feeding child (Table 8). Some undermined importance of hand washing to avoid diarrhoea because they believed diarrhoea would occur due to other reasons,

even if hands were washed. Others argued "we work in our farms. We take a short lunch break while working on our fields. Even if we wash our hands, we soon go back to our routines that keep us in contact with soil again".

Table 8. Households' personal hygiene attitude in the study areas

Personal hygiene attitude	Kebele	Affirmative	Negative	Not sure
Perceived susceptibility				
Likelihood of oneself or child having stomach ache or diarrhoea, from not washing your hands.	K01	133(100)		
	K026	112(100)		
Perceived severity				
Seriousness if one or child gets diarrhoea from oneself not washing one's hands.	K01	125(94)	8 (6)[1]	0
	K026	62 (55.4)	47(42)[1]	3 (2.6)
Perceived benefits				
Goodness of washing one's hands before preparing food or before feeding a child/eating.	K01	133(100)		
	K026	112 (100)		
Perceived barriers				
Difficulty to wash one's hands before preparing food or before feeding a child/eating?	K01		133(100)	
	K026		109 (97.3)	3(2.7)
Perceived self-efficacy				
Confidence in washing one's hands properly?	K01	133(100)		
	K026	91(81.3)	5(4.5)[2]	16(14.3)

[1]We think diarrhoea comes by things other than washing hands.

[2]As farmers, we work in our farms. We have lunch in our farms. Even if we wash our hands, we soon go back to handling soil again.

3.3.6. Households Personal hygiene practice

Personal hygiene practice was evaluated in terms of step-by-step description of hand washing. The findings showed that respondents from Kebele 01 and 026 had low proportion of Average appropriate practice level of 24% and 29%, respectively (Table 9). However, use of water and soap or ash was practiced by a good proportion of respondents (>50%), with more

respondents from the peri-urban kebele (87%) using soap and water than those in the rural kebele (55%). This difference might be due to awareness obtained through closeness to urban environments where information through mass media is better accessed. Few respondents said that they washed their hands by pouring water with a jog, but they did it by themselves. This practice is ineffective because appropriate handwashing requires rubbing palm and fingers of both hands against each other using soap and water. According Weinstein, (1991) poor personal hygiene causes more than 90% of food-borne diseases, and improper hand washing alone accounts for more than 25% of all food-borne diseases.

Table 9. Personal hygiene practice of household members

	Kebele	
Personal hygiene practice	**K01**	**K026**
Ways of washing hands		
Washing by pouring water from a jug by oneself	9(6.8)	11 (9.8)
Washes hands in a bowl of water (sharing with other people) — poor practice	1(0.8)	5 (4.5)
With someone pouring a little clean water from a jug onto one's hands - appropriate practice	4(3.0)	34 (30.4)
Under running water — appropriate practice	3 (2.6)	0
Washes hands with soap or ashes— appropriate practice	116 (87.2)	62 (55.4)

3.3.7. Households' knowledge of Water sanitation

Household knowledge of water sanitation was measured in terms of methods to disinfect water from harmful microbes that contaminate food. Households in the study area had low Average knowledge of water sanitation (<15%) with no significant difference between both kebeles ($p>0.1$), which was notably lower than the 49% reported for Dabat, Northwest Ethiopia (Bikes *et al*. 2017), 75% for Hanoi, Vietnam (Takanashi*et al*. 2009) or Nepal (Sah *et al.* 2017). Of the seven given options, about 76% of respondents from both kebeles knew only one method of water sanitation (Table 10). None of the respondents in both kebeles used chlorine to sanitize water, although it was advised through the mass media to use chlorine-based water treatment tablets (*weha-aggar,* etc.) for the purpose. A very small proportion of respondents from Kebele 01

(13%) boiled water to sanitize. This proportion is similar to the report of Bayeh *et al*. (2018) from Northwest Ethiopia but lower than the 15% reported by Joshi *et al*. (2014) from India. Over 75% of respondents from kebele 01 believed that straining water through cloth or letting it stand to settle made water safe for drinking. Microbes are microscopic organisms which can easily pass through regular filters or remain suspended without settling to the bottom of container. Nonetheless, straining or filtering may remove non-microscopic parasite cysts or adults from water. Boiling is the easiest and dependable way to make water safe. Unfortunately, shortage of fuel wood in rural areas may not encourage boiling. In such cases, adding bleach/chlorine in the right concentration or other available sanitizers (*Weha-aggar, Aquatabs,* etc.) to make water safe is another acceptable option. Otherwise, turbid water, even slightly, should be discarded.

Table 1. Households' knowledge of water sanitation

If you know that the water you are going to use for cooking or drinking is not safe or does not come from a safe source, what should you do?	**Kebele**	
	K01	**K026**
• Boil it	18 (13.5)	0 (0)
• Add bleach/chlorine	0 (0)	0 (0)
• Strain it through a cloth	91 (68.4)	27 (24.1)
• Use a water filter (ceramic, sand, composite, etc.)	0 (0)	0 (0)
• Use solar disinfection	0 (0)	0 (0)
• Let it stand and settle	10 (7.5)	23 (20.5)
• Discard it and get water from a safe source	14 (10.5)	62 (55.4)
• Other	0 (0)	0 (0)
• Do not know	0 (0)	0 (0)
One correct answer	101 (76)	85 (75.9)
Two correct answers	20 (15)	17 (15.2)
Three correct answers	12 (9)	10 (8.9)

3.3.8. Households' attitude to water sanitation

Household attitude on water sanitation was assessed in terms of perceptions regarding one's susceptibility to get diarrhoea from unsafe water, severity of the illness, and goodness or difficulty of boiling water to make it safe. Over 70% of the respondents in both kebeles had positive attitude towards need for water sanitation (Table11). This is much higher than water sanitation attitude (57%) reported from Nepal (Sah*et al*. 2017). About 10% of

respondents from Kebele 026 either did not pay attention to or were not sure about water being the source of diarrhoea. Unlike what was observed in Dabat, Northwest Ethiopia (55%) by Bikes *et al.* (2017), over 80% of our respondents from both kebeles perceived the benefit of boiling water before use. However, more than half and almost all respondents from Kebele 01 and 026, respectively, thought that boiling water before drinking was a difficult undertaking because rural life required them to use firewood for cooking, which they used sparingly. In addition, some believed that the smoke from firewood would make the water dark. Such attitudes distracted users from taking correct water sanitation steps as noted in Kenya (Kioko and Obiri, 2012).

Table 21. Households' water sanitation attitude

Water sanitation Attitude		It is	It is not	Not sure
Perceived susceptibility				
Likelihood of oneself or one's child to get diarrhoea from using unsafe water?	K01	133(100)		
	K026	101(90.2)	4 (3.6)[1]	7(6.2)
Perceived severity				
Seriousness of getting sick from using unsafe water?	K01	128(96.2)	5 (3.8)[2]	0
	K026	98(87.5)	14 (12.5)[2]	0
Perceived benefits				
Goodness of boiling water before drinking or using it?	K01	131(98.5)	0	2 (1.5)
	K026	92(81.1)	0	20 (17.9)
Perceived barriers				
Difficulty of boiling water before drinking or using it	K01	67(50.4)[3]	15(11.3)	51 (38.3)
	K026	111(99.1)[3]	0	1 (0.9)
Perceived self-efficacy				
Confidence in boiling water before drinking or using it?	K01	67(50.4)	15(11.3)[4]	51 (38.3)
	K026	111(99.1)	0	1 (0.9)

[1]We don't pay attention to it.

[2]We have never been sick so far. We don't know how serious it is.

[3] Rural life requires us to use fire wood for cooking, which we use sparingly. The smoke from it makes the water dark.

[4] Not confident because boiled water tastes bland.

3.3.9. Households' Practice of Water Sanitation

Practices of water sanitation was measured in terms of main sources of safe water, safe collection and storage of water, and treatment of water to make it safe. The households used different types of activities for safe collection and storage of water and for treating it to make safe for consumption (Table 12). Over 99% of the households in both kebeles got water from tap/stand pipe that came from a well-protected spring, though not treated with chlorine. This was, unusually, very high for rural environments in Ethiopia, where most inhabitants collect drinking water from unprotected wells, springs or rivers (Bikes *et al.* 2017). Only 20% of a community in Dabat district, Northwestern Ethiopia got water from pipe or public tab (Bikes *et al*. 2017). Respondents, in this study, used different types of materials to clean up collecting materials. They used soap, water, sand or various plant leaves. Appropriate practice of treating water to make it safe was very low (4.5% and 0% in kebeles 01 and 026, respectively) despite the observed positive attitude to sanitize water before consumption.

However, majority (87%) of the households strained it through cloth to make it safe to drink. Unfortunately, straining does not filter out microbes from drinking water, although those attached to small solid particles may be strained out. No significant difference in practice of water sanitation was noted between the two kebeles ($p>0.1$). Over 70% of urban slum dwellers in Delhi, India did nothing to treat water for consumption (Joshi *et al.* 2014). About 60% of respondents from both kebeles acknowledged advice support from health extension workers regarding food safety. This, though commendable, should be improved to address all rural households as awareness creation may be the less costly but effective means of enhancing appropriate food and water safety practices.

Table 3. Households' practice of water sanitation

Water sanitation Practice	**Kebele**	
	K01	**K026**
1. Main source of water for drinking, cooking and hand washing		
- Piped water	35 (26.3%)	
- Public tap/standpipe	55 (41.4 %)	112(100 %)
- Piped into yard or plot	42 (31.6%)	
- Surface water	1 (0.8 %)	
2. Collection of water for domestic use		
- Yes	133 (100%)	112 (100%)
- No		
- Collecting item		All Jerry Can
3. Treating collection item to make it clean		
- Yes	133(100%)	112(100%)
- No		
- Use of water and soap (clean container)	120(90.2 %)	81 (72.3%)
- Other	13 (9.8%)[1]	31(27.7 %)[1]
4. Description of how water is stored		
- Clean container or jar	24(18 %)	20(17.9%)
- Covered container or jar	22 (16.5 %)	19(17 %)
- Clean and covered container or jar	56(42.1 %)	24(21.4 %)
- Other	3(23.3%)[2]	49(43.8%)[2]
- Don't know/no answer		
5. Treatment of water to make it safe to drink		
- Yes	133(100 %)	96(85.7 %)
- No	0	16 (14.3 %)
6. Actions usually done to the water to make it safer to drink		
- Boil it	10 (7.5 %)	0
- Add bleach/chlorine	2 (1.5 %)	0
- Strain it through a cloth	114(85.7 %)	89 (79.5 %)
- Use a water filter (ceramic, sand, composite)	0	0
- Let it stand and settle	7 (5.3 %)	23 (20.5 %)
- Don't know/no answer	0	0
7. Any lessons or advice from health extension worker about food safety		
- Yes	83(62.4%)	65(58.0%)
- No	23(17.3%)	27(24.1%)

[1]By using sand or using *Vernonia (*grawa*)*or *Juniperus* (tid) leaves.

[2] We store it in the same Jerry can we collect water with.

4. Conclusion

This study has shown that there were food safety gaps in terms of knowledge, attitude and practice in food handling, personal hygiene and water sanitation in the peri-urban and rural kebeles considered in this study. Households should be educated on principles of basic individual hygiene and environmental sanitation, such as critical moments and methods of appropriate hand washing, methods to store left over foods, separation of raw and cooked foods, proper personal hygiene during food handling and practice of treating unsafe water. The crucial role played by health extension workers in providing basic information on proper food and water safety practices to households and communities in urban and rural areas should be appreciated and further strengthened.

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Annex 1. HFIAS during the study period in the study kebeles

		Occurrence		Frequency		
HFIAS Questions	**Location**	***Yes***	***No***	***Rarely***	***Sometimes***	***Often***
1. In the past four weeks, did you worry that your household would not have enough food?	Kebele 01	103	30	49	54	0
	Kebele 026	85	27	47	38	0
2. In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	Kebele 01	102	31	46	56	0
	Kebele 026	85	27	46	39	0
3. In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	Kebele 01	101	32	47	54	0
	Kebele 026	85	27	46	39	0
4. In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	Kebele 01	96	37	49	47	0
	Kebele 026	85	27	46	39	0
5. In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was	Kebele 01	13	120	13	0	0
	Kebele 026	44	68	29	15	0

HFIAS Questions	Location	Occurrence		Frequency		
		Yes	***No***	***Rarely***	***Sometimes***	***Often***
not enough food?						
6. In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	Kebele 01	0	133	0	0	0
	Kebele 026	1	111	1	0	0
7. In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	Kebele 01	-	133	0	0	0
	Kebele 026	-	112	0	0	0
8. In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	Kebele 01	-	133	0	0	0
	Kebele 026	-	112	0	0	0
9. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	Kebele 01	-	133	0	0	0
	Kebele 026	-	112	0	0	0