

Household food security, child nutrition and food safety among vegetable producers and non-producers in Dugda woreda, Oromia region, Ethiopia

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ABSTRACT

Household vegetable production is believed to contribute to household food security. This prompted the study to evaluate household food security status, household knowledge and practices in child nutrition, food safety and water sanitation among vegetable-producing and non-vegetable-producing households in two kebeles found around Meki town, Dugda woreda. For comparison, 147 households who produced vegetables and 147 other households who did not produce vegetables were randomly selected. Qualitative and quantitative data were collected using structured questionnaires, key informant interviews and focus group discussions and analyzed using descriptive statistics. Vegetable producing households (49%) generated higher monthly income (ETB 3000 - > 4000) than non-producing ones (ETB 500 to 2000). More vegetable-producing households (61%) were food secured than non-vegetable-producers (16%). Based on Bloom's cut off point, knowledge, positive attitude and appropriate practice in child feeding practices in all households was poor (< 60%). Vegetable producers and non-producers had good (87%) and moderate (77%) knowledge, and moderate positive attitude towards safe food handling (61%, 64%, respectively). Appropriate food handling practices were poor (< 60%) in both cases. Personal hygiene knowledge and practice were also poor in both types of households although positive attitude towards personal hygiene was moderate in both cases (61%-64%). Knowledge, attitude and practice in water sanitation was poor in both types of households. This study showed that, although vegetable producers earned more income and were in a better food security status, adequate training in child nutrition and food safety, which are important components of food security, is needed.

Keywords: Vegetable production; Food security; Child nutrition; Food safety

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INTRODUCTION

Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary

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needs and food preferences for an active and healthy life (FAO, 2019). The food safety and nutritional dimensions are integral to the concept of food security. Child malnutrition is one of the most severe public health and developmental issues in the developing world, affecting particularly the vulnerable and underprivileged segment of the community (Van de Poel *et al.*, 2008). In developing countries, children are most vulnerable to malnutrition due to low dietary consumption and a lack of proper feeding habits (Birara Melese, 2014). An estimated 230 million under-five children are believed to be chronically malnourished in developing countries (Alem-Meta Assefa and Singh, 2018).

Adequate nutrition during infancy and early childhood is fundamental to the development of each child's full human potential. Inappropriate complementary feeding practices remain a major public health problem in many developing countries where many children are victims of malpractice (Lutter *et al.*, 2011). Ethiopia is one of the countries affected by malnutrition. In Ethiopia, only 59% of infants under 6 months are exclusively breastfed (EPHI/ICF, 2019). After the sixth month of age, breast milk alone is no longer sufficient to meet the nutritional requirements of children who are 6-23 months of age (WHO, 2003). Good knowledge, and positive attitude of the mothers/caregivers on a proper infant, and young child feeding practice is extremely crucial to maintain and promote the health and nutritional status of young children (Kliegman and Nelson, 2011).

According to FAO (2013), a household with access to safe and nutritious food, coupled with a sanitary surrounding, is said to be nutritionally secure. Safe food is an important component of food security and can be guaranteed through food safety measures. According to the Director-General of FAO (2019), there is no food security without food safety. The term food safety indicates the assurance that when food is consumed in the usual manner, it does not affect human health and wellbeing. However, WHO (2021) indicates that 600 million people globally fall ill and 420,000 die each year after consuming unsafe food. Poor knowledge, attitude, and practices (KAP) of hygiene, lack of basic sanitary facilities, and ignorance and negligence in safe food handling are major causes of poor sanitary conditions of food and drinking water at household level (Eyerusalem Kassa *et al.*, 2017). A considerable proportion of food-borne diseases are caused by contamination from food handlers (Mudey *et al.*, 2010). In developing countries, mothers are usually the food handlers in homes and are responsible for ensuring food safety at the household level. It is, thus, important to evaluate the status of their food handling knowledge and practices. Unsafe food containing harmful bacteria, viruses, parasites, or chemical substances is responsible for more than 200 diseases ranging from diarrhea to cancer (WHO, 2020). A substantial proportion of food-borne diseases are attributable to improper food preparation practices at consumers' homes.

Previous studies indicate that diverse diet would ensure the food and nutrition security of households (Nabuuma *et al.*, 2021) and vegetable production for home consumption is believed to improve dietary diversity (Blakstad *et al.*, 2021). Vegetables are good sources of micronutrients which help to avoid various deficiency diseases (Sinyolo *et al.*, 2021). However, as vegetables are also the main source of foodborne disease-causing organisms (Murray *et al.*, 2017), household food safety measures should be implemented to avoid or reduce the likely hazard.

The aim of this study was, therefore, to evaluate the household food security status, household knowledge and practices in child nutrition and food safety among vegetable producing and non-producing households in two kebeles found around Meki town, Dugda woreda, where vegetable production is the economic mainstay of the producers.

MATERIALS AND METHODS

Description of the study area

Dugda is one of the woredas in the Oromia Region and is located 141 km south of Addis Ababa. The total population of the area is 192,806 (52% male). The rural population of 118,362 consisted of 51% females. The topography of the study area is 1600-2220 m.a.s.l. with an annual rainfall of 750 mm and an average annual temperature of 26 °C. The agro-ecology of the area is 55% *kola* and 45% *dega*. The topography is 97% flat land and 3% slope. The soil type of the area is 59% sandy loam and 41% clay loam (CSA, 2016).

Rural farmers who were growing vegetables using irrigation or crops under rain-fed agriculture in Dugda woreda were considered in this study. The study kebeles were chosen purposively based on the number of vegetable producers and other logistic reasons. This study mainly focused on vegetable-growing farmers and those who were not engaged in vegetable production for comparison purposes. All vegetable producers in the study kebeles (n=147) and an equal number of non-vegetable producers were randomly and proportionally selected from both kebeles, thus making the total number 294. The sample households were used to compare the positive impact of vegetable production on child nutrition and the food security status of households.

Both quantitative and qualitative methods were followed in this study. The primary data were collected through field observation, surveys, focus group discussion (FGD) and key informant interviews (KII). Structured questionnaires were used to generate quantitative data on food security status, knowledge, attitude

and practice of child nutrition and household food safety. Separate focus group discussions were undertaken with groups selected from vegetable producers, non-producers and woreda agricultural office experts. Selected extension experts and woreda agricultural extension officers were interviewed as key informants. Various documents available at woreda and kebele offices were also reviewed and used to generate secondary information. Information generated from key informant interviews, from focus group discussions and from personal observations were analyzed qualitatively. The quantitative data generated from the household survey were coded, entered into computer and analyzed using descriptive statistics. Macias and Glasauer's (2014) method was adopted to assess child nutrition and knowledge in food safety practices.

Percentage of total knowledge/attitude/practice among population was determined as:

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

Child nutrition and food safety KAP of respondents was categorized using Bloom's cut-off points as good ($\geq 80\%$), moderate (60%-79%) and poor ($<60\%$) (Jember Azanaw *et al.*, 2021). Household food insecurity access scale was measured according to Coates *et al.* (2007).

To ensure data quality, it was pretested on 10% of the total sample size, orientation was given to data collectors and supervisors, and each questionnaire was regularly checked for consistency and completeness.

Ethical considerations

Informed consent to participate in the study was obtained from respondents. Information obtained from respondents was kept confidential and anonymous. Local administrators were communicated to enter the study area, and local cultural aspects were respected.

RESULTS AND DISCUSSION

Description of vegetable production in the study area

A total of 17,077 ha of land was used for vegetable production in Dugda Woreda during the study period (2021) and 2253 households were involved in vegetable production. Sixty-seven percent of the vegetable producers grew vegetables on their own land, and the remaining grew it on rented land or on land owned by the family. In most cases, irrigation water for vegetable production was pumped in

from lakes Batu and Meki. A considerable number of producers used groundwater dug on a vegetable farm. A variety of vegetables were grown in the area that ranged from 14,000 kg to over a million kg per production season (Table 1). Vegetables were produced mainly for income generation (90%), and the producers considered the income generated as good to excellent. Most producers got extension support from the woreda agricultural office.

Table 1. Description of vegetable production in the study woreda.

Variables	Levels	Description
Ownership of land for vegetable production	Own	66.7%
	Rent	8.1%
	Family	25.2%
Source of water	Ground water	Dug on-farm site
	Pump irrigation	Lakes Batu and Meki
Vegetable type and the amount produced per production season	Cabbage	16492 kg
	Tomato	361,620 kg
	Green pepper	117,967.5 kg
	Onions	1,337,700 kg
	Green beans	19406.25 kg
Purpose of production	Carrot	14207 kg
	HH consumption	10.3%
	Income generation	89.7%
Benefit of vegetable production	Good and excellent	84%
	Moderate	12%
	Low	4%
Support from woreda agricultural office	Yes	83.4% (extension service only)
	No	16.6%

Socio-demographic characteristic of the respondents

Age distribution of the household members varied considerably. The age of respondents ranged from 20 to 50 years and the age group 41-50 comprised 47.3% of the respondents (Table 2). All respondents were married. The number of children per sample household ranged from two to over six. About 55% of vegetable producing and 46% of non-producer households had five or more children. The majority of respondents in both groups (around 90%) were Christians and the rest were Muslim. Of the respondents, 18% of vegetable producing and 12% non-producing households could not read or write. About 57% of vegetable-producing respondents had elementary and 24.5% secondary level education. About 86% of non-vegetable producing respondents had only elementary-level education. A good proportion of vegetable producers in our study received support from agricultural extension workers, and their educational level might help them to practice technical innovations. According to Adeoye (2020), educational level is one of the factors that increase technical efficiency in

vegetable production. Almost all respondents in both groups were farmers and a few non-vegetable producers (10%) were daily laborers. All non-vegetable producers had monthly income ranging from ETB 500 to 2000. On the other hand, about 52% of vegetable-producing households had a monthly income ranging from ETB 2000 to > 4000. Similar to our observation, Bahta and Owusu-Sekyere (2019) reported that vegetable production significantly improved the income of vegetable producers in South Africa.

Table 2. Socio-economic and demographic status of the study population.

Variables	Category	Vegetable producers (n = 147)	Non-vegetable producers (n = 147)
Mother Age group (Years)	< 30	7%	20%
	31-50	93%	80%
Marital status	Married	100%	100%
Number of < 2 years children per household	< four months	44%	54%
	Five and six	35%	46%
	> Six	21%	0
Religion	Orthodox	75.5%	67.3%
	Other	25%	33%
Education (mothers)	Not read & write	18.4	11.6
	Grades 1 to 8	57%	86%
	≥ Grades 9	25%	2%
Occupation	House wife	19%	15.6%
	Farmer	81%	73.5%
	Other	-	10.9%
Monthly household income (ETB)	< 2000	38%	100%
	2001 - > 4000	52%	0

On how vegetable production became so popular in the Woreda, a key informant had the following to say:

“Vegetable producers have formed a union called ‘Meki-Batu Union’ in 2002 which now has 527 members. The Union helps farmers to solve market problems. It collects and sells vegetables produced by members in local and foreign markets, and provides them with technical and advisory support.”

Such agricultural cooperatives were known to mobilize farmers’ groups to facilitate access to technical training and marketing of produce (Tran *et al.*, 2021). Although vegetable producers admitted that vegetable production had put them in a better financial position, they raised the following in a focus group discussion:

“The most important constraints we face are access to credit, to inputs such as seeds of improved varieties, pesticides and fertilizers. The cost of pesticides and seeds of improved varieties is unaffordable.”

According to Djoumessi *et al.* (2018) farm credit is crucial in increasing agricultural productivity and farm incomes and has been increasingly accepted as a powerful instrument to lift the rural poor from abject poverty.

Respondents who did not produce vegetables said the following in a focus group discussion:

“Underground water and lakes are available for vegetable production. The major constraint we face to start vegetable production is the money to buy inputs. Moreover, we fear market failure even if we could get credit from other individuals. To start a vegetable production venture on a land size of a quarter of a hectare requires more than ETB 20,000 as an initial investment. Generally, we need access to credit, input and advice to begin vegetable production.”

A key informant also supported the opinion of vegetable non-producers by stating the following:

“The main constraints to engage non-producers in vegetable production are lack of credit services, of awareness and willingness to produce vegetables, the practice of renting their lands for vegetable production and increment in costs of inputs.”

Food security status of households

Household food insecurity access scale (HFIAS) was used, in this study, to evaluate the food security category of vegetable producer and non-producer respondents. About 61% of vegetable producing and only 16% of non-vegetable producing households were food secure. The proportion of mildly, moderately or severely food insecure households was markedly higher among vegetable non-producing households (Table 3).

Table 3. HFIA prevalence of respondents*

Category	A (n=147)	B (n=147)	Total (n=294)
Food secure	61.2%	15.6%	38.4%
Mildly food insecure	25.2%	42.2%	33.7%
Moderately food insecure	7.5%	25.2%	16.3%
Severely food insecure	6.1%	17.0%	11.6%

*details are given in appendix 1.

A, vegetable producers; B, vegetable non-producers

The food insecurity status of vegetable non-producers in the current study was almost similar to that among irrigation non-users in Bona-Zuria Woreda, Sidama Region in which about 15% were severely food insecure (Tizita Damtew, 2017). Vegetable-producing households were in a better food security status possibly

because fruit and vegetable crops generated more income for farmers when compared to staple crops. The relatively higher income of vegetable-producing households, which was over three times higher than that of the non-producing households, could result in better purchasing power. Additionally, they would generate employment for the agricultural workers, thus improving access to food for others (Weinberger and Lumpkin, 2007). The low purchasing power of households who did not produce vegetables could affect one of the pillars of food security, namely accessibility. Thus, they might not be financially strong enough to purchase available food.

Food insecurity experiences, as expressed in terms of anxiety and uncertainty, reducing the quality of meals, reducing the quantity of meals or feeling hungry was higher among vegetable non-producing households than in vegetable producing ones (Table 4). The low monthly income of non-vegetable producers would expose them to food insecurity.

Table 4. Average food insecurity experiences of vegetable-producing (n=147) and non-producing (n=147) households.

Household food insecurity experience	Occurrence	Frequency			
		Rarely	Sometimes	Often	
Feeling of anxiety and uncertainty	A	93	36	37	20
	B	119	23	62	34
Reducing quality of food HH member eats	A	38	26	12	0
	B	95	53	33	9
Reduced quantity of food	A	38	27	11	0
	B	64	38	26	0
Experience of hunger by HH member	A	4	4	0	0
	B	17	13	4	0

Rarely (1 or 2 times), sometimes (3 to 10 times), Often (more than 10 times)
A, vegetable producers; B, vegetable non-producers

Household nutritional knowledge and practice

Nutritional knowledge, attitude, and practice (KAP) was assessed concerning child feeding. Knowledge among vegetable-producing and non-producing households in child feeding, in general, was poor, particularly in child diet diversity and responsive feeding (Table 5). Although both groups of households had a high positive attitude (about 90%) towards giving different types of foods to their children several times each day, about 60%-80% of them believed that it was difficult to do so and, at the same time, continue breastfeeding beyond six months. Very few households in both settings practically breastfed children and supplemented their diet with diverse food for, at least, four times a day. Child feeding KAP between vegetable-producing and non-producing households was also poor (<60%). Similarly, optimal breastfeeding and complementary feeding

practices in Malawi were reported to be suboptimal (Walters *et al.*, 2019). Mothers in Assosa, Ethiopia, however, were reported to have good knowledge and attitude but moderate appropriate practice in child feeding (Dawit Getachew *et al.*, 2021). All children should exclusively be breastfed for the first six months and this should continue along with complementary foods for about two years or longer. The natural first food for infants is breast milk as it provides all the energy and nutrients an infant requires for the first six months of life.

Table 5. Knowledge, attitude and practice in child nutrition among mothers in vegetable-producing and non-producing households*

	A (n=147)	B (n=147)
Child nutrition knowledge		
Continuing breastfeeding	56%	84%
Complementary feeding	75%	80%
Appropriate consistency of meal	75%	75%
Diet diversity	48%	33%
Responsive feeding	17%	17%
<i>Total average proper knowledge (%)</i>	<i>54%</i>	<i>59%</i>
Child nutrition attitude		
Self-confidence in preparing food for the child	4%	12%
Perceived benefits: Good to give different types of food, several times each day, to one's child each day and continue breastfeeding beyond six months	98%	88%
Perceived barriers: Not difficult to give different types of food, several times each day to one's child each day and continue breastfeeding beyond six months	39%	22%
<i>Total positive attitude (%)</i>	<i>47%</i>	<i>41%</i>
Child nutrition practice		
Child breastfed during the day or at night	12%	23%
Diverse foods child ate yesterday	35%	7%
Fed child four or more times a day	40%	0%
<i>Total appropriate practice</i>	<i>28%</i>	<i>10%</i>

* For details, see appendices 2a, b, and c.

A=vegetable-producing households; B=vegetable non-producing households

Food handling knowledge and practice

A food handler is a person who handles food or has contact with any utensils or equipment that come in contact with food. The role of food handlers, who are dominantly mothers in rural settings and poor households, in guaranteeing food safety at the household level is particularly important. Globally, more than 50% of the total food poisoning cases are attributed to improper food handling procedures (Lee *et al.*, 2017). Therefore mothers' knowledge, beliefs, and practices in safe

handling of foods are crucial. Mothers in vegetable-producing households and non-producing households had moderate to good knowledge in food handling, although the knowledge level of mothers in vegetable-producing households was relatively higher than their counterparts in non-producing households (Table 5). The knowledge level of mothers in our study was higher than that observed by Jember Azanaw *et al.* (2021) from Gondar, Northwest Ethiopia.

A positive attitude towards proper food handling was also moderate among mothers in both settings. However, most mothers in both settings did not think that contaminated food could cause disease which could be serious. Unfortunately, the major manifestation of foodborne diseases in children is diarrhea and it is known to kill about 2200 children every day globally (Liu *et al.*, 2012). Mothers in both settings also had a positive attitude towards keeping perishable foods in cool places, reheating leftover foods before eating, and washing fruits and vegetables before consumption. They did not also think that these actions were difficult to accomplish. No marked differences were observed in the attitudes of mothers in both settings. The positive attitude mothers had in food handling was, however, not translated into practice as mothers, in both settings, had poor practices (<60%) in washing kitchen surfaces and storing perishable foods in cool places (Table 5). Food handling practices in both types of households were also poor. Kitchens play an important role in transmitting pathogens to food and, subsequently to humans (Rahimi *et al.*, 2019). Therefore, kitchen surfaces should always be thoroughly cleaned and sanitized before and after use.

Personal hygiene knowledge and practice

Among the requirements that ensure the preparation and consumption of safe food, the personal hygiene of food handlers is important. Good personal hygiene in food handling is important to prevent the transmission of pathogens from food handlers to consumers. Poor personal hygiene of food handlers resulted in close to 75% of foodborne illness outbreaks (Zemichael Gizaw *et al.*, 2014). Knowledgeable food handlers play a key role in ensuring strict adherence to food safety principles throughout the whole process.

Knowledge of mothers in personal hygiene was assessed in terms of the importance of the removal of feces from the home and surroundings and critical moments of handwashing (Table 6). Total average knowledge of personal hygiene among mothers in vegetable producing and non-producing households was generally poor (around 50%). Knowledge in the removal of feces from home and surroundings was, particularly, lacking. Personal hygiene knowledge observed in this study was almost similar with that observed among university students in Kotebe, Addis Ababa (Getachew Dagnaw and Dessalegn Berihun, 2018).

Table 5. Food handling knowledge, attitude, and practice*

Food handling knowledge	A (n=147)	B (n=147)
Raw animal foods often contain germs	79%	62%
sign of well crookedness	84%	77%
Food that should be placed in the refrigerator or a cool place,	98%	83%
Reasons for not eating leftovers that were not kept in a cool place	96%	84%
What to do before eating raw fruits and vegetables	89%	78%
<i>Total average knowledge</i>	<i>89%</i>	<i>77%</i>
		<i>P<0.01</i>
Food handling attitude		
<i>Perceived susceptibility</i> : Likely to get sick from eating contaminated food	35%	48%
<i>Perceived severity</i> : Getting sick from eating contaminated food is serious	22%	28%
<i>Perceived benefits</i> : Good to keep foods of animal origin or cooked food in a cool place; good to re-heat left-overs before eating; good to wash fruits and vegetables with clean water	94%	86%
<i>Perceived barriers</i> : Not difficult to re-heat leftovers before eating; not difficult to wash fruits and vegetables with clean water	91%	94%
<i>Total average attitude</i>	<i>61%</i>	<i>64%</i>
		<i>p>0.1</i>
Food handling practices		
Appropriate cleaning of kitchen surfaces and utensils after preparing dinner	53%	53%
Storing perishable fresh foods such as raw meat and poultry in cool places	47%	40%
<i>Total average practice</i>	<i>50%</i>	<i>47%</i>
		<i>p>0.1</i>

* For details, see Appendices 3a, b and c.

A=vegetable-producing households; B=vegetable non-producing households

Although the total average attitude towards maintaining good personal hygiene was acceptable among mothers in both settings (around 60%), mothers did not think that children could suffer from diarrhea if they did not wash their hands or the disease caused by lack of handwashing was not serious to the child. Similarly, the handwashing practice of respondent mothers from both settings, as assessed by step by step description of handwashing, was very poor and inappropriate (30% or less). In children from low and middle-income countries, the major disease burden comes from diarrheal diseases, which are major public health problem globally (WHO, 2021). Every year, in children under five years, over 1.5 billion cases of childhood diarrheal episodes occur globally, which causes about half a million deaths (WHO, 2021). Diarrhea also leads to malnutrition in children under five (Liu *et al.*, 2012) in the form of the ‘diarrhea → malnutrition → diarrhea vicious cycle. A finding in a multi-country study on handwashing suggested that mother or

caretaker handwashing with soap or ash had a protective effect on the prevalence of diarrhea in children (Edward *et al.*, 2019). Nevertheless, respondent mothers in both settings believed in the benefit of washing hands before preparing food or feeding the child and also thought that it was not difficult to do so. Total average food handling practice among respondent mothers in our study was notably less than that observed in northwest Ethiopia (Fasikaw Adbarie *et al.*, 2019), but higher than the finding from Hossana town, Southern Ethiopia (Alula Seyum *et al.*, 2018).

Table 6. Personal hygiene knowledge, attitude, and practice*

Personal hygiene knowledge	A (n=147)	B (n=147)
Removal of feces from the home and surroundings	42%	28%
Washing hands (after going to the toilet and cleaning the baby's bottom)	59%	72%
<i>Total average knowledge</i>	51%	50%
Personal hygiene attitude		
<i>Perceived susceptibility</i> : Likely for one's child to get stomach ache or diarrhea, from one not washing your hands	35%	48%
<i>Perceived severity</i> : child diarrhea from oneself not washing one's hands is serious	22%	28%
<i>Perceived benefits</i> : Good to wash one's hands before preparing food or before feeding a child/eating	94%	86%
<i>Perceived barriers</i> : Not difficult to wash one's hands before preparing food or before feeding a child/eating	91%	94%
<i>Perceived self-efficacy</i> : Confidence in washing one's hands properly		
<i>Total average attitude</i>	61%	64%
Personal hygiene practices		
Step by step description of handwashing	24%	30%
<i>Total average practice</i>	24%	30%

* For details, see appendices 4a, b and c.

A=vegetable-producing households; B=vegetable non-producing households

Households water sanitation KAP

Water for drinking or other household uses obtained from municipal sources is normally considered to be disinfected and safe. Water from environmental sources should, however, be disinfected to avoid any disease-causing organisms. Respondent mothers' knowledge in household water sanitation was measured basically on how they treat unsafe water, which was very poor among mothers in both settings (<22%) (Table 7). This was lower than the water sanitation knowledge reported from Tigray, Ethiopia (Abera Aregawi *et al.*, 2020). Boiling and adding disinfectants (such as bleach or chlorine) to unsafe water in the right

concentration ensure water safety for drinking (CDC, 2020). If these or other milder water treatment steps cannot be accomplished, the water must be discarded. The attitude of most mothers towards water safety was generally poor (<60%). Most mothers did not believe that unsafe water could be a cause of diarrhea and the disease caused would not be serious. Although almost all mothers in both settings believed that it was good to boil water before drinking or using it, most thought that it was difficult for them to boil water for various practical reasons including shortage of fuelwood.

Table 7. Household water sanitation knowledge, attitude, and practice*

Water sanitation knowledge	A (n=147)	B (n=147)
How to treat unsafe water	15%	22%
Water sanitation attitude		
Perceived susceptibility: Likely for a child to get diarrhea from unsafe water	10%	31%
Perceived severity: getting sick from using unsafe water is serious	28%	29%
Perceived benefits: Good to boil water before drinking or using it	95%	100%
Perceived barriers: Not difficult to boil water before drinking or using it	17%	20%
Confidence in boiling water before drinking or using it	73%	75%
<i>Total average attitude</i>	<i>45%</i>	<i>51%</i>
Water sanitation practice		
Treated collection items to make them clean	89%	88%
Stored water appropriately	15%	21%
Treated water for safety	28%	16%
Got lessons or advice from health extension workers about food safety	65%	67%
<i>Total average practice</i>	<i>48%</i>	<i>33%</i>

* For details, see appendices 5a,b and c.

A=vegetable-producing households; B=vegetable non-producing households

Appropriate practice in household water sanitation was also poor among mothers in both settings (< 50%), particularly in water storing or treating practices. Safe treatment and storage of drinking water can reduce the prevalence of waterborne diseases by 30-50% (UNICEF, 2016). Even if drinking water is obtained from safe sources, it may become contaminated during storage in the house (Jensen *et al.*, 2002). Therefore, thorough cleaning of storage containers with water or other sanitizing materials can avoid possible infection from drinking water. The source of water might be safe, but according to Wright *et al.* (2004), the water can get contaminated in storing containers. Similarly, safe water was found frequently contaminated with large amount of fecal microorganisms during storage in households (Clasen and Bastable 2003).

CONCLUSION AND RECOMMENDATIONS

This finding revealed that vegetable production improved the household food security status through increased income, although its contribution to diet diversity of children was minimal. It is recommended to make credit services available, particularly to those who are not currently producing vegetables and help them improve their food security status through vegetable production by supplying the required inputs at affordable prices. Nutrition KAP among vegetable-producing and non-producing households was generally poor. Although knowledge in and positive attitude towards safe handling of food were moderate to good in both types of households, they were, unfortunately, not translated into appropriate food handling practice. Similarly, knowledge and practice in personal hygiene and household water sanitation were poor among respondents of both settings. These conditions would expose them to foodborne diseases. As the ultimate goal of food security is to lead a healthy and active life, it is recommended that appropriate training by health extension workers should also focus on child nutrition and household food safety issues.

CONFLICT OF INTEREST

The authors declare that there was no conflict of interest.

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APPENDICES

Appendix 1. HFIAS in the past four weeks in study households.

HFIAS		Occurrence			Frequency		
		Yes	No	Rarely (1)	Sometimes (2)	Often (3)	
1. In the past four weeks, did you worry that your household would not have enough food?	A	93	54	36	37	0	
	B	119	23	0	62	34	
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?	A	38	109	22	16	0	
	B	86	61	34	27	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?	A	37	110	28	9	0	
	B	99	48	62	37	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?	A	38	109	27	11	0	
	B	99	48	63	36		
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 not enough food?	A	37	110	27	9	0	
	B	63	84	38	25	0	
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?	A	38	109	27	11	0	
	B	64	230	37	27	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?	A	11	136	11	0	0	
	B	25	132	14	11	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?	A	-	147	0	0	0	
	B	25	132	25	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?	A	0	147	0	0	0	
	B	0	147	0	0	0	

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

A, vegetable producers; B, vegetable non-producers

Appendix 2a. Household child nutrition knowledge.

	Know	
	A	B
1: Continued breastfeeding		
" Six months or less	43.6%	4.1%
" 12–23 months	0%	0%
" 24 months and more (correct response)	56.4%	84.4%
2: Age of start of complementary foods		
" At six months	89.1%	80.2%
" Other	10.9%	19.8%
3: Reason for giving complementary foods at six months		
" Breastmilk alone is not sufficient	60.8%	70.4%
" <i>Other</i>	39.2%	29.6%
4: Appropriate consistency of meals		
- thick porridge	65%	88.4%
- watery	39.5%	11.6%
5: Reason for consistency of meals		
" Because it is thicker (more nutritious/because it is prepared with various ingredients (food diversity)	68.38%	88.4%
- <i>other</i>	32.62%	11.6%
6: Dietary diversity and ways of enriching porridge by adding:		
" Animal-source foods (meat, poultry, fish, liver/organ meat, eggs, etc.)	42.6%	0%
" Pulses and nuts: flours of groundnut and other legumes (peas, beans, lentils, etc.), sunflower seed, peanuts, soybeans	100%	100%
" Vitamin-A-rich fruits and vegetables (carrot, orange-fleshed sweet potato, yellow pumpkin, mango, papaya, etc.)	0%	0%
" Green leafy vegetables (e.g. spinach)	42.6%	0%
" Energy-rich foods (e.g. oil, butter/ghee)	42.6%	16%
" Other	27.2%	88.4%
7: Responsive feeding: ways to encourage young children to eat		
" Giving them attention during meals, talk to them, make meal times happy times		
" clap hands		4.1%
" make funny faces/play/laugh	0%	0%
" demonstrate opening your own mouth very wide/modeling how to eat	3.66%	11.5%
" say encouraging words	90.8%	72.8%
" draw the child's attention	5.54%	11.6%

A, vegetable producers; B, vegetable non-producer

Appendix 2b. Households child nutrition attitudes.

Attitudes	A	B
1 Self-confidence in preparing food for the child?		
" 1. Not confident	93.4%	82.3%
" 2. Ok/so-so	2.7%	6.1%
" 3. Confident	4.1%	11.6%
2. Giving a diversity of food (foods from many food groups)		
<i>Perceived benefits.</i> Goodness of giving different types of food to one's child each day?		
" 1. Not good	2.7%	0%
" 2. You're not sure	2.7%	11.6%
" 3. Good	94.5%	88.4%
<i>Perceived barriers</i>		
" 1. Not difficult. to give different types of food to child each day	2.7%	0%

.. 2. So-so	0%	11.6%
.. 3. Difficult	97.2%	88.4%
3. Feeding frequently		
<i>Perceived benefits</i> How good do you think it is to feed your child several times each day?		
.. 1. Not good	0%	0%
.. 2. You're not sure	0%	11.6%
.. 3. Good	100%	88.4%
<i>Perceived barriers</i>		
How difficult is it for you to feed your child several times each day?		
.. 1. Not difficult	13.6%	0%
.. 2. So-so	0%	11.6%
.. 3. Difficult	86.4%	88.4%
4. Continuing breastfeeding beyond six months		
<i>Perceived benefits</i> ; How good do you think it is to continue breastfeeding beyond six months?		
.. 1. Not good	0%	0%
.. 2. You're not sure	0%	11.6%
.. 3. Good	100%	88.4%
<i>Perceived barriers</i> How difficult is it for you to continue breastfeeding beyond six months?		
.. 1. Not difficult	100%	65.3%
.. 2. So-so	0%	23.1%
.. 3. Difficult	0%	11.6%
Any extension support on child feeding		
-Yes	58.4%	36.4%
-No	41.6%	63.6%
<i>No answer</i>	0%	0%

A, vegetable producers; B, vegetable non-producer

Appendix 2c. Household child nutrition practice.

PRACTICE		A	B
1. Continued breastfeeding			
	Yes	88.44%	65.3%
Was the child breastfed or did he or she consume breastmilk yesterday during the day or at night?	No	11.56%	23.1%
2. Dietary diversity – foods the child ate yesterday			
Group 1: Grains, roots and tubers			
	Yes	100%	88.4%
Porridge, bread, rice, noodles or other foods made from grains, White potatoes,	No	0	11.6%
Group 2: Legumes and nuts Any foods made from beans, peas, lentils, nuts or Seeds			
	Yes	56%	0%
	No	44%	100%
Group 3: Dairy products Infant formula(4x)			
	Yes	36%	0%
	No	54%	100%
Milk, such as tinned, powdered or fresh animal milk (3x)			
	Yes	56%	0%
	No	100%	100%
Yogurt or drinking yogurt (1x)			
	Yes	56%	0%
	No	44%	100%
Cheese or other dairy products (1x)			
	Yes	56%	0%
	No	44%	100%
Group 4: Flesh foods			
Any meat, such as beef, lamb, goat, or chicken			
	No	100%	100%
Fresh or dried fish			
	Yes	56%	0%
	No	44%	100%

Group 5: Eggs	Yes	2%	0%
	No	98%	100%
Group 6: Vitamin A, fruits and vegetables Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside	Yes	0%	0%
	No	100%	100%
Any dark green vegetables (kale)	Yes	0%	0%
	No	100%	100%
Ripe mangoes (fresh or dried [not green]), ripe papayas (fresh or dried), musk melon	Yes	0%	0%
	No	100%	100%
Group 7: Other fruits and vegetables	Yes	0%	0%
Any other fruits or vegetables	No	100%	100%
Any oil, fats, or butter or foods made with any of these	Yes	100%	88.4%
	No	0%	11.6%
Any sugary foods, such as chocolates, sweets, candies, pastries, cakes or biscuits	Yes	0%	0%
	No	100%	100%
Condiments for flavor, such as chilies, spices, herbs or fish powder	Yes	0%	0%
	No	100%	100%
3. Minimum meal frequency			
Number of times the child ate foods the previous day during the day or at night?	2x	23.4%	43.2%
	3x	36.24%	56.8%
	4x	40.36%	0%
	5x	0%	0%

Appendix 3a.: Household food handling knowledge.

	Know	
	A	B
Why should you prevent raw meat, offal, poultry and seafood from touching other food?		
“Raw animal foods often contain germs	78.65%	61.6%
“ Other	0	0
- Don't know	21.45%	39.4%
When cooking soups and stews, what sign shows that these are ready and safe to be served?		
They are boiling/ well cooked	84.4%	77.2%
“ Other	16%	22.8%
What kinds of food should be placed in the refrigerator or in a cool place, such as an icebox or cool box?		
“ Meat, offal	100%	84%
“ Poultry	100%	100%
“ Fish	97.7%	56%
“ Milk/dairy products	100%	100%
- Cooked foods	93%	74%
“ Don't know	0%	0%
Why should someone avoid eating leftovers that were not kept in a cool place?		
“ Because food is not safe anymore	100%	93%
- germs multiply very quickly and can cause illness	100%	82.3%
“ Higher temperatures make germs grow faster	89.9%	77.7%
What should you do before eating raw fruits and vegetables?		
“ Wash them with clean water	89%	78%
“ Other -	11%	22%

A, vegetable producers; B, vegetable non-producer

Appendix 3b. Household food handling attitude

Food Handling Attitude		It is	It is not	Not sure
Perceived susceptibility				
Likelihood of getting sick from eating contaminated food?	A	34.6%		
	B	48.4%	41.2%	10.4%
Perceived severity				
Seriousness of getting sick from eating contaminated food.	A	22.1%	87.9%	
	B	28.4%	71.6%	
Perceived benefits				
Goodness of keeping meat, poultry, fish, or cooked food in a cool place.	A	100%	0%	
	B	100%	0%	
Goodness of re-heating left-overs before eating or serving them	A	82%	0%	18%
	B	59.4%	40.1%	
Goodness of washing fruits and vegetables with clean water	A	100%	0%	
	B	100%	0%	
Perceived barriers				
Difficulty of re-heating leftovers before eating or serving them	A	17.2%	81.8%	
	B	12%	88%	
Difficulty of washing fruits and vegetables with clean water	A	0%	100%	
	B	0%	100%	

A, vegetable producers; B, vegetable non-producer

Appendix 3c. Household food handling practice.

Food handling Practice	Vegetable producers	Non-vegetable producers
Usual cleaning of kitchen surfaces and utensils after preparing dinner		
“ Scrape excess food into rubbish bin	86%	98%
“ Wash with hot water	3%	0%
“ Wash with detergent	71%	62%
Storing perishable fresh foods such as raw meat, poultry and seafood		
“ In the refrigerator (below 5 °C)/cool box	34%	0%
“ Covered (protected from insects, rodents, pests and dust)	61.7%	56.4%
“ Separated from cooked or ready-to-eat foods	44.3%	63.6%

Appendix 4a. Household personal hygiene knowledge.

	Know	
	Vegetable producers	Non-vegetable producers
	No (%)	No (%)
Wash hands (after going to the toilet and cleaning the baby's bottom)	58.5%	72.1%
“ Remove feces from the home and surroundings	41.5%	27.9%
- Other	0%	0%
- No answer	0%	0%
Key moments you wash your hands		
After going to the toilet/latrine	100%	100%
After cleaning the baby's bottom/ changing a baby's nappy	100%	100%

“ Before preparing/handling food	100%	100%
“ Before feeding a child/eating	100%	100%
After handling raw food	100%	100%
After handling garbage	100%	100%
Other	0%	0%
No answer	0%	0%

Appendix 4b. Household personal hygiene attitude.

Personal Hygiene Attitude		It is	It is not	Not sure
Perceived susceptibility				
Likelihood of oneself or child having stomach ache or diarrhea, from not washing your hands.	A	27.2%	72.8%	0%
	B	42.2%	57.8%	0%
Perceived severity				
Seriousness if one or child gets diarrhea from oneself not washing one’s hands	A	32.7%	64.6%	0%
	B	23.8%	76.2%	0%
Perceived benefits				
Goodness of washing ones hands before preparing food or before feeding a child/eating.	A	93.2%	0%	6.8%
	B	100%	0%	0%
Perceived barriers				
Difficulty to wash ones hands before preparing food or before feeding a child/eating?	A	0%	100%	0%
	B	0%	100%	0%
Perceived self-efficacy				
Confidence in washing ones hands properly?	A	76.2%	19.7%	4.1%
	B	83%	17%	0%

A, vegetable producers; B, vegetable non-producer

Appendix 4c. Household personal hygiene practice.

Personal hygiene Practice	Know		Do not know	
	Vegetable producers	No-vegetable producers	Vegetable producers	Non-vegetable producers
Could you please describe step by step how you wash your hands?				
a. Washes hands in a bowl of water (sharing with other people) — poor practice	0%	0%	27.2%	11.6%
b. With someone pouring a little clean water from a jug onto one’s hands - appropriate practice	39.5%	38.8%	0%	0%
c. Under running water — appropriate practice	0%	0%	0%	0%
d. Washes hands with soap or ashes— appropriate practice	33.3%	49.7%	0%	0%

Appendix 5a. Household water sanitation knowledge.

Water sanitation Knowledge	Know	
	Vegetable producers	No-vegetable producers
Treating unsafe water		
Water treatment	55.8%	30.6%
Boil it	19.0	0%
Add bleach/chlorine	25.9%	65.3%
Strain it through a cloth	0%	0%
Use a water filter (ceramic, sand, composite, etc.)	0%	0%
Use solar disinfection	0%	0%
Let it stand and settle	55.1%	34.7%
Discard it and get water from a safe source	0%	0%
- Other	0%	0%
- Do not know	0%	0%

Appendix 5b. Household water sanitation attitude.

Water sanitation Attitude		It is No (%)	It is not No (%)	Not sure No (%)
Perceived susceptibility				
Likelihood of oneself or one's child to get diarrhea from using unsafe water?	A	9.5%	74.1%	16.3%
	B	74.8%	17.7%	7.5%
Perceived severity				
Seriousness of getting sick from using unsafe water?	A	27.6%	71.4%	0%
	B	29.3%	70.7%	0%
Perceived benefits				
Goodness of boiling water before drinking or using it?	A	94.6%	2.7%	2.7%
	B	100%	0%	0%
Perceived barriers				
Difficulty of boiling water before drinking or using it	A	28.6%	68.7%	2.7%
	B	49.7%	50.3%	0%
Perceived self-efficacy				
Confidence in boiling water before drinking or using it?	A	72.8%	24.5%	2.7%
	B	74.8%	17.7%	7.5%

A, vegetable producers; B, vegetable non-producer

Appendix 5c. Household water sanitation practice.

Water sanitation Practice	Vegetable producers	No-vegetable producers
1. Source of water		
Piped water	95.9%	36.7%
Public tap/standpipe	0%	0%
Piped into yard or plot	0%	4.1%
Surface water	4.1%	59.2%
2. Collection of water for domestic use		
- Yes	100%	100%
- No	0%	0%
3. Treating collection item to make it clean		
Yes	89.1%	88.4%

No	10.9%	11.6%
4. Use of water and soap (clean container)	83.7%	27.2%
5. Could you describe how you store water?		
" Clean container or jar	75.5%	0%
" Covered container or jar	9.5%	78.9%
4. Use of water and soap (clean container)	83.7%	27.2%
5. Could you describe how you store water?		
" Clean container or jar	75.5%	0%
" Covered container or jar	9.5%	78.9%
" Clean and covered container or jar	15%	21.1%
" Don't know/no answer	0%	0%
6. Did you treat water in any way?		
" Yes	55.8%	30.6%
" No	44.2%	61.9%
" Boil it	38.1%	0%
" Add bleach/chlorine	17.7%	30.6%
" Strain it through a cloth	0%	0%
" Use a water filter (ceramic, sand, composite, etc.)	0%	0%
" Let it stand and settle	42.2%	34.7%
" Don't know/no answer	0%	0%
7. Any lessons or advice from health extension worker about food safety		
-Yes	64.7%	67.3%
-No	35.3%	32.7%