

Complementary Food Hygiene Practice among Mothers or Caregivers in Bale Zone, Southeast Ethiopia: A Community Based Cross-Sectional Study

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Abstract

Introduction:

Diarrhea and other foodborne diseases are a major public health problem which predominantly affects infants and young children. Appropriate complementary food hygiene practice is very important to reduce the prevalence of foodborne illnesses among children. This study is aimed to assess complementary food hygiene practices among mothers of children aged 6–23 months.

Methods

A community based cross-sectional study was conducted in Robe town. Sample of 517 mother-child pairs were selected using systematic sampling techniques. Data was collected using pre-tested and structured questionnaire. Each variable were described by using the frequency and percentage. Bivariate and multivariate logistic regression analyses were used to identify factors associated with complementary food hygiene practice score. Odds ratios with 95% confidence interval were used to assess level of significance.

Results

From a total of 508 mothers that were interviewed, 55% of them scored above the mean score of food hygiene practices. Mothers had higher odds to practice good food hygiene measures than those of aged 6–11 months. Mothers whose child attends growth monitoring session practice good food hygiene than their counterpart. Mothers having media exposure, and having knowledge on critical times of hand washing practice relatively good food hygiene measures. Among food hygiene measures; handwashing practice with water and soap were low before eating food, before feeding children and before preparing food when compared with after visiting toilet and touching dirt.

Conclusions

The study identified food hygiene practices in the current study area were mainly associated with child age, growth monitoring follow-up, maternal awareness about critical times of hand washing, and media exposure. Improving knowledge of mothers on critical times of handwashing, strengthening growth monitoring follow-up and media promotion are important measures to improve food hygiene practices among mothers of infants and young children.

1. Introduction

Food hygiene is the conditions and measures necessary to ensure the safety of food from production to consumption. Food can become contaminated at any point during slaughtering or harvesting, processing,

storage, distribution, transportation and preparation [1, 2]. Appropriate food hygiene practices have been found to reduce the risk of diarrhea in children below 2 years of age [3]. The most critical household food hygiene actions to be practiced by mothers in developing country settings include cooking at adequate temperature, decreasing the time food is stored at room temperature, reheating at adequate temperature, adequate hand washing at all critical times, use of clean utensils and storage of food at sufficiently low or high temperatures to prevent bacterial multiplication [4].

The period of complementary feeding, which covers a child from 6–23 months of age, is a very vulnerable period when under nutrition starts in many infants, contributing to the high prevalence of under nutrition in children under two years of age [5]. Under nutrition is the outcome of insufficient food intake to meet the body's requirements for nutrients, and/or poor absorption and/or poor biological use of nutrients consumed. as a result of repeated infectious disease [6, 7].

Foodborne disease is a problem in both developing and developed countries [1, 4]. In low-resource settings food given to young children is often highly contaminated with fecal pathogens [6]. The burden of disease due to contaminated food is therefore, in the African region causing strain on health care systems; severely affects infants and young children; creates a vicious cycle of diarrhea and malnutrition; and hurts the national economy and development and international trade [1, 8]. Repeated episodes of diarrhea in the first 2 years of life adversely affects a child's nutritional status [9]. A study revealed that around 72% of death associated with diarrhea happen in this period of life [10].

International consultations among professionals identified hand washing with soap and water as a top priority in all settings [11]. A study confirmed that bacteria were found after no hand washing in 44% of samples; this figure was reduced to 23% after washing hands with water alone and to 8% after washing hands with water and soap [12]. Therefore, maternal hand washing with soap is important to reduce the risk of diarrhea in children [13]. Even though hand washing with soap and water is a simple and efficient method for reducing the risk of infectious diseases [12], Studies showed that mothers do not wash their hands regularly [14, 15].

World Health Organization (WHO) recommends keeping clean all food contact surfaces and equipment used in food preparation [1, 16]. In addition, cooked food should be stored carefully at an appropriate temperature. It should either be kept cold, ideally in a refrigerator (temperature below 5°C), or it should be kept hot (above 60°C) [1, 17]. Storage of prepared food at room temperature for a long period of time for multiple feeding is the main factor for contamination of complementary food [18, 19]. A study indicated that a load of microorganisms were high in complementary foods which stayed at room temperature for four hours as compared with the counts taken immediately after preparing the food [19]. For this reason, WHO recommends that food should be eaten immediately within 2 hours or stored food should be reheated thoroughly before feeding [1, 16]. Even though reheating is vital in the prevention of foodborne disease, studies indicate that reheating of leftover foods fed to infants is rarely practiced [18, 20].

This study is intended to describe food hygiene practices which would contribute insight for the magnitude of the problems concerning this subject area. In addition, it recommends some of the possible

solutions to be taken to tackle the problems identified at the end of the study. So, it could suggest an appropriate strategy for local health planners, health administrators and those organizations working on children's health.

2. Methodology

2.1. Study area and period

A community based cross-sectional study was conducted from March to April 2017 in Robe town, which is a town in South East Ethiopia located in the Bale Zone of the Oromia Regional State. It is located about 430 kilometers by road from Ethiopia's capital Addis Ababa. The town has three main kebeles; Baha Biftu, Cafe Donsa and Oda Robe. Based on the town health office data of 2017, there were 2873 households having children aged 6–23 months during the study period. In addition to two governmental health institutions (one district Hospital and one Health Center), there are 51 private health institutions delivering health services in the town.

2.2. Source and study population

The source populations of the study were all mothers of infants and young children aged 6–23 months who live in the town. The study population was all sampled mothers of children aged 6–23 months. Mothers who are permanent residents (resides in the town at least for 6 months) and have infants or young children aged 6–23 months were included in the study.

2.3. Sample size and sampling technique

Sample size was determined by using Epi Info version 7 statistical sample size calculators for population survey. Assuming 95% level of confidence; 3% acceptable margin of error; and 10% possibility for non-response rate 517 final required minimum sample size was obtained. The systematic sampling technique was employed to reach the study participants. The sample size was divided proportionally between the three kebeles. The total number of mothers having target children in the town was taken from the town health office and then is divided by the total sample size to determine the interval between consecutive mothers having target children, and sampling interval was calculated. Then, 517 households were selected using a systematic sampling method. The first participant was randomly selected and the second and next participants were selected based on the interval. When the mother/caregiver is not available at the time of data collection, one-time revisits were made on the same day. When that fails, the next participants were considered.

Data were collected using an interviewer-administered and structured questionnaire. The data collection tools regarding the various socio-demographic and environmental variables were adopted from Ethiopian Demographic and Health Survey (EDHS) questionnaire with some modification to fit with the context. Data collection tool for food hygiene practices were adapted from FAO guidelines for assessing nutrition-

related KAP [21] and some food hygiene questions were developed from WHO Infant and Young Child Feeding (IYCF) guideline [16].

2.4. Data collection and analysis

The data were collected using pre-coded questions that relate to food hygiene practices by interviewing the mothers and questions on data of household sanitation facilities like latrine type was accompanied with observation. A questionnaire was prepared in English. Then the questionnaire was translated into Afan Oromo and back to English. After that pre-test was conducted on mothers having target children before actual data collection in Goba town which is found out of the study area. Necessary revisions were done based on the gaps identified during the pre-test interview before the beginning of actual data collection.

Data were collected by six personnel, one degree, and five diploma nurses. Data collectors were supervised by two public health professionals. To ensure data quality, and to form a common understanding, supervisors and data collectors were trained in the overall introduction of the study process; including its objective, technique of interviewing, how to maintain ethical issues and on definitions of terms used in the questionnaire. During data collection, the supervisors reviewed and monitored every questionnaire for completeness, clarity, and consistency. The collected data were checked every day by the investigator and correction feedback was given every morning for supervisors and data collectors.

Data were entered and analysed by using SPSS version 20 for windows. Descriptive statistics were used to describe the frequency and percentage of each variable. Bivariate logistic regression was used to check which variables had an association with the dependent variable individually and multivariate logistic regression was conducted to identify factors that were associated with complementary food hygiene practices. All variables with p-value < 0.25 in bivariate logistic regression were moved into multivariate logistic regression. Then, independent predictors were determined to be predictive for outcome variable using p-value < 0.05. Adjusted odds ratios with 95% confidence interval were used to write reports of the analysis.

2.5. Study variables

2.5.1. Dependent variable

Food hygiene practice was the outcome variables of the study.

2.5.2. Independent variables

Maternal age, maternal education, maternal knowledge, maternal occupation, and marital status of the mother, place of delivery, religion, ethnicity, paternal education and paternal occupation; age of the child, sex, growth monitoring follow-up, breast feeding status, exposure to media, number of under-five aged children, family size, and monthly income, type of latrine and source of drinking water were considered as independent variables.

2.6. Operational definitions

1. Food hygiene practices: To assess the level of food hygiene practices, mothers were asked food hygiene practice questions from the questionnaire and those who had score less than the mean value were considered as having poor food hygiene practices and those who scored greater than the mean value were considered as having good food hygiene practices [3].
2. Knowledge on critical times of hand washing: To assess the level of knowledge on key moments for hand washing, mothers were asked one question that has a list of six correct answers. Each respondent is given a score based on the number of correct responses provided. Those mothers who scored less than the mean score were considered as not having knowledge and those who mentions greater than the mean score were considered as having knowledge on critical times of hand washing [21].
3. Improved latrine: Include flush/pour flush to a piped sewer system, septic tank or pit latrine; ventilated improved pit latrine, composting toilet or pit latrine with slab. Whereas unimproved latrine includes pit latrines without slabs, hanging latrines, bucket latrines [11].
4. Improved water sources: include piped water, boreholes or tube wells, protected dug wells, protected springs and packaged or delivered water. Whereas unimproved water source includes unprotected wells, unprotected springs and surface water [11].
5. Exposure to media: A respondent at least once a week reads a Newspaper, watches Television, or listens to the radio [22].

2.7. Ethics approval and consent

A letter of permission and ethical clearance were obtained from Ethical Review Committee of Madda Walabu University. The town administrative office provided a permission letter to each kebele. The privacy and confidentiality of information from each respondent were maintained through anonymity. Informed written consent of each respondent was secured before the commencement of the interviews. The mothers agreed to participate in the study and they were given the freedom to refuse or participate in information provisions.

3. Results

3.1. Socio-demographic characteristics of the study participants

A total of 508 mothers were participated in the study making a response rate of 98%. One hundred ninety nine (39.2%) of them were in the age group 25–29 years and 337 (66.3%) were Muslim followers in religion and 470 (92.5%) were Oromo in an ethnic group. Concerning the educational status of the mothers, 61 (12%) had no formal education and three fourth of participated mothers were housewives.

Regarding households of the study participants, 293 (57.7%) of households had only one under-five child and 261 (51.4%) of households had five or more than five total family sizes.

3.2. Water and sanitation characteristics of households

Two hundred thirty-eight (47%) of households used an improved latrine, which includes pour flush toilets to septic tanks and other improved latrines (pit latrine with slab and ventilated improved pit latrine). However, more than half (53%) of households are using an unimproved type of latrine. Pit latrine without slabs (unimproved types of latrine) dominates in the study area. They are used by (52%) households (Fig. 2).

The principal source of drinking water for the households was improved source. Four hundred twenty-four (83.5%) of households were using piped water and fewer households (0.4%) were using an unimproved source of drinking water (Fig. 3).

3.3. Food hygiene practices

3.3.1. Food preparation and storage practice

Four hundred sixty-seven mothers (91.9%) prepare food for their child separately from food of other family members, while the rest mothers reported they were giving food for their child from domestic foods prepared for other family members. This study also revealed that 155 (30.5%) and 204 (40.2%) of mothers reported that prepared food is served immediately after preparation and within two hours, respectively. But the study revealed that 149 (29.3%) mothers were storing prepared food for more than two hours, which they use to serve it two and more times. Four hundred sixty-six mothers (87.8%) store prepared food in a covered place. However, 49 (9.6%) of interviewed mothers store uncovered food in room temperature. Forty-one (8%) of participated mothers store food in the refrigerator and 11 (2%) of them left it as hot in high temperature until served for another time (Table 1).

3.3.2. Reheating practice

More than half (58%) of mothers participated in the study reported they always reheat food when they want to give their child ready to eat food (cooked food) that stayed more than two hours at room temperature. Whereas 142 (28%) of them discard it and 70 (13.8%) of them feed without reheat.

3.3.3. Hand washing at critical times

Concerning hand washing at critical times, most mothers 414 (81.5%) wash their hands after using the toilet and only 166 (32.7%) of them reported they wash their hands before feeding their child. But the proportion of mothers who have practiced hand washing with soap at a critical time was lower. For instance, 89 (17.5%), 108 (21.3%) and 166 (32.7%) of them were reported, they wash their hands with soap before eating food, before feeding baby and before preparing food, respectively (Fig. 4). Most of the mothers who did not report hand washing with soap at critical times reported that they use soap other

times such as; after they eat or prepare foods containing fat and oil, after touching char coal, after meal, morning and evening, and before religious practices (i.e., during salat).

3.3.4. Method of child feeding

The mothers were asked type of utensils or methods they use to feed their child. Most of them responded more than one answer. According to the result of the study 440 (86.6%) of mothers use a spoon/cup, and 207 (40.7%) of them use their bare hands. From which 145 (28.5%) of mothers use both spoon and bare hand simultaneously depending on types of food. For foods like bread and '*injera*' they use their bare hands, whereas for foods like milk and semi-solids they use spoon or cups. Bottle feeding were also practiced by 178 (35%) of mothers (Fig. 5).

3.3.5. Utensils cleaning practice

The majority of mothers 405 (79.7%) and 282 (55.5%) use soap and hot water respectively to clean utensils used for child feeding, whereas some mothers 104 (20.5%) used only cold water to clean utensils, while few numbers of mothers 20 (9%) did not use soap and hot water at the same time to clean and sanitize spoons and plates used to feed their children (Table 1).

3.3.6. Domestic waste disposal practices

Pertaining to waste disposal practices, 76 (15%) of mothers dispose of the children's feces to open field. Few mothers responded that they do not dispose of child feces in the latrine; they throw out at other places; for example, near the fence where the adults' feet could not reach (the traditional practice found in the community). In another way, more than half of study participants 289 (57%) practiced open field disposal of other liquid wastes generating from the household.

Table 1
Complementary Food hygiene practices among Mothers or Caregivers in
Robe town, Southeast Ethiopia

Variables	Frequency	%
Hand washing practice with soap at critical times*		
Before food preparation	166	32.7
Before feeding baby	108	21.3
Before eating food	89	17.5
After defecation	414	81.5
After touching child stool	347	68.3
Wash child hand before giving food		
Yes	391	77.0
No	117	23.0
Do you prepare for the child separately		
Yes	467	91.9
No	41	8.1
Thorough cooking of food		
Yes	504	99.2
No	4	0.8
Duration of cooked child meal lasts until served		
Immediately after preparation	155	30.5
Less than 2 hours	204	40.2
More than 2 hours	149	29.3
Where you store child meal?*		
In the refrigerator	41	8.1
Kept as hot	9	1.8
Kept in room temperature	458	90.8
Kept covered	446	87.8
What do you do leftover lasts > 2 hrs?		

* =Multiple response

Variables	Frequency	%
Reheat always before feeding	296	58.3
Never/sometimes reheat	70	13.8
Discard	142	28.8
By what you feed your child?*		
Feed with spoon	440	86.6
Feed with a bare hand of mother	207	40.7
Bottle feeding practice?		
Yes	178	35.0
No	330	65.0
Utensils cleaning method*		
Wash with hot water	282	55.5
Wash with detergent	405	79.7
Wash with cold water only	104	20.5
Raw fruits and vegetable washing practice		
Yes	490	96.5
No	18	3.5
Child's feces disposal practice		
Closed (in latrine)	434	85.4
Open field	74	14.6
Other liquid waste disposal method		
Closed (in the latrine or in sewage pit)	219	43.1
Open field	289	56.9
* =Multiple response		

3.4. Factors associated with food hygiene practices

According to the result of the current study the overall food hygiene practice of mothers were significantly associated with child age, growth monitoring follow-up, media exposure and knowledge of mothers on critical times of hand washing. Mothers of children aged 12–23 months practice appropriate food hygiene 1.63 times higher than that of children aged 6–11 months of age. Mothers whose child attend growth monitoring session practice good food hygiene than their counterpart AOR, 2.74 95% CI (1.49,

5.06). The finding also identified that mothers who have media exposure practiced good food hygiene practices compared to mothers who have no media exposure AOR, 0.73 95 CI (1.14, 2.62). Mothers who have knowledge on critical times of hand washing have more likely to practice better food hygienic practices than mothers who does not have knowledge on critical times of hand washing AOR, 1.94 95% CI (1.33, 2.82). Educational status of mothers, occupation of fathers and marital status of mothers showed significant association in bivariate regression, but not in a multivariate regression model (Table 2).

Table 2

Bivariate and multivariate logistic regression analysis for factors on Complementary food hygiene practice among mothers of children aged 6–23 months in Robe town

Predictor variables	Food hygiene practices		COR (95% CI)	AOR (95% CI)
	Good (%)	Poor (%)		
Child sex				
Female	135(52)	126(48)	1	1
Male	144(58)	103(42)	1.30(0.92, 1.85)	1.22(0.84, 1.77)
Child age (months)				
6–11	72(47)	83(53)	1	1
12–23	207(59)	146(41)	1.63(1.12, 2.39)*	1.82(1.21, 2.73)*
Growth monitoring follow-up				
No	18(29)	44(71)	1	1
Yes	2261(58)	185(42)	3.45(1.93, 6.16)**	2.74(1.49, 5.06)**
Mother's education				
No education	24(39)	37(61)	1	1
Primary education	130(53)	115(47)	1.74(0.98, 3.09)	1.31(0.69, 2.45)
Secondary and above	125(62)	77(38)	2.50(1.39, 4.50)**	1.42(0.69, 2.88)
Marital status				
Not in union	5(23)	17(77)	1	1
In union	274(56)	212(44)	4.39(1.59, 12.10)**	2.54(0.86, 7.51)
Media exposure				
No	68(45)	84(55)	1	1
Yes	211(59)	145(41)	1.79(1.22, 2.64)**	1.73(1.14, 2.62)*

** = Statistically significant at $p < 0.01$, * = statistically significant at $p < 0.05$, COR = Crude odds ratio, AOR = Adjusted odds ratio, CI = Confidence interval.

Predictor variables	Food hygiene practices		COR (95% CI)	AOR (95% CI)
	Good (%)	Poor (%)		
Father's education				
No education	20(44)	25(56)	1	1
Primary education	124(52)	117(48)	1.32(0.69, 2.51)	0.73(0.34, 1.54)
Secondary and above	135(61)	87(39)	1.94(1.02, 3.70)*	0.95(0.44, 2.07)
No of children under age 5				
One	163(56)	130(44)	1	1
Two	102(56)	79(44)	1.03(0.71, 1.49)	1.12(0.74, 1.70)
3 and above	14(41)	20(59)	0.56(0.27, 1.15)	0.83(0.37, 1.87)
Father's occupation				
Daily laborer	94(53)	85(47)	1	1
Employed	62(64)	35(36)	1.60(0.96, 2.66)	0.78(0.39, 1.54)
Merchant	91(55)	76(45)	1.08(0.71, 1.65)	0.77(0.48, 1.25)
Others	32(49)	33(51)	0.88(0.49, 1.55)	0.86(0.46, 1.60)
Family size				
Less than 5	146(59)	102(41)	1	1
5 or more	133(51)	127(49)	0.73(0.52, 1.04)	0.79(0.54, 1.15)
Knowledge on critical times of handwashing				
Doesn't know	111(45)	133(55)	1	1
Knows	168(64)	96(36)	2.09(1.47, 2.99)**	1.94(1.33, 2.82)**
** = Statistically significant at p < 0.01, * = statistically significant at p < 0.05, COR = Crude odds ratio, AOR = Adjusted odds ratio, CI = Confidence interval.				

4. Discussion

The result of the study showed that 55% of interviewed mothers scored above the mean score of overall food hygiene practices. Their practice of food hygiene is significantly associated with age of the child. Mothers of younger children had lower odds of practicing good complementary food hygiene than those of older children (12–23 months). This might be because of most of the time mothers consider hygiene measures for their children when they become older, spatially hand washing. Mothers having media exposure, and knowledge on critical times of hand washing practiced relatively good food hygiene compared to their counterpart. It is clear that media exposure have positive association with their knowledge, which in turn has positive influence on their practice of good food hygiene. Similarly mothers whose child attended growth monitoring session practice good food hygiene than those did not attend. This might be as a result of counseling given for mothers or care givers during this session.

When we see handwashing practices of the study participants, the study showed that 33% of mothers reported they wash their hands with water and soap before food preparation. It was lower than a study conducted in India which was 74% [23]. Even though handwashing practice with water and soap after using latrine is higher 81%, only 21% of mothers reported they wash their hands with water and soap before feeding their children. This was very low compared to that of India 79% and Bangladesh 55% [14, 23]. The study showed that some of the mothers reported they wash their hands with soap only during special occasions which are not considered as critical times. The times they use soap for hand washing frequently responded by study participants were after eating foods containing fat or oil, the morning when they wake up and when they touch fume. These reported practices have minimal public health importance. In addition, those mothers did not have a habit of washing their hands with soap at critical times. This could be risky for children's and other families' health.

Concerning cleaning and sanitizing of utensils, few mothers (20%) were not properly washed the plates and spoons used for serving food after previous use. They use only cold water to clean utensils, and this may contribute to post cooking contamination of the food. Ideally, all mothers should clean and sanitize utensils used for an infant or young child's food thoroughly to remove microorganisms found on it. In another way, a number of study participants (35%) also use bottles with teats to feed their children, which is difficult to clean and sanitize regularly in the context of current study setting. The use of bottles is an obviously harmful practice which increases the risk of food contamination and diarrheal diseases and should not be practiced at all.

In another way, 40% of mothers of the study area use their bare hand to feed the children. Further analysis of the result of the study indicated that 19% of them who feed their children with their bare hands reported they wash their hands using soap and water, which also contributes for the contamination of complementary foods and childhood diarrheal.

According to this finding, 29% of mothers store prepared food more than two hours to serve it two times and more. The place where this food stored determines the level of contamination. If it refrigerated the bacterial multiplication becomes very slow. If it does not refrigerated it should be eaten soon, no more

than 2 hours, before microorganisms have time to multiply. However, the finding of this study shown that only 8% of families store food in the refrigerator. However, when we talk about refrigerator the issue of proper operation and maintenance should be raised. Because, if there is a discontinuity in power supply or faulty of temperature control, it could be harmful for the food spoilage and contamination. Therefore, cooking small amounts of food which child can consume within a short period of time to avoid long periods of storage and spoilage is the first one choice and could solve the problems related to food storage practice especially in low-income families of slum areas.

This study has shown that 30% of mothers feed always fresh food immediately after preparation and 29% of mothers store food more than two hours to serve it another time. This can increase the risk of contamination and diarrheal among children due to the fact that microbial counts increased as food stored at room temperature and can reach its infective dose within two hours [19, 24]. Most of mothers store foods covered and few of them, however, stored in uncovered place and increases the level of food contamination [25]. Ideally, it is important to never store complementary food to prevent contamination [26]. But, especially in low socioeconomic households whose purchasing power is low, it is difficult to discard leftovers at every time food is prepared for the children. Rather it is important to educate mothers the principles of food hygiene practices.

The study also revealed that 58% of mothers always use reheating method after serving leftover. Reheating is easy to prescribe but could be difficult, especially for poor and busy mothers to practice. The reason for reheating food among our mothers is another critical issue to be considered, because most of them practice reheating simply to make foods warm to make it palatable, rather than to destroy harmful microorganisms. As previous studies shows, reheating foods before consumption can considerably reduce food contamination and the risk of illness [24, 27].

5. Limitations Of The Study

The mothers' food hygiene practices were determined based on self-reported data and it could overestimate the appropriate practices.

6. Conclusion

In general, food hygiene practices score of mothers was affected by factors like child age and media exposure. Usual handwashing practice with water and soap at all critical times were relatively low before eating food, before feeding children and before preparing food. The practice of food storage at an appropriate temperature was also low. Unhygienic child feeding methods, like bottle feeding and feeding by bare hand, are the identified undesirable food hygiene practices in the current study area.

The findings suggest the following recommendation for effective intervention strategies of infants and child feeding practices.

- Urban health care workers and other health care staffs need to educate mothers on how they improve hygienic handling practices, especially for infants under one year of age.
- Health care workers need to strengthen counseling mothers during growth monitoring sessions on complementary food handling.
- In addition to local media, education materials like posters and leaflets should focus on complementary food handling and hygienic preparation.
- Extra qualitative research is needed to explore the reason why some households did not practice appropriate food hygiene.

Declarations

Conflicts of interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Authors' contributions

Conceptualization: SB was generated the research area and developed the proposal, and performed data analysis and prepared manuscript: TB, MT were involved in proposal development and data analyses. SS, SH were involved in manuscript reviewing. All authors read and approved the final manuscript.

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Figures

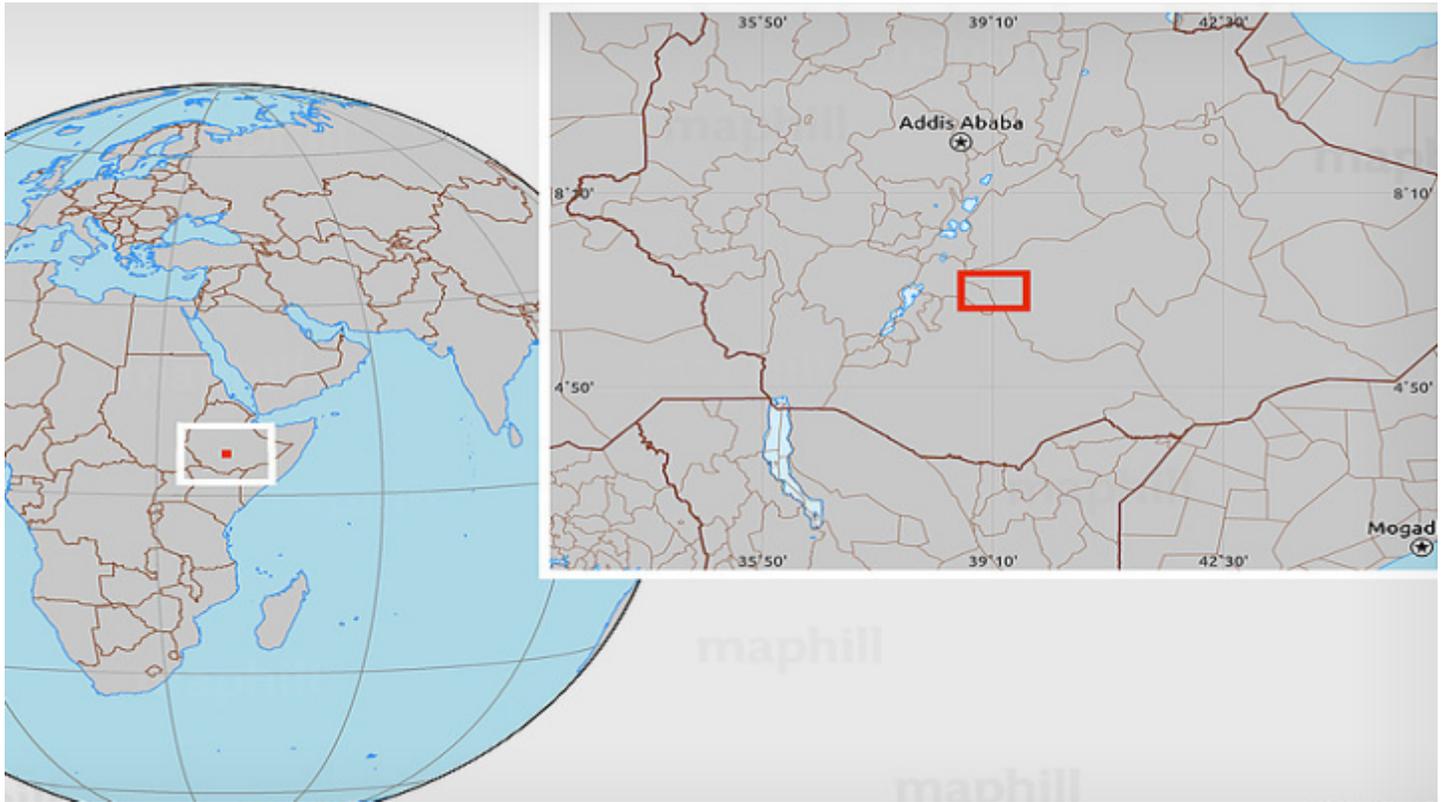


Figure 1

Location map of the study area

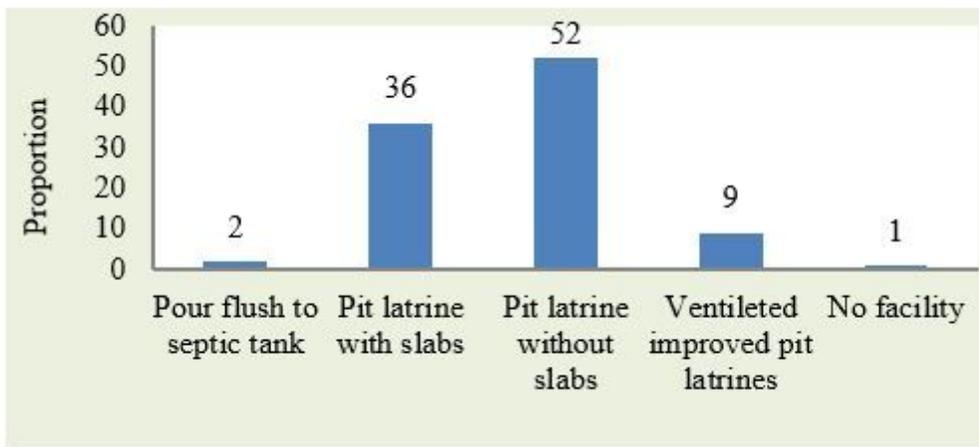


Figure 2

Different types of sanitation facilities of households having children in Robe town, Southeast Ethiopia

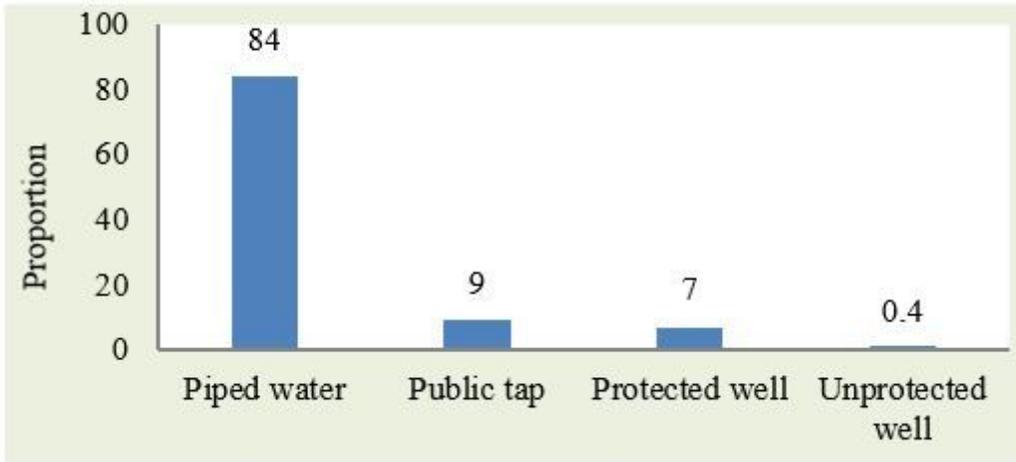


Figure 3

Sources of drinking water of households having children in Robe town, Southeast Ethiopia

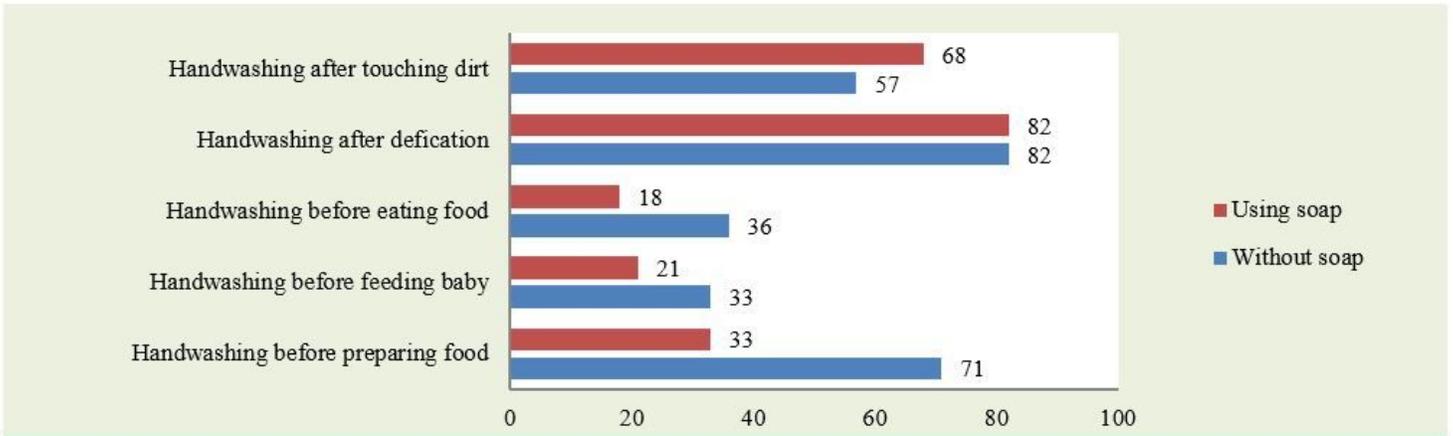


Figure 4

Hand washing practices at critical times with and without using soap among mothers or caregivers in Robe town Southeast Ethiopia

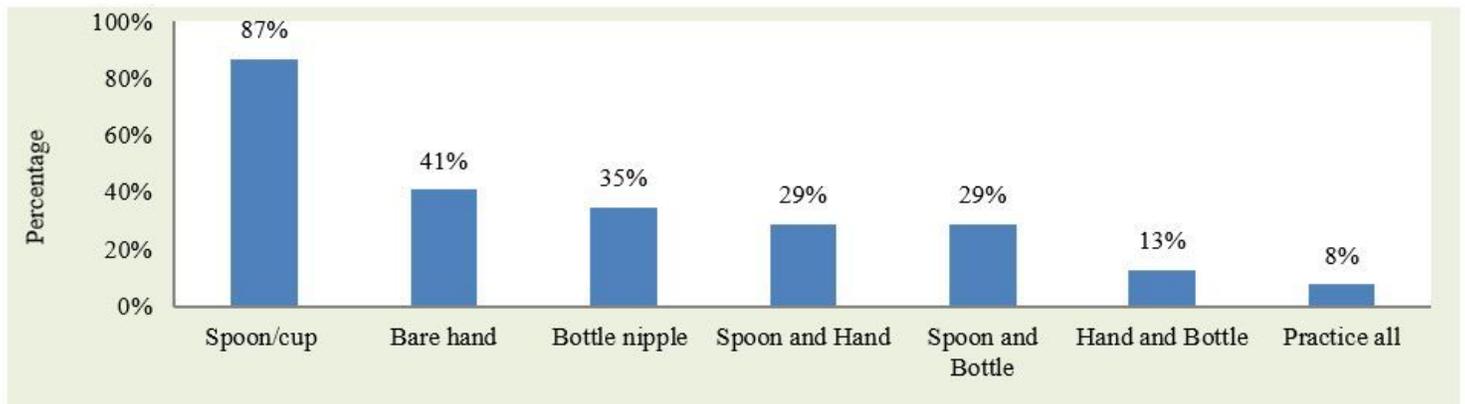


Figure 5

Methods used to feed their child among mothers of infants and children aged 6-23 months in Robe town
Southeast Ethiopia