

Hand Washing Practice and Food Insecurity are Associated With Undernutrition of Breastfeeding Mothers in Rural Ethiopia: A Cross-sectional Study

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ABSTRACT

BACKGROUND: Breastfeeding mothers are prone to undernutrition. However, factors contributing to maternal undernutrition are not exhaustively understood. Hence, this study aimed to determine prevalence of undernutrition among breastfeeding mothers and identify associated factors.

METHODS: A cross-sectional study was conducted among 606 breastfeeding mothers from selected rural districts in Oromia and Sidama regional states of Ethiopia. Data were collected through an interviewer-administered questionnaire. Nutritional status was assessed using body mass index (BMI) and mid-upper-arm-circumference (MUAC). Logistic regression analysis was used to identify factors associated with maternal undernutrition.

RESULTS: One out of ten breastfeeding mothers was found undernourished as determined by BMI (12.6%) and MUAC (10.7%). Mothers who did not practice hand washing after cleaning children's bottom were 2 and 3 times more likely to be undernourished compared to their counterparts, as measured by BMI (AOR = 2.29, $P = .002$) and MUAC (AOR = 3.03, $P < .001$), respectively. Mothers living in mildly or moderately food insecure households (AOR = 2.37, $P = .019$) were more than two times more likely to be undernourished as determined by MUAC. Mothers who breastfed children in the age range of 9 to 11 (AOR = 2.79, $P = .025$) or 12 to 23 (AOR = 2.57, $P = .018$) months were more than two and half times more likely to be undernourished as determined by BMI.

CONCLUSIONS: Maternal undernutrition is a medium-level public health problem in rural districts of Oromia and Sidama regional states in Ethiopia. The lack of hand washing practice after cleaning a child's bottom, household food insecurity and higher child age increased the odds of maternal undernutrition. Mothers should prioritize and improve their nutritional care as the age of their breastfed child increases. Nutrition programs in rural districts of Ethiopia should also aim to improve personal hygiene practices and food insecurity integrated with implementation researches to evaluate program's impact on nutritional status of breastfeeding mothers.

KEYWORDS: Breastfeeding mothers, Ethiopia, food insecurity, maternal undernutrition, hand washing, rural

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Background

Women are more vulnerable to food insecurity and malnutrition than men.^{1–4} Especially, breastfeeding mothers who are living in resource limited settings experience health and nutrition related challenges. So, their chance of being undernourished increases during breastfeeding period.⁵ The physiological changes, physical and psychological stress,⁶ increased nutritional needs, weakened immunity, increased susceptibility to infections and cultural food taboos^{7–10} are among the contributing factors to maternal undernutrition.

Although the nutritional status of Ethiopian women of childbearing age has not been extensively studied compared to other developing countries,^{11–13} a national-level report¹⁴ and a regional state specific study¹⁵ have documented that considerable proportions (22%–35%) of women of reproductive age

(WRA) in Ethiopia suffer from undernutrition. A study conducted on adult urban dwellers (71% female and 29% male) found that 12.9% of the participants were undernourished.¹⁶ Additionally, maternal BMI was associated with weight for height (WHZ), height for age (HAZ) and BMI for age Z-score (BAZ) values of their children. Moreover, healthy maternal nutritional status was positively associated with the nutritional status of children.^{17–20}

Despite researches conducted to assess the nutritional status of women of reproductive age in Ethiopia, less attention has been given to the nutrition of breastfeeding mothers. Furthermore, the nutritional status of breastfeeding mothers residing in rural districts of the country has been less studied. Moreover, factors contributing to maternal undernutrition have not been thoroughly identified, resulting in fewer tailored efforts



to tackle maternal undernutrition in an integrated and sustainable way. Therefore, this study aims to assess the prevalence of undernutrition among breastfeeding mothers from rural districts of two regional states in Ethiopia and identify contributing factors. The findings of this study contributed filling the evidence gap regarding the nutritional status of breastfeeding mothers in rural districts of Ethiopia and the contributing factors. Further, it aided in identifying focus areas to design nutrition sensitive interventions to improve the nutritional status of breastfeeding mothers in rural settings of Ethiopia.

Materials and Methods

Study area and design

The study was conducted in Sidama and Oromia regional states of Ethiopia. Three districts from Sidama and Oromia regional states were included in the study. Arsi Negele was the district included from the Oromia regional state while Dale and Wondo Genet were the districts from Sidama regional state. A community-based cross-sectional study design was applied and data were collected from May to July in 2018.

Sample size calculation and sampling

Sample size was calculated using the single population proportion formula²¹ with a 95% confidence level, 0.05 margin of error and a design effect of 1.5. A two-stage sampling technique was used to select the enumeration areas and breastfeeding mothers. In the first stage, four kebeles ($n=12$, the lowest unit in the administrative structure of Ethiopia) were selected randomly from each of the study districts ($n=3$) as enumeration areas. In the second stage, two activities were carried out. First, a house-to-house census was conducted to develop a list of eligible participants for each kebele, eligibles were households with breastfeeding mothers. Households with breastfeeding but pregnant mothers were excluded to avoid its effect on nutritional status assessment using BMI. Secondly, equal proportional allocation was used to select participants from each kebele. Consequently, a total of 606 breastfeeding mothers (25 from each kebele) were selected using a random sampling technique.

Data collection

The data collection questionnaire was consisted of sections for household food insecurity,²² anthropometry, past 2 weeks sickness history, maternal, breastfed child and household-level socio-demographic and economic characteristics as well as water, hygiene and sanitation (WASH) characteristics. The tool was pre-tested and necessary amendments were made before its application to the actual data collection. The data collectors underwent a three day training on basics of research methods, research ethics, data collection techniques and purpose of this study. Data were collected through interviewer administered questionnaires.

Weight, height and mid-upper arm circumference (MUAC) measurements were taken by the principal investigator who led, coordinated and supervised the data collection. Standing height in centimeter and weight in kilogram were measured using a SECA stadiometer and SECA weight scale, respectively. Mid upper arm circumference was measured in centimeter using standard MUAC-tape produced by world food program.

Data analysis

Data integrity was checked by considering the completeness and consistency of responses in subsequent questions. The principal investigator randomly checked completed questionnaires for completeness, marking any that were found incomplete. Once these activities were completed, the supervisor re-visited the questionnaires to ensure consistency. Furthermore, the consistency was checked by comparing responses to follow up questions with preceding questions. These activities were also checked by the principal investigator. Any inconsistency or incompleteness found were immediately corrected and, in some cases, corrected the next day. After the data were checked for completeness and consistency, they were coded, entered into statistical package for social sciences (SPSS) version 20 and cleaned. Frequencies, proportions, mean or median scores, standard deviations (SD), or interquartile ranges (IQR) were computed.

Body mass index was calculated by dividing weight in kilogram by squared height in meter, and was further categorized in to underweight, normal weight, and overweight. Measurements obtained for MUAC were categorized in to undernourished and not undernourished. The cutoffs used to categorize BMI and MUAC were based on the recommendations in a nutritional assessment book.²³

Data on water sources were dichotomized in to safe and unsafe. Safe water sources included tap or public stand pipes and protected well or spring. Unsafe water sources included unprotected well or spring, river and streams. Solid and liquid waste disposal practices were also dichotomized in to proper and improper disposal practices. Proper solid waste disposal referred to households that dispose in pit or burned it or used it as compost or fertilize or disposed in farms. Improper solid waste disposal referred to households that disposed of waste compound, at road side or throw into rivers. Proper liquid waste disposal referred to households that drain waste into latrine, separate pit or drain to garden. Improper liquid waste disposal referred to households that flushed waste in own residency compound or on roads.

Logistic regression analysis was conducted to identify factors associated with undernutrition among breastfeeding mothers. Bivariate logistic regression analysis was performed to select eligible variables for multivariable logistic regression analysis. Based on the result from the bivariate logistic regression analyses, variables with $P < .25$ were selected to be included in the

multivariable analysis.²⁴ Once the candidate variables were identified, all eligible variables were entered into the multivariate regression model using the forward stepwise enter method. Multivariable forward stepwise logistic regression analysis was applied to identify predictors of maternal undernutrition at statistical significance level of .05.

Results

Sociodemographic and economic characteristics: Maternal and household

Nearly all of the mothers (96.9%) were married. More than half of the mothers identified themselves as Sidama in Ethnicity (62.9%) and protestant (67.7%). The average age of the mothers was 25.63 (5.02) years. Two-thirds (66%) of the mothers completed primary education. Eight out of ten (79.8%) mothers were housemakers.

Almost all of the households (93.6%) were male headed. About 60% of the households had five or more members. The median (IQR) for estimated household level annual income was 7700 (3000, 15 700) Ethiopian Birr (ETB) or \$251 (98, 513). In more than half of the households (58%) women alone decided on the purchase of household daily needs (Table 1).

Water, Hygiene, and Sanitation Conditions and Practices

Nearly all of the breastfeeding mothers (92.4%) reported that their households fetch water from safe sources. In this case, it means safe in terms of the operational definition we used for data management, not that the households, where breastfeeding mothers who participated in this research reside, fetch water from improved water sources. For majority (75%) of breastfeeding mothers, the maximum time it took to fetch water was ≤ 30 minutes with median (IQR) of 20 (9, 75). This show that the study areas are with nearby potential water sources. The majority of the households (94%) fetched less than 15 L of water per person per day in 24 hours before the date of data collection. This could be an indication for possible water shortage to meet the percapita water requirement. Also, nine out of ten households (90%) practiced none of household-level drinking water treatment options. Majority of the households practiced proper solid waste disposal (86.5%) and liquid waste disposal (62.9%) disposal. Nearly all of the households (98.3%) reported that they owned toilet facility. Nine out of ten (90%) breastfeeding mothers use water with soap or ash for hand washing. The majority of mothers practice hand washing after visiting toilet (84.5%), after cleaning child's bottom (76.2%), before cooking (94.6%), and before every meal (95%) (Table 2).

Nutritional Status of Breastfeeding Mothers

Median scores for height, weight, BMI and MUAC of breastfeeding mothers were 156.5 (153, 160), 50.5 (46, 56), 20.5 (19, 22) and 24.5 (23, 26), respectively. About 12.6% of the breastfeeding

Table 1. Sociodemographic and economic characteristics of the breastfeeding mothers and households (n=606).

MATERNAL CHARACTERISTICS	N	%
<i>Age in completed years</i>		
≤ 26	363	59.9
≥ 27	243	40.1
<i>Marital status</i>		
Married	587	96.9
Single/Divorced/Widowed	19	3.1
<i>Ethnicity</i>		
Sidama	381	62.9
Oromo	187	30.9
Wolayta	16	2.6
Amhara	11	1.8
Others ^a	11	1.8
<i>Educational status</i>		
No formal education	119	19.6
Grades 1-4	160	26.4
Grades 5-8	236	38.9
Grades 9 and above	91	15.0
<i>Religion</i>		
Protestant	410	67.7
Muslim	164	27.1
Orthodox/Catholic	32	5.3
<i>Occupation</i>		
Housemaker	482	79.5
Merchant	50	8.3
Farmer	47	7.8
Others	27	4.5
<i>Did the mother get sick in the last 2 weeks?</i>		
No	396	63.5
Yes	210	34.7
HOUSEHOLD CHARACTERISTICS		
<i>Family size</i>		
≥ 5	363	59.9
≤ 4	243	40.1
<i>Who is the head of the household?</i>		
Female	23	3.8
Male	567	93.6

(Continued)

Table 1. (Continued)

MATERNAL CHARACTERISTICS	N	%
<i>Estimated household annual income in Ethiopian birr</i>		
≤5000/\$163	276	45.5
50001-10 000/\$164-326	121	20.0
10001-15 000/327-490	65	10.7
15001-20 000/\$491-653	45	7.4
>20000/>\$653	99	16.3
<i>Who usually makes decisions about making purchase for daily household needs?</i>		
Both wife and husband	186	30.7
Wife/Woman	352	58.2
Husband/other	68	11.2
<i>Number of under-five children in the household?</i>		
≥2	323	53.3
1	283	46.7
<i>Agricultural land ownership in hectare</i>		
<1	305	50.3
1-2	232	38.3
>2	69	11.4
<i>Household food insecurity</i>		
Food Secure	169	27.9
Mild or moderate food insecurity	259	42.7
Severe food insecurity	178	29.4

^aKembata and Hadiya.

mothers were identified undernourished using BMI and 10.7% were identified undernourished using MUAC. This means that approximately one out of ten breastfeeding mothers was found being undernourished based on either BMI 12.6% or MUAC 10.7% (10.7%) (Figure 1).

Predictors of Nutritional Status of the Breastfeeding Mothers

Characteristics associated with maternal nutritional status as measured by BMI or MUAC were identified using multi-variable stepwise forward regression analyses. Accordingly, the following factors were considered: household head's gender, maternal occupation, marital status, time taken to fetch water-round trip including waiting time, household-level drinking water treatment practice, hand washing practice after visiting toilet or cleaning the child's bottom, liquid waste disposal practice-proper or improper, estimated annual income of households, livestock ownership (cow or chicken)

Table 2. Water, hygiene and sanitation condition and maternal hand washing practice (n=606).

VARIABLES	N	%
Water source		
Unsafe	46	7.6
Safe	560	92.4
Time to fetch water, in minutes		
≤30	454	74.9
>30	152	25.1
Water fetched last 24 h in liters		
<15	571	94.2
≥15	35	5.8
Practice household-level drinking water treatment		
Yes	63	10.4
No	543	89.6
Hand washing occasions		
After visiting toilet	512	84.5
After cleaning child's bottom	462	76.2
Before cooking	573	94.6
Before breast feeding	347	57.3
Before every meal	576	95.0
Hand washing materials		
Water only	62	10.2
Water with soap/ash/other ^a	544	89.9
Solid waste disposal		
Improper	82	13.5
Proper	524	86.5
Liquid waste disposal		
Improper	225	37.1
Proper	381	62.9
Toilet facility		
No toilet	10	1.7
Toilet with no shade and slab	372	61.4
Toilet with shade and slab	215	35.5
Ventilated improved toilet	9	

^aFlour, fermented flour, sand, soil, fermented.

and household food insecurity. Those factors became eligible for multivariable logistic regression against maternal under-nutrition by MUAC (Table 3).

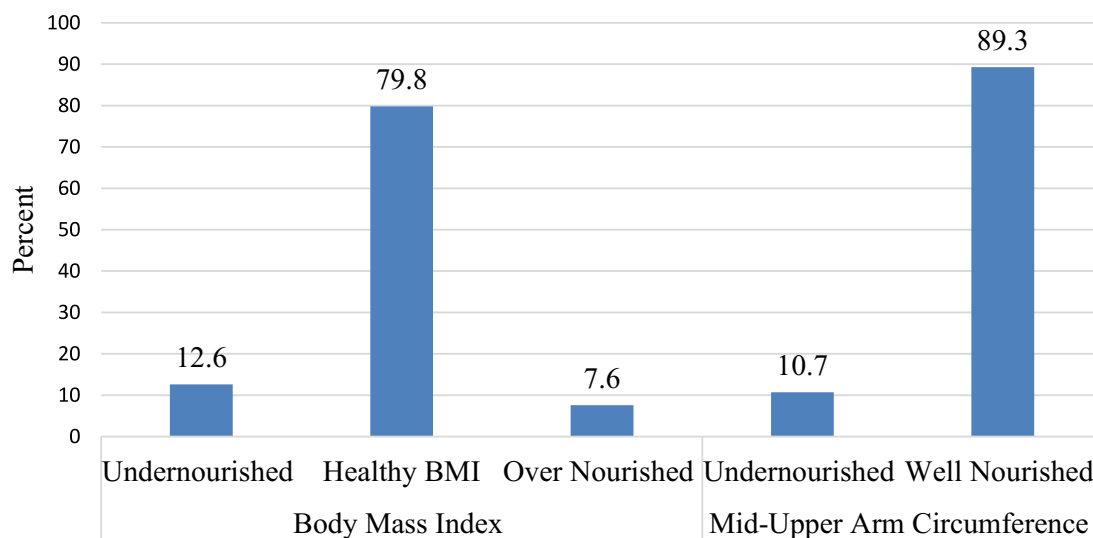


Figure 1. Percentage distribution of nutritional status of lactating mothers as identified by body mass index and mid-upper arm circumference (n=606).

On the other hand, water source-safe or unsafe, household level drinking water treatment, hand washing practice after cleaning the child's bottom, agricultural land or livestock ownership, maternal educational achievement, household annual income, age of the child being breastfed-in months, maternal age-in completed years, and household food insecurity became eligible for multivariable logistic regression analysis to identify predictors of maternal undernutrition as identified by BMI (Table 4).

On multivariable logistic regression, hand washing practice of the mothers after cleaning the child's bottom, age of being breastfed child and household food insecurity were found being associated with undernutrition among breastfeeding mothers. Mothers who did not practice hand washing after cleaning their children's bottom were three times more likely to be undernourished as identified by MUAC [AOR=3.028 (95% CI: 1.678, 5.464), $P < .001$] and two times more likely to be undernourished as identified by BMI [AOR=2.292 (95% CI: 1.364, 3.850), $P = .002$] compared to mothers who practice hand washing after cleaning their children's bottom. Mothers who breastfeed children in the age range of nine to eleven months [AOR=2.79 (95% CI: 1.14, 6.83), $P = .025$] and twelve to twenty three months [AOR=2.57 (95% CI: 1.17, 5.62), $P = .018$] were more than two and half times likely to be undernourished, as identified by BMI, compared to mothers who breastfeed children aged six to eight. Breastfeeding mothers who lived in households with mild or moderate food insecurity were more than two times [AOR=2.37 (95% CI: 1.15, 4.86), $P = .019$] more likely to be undernourished (identified using MUAC) than mothers who lived in food secure households (Table 5).

Discussion

Breastfeeding is a period during which mothers are prone to undernutrition, and multiple factors at different levels may

Table 3. Bivariate logistic regression analysis on MUAC of breastfeeding mothers.

CHARACTERISTICS	COR (95% CI)	P-VALUE
Drinking water treatment		
No	0.522 (0.257, 1.06)	0.072
Yes	Ref	
Hand washing after visiting toilet		
No	1.938 (1.050, 3.579)	0.034
Yes	Ref	
Hand washing after cleansing child's bottom		
No	2.216 (1.29, 3.80)	0.004
Yes	Ref	
Hand washing before cooking		
No	4.024 (0.541, 29.95)	0.174
Yes	Ref	
Liquid waste disposal		
Improper	0.618 (0.349, 1.09)	0.098
Proper	Ref	
Infant and young child got sick in the last 2 wk		
No	Ref	
Yes	1.585 (0.943, 2.66)	0.082
Cow ownership		
No	0.666 (0.388, 1.15)	0.141
Yes	Ref	

(Continued)

Table 3. (Continued)

CHARACTERISTICS	COR (95% CI)	P-VALUE
Chicken ownership		
No	0.559 (0.319, 0.979)	0.042
Yes	Ref	
Household food insecurity		
Food secure	Ref	
Mild/Moderate food insecurity	2.319 (1.15, 4.69)	0.019
Severe food insecurity	1.616 (0.740, 3.53)	0.229
Time to collect water		
<30 minutes	Ref	
≥30 minutes	1.664 (0.99, 2.79)	0.054
Maternal age (y)		
≤26	Ref	
≥27	0.634 (0.36, 1.10)	0.107
Marital status		
Married	Ref	
Single/Divorced/Widowed	3.137 (1.092, 9.013)	0.034

Table 4. Bivariate logistic regression on BMI of breastfeeding mothers.

CHARACTERISTICS	COR (95% CI)	P
Water source		
Unsafe	0.458 (0.139, 1.52)	0.20
Safe	Ref	
Water treatment		
No	0.578 (0.293, 1.14)	0.114
Yes	Ref	
Hand washing after cleansing child's bottom		
No	0.430 (0.260, 0.711)	0.001
Yes	Ref	
Livestock ownership		
No	0.680 (0.402, 1.149)	0.149
Yes	Ref	
Child age in completed months		
6-8	Ref	
9-11	0.393 (0.182, 0.852)	0.018
≥12	1.074 (0.593, 1.944)	0.814

(Continued)

Table 4. (Continued)

CHARACTERISTICS	COR (95% CI)	P
Household food insecurity		
Food secure	Ref	
Mild/Moderate food insecurity	1.487 (0.820, 2.69)	0.192
Severe food insecurity	1.062 (0.541, 2.09)	0.862
Maternal age in completed years		
≤26	0.557 (0.330, 0.941)	0.029
≥27	Ref	

contribute to it. In the current study, the nutritional status of breastfeeding mothers was assessed using BMI and MUAC. Additionally, maternal, household, household related agricultural, and water, sanitation and hygiene (WASH) characteristics were considered to identify the multi-level factors contributing to maternal undernutrition. The findings of the present study revealed that 12.6% (using BMI) and 10.7% (using MUAC) of the breastfeeding mothers were undernourished. This prevalence is comparable with results of different studies. A 17.4% prevalence of maternal undernutrition was documented in Arbaminch,²⁵ 17.7% in Moyale,²⁶ 13% in Samare²⁷ and 14.2% in Hula¹⁷ districts of Ethiopia. However, it is much lower than the prevalence (50.6%) reported for the undernutrition among orthodox lean fasting practicing lactating mothers in rural Tigray.²⁸ The significant difference could be attributed to weight loss resulting from abstaining from any food and water for at least about six to twelve hours in a day for more than two hundred days within a year, coupled with dominant plant source foods dominated meals and prevalent food insecurity, which affect the quality of their diet despite nursing their children. The World Health Organization (WHO)²⁹ classifies underweight (by BMI) based on prevalence as low (5%-9%), medium (10%-19%), high (20%-39%) and very high (≥40%) public health problem.²⁷ Accordingly, the prevalence of maternal undernutrition reported by this study is a medium-level public health problem among breastfeeding mothers residing in the rural areas where this research was conducted. This calls for the identification of contributing factors for tailored interventions to reduce the magnitude below the tolerable threshold.

Furthermore, in addition to determining the prevalence of undernutrition among breastfeeding mothers, this study revealed an association between maternal personal hygiene practices and their nutritional status. Maternal hand washing practice after cleaning the child's bottom was associated with maternal undernutrition as determined by BMI and MUAC. Mothers who did not practice hand washing after cleaning the child's bottom were more likely to be

Table 5. Predictors of nutritional status of the breastfeeding mothers (n=606).

CHARACTERISTICS	CATEGORY	AOR (95% CI)	P
Undernourished as determined by MUAC			
Hand washing after cleaning child's bottom	No	3.03 (1.68, 5.46)	0.000
Household food insecurity	Mild/Moderate	2.37 (1.15, 4.86)	0.019
Undernourished as determined by BMI			
Hand washing after cleaning child's bottom	No	2.29 (1.36, 3.85)	0.002
Child age in months	9-11	2.79 (1.14, 6.83)	0.025
	12-23	2.57 (1.17, 5.62)	0.018

Abbreviations: BMI, body mass index; MUAC, mid-upper arm circumference.

undernourished as identified by BMI and MUAC. Similar to the finding of the this study, a study conducted in rural provinces of Nepal also found an associations between personal hygiene (hand washing practice after cleaning the baby's bottom and overall cleanliness of the mother's hands) and nutritional status of the mothers.³⁰ Water, hygiene and sanitation are key components of human life and have been documented to be associate with nutritional status.³¹⁻³⁴ In fact, the poor maternal personal hygiene practices may lead to contamination by pathogenic microorganisms, which can result in communicable diseases and subsequent maternal undernutrition due to appetite loss or decreased food intake, metabolic alteration and loss of nutrients. Therefore, this research emphasizes the need to consider child caring practice from a WASH perspective not only for the benefit of the growing children, but also for maternal safety, health and good nutrition status.

Sustaining good nutrition practices and healthy nutritional status are challenges that all stakeholders should focus on to ensure that desired health outcomes continue for long period. In the present study, the age of breastfed children was found being associated with undernutrition (as identified using BMI) among breastfeeding mothers. Mothers with children in the age range of nine to eleven or twelve to twenty-three months had an increased probabilities of being undernourished, as identified using BMI. The higher likelihood of undernourishment for mothers with children in the upper age category may be due to depletion of their nutrition reserves, non-sustainability of cares provided to breastfeeding mothers throughout the breastfeeding period, and the increased needs of nutritional needs of the growing children.³⁵ Food insecurity was also associated with undernutrition (identified using MUAC) among breastfeeding mothers. Against breastfeeding mothers' increased nutritional requirement, food insecurity is a condition that negatively affects energy and nutrient supply. Individuals residing in food secured households tend not to meet their nutritional requirements. Similar to the

finding of this study, a study from BurkiFaso reported an increase in magnitude of maternal undernutrition during the season of food shortage.¹⁸

The application of findings of this study for intervention and further interpretation continued programatic and investigation projects should consider its strengths and limitations. To support this, assessing nutritional status of breastfeeding mothers from rural areas using more than one nutritional indicator and considering multiple livelihood issues in the statistical model to identify factors contributing to maternal undernutrition can be considered as strengths. However, the cross-sectional nature of the study, usage of a single 24 hours period (a day before the survey) to recall data on the amount of water fetched, and openlization of water source (safe vs unsafe) and waste disposal practices (proper vs improper) might be the limitations.

Ensuring proper nutrition for breastfeeding mothers is one of the important ways to break the intergenerational cycle of malnutrition and to positively impact the nutritional outcomes of the future generation. Although the nutrition of women has been considered in food and nutrition policy³⁶ and national nutrition program³⁷ of Ethiopia, this study revealed that a considerable proportion of breastfeeding mothers in rural districts of Ethiopia were challenged to achieve a healthy or good nutritional status, and WASH and food insecurity contributed to maternal undernutrition.

Conclusions

The study findings indicated that underweight is a medium-level public health problem among breastfeeding mothers in rural settings of Ethiopia. Mild or moderate household food insecurity has a negative impact on maternal MUAC. Not practicing hand washing after cleaning child's bottom increased the likelihood of maternal undernourishment. Overall, the findings emphasized the association between maternal undernutrition and living condition indicators such as WASH and food insecurity. Additionally, mothers with older children are more susceptible to undernutrition.

In rural settings of Ethiopia, nutrition programs integrated with operational or implementation researches should prioritize activities that can improve livelihoods supported by behavioral change communication, to enhance the nutritional status of breastfeeding mothers.

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Author Contributions

A.K.D and K.A. conceptualized and designed the study and did the supervision of data collection; A.K.D., B.B.D., and A.M. did data analysis, interpretation of results and manuscript drafting; A.K.D., K.A., B.B.D., and A.M. reviewed the manuscript. All authors read and approved the final manuscript.

Consent for Publication

Not applicable.

Data Availability

The datasets used and/or analyzed are available from the corresponding author on reasonable request.

Ethical Approval

This study adhered to the guidelines outlined in the Declaration of Helsinki and all procedures involving human subjects receive approval from the institutional review Board of Hawassa University [Ref. No.: IRB/027/10]. The study purposes and procedures were explained to the participants by data collectors using the local languages. Participation was voluntary. Verbal informed consents were obtained from all subjects. Consents were witnessed and documented formally. All mothers were informed of their nutritional status based on their respective MUAC results. Mothers identified as undernourished were provided counseling on key messages for the nutrition of lactating mothers, while well-nourished mothers were congratulated and advised to maintain their nutritional status.

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