ECRONICON OPEN ACCESS

EC NUTRITION
Research Article

Minimum Meal Frequency and its Association with Underweight among Non-Breastfed Infants and Young Children Aged 6 to 23 Months in Hawassa City, Ethiopia

Lidetash Wolde[1]*, Robel Yirgu[2] and Solomon Shiferaw[2]

[1]Department of Public Health, Dawuro Tarcha Campus, Wolaita Sodo University, Tarcha, Ethiopia

[2]Department of Public Health Nutrition and Dietetics, School of Public Health, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia

***Corresponding Author:** Lidetash Wolde, Department of Public Health, Dawuro Tarcha Campus, Wolaita Sodo University, Tarcha, Ethiopia.

Received: September 01, 2025; **Published:** November 03, 2025

Abstract

Background: The increasing practice of non-breastfeeding is a major concern, particularly in urban areas. Meal frequency measurement has different standards among non-breastfed children. However, the primary focus of nutrition studies has been on breastfeeding, leading to a lack of comprehensive data on meal frequency and its association with underweight status among non-breastfed infants.

Objective: This study was aimed at assessing the minimum meal frequency and its association with underweight among non-breastfed infants and young children aged 6 to 23 months in Hawassa city, Ethiopia, from May 12, 2024, to July 08, 2024.

Methods: A community-based cross-sectional study was conducted among 423 non-breastfed children aged 6 to 23 months in Hawassa City. First, the estimation was made to know whether there is an adequate sample of non-breastfed or not in the community. Then, the sample was allocated proportionally to all sub-cities based on population size. After that, one of the sub-cities was chosen at random, and the first non-breastfed child from that sub-city was identified. Finally, the collection process began with the identified child and proceeded using consecutive sampling. Data was collected using Kobo Collect-enabled mobile phones, an interviewer-administered questionnaire, and a weight scale. The association between underweight and explanatory variables was assessed using binary logistic regression.

Result: A total of 420 respondents participated in the study. The percentage of non-breastfed children who fulfilled minimum meal frequency (MMF) was 62.9%, and the prevalence of underweight was 10%. Non-breastfed children who did not fulfill the MMF were 5.2 times more likely to be underweight compared to those who met the requirement per day (p = <.001, AOR; 5.2, 95% CI: 2.5, 11.0). Compared to the children whose mothers' age was above 35, those children whose mothers' age was between 15 and 24 and between 25 and 34 had a lower risk of being underweight (p = 0.04, AOR; 0.15, 95% CI: 0.02, 0.93) and (p = 0.03, AOR; 0.15, 95% CI: 0.03, 0.8), respectively.

Conclusion: The findings of our study indicated that about three out of five children were fed with meal frequency according to World Health Organization recommendations. Adherence to the recommendation of meal frequency might reduce the risk of being underweight. Studies incorporating qualitative approaches might be helpful in generating in-depth information to address the issue related to the causes of having lower meal frequency among non-breastfed IYC.

Keywords: *Non-Breastfed; Underweight; Minimum Meal Frequency; Non-Breastfed, Hawassa*

Abbreviations

ANC: Antenatal Care; EDHS: Ethiopian Demographic and Health Survey; EMDHS: Ethiopian Mini Demographic and Health Survey; HEW: Health Extension Workers; IYC: Infants and Young Children; IYCF: Infant and Young Child Feeding; MAD: Minimum Acceptable Diet; MAM: Moderate Acute Malnutrition; MDD: Minimum Dietary Diversity; MMF: Minimum Meal Frequency; MMFF: Minimum Milk Feeding Frequency; SAM: Severe Acute Malnutrition; SSA: Sub-Saharan Africa; UNICEF: Unite Nations Children's Fund; WHO: World Health Organization

Introduction

The nutritional status of infants and young children (IYC) under two years is directly affected by their feeding practices [1]. To assess IYC feeding practices, the World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) introduced a number of complementary feeding indicators. Among these was the minimum meal frequency (MMF). MMF measurement in non-breastfed infants follows different recommendations both in content and frequency. For breastfed IYC, it measures the percentage of IYC aged 6-23 months who consumed solid, semi-solid, or soft foods at least two times for those aged 6-8 months and three times for those aged 9-23 months in the past 24 hours. For non-breastfed IYC, it measures the percentage of non-breastfed children 6-23 months of age who were fed solid, semi-solid, or soft foods, including milk feeds, at least four times in the previous 24 hours [2]. Non-breastfed IYC is those who did not receive breast milk in the past 24 hours for any reason [2,3].

Worldwide, improper feeding practices during the first two years of life are responsible for over two-thirds of child deaths from both under- and over-nutrition [4]. Underweight, a form of under-nutrition, is defined as low weight-for-age [5]. Globally, 99 million under-five children were underweight, with almost one-third of them living in Africa [6]. The magnitude of underweight in Ethiopia was 23.3% in 2016 [7] and 21% according to the Ethiopian Mini Demographic and Health Survey (EMDHS) 2019 [8]. Numerous factors, such as the child's gender, birth size, mother's educational attainment, household wealth index, antenatal care (ANC) visits [9], child age, type of toilet facility [10], husband's education [11], and mother's age [12] influence underweight.

There are efforts underway in Ethiopia to implement a multi-sectorial nutrition intervention plan. The Ethiopian government developed the Seqota Declaration in 2015, a 15-year commitment to eradicate child malnutrition in Ethiopia by 2030 [13]. Additionally, in order to end hunger by 2030, Ethiopia supported the National Nutrition Program II in 2016, which offers a framework for the coordinated implementation of nutrition interventions. One of the main interventions under NNP II to reduce under-nutrition was optimal complementary feeding [14]. Furthermore, in 2018, National Food and Nutrition Policy was also developed to addresses immediate and underlying causes of malnutrition in Ethiopia, focusing on prevention of under-nutrition [15]. However, in Ethiopia only 45 per cent of IYC aged 6-23 are fed at least three times a day in 2022 [16]. EMDHS 2019 reported that the percentage of non-breastfed IYC who met the MMF increased marginally from 49% to 51% since 2016 [8].

A child's energy intake can be inferred from the minimum meal frequency [17]. One of the reasons for the indicator MMF was that eating meals/snacks less frequently than advised can impair total calorie and micronutrient intake, resulting in poor weight gain [18]. Breastfeeding has many advantages and is advised for up to two years or beyond [38]; however, there has been higher practice of non-breastfeeding in Ethiopia, particularly in urban areas. This is due to mothers working conditions and lack of a breastfeeding place at the working area. For instance, only 5.28% of the children were not breastfeeding in 2016 [39], but about 47% of mothers terminate breastfeeding before 24 months in 2023 [40]. Despite increasing practice of non-breastfeeding, little attention is given to ensuring that these children are getting the optimal meal. In Ethiopia, various studies were undertaken to investigate MMF among IYC. Nonetheless, MMF measurement has different standards among non- breastfed IYC and hasn't been measured among these IYC. In addition, never or interrupted breastfeeding with inappropriate feeding practices increases the likelihood of malnutrition and mortality [4], and studies have shown breastfeeding has a protective effect on underweight [41]. Similarly, many studies investigated the prevalence of underweight

among children under- five. However, none of the studies indicated the prevalence of underweight based on the child's breastfeeding status. Breastfeeding has many advantages and is advised for up to two years or beyond [38]; however, there has been higher practice of non-breastfeeding in Ethiopia, particularly in urban areas. For instance, only 5.28% of the children were not breastfeeding in 2016 [39], but about 47% of mothers terminate breastfeeding before 24 months in 2023 [40]. Despite increasing practice of non-breastfeeding, little attention is given to ensuring that these children are getting the optimal meal. In Ethiopia, various studies were undertaken to investigate MMF among IYC. Nonetheless, MMF measurement has different standards among non-breastfed IYC and hasn't been measured among these IYC. In addition, never or interrupted breastfeeding with inappropriate feeding practices increases the likelihood of malnutrition and mortality [4], and studies have shown breastfeeding has a protective effect on underweight [41]. Similarly, many studies investigated the prevalence of underweight among children under- five. However, none of the studies indicated the prevalence of underweight based on the child's breastfeeding status.

Objectives of the Study

To examine the prevalence of MMF and its association with underweight status among non-breastfed IYC aged 6 to 23 months in Hawassa city.

Materials and Methods

Study area and period

Our study was carried out in Hawassa City, Sidama National Regional State, and Southern Ethiopia. Hawassa city is located 273 Km away from Addis Ababa, the capital of Ethiopia. In 2024, the city had an estimated total population of 415,816 and the total number of children aged 6 to 23 months in Hawassa City was 14,595. The city had 8 sub-cities, four public hospitals (1 comprehensive specialized hospital, 1 general hospital, and 2 primary hospitals), six private hospitals, seven health centers, 47 private clinics, and 15 health posts (Hawassa city health department). According to estimates, the city's non-breastfed population was 771(5.3%). This study was conducted from May 12, 2024 to July 08, 2024.

Study design: A community-based cross-sectional study design was used.

Source population: All non-breastfed infants and young children aged 6-23 months residing in Hawassa City in 2024.

Study population: All selected non-breastfed infants and young children aged 6-23 months living in Hawassa City.

Inclusion criteria: Infants and young children aged 6-23 months:

- Who didn't breastfeed in the past 24 hours during the data collection.
- Who never started breastfeeding, and were not breastfed for a long time (started but stopped).

Exclusion criteria: The children were excluded when they had the following conditions:

- The child was on ready-to-use therapeutic food and hospital visit in the last week.
- The mother/caregiver was absent from the household for those who were on breastfeeding but not breastfed in the previous 24 hours.
- The house is closed after three visits for those who either never started or started but ceased breastfeeding.
- The mother/caregiver was unable to raise a child by herself.

Sample size determination

The sample size was calculated using a single population proportion formula, with a proportion of 50% for this study. It is by considering 50% of children will be underweight. This is because no studies were undertaken specifically among non-breastfed children aged 6 to 23 months regarding our topic, and the sample size for the other specific objectives was also not determined independently for the same reasons.

$$n = \frac{(Z\alpha/2)^2 p(1-p)}{d^2}$$

$$n = \frac{(1.96)^2 (0.5)(0.5)}{(0.05)^2} = \frac{(3.8416)(0.25)}{0.0025} = 384$$

= 384 +38.4 = 423 with consideration of 10% contingency to non-responders

Where

n - Required sample size.

$Z_{1-\alpha/2}$ - Critical value for normal distribution at 95% confidence level which equals to 1.96.

P - The estimate of proportion = 0.5, taking into account that 50% of children will be underweight.

d - Possible margin of sampling error tolerated which is 5%.

Sampling procedure

The study was conducted in all eight sub-cities. To obtain individual sample units or subjects at the household level, the following steps were followed:

- First, the estimation was made to know whether there is an adequate sample of non-breastfed or not in the community. This was needed before conducting the survey since non-breastfed are rare populations, and the number of non-breastfed in the city was unknown. To estimate the number, the total number of children aged 6 to 23 months in Hawassa city = 3.51% = 14,595 (Hawassa city health department) and the magnitude of non-breastfeeding in Ethiopia = 5.28% (39) were used. Based on these data, an estimated number of non-breastfed children in the city was 771 = the total number of children aged 6 to 23 months in Hawassa city (14595) * the prevalence of non-breastfeeding in Ethiopia (0.0528).
- Next, the calculated sample size (423) was divided and proportionally allocated to all eight sub-cities based on their total population.
- After that, one of the sub-cities was chosen at random, and the first non-breastfed child from that sub-city was identified.
- Finally, the collection process began with the identified child and proceeded using consecutive sampling. The use of this sampling method was necessary because this study can't have a sampling frame. This is also because this study included those IYC who were temporarily not breastfed for any reasons in the previous 24 hours. Children who were identified as not-breastfed in the previous 24 hours during identification time may begin breastfeeding when the collectors come back to collect the actual data. Therefore, the date of data collection and the identification of children who are not breastfed should coincide.

Dependent variable

Underweight: Weight-for-age z-score is less than −2 SD from the median of the reference population (65).

Independent variables

Socio-demographic characteristics

- Child sex.
- Parental characteristics (marital status, education level, occupation and mother's religion and age).
- Household characteristics (family size and wealth index).

The underlying causes:

Food access

- Food insecurity.

Feeding and care practices for children

- History of breastfeeding status (never started, started but ceased or not breastfed in the previous 24hr).

Maternal and child health services and household environment

- ANC visits
- Vaccination
- Vitamin A supplementation
- Place of delivery
- Hygienic practice
- Household toilet facility and the source of drinking water.

Immediate causes:

Illness/disease experience

- Diarrhea episodes/fever.

Dietary intake

- Meal frequency
- Dietary diversity
- Minimum acceptable diet.

Data collection procedures

Data were collected from mothers and caregivers of children 6-23 months of age using an interviewer-administered questionnaire face-to-face. WHO/UNICEF's interviewer-administered structured standard questions were used to collect data for infant and young child indicators [18] and questions for socio-demographic characteristics and other explanatory variables were adapted from other similar studies [8,30,36,37,42] with some modifications to fit the local context. The questionnaire was translated into the local language, Amharic, for data collection. The weight of the children was measured using a calibrated digital scale, GST-221 (INDIA), by removing heavy clothing and double-checking the weight. The digital scale has a maximum load capacity of 180 kg. The mother and child were weighed together, and the mother's weight was subtracted to get the child's weight. The data were collected and supervised by 3 diploma-holder nurses and 1 BSc-holder healthcare professional, respectively. The Kobo Collect enabled mobile phones were used to gather the data.

Operational definitions

- **Non-breastfed infants and young children:** They were infants and young children who were not breastfed in the past 24 hours [2].
- **Minimum meal frequency:** Non breastfed children 6-23 months of age who receive both milk feeds and solid/semi-solid feeds at least 4 times in the past 24 hours. Milk feeds include liquid milk products such as infant formula, cow milk or other animal milk and yogurt [17].
- **Improved drinking water sources:** This includes drinking water from pipes, protected dug wells or springs, boreholes or tube wells, rainwater, and packaged or delivered water [51].
- **Unimproved toilet facilities:** The use of pit latrines without a slab or platform and flush and pour-flush toilets discharging to an open drain [51].
- **Household food security status:** Was assessed by nine food insecurity questions that hold the occurrence of food insecurity in the previous month. It was measured using the Household Hunger Scale and categorized as non/light hunger, moderate hunger, and severe hunger [52].
- **Household wealth index:** Was assessed by fifteen household wealth index questions and created by using principal component analysis (PCA). A household wealth score was classified into lowest, middle, and highest [8].

Data management and analysis procedure

The data were collected using Kobo Collect and were exported to the Statistical Package for Social Sciences (SPSS) version 27 for cleaning and analysis.

Descriptive statistics, such as frequencies and proportions, were used to describe data. Principal component analysis (PCA) was used to construct a household wealth index, and a household wealth score was classified into lowest, middle, and highest. WHO Anthro software version 3.2 was used for classification of child nutritional status based on weight-for-age. The child was categorized as underweight if weight-for-age < -2 z-score and no underweight if weight-for-age ≥ -2 z-score (WHO standards) [50]. The percentage of non-breastfed IYC who fulfilled minimum meal frequency (MMF) was calculated by dividing the number of non-breastfed children aged 6 to 23 months who met the MMF by the total number of surveyed children aged 6 to 23 months and multiplying it by 100. The MMF was dichotomized and coded as 1 and 0, representing those who met and those who did not meet MMF. Binary logistic regression was used to determine the association between the outcome and explanatory variables. Models were fitted to adjust for confounding variables and determine the association. The p-value of less than 0.25 was used to select candidate variables in bivariate analysis. The goodness-of-fit for the final regression models was checked by the Hosmer-Lemeshow goodness-of-fit test, which yielded a p value of p of 0.89. To declare statistical significance, a p-value of less than 0.05 was used. Adjusted odds ratio and 95% confidence interval were used to explain the association.

Data quality assurance

Data collection tools were initially prepared in English and translated into Amharic and then back to English to check for their consistency. Training on the tool was given to the data collectors and supervisor for a day. A pretest was done on 5% of the study sample at Yirgalem town. Then necessary modifications were made on the tool based on the pre-test results before commencing the actual data collection. The principal investigator coordinated, and the supervisor coached the data collection process on a daily basis.

Ethical consideration

The study was conducted after getting ethical clearance from the Addis Ababa University, School of Public Health Research Ethics Committee (REC). A formal letter of permission was obtained from Addis Ababa University, the Sidama Regional Health Bureau, and the Hawassa City Health Department. Informed verbal consent was obtained from the mothers and caregivers of children after explaining the objective and benefit of the study. Furthermore, the participants were assured about the confidentiality of the data, and the information was recorded anonymously.

Results

From 423 eligible samples, about 420 mother-child pair participated in this study, attaining a 99.3% response rate.

Socio-demographic and economic characteristics

Of the 420 mothers who participated in the study, 311 (74%) were between the ages of 25 and 34, 220 (52.4%) were protestant by religion, 335 (79.8%) were college-educated or above, 214 (50.8%) were employed by the government, and almost all of the mothers, 415 (98.8%) were married. Among the fathers' of the children who participated in the study, 348 (82.9%) were college-educated or above, and 275 (65.3%) were public employees by occupation. Among the IYC, 291 (69.3%) were categorized under the age group 18-23 months. From the total of 420 households, 275 (65.5%) had less than 5 family members, and 142 (33.8%) were each lowest and middle in wealth index (Table 1).

Variables	Frequency	Percentage
Maternal age (in years)		
15-24	98	23.3
25-34	311	74.0
> = 35	11	2.6
Religion		
Protestant	220	52.4
Orthodox	113	26.9
Catholic	31	7.4
Apostles	25	6.0
Muslim	14	3.3
Other	17	4
Maternal education level		
Have no formal education-able to read and write	3	0.7
Primary education	3	0.7
Secondary education	73	17.4
College and above	335	79.8
Don't know	6	1.4
Maternal occupation		
Public employee	214	51.0
Businesswomen	89	21.2
House wife	81	19.3
Private employee	33	7.9
Daily laborer	3	0.7
Paternal educational level		
Have no formal education-able to read and write	1	0.2
Primary	5	1.2
Secondary	63	15
College and above	348	82.9
Don't know	3	0.7
Paternal occupation		
Public employee	275	65.5
Businessman	96	22.9
Private employee	28	6.7
Daily laborer	21	5.0
Marital Status		
Married	415	98.8
Others (divorced, never married and widowed)	5	1.2
Child age (in completed months)		
6-11	45	10.7
12-17	84	20.0
18-23	291	69.3
Family size		
= <5	275	65.5
> = 6	145	34.5
Household wealth index		
Lowest	142	33.8
Middle	142	33.8
Highest	136	32.4

Table 1: *Socio-demographic and economic characteristics of the study participants in Hawassa City, Ethiopia, 2024 (n = 420).*

Underlying causes of underweight

About 400 (95.2%) of the 420 mothers who took part in the study had ANC follow-up at least 4 times, 399 (95.0%) gave birth in a health facility, 417 (99.3%) washed their hands with soap while feeding their children, 409 (97.4%) were not served food within 2 hours after cooking, and 412 (98.1%) cleaned their child's utensils with soap. Of the 420 infants and young children in the study, 253 (60.2%) had started breastfeeding but had stopped before the age of two, 318 (75.7%) had not received vitamin A in the previous six months, and 377 (89.8%) had received the vaccinations least 4 times. Of the households, 346 (82.4%) were either food secure or had light hunger, 403 (96%) had improved toilet facilities, and 420 (100%) had improved sources of drinking water (Table 2).

Variables	Frequency	Percentage
History of breastfeeding status		
Haven't fed in the past 24h	98	23.3
Haven't started since birth	69	16.4
Started, but terminated	253	60.2
Antenatal Care (ANC) Visits		
None	3	0.7
1-3	2	0.5
> = 4	400	95.2
Don't know	15	3.6
Place of delivery		
Health facility	399	95.0
Home	13	3.1
Don't know	8	1.9
Received vitamin A in the past six months		
Yes	84	20
No	318	75.7
Don't know	18	4.3
Frequency of vaccination the child		
> = 4	377	89.8
< 4	43	10.2
Washing hands with soap while feeding child		
Yes	417	99.3
No	3	0.7
Serving food within 2 hours after cooking		
Yes	11	2.6
No	409	97.4
Child's private feeding utensils are clean		
Yes	412	98.1
No	8	1.9
Toilet facility		
Improved	403	96
Unimproved	17	4
Household food insecurity		
Non/Light hunger	346	82.4
Moderate hunger	70	16.7
Severe hunger	4	1.0

Table 2: *The underlying causes of underweight among non-breastfed infants and young children aged 6-23 months in Hawassa City, Ethiopia, 2024 (n = 420).*

Immediate causes of underweight

Among the IYC, 409 (97.4%) consumed at least two milk feeds, 264 (62.9%) (95% CI: 58.3-67.6) met the minimum meal frequency, only 41 (9.8%) consumed at least five food groups, 19 (4.5%) met the minimum acceptable diet, and 325 participants (77%) reported having fever or diarrhea in the two weeks prior to the survey (Table 3).

Variable	Frequency	Percentage
Minimum dietary diversity <5 > = 5	379 41	90.2 9.8
Minimum meal frequency <4 > = 4	156 264	37.1 62.9
Fulfill minimum acceptable diet Yes No	19 401	4.5 95.5
History of fever/Diarrhoea illness (within the two weeks immediately prior to the survey) Yes No	325 95	77.4 22.6

Table 3: *Immediate causes of underweight among non-breastfed infants and young children aged 6-23 months in Hawassa City, Ethiopia, 2024 (n = 420).*

Prevalence of Underweight

The prevalence of underweight among non-breastfed infants and young children aged 6-23 months in Hawassa City was 10% (95% CI: 7.4-12.6) with 4% severely underweight (95% CI: 2.4- 6).

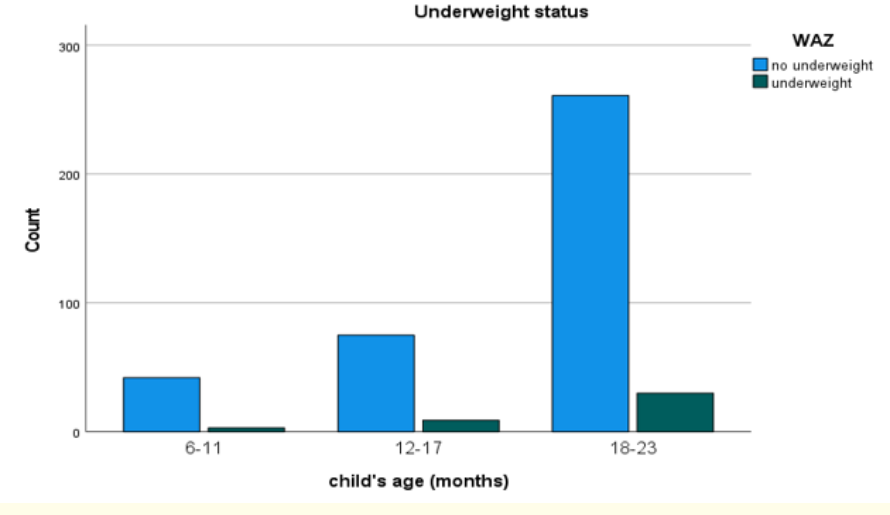

Figure 1: *Underweight status distribution among non-breastfed children aged 6 to 23 months in Hawassa City, Ethiopia, 2024.*

Association between minimum meal frequency and underweight among non-breastfed infants and young children

Eight variables out of the twenty-eight in the binary logistic regression analysis had a p-value below 0.25, making them potential candidates for multivariable logistic regression.

The binary logistic regression was employed to identify factors associated with outcomes of underweight. Non-breastfed children aged 6-23 months who did not meet the minimum requirement of meal frequency per day had a 5.2-fold higher risk of being underweight than those who did (p = <.001, AOR; 5.2, 95% CI: 2.5, 11.0). Compared to the children whose mothers' age was above 35, those children whose mothers' age was between 15 and 24 had a 96% lower risk of being underweight (p = 0.04, AOR; 0.15, 95% CI: 0.02, 0.93), and those whose mothers' age was between 25 and 34 had 97% lower odds of being underweight (p = 0.03, AOR; 0.15, 95% CI: 0.03, 0.8).

Variables	Underweight			
	Yes (%)	No (%)	COR (95% CI)	AOR (95% CI)
Minimum meal frequency				
<4	30 (7.1)	126 (30)	5.0 (2.5, 10.0)	5.2 (2.5, 11.0)*
> = 4	12 (2.9)	252 (60)	1	1
Maternal age				
15-24	8 (1.9)	90 (21.4)	0.10 (0.03,0.43)	0.15 (0.02,0.93)*
25-34	29 (6.9)	282 (67.1)	0.12 (0.04,0.43)	0.15 (0.03,0.79)*
> = 35	5 (1.2)	6(1.4)	1	1
Maternal occupation				
Daily laborer	1 (0.2)	2 (0.5)	4.6 (0.4, 52.0)	6.9 (0.2, 379)
House wife	7 (1.7)	74 (17.6)	0.9 (0.4, 2.1)	0.6 (0.2, 1.9)
Business women	9 (2.1)	80 (19)	1.0 (0.5, 2.4)	0.5 (0.2, 1.6)
Private employee	4 (1)	29 (6.9)	1.3 (0.4, 4.0)	1.1 (0.3, 4.4)
Public employee	21 (5)	193 (46)	1	1
Paternal occupation				
Daily laborer	2 (0.5)	19 (4.5)	1.2 (0.3, 5.3)	0.48 (0.04, 5.93)
Businessman	12 (2.9)	84 (20)	1.56 (0.7,3.3)	1.5 (0.6, 4.2)
Private employee	5 (1.2)	23 (5.5)	2.4 (0.8, 6.9)	2.09 (0.57, 7.67)
Public employee	23 (5.5)	252 (60)	1	1
Family size				
> = 6	18 (4.3)	127 (30.2)	0.5 (0.3, 0.1)	0.7 (0.3, 1.8)
= <5	24 (5.7)	251 (59.8)	1	1
History of child breastfeeding status				
Haven't fed in the past 24 hour	7 (1.7)	91 (21.7)	0.57 (0.24, 1.35)	0.4 (0.2, 1.1)
Haven't started since birth	5 (1.2)	64 (15.2)	0.58 (0.23, 1.56)	0.6 (0.2, 1.9)
Started, but terminated before two years	30 (7.1)	223 (53.1)	1	1
Place of delivery				
Health facility	38 (9)	361(86)	0.16 (0.04, 0.76)	0.23 (0.02, 2.9)
Home	1 (0.2)	12 (2.9)	0.14 (0.01, 1.68)	0.22(0.01, 6.61)
Not applicable	3 (0.7)	5 (1.2)	1	1

Household food insecurity				
Non/Light hunger	37 (8.8)	309 (73.6)	0.36 (0.36, 3.5)	0.56 (0.03, 11.6)
Moderate hunger	4 (1)	66 (15)	0.18 (0.02, 2.2)	0.32 (0.02, 7.08)
Severe Hunger	1 (0.2)	3 (0.7)	1	1

Table 4: *Binary logistic regression for association between minimum meal frequency and underweight among non-breastfed infants and young children aged 6-23 months in Hawassa City, Ethiopia, 2024 (n = 420).*

Notes*: Hosmer-Lemeshow goodness-of-fit test p-value = 0.89.*

** = p-value < 0.05.*

COR: Crude Odds Ratio, AOR: Adjusted Odds Ratio.

Discussion

The objective of this study was to assess the prevalence of minimum meal frequency and its association with underweight among non-breastfed infants and young children aged 6 to 23 months in Hawassa city. Minimum meal frequency and child sex were among the factors associated with the underweight status of the children.

Our study revealed that the prevalence of minimum meal frequency (MMF) was 62.9%. This prevalence was consistent with the prevalence reported by a systematic review and meta-analysis carried out in Ethiopia, which was 63.8% [27]. The consistency might be due to both studies being conducted in Ethiopia. Even if the mentioned systematic review included all IYC aged 6 to 23 months regardless of their breastfeeding status, the MMF prevalence was found to be consistent with the current study. However, the finding of this study was significantly lower compared to a similar study conducted in Brazil that revealed an overall prevalence of MMF among non-breastfed IYC was observed to be 94.9% [43]. This wide difference might be because of the socio-economic variance between the two nations, as Brazil is one of the upper middle-income countries. On the other hand, our MMF prevalence was higher compared to EMDHS 2019, which showed the overall prevalence of MMF among non-breastfed was 52% [8]. The higher prevalence could be explained by the fact that our study was limited to an urban area, and this might be due to having better educational status, food availability, and information accessibility in urban areas.

In terms of the magnitude of underweight, the current study showed the prevalence of underweight is 10%, which is in line with a study conducted in South-East Ethiopia (9%) [44]. Nonetheless, this study's magnitude was higher than that of Addis Ababa (2.17%) [53]. The inconsistency might be due to the difference in study participants, in which these studies actually included all breastfed and non-breastfed IYC. This might imply a lack of so many advantages of breastfeeding for non-breastfed IYC and may increase the odds of being underweight among them. On the other hand, our underweight prevalence was lower compared to the study conducted in the Oromia region in Ethiopia, which reported the prevalence of underweight was 27.7% [54]. This higher prevalence could be explained by the fact that the Oromia study was conducted in largely food insecure and rural areas. This might indicate better feeding practices in cities compared to rural areas.

Regarding the association between the children's underweight status and the minimum meal frequency, the current study demonstrated that non-breastfed children who did not meet the WHO minimum requirement of meal frequency had a higher chance of being underweight than those who did. This result is consistent with various studies in India [22], Tanzania [24], and Malawi [46] involving infants and young children of the same age group corroborate the link between a lower risk of underweight and appropriate consumption of minimum meal

frequency. Since this Complementary Feeding Indicator principally evaluates quantity, it was expected that the main anthropometric parameter it affects will be weight for age, which is a marker of early caloric deficit. When a child consistently consumes fewer calories than their body requires for growth and development, it can lead to insufficient energy availability, resulting in weight loss or the inability to gain weight appropriately.

Unlike our study finding, different studies in Cameroon [49], Malaysia [47], and Ghana [48] conducted to assess similar issues reported there is no significant association between minimum meal frequency and child underweight status. This contentious finding of the studies could be attributed to differences in study design, which is hospital-based cross-sectional, involving children attending Infant Welfare Clinics in the case of Cameron. This is due to the major concern, which is selection bias: patients in a hospital are not representative of the general population, and if the sample is not representative of the population of interest, the observed association may not generalize to the population and can lead to biased estimates of the association's strength. It may be due to the effect of a lower sample size (conducted using only 94 IYC aged 6 to 23 months) in the case of the Malaysia study. This is also due to the fact that small samples are more susceptible to random variation. Even if there's a true association, a small sample might not provide enough evidence to detect it, leading to a weak or non-significant result. And it might be due to differences in the study period in the case of the Ghana study.

Conclusion

Based on the findings of this study, more than three out of five infants and young children were fed meal frequency according to WHO recommendations. One out of ten non-breastfed infants and young children were underweight. The result also indicated that adherence to the WHO recommendation of meal frequency might reduce the risk of being underweight among non-breastfed children.

Acknowledgements

The authors would like to thank Wolaita Sodo University for funding us this thesis work. The authors gratefully thank all respondents, data collectors, and supervisors.

Conflict of Interest

There is no conflict of interest among the authors of this research work.

Bibliography

1. USAID FANTA and FHI 360. "Developing tools to measure progress on infant and young child feeding" (2014).
2. World Health Organization and the United Nations Children's Fund (UNICEF). "Indicators for assessing infant and young child feeding practices" (2021).
3. Ministry of Health Ethiopia. "Guideline for Infant and Young Child Feeding in Emergencies for Ethiopia" (2021).
4. World Health Organization and United Nations Children's Fund. "Global Strategy for Infant and Young Child Feeding" (2002).
5. World Health Organization. "Malnutrition" (2024).
6. UNICEF WHO and The World Bank. "Levels and trends in child malnutrition" (2014).
7. Tekile KA., *et al*. "Prevalence of malnutrition and associated factors among under-five children in Ethiopia: evidence from the 2016 Ethiopia Demographic and Health Survey". *BMC Research Notes* 12.1 (2019): 391.

8. Ethiopian Public Health Institute (EPHI) Central Statistical Agency (CSA) WB USAID and UNICEF. "Mini Demographic and Health Survey 2019" (2021).

9. Tamir TT., *et al*. "Underweight and associated factors among children under age of five in low and lower-middle income African countries: hierarchical analysis of demographic and health survey data". *Frontiers in Public Health* 12 (2024): 1423603.

10. Moshi CC., *et al*. "Determinants of underweight among children aged 0-23 months in Tanzania". *Food Science and Nutrition* 10.4 (2022): 1167-1174.

11. Birhan YT and Angaw AD. "Trends and determinants of underweight among children under five years in Ethiopia: Further analysis with Ethiopian demographic and health survey 2005-2016-multivariate decomposition analysis". *Journal of Nutrition and Metabolism* (2022): 6663756.

12. Fenta MH., *et al*. "Trends and determinants of underweight among under-five children in Ethiopia: Data from EDHS". *International Journal of Pediatrics* (2020): 3291654.

13. Government of Ethiopia. "Seqota Declaration" (2015).

14. Federal Democratic Republic of Ethiopia. "National Nutrition Program 2016-2020" (2016).

15. Federal Democratic Republic of Ethiopia. "Food and Nutrition Policy" (2018).

16. UNICEF. "Annual report UNICEF Nutrition Ethiopia" (2022).

17. World Health Organization. "Indicators for assessing infant and young child feeding practices" (2008).

18. World Health Organization and the United Nations Children's Fund. "Indicators for assessing infant and young child feeding practices" (2021).

19. Rai S and Unisa S. "Complementary feeding practices and underweight status among children age 6-23 months in India". *The Journal of Family Welfare* 64 (2019).

20. Masuke R., *et al*. "Effect of inappropriate complementary feeding practices on the nutritional status of children aged 6-24 months in urban Moshi, Northern Tanzania". *PLOS ONE* 16.5 (2021): e0250562.

21. Wake DA. "Prevalence of minimum meal frequency practice and its associated factors among children aged 6 to 23 months in Ethiopia: A systematic review and meta-analysis". *Global Pediatric Health* 8 (2021): 2333794X211026184.

22. Hossain M MM., *et al*. "Prevalence and risk factors of underweight among under-5 children in Bangladesh: Evidence from a countrywide cross-sectional study". *PLOS ONE* 18.4 (2023): e0284797.

23. Adedokun ST and Yaya S. "Factors associated with adverse nutritional status of children in sub-Saharan Africa: Evidence from the demographic and health surveys from 31 countries". *Maternal and Child Nutrition* 17.3 (2020): e13198.

24. Tafese Z., *et al*. "Child feeding practice and primary health care as major correlates of stunting and underweight among 6- to 23-month-old infants and young children in food-insecure households in Ethiopia". *Current Developments in Nutrition* 4.9 (2020): nzaa137.

25. World Health Organization Department of Child and Adolescent Health and Development Department of Nutrition for Health and Development. Feeding the non-breastfed child 6-24 months of age (2004).

26. Wondim A., *et al*. "Major maternal related determinants of nonbreastfeeding among mothers in Ethiopia: A multilevel analysis from DHS Ethiopia 2016". *PLOS ONE* 18.6 (2023): e0286662.

27. Tesgara BB., *et al*. "Early termination of breast-feeding practice and associated factors among mothers of children under 2 years old in Asella Referral and Teaching Hospital". *Science Set Journal of Pediatrics* 2.2 (2024): 1-15.

28. Celik NM and Köksal E. "Application of the infant and young child feeding index and the evaluation of its relationship with nutritional status in 6-24 months children". *Brazilian Journal of Nutrition* 37.1 (2024).

29. Acquah E., *et al*. "Predictors of underweight in children under-five years in Ghana". *Ghana Medical Journal* 53.1 (2019): 71-78.

30. Sewenet T W., *et al*. "Undernutrition and associated factors among children aged 6-23 months in Dessie town, Northeastern Ethiopia, 2021: A community based cross-sectional study". *Frontiers in Pediatrics* 10 (2022): 916726.

31. Tebeje MT., *et al*. "Minimum meal frequency and associated factors among children aged 6-23 months in Sub-Saharan Africa: a multilevel analysis of the demographic and health survey data". *Frontiers in Public Health* 12 (2024): 1468701.

32. Twabi HS., *et al*. "Evaluating the effect of appropriate complementary feeding practices on child growth in Malawi using cross-sectional data: an application of propensity score matching". *Frontiers in Nutrition* 8 (2021): 714232.

33. Bong MW., *et al*. "Nutritional status and complementary feeding among Penan infants and young children in rural Sarawak, Malaysia". *Malaysian Journal of Nutrition* 24.4 (2018): 539-550.

34. Anin KS., *et al*. "Association between infant and young child feeding (IYCF) Indicators and the nutritional status of children (6-23 Months) in Northern Ghana". *Nutrients* 12.9 (2020): 2565.

35. Udoh EE and Amodu OK. "Complementary feeding practices among mothers and nutritional status of infants in Akpabuyo Area, Cross River State Nigeria". *Springerplus* 5.1 (2016): 2073.

36. Federal Ministry of Health Ethiopia. "National guideline for the management of acute malnutrition in Ethiopia" (2019).

37. Ethiopian Federal Ministry of Health (FMoH). "National standard definitions for sanitation hygiene and water" (2021).

38. Coates Jennifer., *et al*. "Household food insecurity access scale (HFIAS) for measurement of food access: indicator guide". Washington, D.C.: FHI 360/FANTA (2007).

39. Shibeshi AH and Asfaw ZG. "The influence of minimum dietary diversity on undernutrition among children aged 6-23 months in Ethiopia: a multilevel mixed-effect analysis based on 2019 Ethiopian mini demographic and health survey". *Frontiers in Public Health* 12 (2024): 1436683.

40. Tafese Z., *et al*. "Undernutrition and associated factors among children 6-23 months old in largely food insecure areas of rural Ethiopia". *Journal of Nutritional Science* 11 (2022): e63.

Volume 20 Issue 3 November 2025