

Magnitude of Undernutrition and Associated Factors among Infants and Young Children aged 6-23 Months in Sinan district, Northwest Ethiopia Amhara regional state: A crosssectional study

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Abstract

Background: Childhood undernutrition continues to be the most serious public health problem in the developing world particularly in the rural area. Determining the nutritional status among children less than two years is needed to plan a good nutrition intervention and to provide nutrition education to the community. Despite this, there is limited research conducted in the study area.

Objective: To assess undernutrition and associated factors among infants and young children aged 6-23 months in Sinan District, Northwest Ethiopia, 2019.

Methods: A Community -based cross-sectional study was conducted among 431 child-mother pairs from March 10, 2019-April 20, 2019 in Sinan District. WHO Anthro software (version 3.2.2) was used to generate the Z-scores. Data were entered using Epi-Data version 4.2 and analysis was done using SPSS version 25. Bivariable and multivariable binary Logistic Regression were fitted. In the multivariable analysis, p-values less than 0.05 were considered as statistically significant factors.

Results: The magnitude of stunting, underweight and wasting were 48.7%, 21.7%, and 8% respectively. Less than two times the daily intake of food (AOR = 3.7, 95% CI: 1.5, 9.3). Being older child (12-23 months) (AOR=0.46, 95% CI, 0.22, 0.96) and low dietary diversity score (AOR=0.53, 95% CI, (0.30, 0.92) were significantly associated with undernutrition. Additionally, not having a hand washing facility in the toilet was a significant predictor for both wasting and underweight.

Conclusion: The prevalence of undernutrition among infants and young children was higher compared with the previous studies. Low dietary diversity score, lower meal frequency, being an older child, and absence of hand washing facility in the toilet were factors related to the nutritional status. Hence, interventions targeting community management of undernutrition might be appropriate to manage the problem. Efforts should also be intensified to reduce by focusing on identified determinants and the provision of nutrition education to mothers focusing on appropriate feeding practices to improve children's nutritional status in the study area.

Background

Now a day's undernutrition is the primary public health concern for many countries. Undernutrition can be defined as a lack of adequate energy, protein, and micronutrients to meet the basic requirements for body maintenance, growth, and development of children. Adequate nutrition is essential in early childhood for healthy growth, proper organ formation and function, a strong immune system, and neurological and cognitive development [1, 2].

Undernutrition is one of the major causes of disability preventing children who survive from reaching their full development potential [3]. Besides, the undernourished status of the children locks them into a vicious cycle of recurring sickness, faltering growth, and diminished learning ability [4].

Even though a reduction has been made over the last decades in the burden of child undernutrition in developing countries, including Ethiopia the problem is still public health concern. Regardless of this success, children aged less than 2 years are still suffering from undernutrition in developing countries. Globally, more than about 178 million children in the world are found to be undernourished according to a recent (UNICEF / WHO) report [5]. The burden of undernutrition is much higher in South Asia compared to Africa and other parts of the world. The prevalence of underweight and stunting in South Asia has been recorded as 46% and 44 %, respectively [6]. Annually, 2.7 million or more than 45% of all child deaths are estimated to be associated with undernutrition more than 90% of these mortalities are reported in developing countries [7].

In Africa, 32 % or 186 million children less than two years of age are stunted, and about 8% or 35 million are wasted. Stunting is associated with poor physical and cognitive development as well as low school performance in children and adolescents. The risk of mortality is higher among stunted children even though it is aggravated when stunting and wasting happened together[8]. Due to the intergenerational impact of chronic malnutrition, childhood stunting is correlated with future maternal undernutrition and a higher risk of death [9]. Premature delivery and giving birth to an underweight baby are commonly reported among undernourished mothers [10]. Under two years of age, children are the most susceptible age for undernutrition, because of their rapid growth and increased vulnerability to infectious disease.

Accordingly, low meal frequency and dietary diversity [11], and not taking prenatal iron supplementation [12], Poor wealth status, unavailability of a latrine, child age: 12–24 months, not receiving maternal postnatal vitamin-A supplementation and source of family food: own food production was significantly associated with higher odds of stunting [13]. Inappropriate age of complementary feeding initiation and bottle feeding, households with a low dietary diversity score [14] and households with the lowest wealth quintile, presence of diarrhea in the past 2 weeks [14], and higher child age [15] are identified as the determinants of stunting. Different studies also elicited the predictors of wasting, according to not breastfeeding during the previous day and diarrheal disease for wasting and underweight [13], being male, a high number of siblings [15] are associated with increased odds of wasting among children under-2 years.

Ethiopia is one of these countries undernutrition is an important public health problem; with a prevalence of stunting, wasting, and underweight of under two-year children were 23.2%, 16.6%, and 12.5% respectively [16]. Although Ethiopia has made substantial achievements in providing for the wellbeing of its citizens, undernutrition in young children remains a major public health concern. Infant and young child feeding is a key area to improve child survival and promote healthy growth and development. About half of children aged six months to two years are not fed the minimum number of meals for their age, increasing their risk of stunting, wasting, and others. Ethiopia is being one of the countries with the highest child mortality rate, with undernutrition underlying 51% of all childhood deaths [17]. Currently, greater emphasis was given to nutrition in the training of health manpower and the use of health agents to monitor growth for effective prevention [18]. Despite increased attention to nutrition; nutritional deficiencies remain a devastating multifaceted problem affecting infants and young children in our

country, especially in the Amhara region. The first 2 years of a child's life are particularly important, since optimal nutrition during this period lowers morbidity and mortality, reduces the risk of chronic disease, and fosters better development overall. Only some children receive nutritionally adequate and safe complementary foods; in many countries, less than a fourth of infants 6–23 months of age meet the criteria of dietary diversity and feeding frequency that are appropriate for their age.

Thus, the present study aimed to assess the nutritional status of children less than 2 years of age in a rural area of Sinan district to identify the factors associated with the occurrence of Undernutrition.

Methods

Study area, design, and period

A community-based cross-sectional study was conducted from March 2019 to April 25, 2019, in Sinan District, Northwest Ethiopia. Sinan District is located about 327 km far from Addis Ababa the capital city of Ethiopia and, 303 km away from Bahir Dar. The District is divided into 17 Keble's, two Keble's in the urban and 15 Keble's are rural. The total population was estimated as **120,000**, children aged 6–23 months years old were 4251. There are 5 health centers and 20 health posts in the District. The people in this area are engaged in different activities such as farming, and trade. The District is also known by its potato which is the main income-generating means for the community. The socio-cultural interaction is strong which shows working together during harvesting, good participation of celebration (wedding, mahiber, Edir, Ekub) together (Sinan District communication office) [19].

Population

The source population was all children aged 6–23 months who reside in Sinan District. The study population was all children aged 6–23 months living –in the selected Kebeles in Sinan District. All children from 6 months to 23 months old age who live in the selected Keble for at least 6 months were included in the study. However, children with a visible physical deformity like kyphosis, scoliosis were excluded from the study since it may under or overestimate anthropometric results.

Sample Size And Sampling Procedure

The required sample size was calculated by considering wasting, underweight, and stunting as exposure variables. Moreover, stunting was considered as an independent variable since it yielded a maximum sample size of which 374. The sample size was computed on single population proportion formula by using: 95% CI (two-sided), 5% margin of error, and 58.1% proportion of stunting among children 6–23 months [14]. By considering 10% for non-response rate a total sample size of 411 mother-child pairs was proposed. Of the 17 administrative clustered Keble's in the District, 6 clusters were selected by simple random sampling technique. A list of households with children aged between 6 to 23 months was

obtained from the health post-EPI registration book. Then all the clustered households were included in the study. By using a cluster sampling technique a total of 431 infants and young children within the selected clustered Keble's was studied.

Data Collection Tool And Procedure

Data were collected through the home to home visits from the mothers or caregivers of the children using an interviewer-administered questionnaire. To maintain consistency, the questionnaire was first prepared in English and then translated to Amharic and then translated back to English. Six data collectors and three field supervisors were recruited for the study. The training was given to data collectors and supervisors. Length and weight measurements of children were taken using calibrated equipment and standardized techniques. The functionality of the equipment used to measure weight and length was checked each in each participant before measurement. Weight was measured to the nearest 10 g using a salter scale for less than 24 months old children. For all measurements, three readings were taken from each child, and the largest was recorded on the questionnaire. A standardized seven food group containing the Dietary Diversity Score (DDS) was used to assess the dietary intake of children [20]. A 24-hour dietary recall method was used, accordingly, the mothers were asked to report the food items consumed by the child in the previous 24-hours preceding the days of the survey.

The household wealth index was computed using a composite indicator for urban and rural residents by considering properties such as selected household assets and the size of agricultural land. Using Principal Component Analysis (PCA), the factor scores were summed and ranked into poor, medium, and rich.

Data processing and analysis

Data were coded and entered into EPI-data version 4.2 statistical software and analysis was done by SPSS Version 25. Nutrition-related data (length and weight) were analyzed using the WHO Anthro software. The Z-scores of indices, Weight-for-Length Z-score (WLZ), WAZ, and Length-for-Age Z-score (LAZ) were calculated and compared using the WHO Multicenter Growth Reference Standard [21].

Bivariable Analysis was done individually for all independent variables with stunting, wasting, and underweight. Variables with a p-value of < 0.25 in the Bivariable analysis were entered into a multivariable logistic regression analysis to identify the independent factors. Odds ratio a corresponding 95% Confidence interval (CI) were computed to assess the strength of the association. In the multivariable logistic regression analysis, variables with a p-value of < 0.05 were considered as statistically significant. The fitness of the model was checked using the Hosmer and Lemeshow goodness of fit test.

Operational Definitions

Undernutrition was defined as the child having either of H/Age Z-score < -2 , or W/Age Z-score < -2 or W/H Z-score < -2 SD [22, 23].

Underweight was defined as children having W/Age Z-score < -2 SD [22, 23].

Stunting was defined as children having H/Age Z-score < -2 SD [22, 23].

Wasting was defined as children having W/H Z-score < -2 SD [22, 23].

Minimum Dietary Diversity

if a child has taken four food groups as the minimum acceptable dietary diversity, a child with a DDS of less than four was classified as poor dietary diversity; otherwise it was deemed to have good dietary diversity [20]

Food insecurity; Food insecurity is a condition in which people experienced limited or uncertain physical and economic access to safe, sufficient, and nutritious food to meet their dietary needs or food preferences for a productive, healthy, and active life [24]. It was assessed by using the household food insecurity access scale. Household food insecurity was measured using the Household Food Insecurity Access Scale (HFIAS) that was developed by the Food and Nutrition Technical Assistance (FANTA) project [24]. For the Household Food Insecurity Access Scale (HFIAS) measurement, each of the questions was asked with a recall period of four weeks (30 days). The respondent was first asked an occurrence question—that is, whether the condition in the question happened at all in the past four weeks (yes or no). If the respondent answers "yes" to an occurrence question, a frequency-of-occurrence question was asked to determine whether the condition happened rarely (once or twice), sometimes (three to ten times), or often (more than ten times) in the past four weeks.

Wealth index

The composite indicator of socio-economic status, which was computed by the application of principal component analysis (PCA). Initially, household asset data were prepared for analysis. Before the PCA, using frequency, important variables that can discriminate households were selected to reduce the number of variables. The binary variables were coded to 0 and 1 and categorical variable options were converted into binary variables and dummy variable was created as 0 and 1. After data preparation, variables were standardized to change variables into the same scale for comparison by subtracting the mean from each value and then dividing the standard deviation. Once standardized, the variables have a mean of 0 and a standard deviation of 1. It was categorized as poor, medium, and rich.

Poor socioeconomic status

household which belonged to lower tercile of wealth index score.

Medium socioeconomic status

household which belonged to medium tercile of wealth index score.

Rich socioeconomic status

household which belonged to a higher tercile of wealth index score.

Results

Socio-demographic characteristics

From a total of 431 mother-child pairs to be included in the study, 427 of them participated with a response rate of 99.07%. From these 263 (61.6%) of the study children were male. The mean age of children was 13.42 months with an SD of (± 4.90) months. Regarding their religion, almost all 422 (98.8%) respondents were orthodox Christians. The majority of 393 (92%) of children's mothers/ caregivers were married. One-tenth 48(11.2%) of mothers and 79 (18.5%) of fathers had formal education. About 309(72.4%) of mothers were farmers and 237 (55.5%) of fathers were farmers (Table 1).

Table 1
Socio-demographic and economic characteristics of the children and their parents, Sinan District, northwest Ethiopia, 2019 (N = 427)

Variables		Frequency (N)	Percent (%)
Child age in months	6–11	191	44.7
	12–23	236	55.3
Sex of the child	Male	263	61.6
	Female	164	38.4
Marital status	Married	393	92
	Others*	34	8
Religion	Orthodox	422	98.8
	Others**	5	1.2
Maternal education	No formal education	379	88.7
	Primary	17	4
	Secondary	11	2.6
	College and above	20	4.7
Maternal occupation	Farmer	309	72.4
	House wife	52	12.2
	Merchant	43	10
	Other	23	5.4
Husband education	Cannot read and write	181	42.4
	Can read and write	167	39.1
	Primary	35	8.2
	Secondary	12	2.8
	College and above	32	7.5
Husband occupation	Farmer	237	55.5
	Merchant	50	11.7
	Daily laborer	48	11.2
	Government employee	55	12.9
	Others	37	8.5

Variables		Frequency (N)	Percent (%)
Head of household	Father	372	87.1
	Mother	55	12.9
Family size	≤4	274	64.2
	5–7	141	33
	> 7	12	2.8
Birth order of index of the child	1st born	132	30.9
	2nd born	169	39.6
	3rd born	69	16.2
	4th and above	57	13.3
Wealth index	Poor	170	39.8
	Medium	153	35.8
	Rich	104	24.4
HFIAS	Food secure household	347	81.3
	Food insecure household	80	18.7

The majority of 368 (92.7%) of the households in the study area used latrine. But, 59 (13.8 %) of the households did not have a toilet facility. On the other hand, 248 (41.9%) of the households had no household waste disposal site. This study revealed that 424 (99.3%) of the mothers practiced washing their hands before feed their child. More than half 228 (53.4%) of the households used public tap/standpipe water as a source of drinking water and one-fifth 86(20.1%) were using unprotected spring/ river as a source of drinking water. Conversely, one-fourth, 113 (26.5%) were using protected well and spring water. Most 424 (99.3%) of households reported that they washed their hands after the toilet and before eating. Only 3(0.7%) reported that they did not wash their hands after toilet use (Table 2).

Table 2

Water supply and hygienic conditions of the study participants (n = 427), Sinan Woreda, East Gojjam Zone, North West Ethiopia, 2019.

Variables		Frequency (N)	Percent (%)
Source of drinking water	Tape water	228	53.4
	Protected spring	113	26.5
	Unprotected spring/river	86	20.1
Have latrine	Present	368	86.2
	Absent	59	13.8
Household use latrine	Yes	355	83.1
	No	13	3.1
Kind of toilet	Flush into a septic tank	9	2.5
	Improved pit latrine	187	50.8
	Unimproved pit latrine	172	46.7
Hand washing facility in the toilet	Present	296	75
	Absent	98	25
Hand washing material in the toilet	Water only	226	76.3
	Soap with water	70	26.7
Wash Your hand after the toilet	Yes	416	97.9
	No	9	2.1
Wash your hand before child feeding	Yes	424	99.3
	No	3	0.7
How to wash caregiver's hands	Only with water	211	49.4
	Soap with water sometimes	120	28.1
	Soap with water always	96	22.5
The household waste disposal site	Present	179	58.1
	Absent	248	41.9

Child caring and feeding practices of participants

Among the study participants, 70(16.4%) of the child got minimum dietary diversity, which is greater than 4 food groups. More than half 281(65.8%) of the child took meals more than four times per day while,

27(6.3%) of the children took meals twice per day. Two-thirds 308(72.1%) of the caregivers had access to information about complementary feeding (Table 3).

Table 3
Household child feeding practice among study subjects (n = 427), Sinan Woreda, East Gojjam Zone, Northwest Ethiopia, 2019.

Variables		Frequency(N)	Percent%
Frequency of meals	Twice	27	6.3
	Three times	119	27.9
	Four times and above	281	65.8
Dietary diversity score	< 4 food groups	357	83.6
	≥ 4 food groups	70	16.4
Access to information on complementary feeding from different sources	Yes	308	72.1
	No	119	27.9
Give Abish (fenugreek) to your child	Yes	365	14.5
	No	62	85.5
With whom your child is eating mostly	Separately	375	87.1
	Father/mother/caregiver	15	3.5
	Older siblings	40	9.4
Meals the child usually eat mostly	Breakfast	238	55
	Lunch	144	33.7
	Dinner	48	11.2
Vaccination status	Completely vaccinated	415	97.2%
	Incomplete vaccination	4	0.9
	Vaccinated According to his/her age	8	1.8
Diarrhea in the last two weeks	Yes	46	89.2
	No	381	10.8
Fever in the last two Weeks	Yes	44	89.7
	No	383	10.3

Factors associated with stunting of participants

The Bivariable logistic regression analysis showed that the frequency of meal taken by children, being second-order birth, being from a food-insecure household, the occurrence of diarrhea, presence of fever, head of household, and dietary diversity score less than four food groups was found to be associated with stunting. In the multivariable logistic regression, having adequate dietary diversity score and frequency of meal taken by children were significantly associated with stunting.

Children who get food less than three times per day were more than three and half times more likely to experience stunting as compared to their counterparts, [AOR = 3.5; 95% CI, 1.5–9.3]. Having adequate dietary diversity score was 47% less risk of stunting as compared to their counterparts (AOR = 0.53, 95% CI, 0.30–0.92) Table 4)

Table 4

Factors associated with stunting on selected variables among children 6–23 months old in Sinan District, East Gojjam Zone, North West Ethiopia, 2019 (n = 427)

Variables	Stunting		COR(95%CI)	AOR CI 95%
	Yes	No		
Food security				
Food secure	162	185	1	1
Food insecure	46	34	1.5 (0.9, 2.5)	1.7 (1, 2.9)
Dietary diversity score				
< 4 food groups	166	191	1	1
≥ 4 food groups	42	28	0.57(0.3, 0.9)	0.53 (0.30,0.92)
Birth order of index child				
1st	56	76	1	1
2nd	92	77	1.6 (1.02, 2.5)	1.4 (0.92, 2.3)
3rd	27	42	0.87 (0.47, 1.5)	0.78 (0.42, 1.4)
4th and above	33	24	1.8(0.9, 3.5)	1.4 (0.75, 2.8)
Fever				
No	182	201	1.5(0.85, 3.00)	1.7 (0.92, 3.4)
Yes	26	18	1	1
Diarrhea last two week				
No	180	201	1	1
Yes	28	18	1.7 (0.92, 3.2)	1.7 (0.88, 3.4)
Meal frequency				
Twice	20	7	3.1(1.2, 7.6)	3.7 (1.5, 9.3)
Three times	54	65	0.9(0.5, 1.4)	1.02 (0.6, 1.6)
Four times and above	134	147	1.00	1
Head of household				
Father	186	186	1	1
Mother	33	22	0.66 (0.37, 1.1)	0.66 (.38, 1.34)
** Significant predictors in the multivariable analysis				

Factors Associated With Wasting Of Participants

In Bivariable logistic regression analysis being older age (12–23) months, low dietary diversity score and absence of handwashing facility in the toilet were significantly associated with wasting whereas multivariable analysis, being older age (AOR = 0.46, 95% CI, 0.22–0.96), and absence of Handwashing facility in the toilet (AOR = 2.5, 95% CI, (1.1–5.9) were significantly associated with wasting.

In this study, children found in the age range of 12–23 months were 54% less risk of being wasted as compared to those children in the age range of 6–11 months (AOR = 0.46, 95% CI, 0.22–0.96). Children living in households who had no handwashing facility in the toilet were 3.7 times more at risk of being wasted than children of households who had a handwashing facility in the toilet (AOR = 3.7, 95% CI, (1.7–7.8) (Table 5).

Table 5

Factors associated with wasting of undernutrition on selected variables among children 6–23 months old in Sinan Woreda, East Gojjam Zone, North West Ethiopia, 2019 (n = 427)

Variables	Wasting		COR(95%CI)	AOR(95%CI)
	Yes	No		
Age				
6–11	21	170	1	1
12–23	13	223	0.47(0.23, 0.96)	0.46(0.22, 0.96)
Dietary diversity score				
< 4 food groups	32	325	3.3(0.7, 14)	2.7 (0.6, 11)
≥ 4 food groups	2	68	1	1
Hand washing facility toilet				
Yes	18	311	1	1
No	16	82	3.3 (0.16, 6.8)	3.7 (1.7, 7.8)

Factors Associated With Underweight Of Participants

Not having a handwashing facility in the toilet, being a younger age child and low meal frequency was significantly associated with underweight in Bivariable analysis. Multivariable logistic regressions showed that children living in households without handwashing facility in the toilet were 2.6 times more likely to be underweight than children living in households of having handwashing facility in the toilet (AOR = 2.6, 95% CI, (1.5–4.3) (Table 6)

Table 6
Factors associated with underweight on selected variables among children 6–23 months old in Sinan District, East Gojjam Zone, North West Ethiopia, 2019 (n = 427)

Variables	Underweight		COR(95%CI)	AOR (95%CI)
	Yes	No		
Age				
6–11	49	142	1	1
12–23	44	192	0.66(0.41-1.0)	0.64 (0.40–1.02)
Meal frequency				
Twice	7	20	1.4(0.56 - 3.4)	0.92 (0.34–2.4)
Three times	30	89	1.3(0.81–2.2)	1.05 (0.60–1.83)
More than Four times	56	225	1	1
Hand Washing facility in the toilet				
Absent	35	63	2.5 (1.5–4.2)	2.6 (1.5–4.3)
Present	58	271	1	1

Discussion

In this study, the prevalence of undernutrition among infants and young children is found to be high with the prevalence of stunting 48.7%, underweight 21.7%, and wasting 8% respectively. The high prevalence of stunting in this study suggests the severe public health significance of the problem. The prevalence of stunting in this study is higher than previous studies conducted in Ethiopia Demographic and Health Survey 23.2% [25]. This finding also showed that a higher percentage of stunting as compared with studies conducted in Angola 32% [26], Mali 28.4% [15], Kamba Woreda 27.8% [27] but, lower than studies done in Gondar 58.1% [14] and Somali region 56.1% [13]. The differences might be due to variation in time, sample size, study period, socio-economic characteristics of study participants, and a difference in infant and young child feeding practices.

Moreover, this study revealed that undernutrition in the study area is a critical public health problem according to the WHO cut-off point [9]. The finding of underweight obtained in this study is in line with reports of other developing countries, such as Mali, 23.9% [15], and the Central Republic of Africa (20.2%). However, this finding is higher than studies reported from the rural part of Angola 15.1% [26], Somali region Awbare 10% [13], the national report of EDHS 2016 12.5% [25] and Benna Tsemay Woreda, 15.3% [27]. This might be due to the difference in the sample size and study period between the current and previous studies. Moreover, the difference observed underweight might be due to the difference in the socio-economic, feeding, lifestyle, and socio-demographic characteristics of the study participants.

The prevalence of wasting documented in this study is comparable with studies done in Benny Tsemay Kemba, 9.9% [27], and the Somali region 10% [13]. On the other hand, this finding is lower than studies conducted in Gondar (17%) [14], Ethiopia Demographic Health Survey 16.6% [25], and Mali (13.9%) [15]. The variation might be due to the difference in sample size, study settings, frequency of feeding, socioeconomic status, and food security. A similar study was reported But, the finding of this study was lower compared to a study done in Angola [19].

This study also focused on identifying the factors that have an association with the undernutrition status of infants and young children aged 6–23 months in the Sinan district. This depicted that low dietary diversity score and low daily meal frequency were identified as a significant factor for the occurrence of stunting. This finding was supported by a study conducted in Egypt [28] and Mali [15]. The similarity might be due to the similarity in socio-economic characteristics particularly on community awareness towards initiation of complementary feeding and diversified food during early childhood ages. Information on complementary feeding is important for starting complementary food based on the recommended date.

In this study child, 6–11 months old age were statically associated factors with wasting. The probable reason might be because of late initiation and inappropriate complementary feeding practice to meet nutritional demand were practiced in the study area. These factors were not reported as a factor of wasting in the previous study rather being an older child was a significant factor for being stunted in the previous literature.

In this study absence of a hand washing facility in the toilet was also identified as a factor for both underweight and wasting. In the previous research, this factor was not reported as a significant factor in different kinds of literature.

Limitation Of The Study

This study recognized the following limitations:

There may be a recall bias in 24 hours recall dietary assessment and measurement bias during data collection time that might affect the study findings. The cross-sectional study may not enable to determine causal relationships.

Conclusion

The result of this study described that the prevalence of stunting, underweight, and wasting among infants and young children aged 6–24 months was relatively high. This showed that undernutrition is still a major public health problem among infants and young children.

A low frequency of daily meal, Lack of adequate dietary diversity score, being younger age of children (6–11 months) and, Absence of hand washing facility in the toilet was found to be significantly associated

with undernutrition.

Recommendations

Based on the finding of this study the following recommendations were forwarded to the concerned bodies. Promote nutrition counseling on appropriate feeding practices, nutrition counseling about the frequency and diversity of diet to all children especially 6–23 months of age, Emphasis should be given for children aged 6–11 months to start adequate complementary foods early in addition to breastfeeding. Additionally, Education should be given to the community to have a hand washing facility in the toilet.

Abbreviations

DDS: Dietary Diversity Score, EDHS: Ethiopia Demographic Health Survey, WAZ: Weight for Age Z score, HAZ: Height for Age Z score, WHZ: Weight for Height Z score, UNICEF: United Nation Children's Fund, WHO: World Health Organization.

Declarations

Ethical approval was obtained from Debre Markos University, College of Health Sciences. An official letter was also written along with the ethical clearance and submitted to Sinan District Administration Health Office. The autonomy of the participants was respected. The purposes and importance of the study were explained at all levels to the caregivers and oral informed consent was secured from each child caregiver. Caregivers selected for the study were on their verbal consents; caregivers who were not voluntary to be interviewed were informed to do so without any restriction. Children's who were found malnourished during the anthropometric measurement were linked to the nearby health facilities for nutritional counseling and treatment.

Consent for publication

Not applicable

Availability of data and material

The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors have declared that they have no competing interests.

Authors' contribution

MG: conception of the research idea, study design, data collection, analysis and interpretation, and manuscript write-up. GK, NA, YS, EF data collection, analysis, interpretation and manuscript write-up. All authors have read and approved the final manuscript.

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Figures

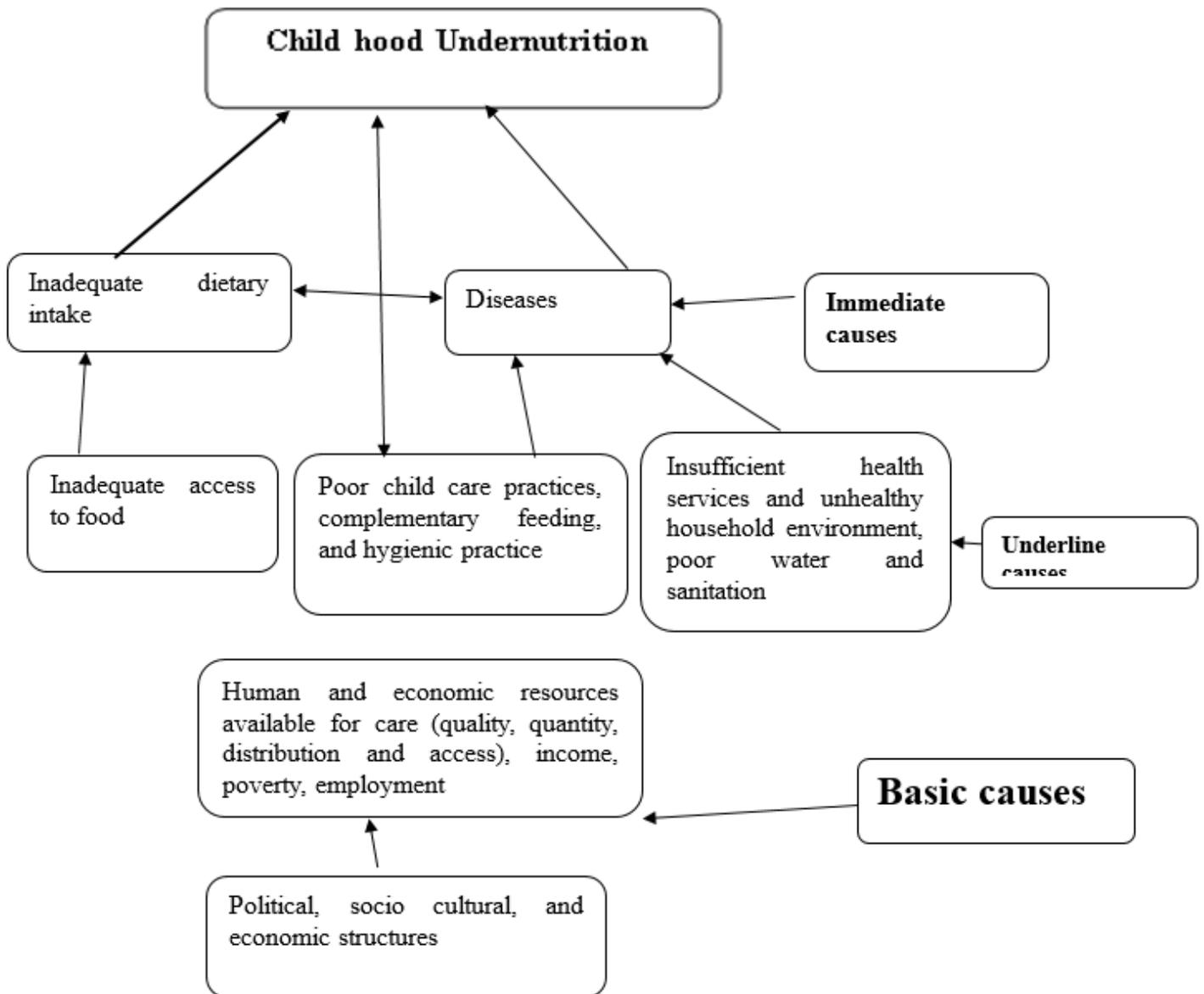


Figure 1

Conceptual framework of factors associated with malnutrition (adopted from UNICEF 2010)

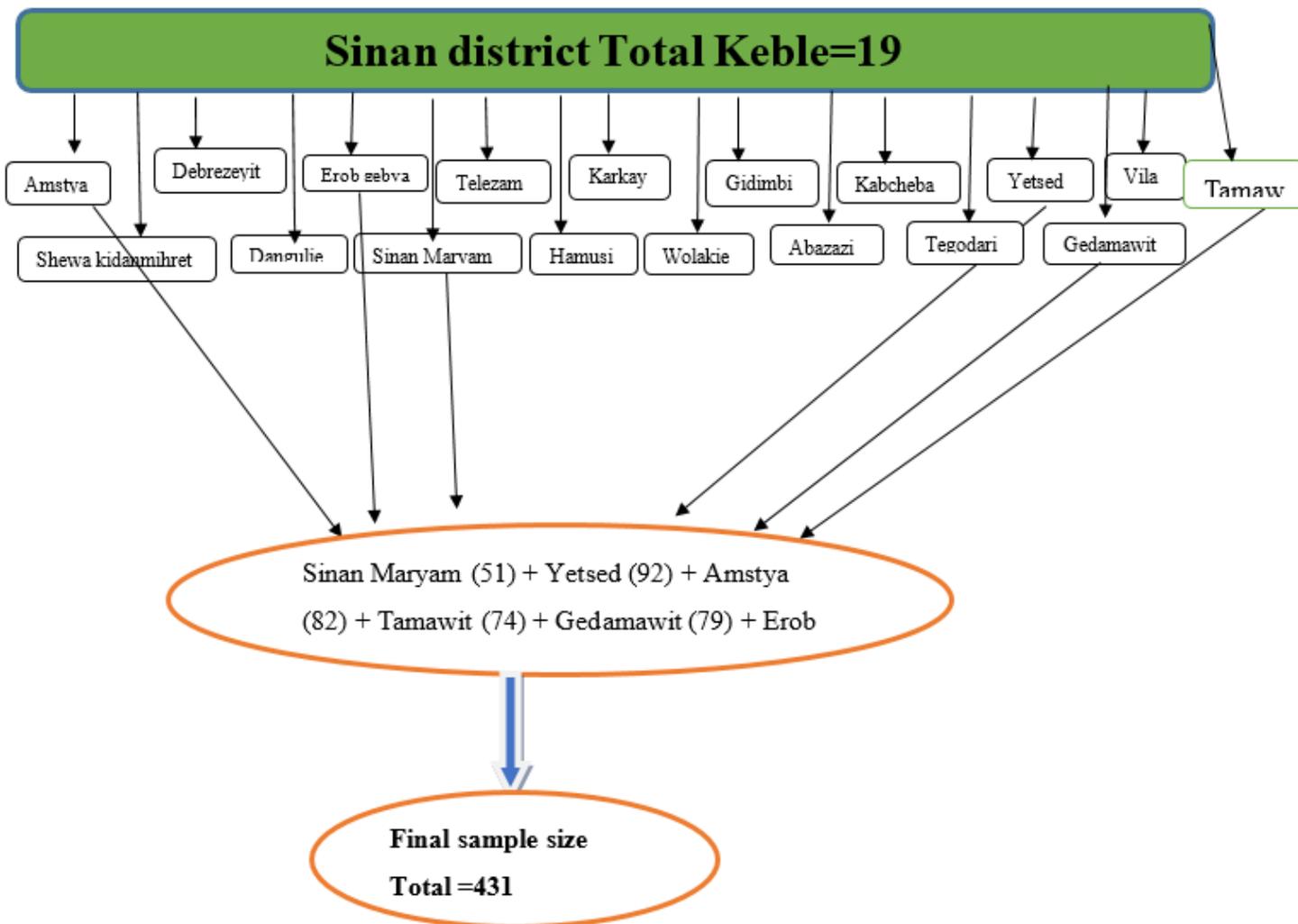


Figure 2

Schematic presentation of sampling procedure in Sinan District, North West Ethiopia, 2019.

Weight for length

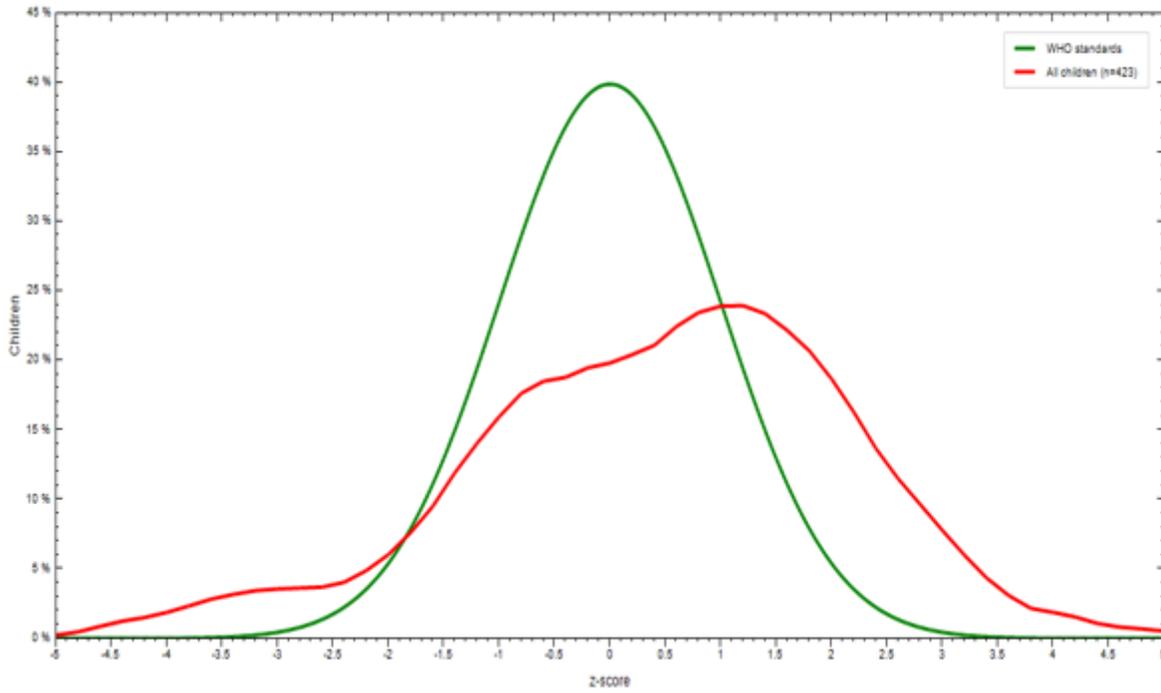


Figure 3

Distribution of wasting among children 6-23 months old in Sinan District, compared with WHO's standard population Sinan District, East Gojjam Zone, North West Ethiopia, 2019 (n=427).

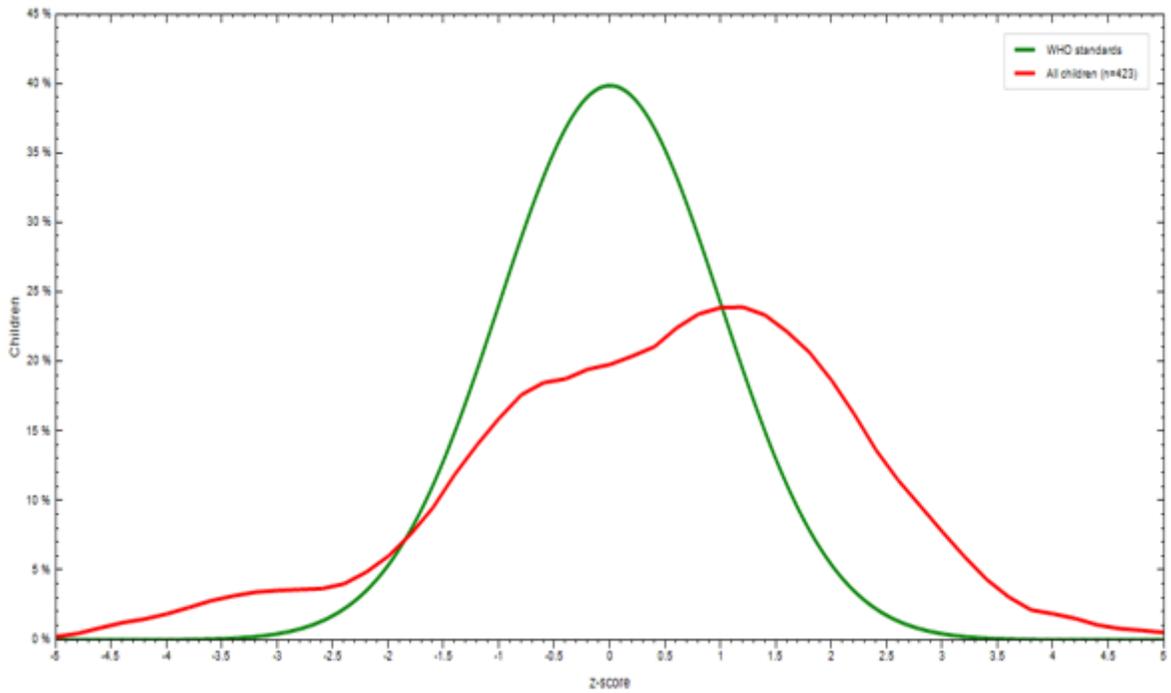


Figure 4

Distribution of wasting among children 6-23 months old in Sinan District, compared with WHO's standard population Sinan District, East Gojjam Zone, North West Ethiopia, 2019 (n=427).

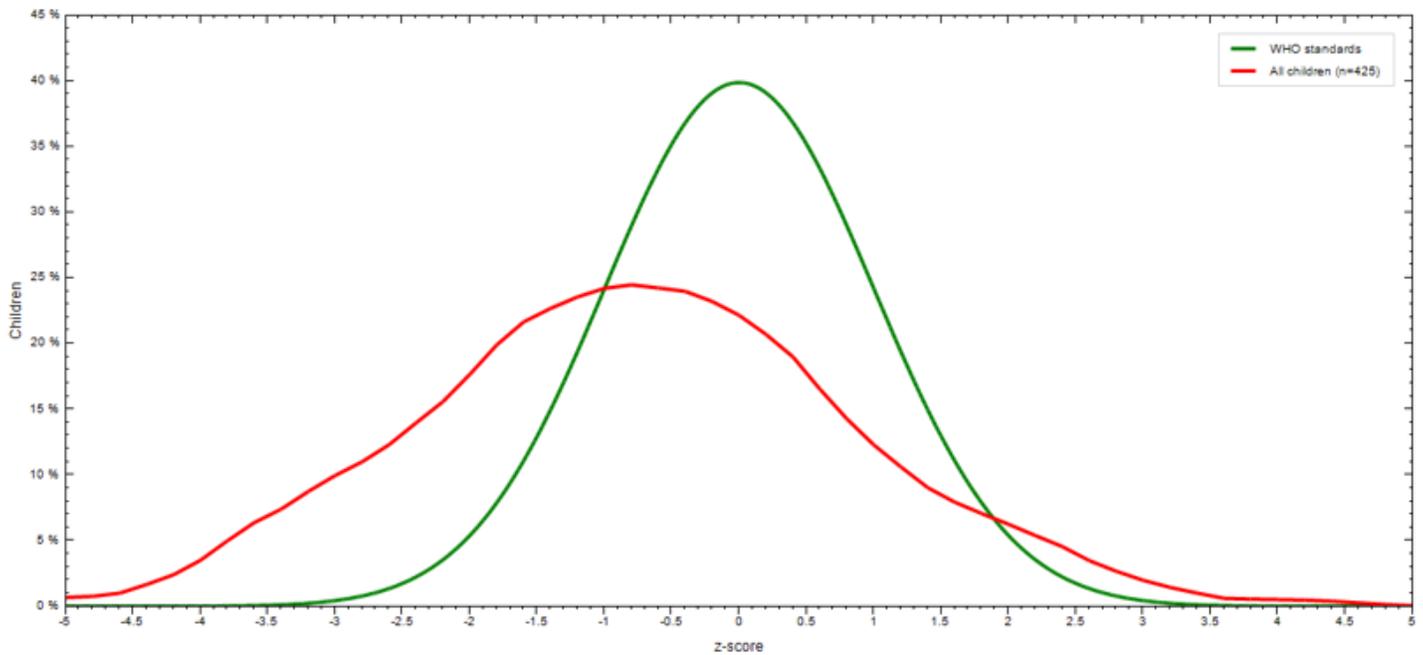


Figure 5

Distribution of underweight among children 6-23 months old in Sinan District, compared with WHO's standard population Sinan Woreda, East Gojjam Zone, North West Ethiopia, 2019 (n=427).

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