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# Determinants of wasting among children aged 6–59 months in North-East Ethiopia: a community-based case-control study

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## ABSTRACT

**Objective** Childhood acute malnutrition, in the form of wasting defined by Weight-for-Height Z-Scores, is a major public health concern. It is one of the main reasons for the death of children in developing countries like Ethiopia. Accordingly, this study aimed to assess determinants of wasting among children aged 6–59 months in Meket district, North Wollo zone, North-East Ethiopia.

**Setting** The study was conducted among communities in Meket district, North Wollo zone, North-East Ethiopia.

**Participants** A total of 327 (109 cases and 218 controls) children aged 6–59 months participated in the study. Children from 6 months to 59 months of age who match the definition of case/wasted/ and control/not wasted were eligible for the study. However, children who had physical deformities which make anthropometric measurements inconvenient were excluded from the study.

**Primary and secondary outcome measures** The main outcome measure was wasting.

**Result** The mean ages of the cases and controls were 21.77±11.41 months and 20.13±11.39 months, respectively. Factors that were significantly associated with wasting were: maternal decision making on the use of household money (adjusted odd ratio (AOR)=3.04, 95% CI 1.08 to 7.83), complementary feeding started in a month (AOR=3.02, 95% CI 1.097 to 6.97), food diversity score (AOR=2.64, 95% CI 1.64 to 5.23), frequency of complementary feeding (AOR=6.68, 95% CI 3.6 to 11.25) and history of acute respiratory infections (ARIs) 2 weeks preceding the survey (AOR=3.21, 95% CI 1.07 to 7.86).

**Conclusion** Our result implies that the right time to introduce complementary foods, the frequency of feeding and also the amount of food consumed were some of the crucial factors that needed to be changed in child nutrition to reduce wasting. Furthermore, within the framework of our study, the empowerment of women in the decision-making process and the prevention of ARI should be seen as a necessary benchmark for acute malnutrition.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study fills gaps in research by enabling specific area-based policy measures and interventions.
⇒ The study was a community-based study so it could have lower bias.
⇒ The study was not supported by qualitative data findings.
⇒ The potential to recall bias since the study design of case-control was used.
⇒ The study was conducted only among children aged 6–59 months, so it may not be generalisable to children of other age groups.

## INTRODUCTION

Malnutrition among children remains a critical public health problem in many parts of the world.[1 2] Wasting and stunting are the the most common forms of malnutrition in children under 5 years.[3] Acute malnutrition, also known as wasting, is characterised by rapid deterioration in nutritional status over a short period of time. It makes a child too thin for his or her height because of weight loss or failure to gain weight.[4 5] For children, it can be measured using the Weight-for-Height Nutritional Index or mid-upper arm circumference (MUAC).[6] It is defined as moderate acute malnutrition (MAM) and severe acute malnutrition (SAM). MAM is defined as Weight-for-Height Z-Score (WHZ) ≥ −3Z score and <−2Z score or MUAC ≥115 mm and < 125 mm (≥11.5 cm and < 12.5 cm). On the other hand, SAM is defined by visible severe wasting, or by the presence of bilateral pitting oedema of nutritional origin, or WHZ < −3Z score or MUAC <115 mm (<11.5 cm) in children aged 6–59 months.[2 7]

Globally, between 8 million and 11 million children under 5 years of age die each year.[8] More than 35% of these deaths are attributed to undernutrition and 1 in 12 children (8%, 52 million) are wasted. It is also one of the major causes of childhood deaths in developing countries.[9–11] More than 90% of undernourished people live in developing countries.[7] Africa carries the heaviest burden of undernutrition.[12] A recent study indicated that 39.9% of children in the same age group

are affected by malnutrition.[7] The prevalence of wasting in East Africa is 6%.[13]

Ethiopia has adopted a multisectorial nutrition policy and has been implementing nutrition programmes with some success.[14 15] In this regard, a programme called 'the sustainable under-nutrition reduction in Ethiopia (SURE)' has been designed in Ethiopia. This programme is a government-led multisectorial intervention that helps to integrate the work of the health and agriculture sectors. It delivers a complex multicomponent intervention to improve child feeding, diversified diet and nutritional behaviour modification to reduce undernutrition.[15]

Although Ethiopia has progressed, in this way, towards achieving the target for wasting, 7.2% of children under 5 years of age are still affected.[16] According to the Ethiopian Demographic and Health Surveys (EDHS) in 2000 and 2005, the prevalences of wasting in children under 5 years of age were 11.1%[17] and 11.0%,[18] respectively. On the other hand, the prevalence of wasting in children under 5 years of age declined from 10%[19] to 9.8%[20] between 2011 and 2016. Moreover, 7% of children in Ethiopia are wasted according to the Ethiopian mini EDHS of 2019.[21] Amhara region is an area with surplus food production in the country, but unfortunately with a highly impacted area.[22] According to a finding from EDHS 2016, 9.8% of children were wasted.[23] The recent findings also showed that high statistically significant hot spots of wasting were found in the northern parts of the country.[24 25]

Multiple factors contribute to childhood wasting. The common determinants reported by several studies include gender,[3 26–28] age of the child,[26–28] diarrhoea in the previous 2 weeks,[26–28] not consuming additional food during pregnancy/lactation,[29 30] non-exclusive breastfeeding practices,[31 32] larger family size,[31 33] mother's education,[26 31] presence of acute respiratory infections (ARIs),[31 34] attending Antenatal Care (ANC),[26 35 36] immunisation status.[32 37] In these cases, ANC helped mothers protect their children from infection and take care of child feeding practices.[38 39]

Childhood wasting varies between localities due to individual and community-level factors. However, studies were done only at the national and regional levels. The prevention strategies and risk factors at the subregional level were not under focus. We argue that having a subregional approach enables application-specific area-based policy intervention. Moreover, we focused on the 6–59 months age group in which wasting is highly prevalent. In this age group complementary feeding is started and feeding practice is fully dependent on caregivers.[40 41] The researchers of this study initiated to conduct further study on the causes of wasting to design local specific interventions. Additionally, this study helps fill the existing knowledge gap by assessing the burden of wasting among children aged 6–59 months in Meket district, North Wollo zone, North-East Ethiopia.

## METHODS AND MATERIALS

### Study area, design and period

A community-based case-control study was undertaken to identify determinants of wasting among children aged 6–59 months in Meket district, North Wollo zone, North-East Ethiopia, from January to February 2020. Meket district is located in Amhara regional state and is situated about 670 km north of the capital city of Ethiopia, Addis Ababa. The district is also 245 km away from Bahir Dar and 145 km away from the city of Woldia in North Wollo Zone. It has 2 urban and 32 rural kebeles. Based on Meket district administration reports, the catchment population includes 208 687 people (106 430female and 102 257 male) in 48 532 households. The total number of children aged 6–59 months in this district was 26 879; out of those 13 708 of them were female and 13 171 male.[42] There is 1 primary hospital, 13 health centres and 36 health posts in this district.

### Source and study populations

All mothers or caregivers that had children aged 6–59 months and who were present in Meket district kebeles during the study period were the source population. Children aged 6–59 months who were admitted due to wasting (WHZ<−2Z score) with their caregivers or mothers were included in the study as cases. Children aged 6–59 months and attending without wasting who came for integrated community case management, screening, immunisation, growth monitoring promotion, and for other purposes were included as controls. Children who had physical deformities which make anthropometric measurements inconvenient were excluded from the study. For instance, children who were born without hands due to congenital deformities, were wounded or had burnt hands were excluded from the study since they had physical deformities.

### Sample size and sampling procedure

The sample size was calculated using Epi Info V.7 statistical software, and a case-control study was used. The size of the sample was determined from a previous study that was conducted in North-West Ethiopia, which was similar to our study setting. All candidate variables of wasting were considered and the largest was taken. Accordingly, we took into account children from households of large family size as it was the main associated factor of wasting in the previous study.[43]

The percentages of exposure among cases and controls in the abovementioned study were 64.4% and 46.6%, respectively. Detecting an OR of 2.7 with 95% CI ($Z\alpha/2=1.96$), a power of 80% ($Z\beta=0.84$) and a case to control ratio of 1:2 were taken from the previous study. Therefore, the total sample size after adding 5% possible contingency for the non-response rate was 327. Of those, 109 cases and 218 controls were approached.

Among the 36 kebeles found in Meket district, 10 were selected using simple random sampling methods. The number of study participants, that is children aged 6–59

months, was assigned for each selected kebele proportionally to its size. The number of children in each kebele was found from the vital statistics report of kebele offices.

After establishing the sampling frame, cases were identified and selected during a house-to-house visit in each selected kebele. A simple random sampling technique was used to select households until the sample size was achieved. For more than one wasted child per house, the lottery method was used. Whereas controls were selected after the matching criterion of age was fulfilled according to other inclusion and exclusion criterias. Individual matching was carried out as one case followed by two controls, based on three age categories from the same neighbourhood found through transect walks. Controls were matched to cases accordingly with an age interval similar to that of the cases (±3 months) and based on their place of residence (village or neighbourhood).[27 43–47]

## Operational definitions

### Wasting

Wasting is the nutritional deficient state of recent onset related to sudden food deprivation or malabsorption, utilisation of nutrients which results from weight loss, weight-for-height below −2 SD from the WHO median value.[48] In this study, acute malnutrition or wasting was used interchangeably which was incorporated in both SAM and MAM. MAM is defined as WHZ between −2 and −3 or MUAC between 115 mm and <125 mm. On the other hand, SAM is defined as WHZ < −3 or MUAC <115 mm, or the presence of bilateral pitting oedema, or both.[30]

#### *Case*

Children aged 6–59 months who were wasted according to the above definition including SAM or MAM.

#### *Control*

Children who weren't wasted or did not fulfil the definition of cases.

## Data collection instruments and quality control

Data were collected from all eligible children by data collectors using an interviewer-administered questionnaire and anthropometric measurements. MUAC was also taken from all children with standardising procedures. In addition to child anthropometry measurement, the mothers or caregivers of the children were interviewed face to face. The mothers or caregivers of the children provided answers on variables such as the socioeconomic and demographic characteristics of the participants.

Five nurses and 10 health extension workers for data collection and five supervisors were recruited. The data collectors and supervisors were provided with training for 3 days before the data collection period. The supervisors regularly monitored and supervised the overall activity to ensure the quality of data during the entire data collection period.

The questionnaire was adopted from different literatures.[27 29 32 34 36 49 50] It was originally prepared in English and then translated to the local language, Amharic. Finally, it was translated back to the English language by a skilled person, who had good proficiency in both English and Amharic, to check its consistency. The questionnaire was also pretested on 5% of actual respondents in Wadla district which is almost similar to the study population of this study. The questionnaire was modified based on the pretest.

Moreover, the questionnaire was comprised of different variables including socioeconomic and demographic factors, child medical characteristics, child-caring practices (feeding practice, immunisation), maternal caring characteristics, and environmental health conditions. Household food insecurity was assessed by using the nine standards of the Household Food Insecurity Access Scale Questionnaire.[51] We also used the WHO validated 7-item Food Frequency Questionnaire to quantify food diversity score.[48] Additionally, the data collectors observed expanded program on immunisation (EPI) cards to check the date of birth of the child and immunisation status.

To assess the physical growth and nutritional status of the children, measurements of height and weight were taken. Additionally, their age was determined by interviewing mothers or caregivers or by checking their birthday cards. These anthropometric data were collected using the procedure stipulated by WHO by trained data collectors, measured two times and then the average was taken.[51]

Anthropometric data were collected through the measurement of the height and weight of children. For those less than 2 years of age, measurement of the height was done without shoes. The height is read to the nearest 0.1 cm by using a horizontal wooden measuring board with the infant in a recumbent position on a hard and flat surface. However, the heights of children 24 months and above were measured using a vertical wooden board by placing the child on the measuring board. In this case, the child was standing upright in the middle of the board. The child's head, shoulders, buttocks and heels touched the board. The heights (lengths) of the children were recorded to the nearest 0.1 cm. Length is usually greater than standing height by 0.5 cm if the child is 85 cm or more. But, if length cannot be measured standing, 0.5 cm were subtracted from the supine length.[51]

The weight of the child was measured by one health professional, with a 25 kg hanging sprint, the scale graduated to the nearest 100 gm with minimum clothing and no shoes. Also, the scale should be at eye level to read easily when the child is calm. Calibration was done before weighing each child. This was done by setting it to zero and checking the normality by weighing a material of preknown weight. If there was a difference of 0.01 kg or more between duplicate weighing, or if a measured weight differs by 0.01 kg or more from the known standard, check the scales. Then, adjust or replace them if necessary.[51] See online supplemental file 1 for details of tools.

### Data analysis and procedures

Epi Info V.7 and SPSS V.24 were used for data entry and analysis, respectively. Besides, anthropometric data were analysed using the WHO Anthro V.2006 software.[52] The outcome variables were dichotomised into cases (1) and controls (0). Then, frequencies and cross-tabulation were used to describe the study population with regard to the relevant variables. Conditional logistic regression was used to fit the data to identify the predictors for wasting.

Bivariate logistic regression analysis was conducted to discover the effect of each study variable on the outcome variable. Variables having a value of p<0.25[53] on the bivariate analysis entered into a multivariate logistic regression analysis to control the possible confounding. In the multivariate logistic regression analysis, variables with a value of p<0.05 were considered statistically significant. The Hosmer-Lemeshow goodness-of-fit test ($\chi^2$/df=4.92; Root Mean Square Error of Approximation (RMSEA)=0.05; Comparative Fit Index (CFI)=0.95; Tucker-Lewis Index (TLI)=0.91) was applied to test the appropriateness of the model. Multicollinearity between independent variables was checked and all of the variables scored variance inflation factors <10.

### Patient and public involvement

No patient was involved.

## RESULTS

### Demographic and socioeconomic characteristics

A total of 327 respondents (109 cases and 218 controls) were interviewed at the community level, with a response rate of 100%. Among all respondents, 48 (44.0%) cases and 110 (50.5%) controls had four to five families per household. Considering the number of children under 5 years of age in the households, 9 (8.2%) cases and 32 (14.7%) controls had less than two children per household. When we see maternal education status, 43 (39.4%) cases and 65 (29.8%) control mothers were not educated. Most decisions on the use of household money were by fathers who accounted for 85 (78.0%) cases and 142 (65.1%) controls (table 1).

### Child medical characteristics

Among the surveyed children, 74 (67.9%) cases and 133 (61.0%) controls were still breast feeding. Regarding the morbidity status of the children, 61 (56.0%) cases and 115 (52.8%) controls had a history of diarrhoea 2 weeks preceding the survey. In addition, 37 (33.9%) cases and 35 (16.1%) controls had a history of ARI 2 weeks before the survey (table 2).

### Child-feeding characteristics

Among all the surveyed children, 58 (53.2%) cases and 172 (78.9%) controls consumed complementary feeding three or more times in a day, while 67 (61.5%) cases and 163 (74.8%) controls were exclusively breast fed. Regarding the frequency of breast feeding, most of the

**Table 1** Socioeconomic and demographic characteristics of study participants in Meket district, North Wollo zone, North-East Ethiopia, January 2020 (n=327)

| Variable | Categories | Case N (%) | Controls N (%) |
|---|---|---|---|
| Head of household | Male headed | 89 (81.7%) | 177 (81.2%) |
| | Female headed | 20 (18.3%) | 41 (18.8%) |
| Marital status | Married | 89 (81.7%) | 177 (81.2%) |
| | Divorced | 17 (15.6%) | 34 (15.6%) |
| | Widowed | 3 (2.8%) | 7 (3.2%) |
| Religion | Orthodox | 70 (64.2%) | 168 (77.1%) |
| | Muslim | 39 (35.8%) | 50 (22.9%) |
| Family size | 2–3 | 42 (35%) | 78 (35.8%) |
| | 4–5 | 48 (30%) | 110 (50.4%) |
| | >5 | 19 (39%) | 30 (13.8%) |
| Children under 5 years of age | <2 | 9 (8.2%) | 32 (14.7%) |
| | 2 | 38 (34.9%) | 78 (35.8%) |
| | >2 | 62 (56.9%) | 108 (49.5%) |
| Maternal education | Illiterate | 43 (39.4%) | 65 (29.8%) |
| | Read and write | 28 (25.7%) | 65 (29.8%) |
| | Primary education | 15 (13.8%) | 33 (15.2%) |
| | Higher education | 23 (21.1%) | 55 (25.2%) |
| Paternal education | Illiterate | 40 (36.7%) | 63 (28.9%) |
| | Read and write | 34 (31.2%) | 84 (38.5%) |
| | Primary education | 15 (13.8%) | 34 (15.6%) |
| | Higher education | 20 (18.3%) | 37 (17.0%) |
| Maternal occupation | Public servant | 7 (6.4%) | 27 (12.4%) |
| | Farmer | 20 (18.3%) | 53 (24.3%) |
| | Merchant | 39 (35.8%) | 59 (27.1%) |
| | House wife | 43 (39.5%) | 79 (36.2%) |
| Paternal occupation | Public servant | 12 (11.1%) | 36 (16.5%) |
| | Farmer | 53 (48.6%) | 82 (37.6%) |
| | Merchant | 19 (17.4%) | 41 (18.8%) |
| | Daily labourer | 25 (22.9%) | 59 (27.1%) |
| Maternal decision-making on use of household money | Yes | 35 (32.1%) | 106 (48.6%) |
| | No | 74 (67.9% | 112 (51.4%) |
| Have livestock | Yes | 61 (56.0%) | 127 (58.3%) |
| | No | 48 (44.0%) | 91 (41.7%) |
| Number of livestock per household | 0 | 50 (45.9%) | 91 (41.7%) |
| | 1–5 | 42 (38.5%) | 88 (40.4%) |
| | >5 | 17 (15.6%) | 39 (17.9%) |

Continued

Table 1 Continued

| Variable | Categories | Case N (%) | Controls N (%) |
|---|---|---|---|
| Have farmland | Yes | 60 (55%) | 111 (50.9%) |
| | No | 49 (45.0%) | 107 (49.1%) |
| Land size, hectares | <0.5 | 67 (61.5%) | 122 (56.0%) |
| | 0.5 | 16 (14.7%) | 36 (16.5%) |
| | ≥0.5 | 26 (23.8%) | 60 (27.5%) |
| Food security status | Food secure | 83 (76.1%) | 180 (82.6%) |
| | Mild food insecure | 7 (6.4%) | 10 (4.6%) |
| | Moderately food insecure | 16 (14.7%) | 23 (10.5%) |
| | Sever food insecure | 3 (2.8%) | 5 (2.3%) |
| Sex of child | Male | 48 (44.0%) | 99 (45.4%) |
| | Female | 61 (56.0%) | 119 (54.6%) |
| Age of children, months | 6–8 | 7 (6.4%) | 6 (2.7%) |
| | 9–11 | 14 (12.8%) | 10 (4.6%) |
| | 12–23 | 54 (49.5%) | 119 (54.6%) |
| | 24–59 | 34 (31.2%) | 83 (38.1%) |
| Place of delivery | Health facility | 56 (51.4%) | 106 (48.6%) |
| | Home | 53 (48.6%) | 112 (51.4%) |
| Wealth Index | Poor | 50 (45.9) | 134 (61.5) |
| | Medium | 36 (33.0) | 45 (20.6) |
| | Rich | 23 (21.1) | 39 (17.9) |

Table 2 Child medical characteristics of the study participants in Meket district, North Wollo zone, North-East Ethiopia, January 2020 (n=327)

| Variable | Categories | Cases N (%) | Controls N (%) |
|---|---|---|---|
| Breast feeding | Yes | 74 (67.9%) | 133 (61.0%) |
| | No | 35 (32.1%) | 85 (39.0%) |
| Diarrhoea 2 weeks before the survey | Yes | 61 (56.0%) | 115 (52.8%) |
| | No | 48 (44.0%) | 103 (47.2%) |
| Fever 2 weeks before the survey | Yes | 72 (66.1%) | 146 (67.0%) |
| | No | 37 (33.9%) | 72 (33.0%) |
| ARI 2 weeks before the survey | Yes | 37 (33.9%) | 35 (16.1%) |
| | No | 72 (66.1%) | 183 (83.9%) |
| History of measles 2 weeks before the survey | Yes | 1 (0.9%) | 1 (0.05%) |
| | No | 108 (99.1%) | 217 (99.5%) |

ARI, acute respiratory infection.

mothers, 48 (44.0%) cases and 111 (50.9%) controls, breast fed their children eight times or more per day. Moreover, 18 (16.5%) cases and 89 (40.8%) controls consumed at least four food groups daily. Most of the surveyed children, 93 (85.3%) cases and 174 (79.8%) controls were immunised. Additionally, 89 (81.7%) cases and 179 (82.1%) controls supplemented with vitamin A (table 3).

### Maternal caring characteristics

Among all the mothers or caregivers, most of them, 71 (65.1%) cases and 124 (56.9%) controls were in the age group between 20 years and 29 years. Ninety-one (83.5%) cases and 191 (87.6%) controls received ANC during pregnancy. With regard to mothers' extra food during pregnancy and lactation, 69 (63.3%) cases and 154 (70.6%) controls responded positively. Additionally, most caregivers, 92 (84.4%) cases and 201 (92.2%) controls gave first birth in the age group between 20 and 29. Moreover, 71 (65.1%) cases and 136 (62.4%) controls already had 1 to 3 children (table 4).

### Environmental health condition

The families who had access to protected water sources included 87 (79.8%) cases and 177 (81.2%) controls. Among the respondents, 67 (61.5%) cases and 130 (59.60%) controls required less than 15 min to fetch water from the sources. About 41 (37.6%) cases and 90 (41.3%) controls used 40–50 L water per household within a day. Of all caregivers, 66 (60.5%) cases and 128 (58.7%) controls used treated water at home. Whereas 40 (36.7%) cases and 122 (56.0%) controls had good washing practice. Among caregivers, 87 (79.8%) cases and 169 (77.5%) controls had latrines. Additionally, 67 (61.5%) cases and 126 (57.8%) controls disposed waste by burning (table 5).

### Determinants of wasting

Among the variables subjected to conditional binary logistic regression, the number of children under 5 years of age in households, maternal decision-making on the use of household money, complementary feeding started in a month, dietary diversity score, frequency of complementary feeding, immunisation, knowing and practising critical handwashing time, households water consumption per day and ARI showed association with a value of p<0.2. Variables that showed association in bi-variable regression analysis were subjected to multivariable logistic regression analysis to see and evaluate the independent effect of each variable on wasting.

Ultimately, the multivariable conditional logistic regression model revealed that the odds of mothers who were making decision on the use of household money were nearly 3.04 times more likely to develop wasting as compared with their counterparts (adjusted odd ratio (AOR)=3.04, 95% CI 1.08 to 7.83). The odds of wasting were nearly 2.64 times riskier among those who did not take at least four food groups daily than their counterparts

Table 3 Child-feeding characteristics of the study participants in Meket district, North Wollo zone, North-East Ethiopia, January 2020 (n=327)

| Variable | Categories | Cases N (%) | Controls N (%) |
|---|---|---|---|
| Frequency of complementary feed per day | ≤2 times | 51 (46.8%) | 46 (21.1%) |
| | ≥3 times | 58 (53.2%) | 172 (78.9%) |
| Frequency of breast feeding per day | 4–7 times | 61 (56%) | 107 (49%) |
| | ≥8 times | 48 (44%) | 111 (51%) |
| Child exclusively breast fed, months | <6 or >6 | 50 (45.9%) | 47 (21.6%) |
| | 6 | 59 (54.1%) | 171 (78.4%) |
| Immunisation | Immunised | 93 (85.3%) | 174 (79.8%) |
| | Not immunised | 16 (14.7%) | 44 (20.2%) |
| Vitamin A supplementation | Yes | 89 (81.7%) | 179 (82.1%) |
| | No | 20 (18.3%) | 39 (17.9%) |
| Dietary diversity score | <4 food groups | 91 (83.5%) | 129 (59.2%) |
| | ≥4 food groups | 18 (16.5%) | 89 (40.8%) |
| Food insecurity | Not secured | 84 (77.1%) | 122 (56.0%) |
| | Secured | 25 (22.9%) | 96 (44.0%) |

(AOR=2.64, 95% CI 1.64 to 5.23). The odds of wasting were 3.52 times higher among children who didn't had complementary breast feeding at optimal time than those who started feeding at 6 months (AOR=3.52, 95% CI 1.097 to 6.97). Children who feed only two times and less were 6.68 times more likely to develop wasting than those who feed more than two times a day (AOR=6.68, 95% CI 3.6, 11.25). Children who had a history of ARI 2 weeks before the survey were 2.21 times more likely to develop wasting as compared with their counterparts (AOR=2.21, 95% CI 1.07 to 7.86) (table 6).

Table 4 Maternal caring characteristics of the study participants in Meket district, North Wollo zone, North-East Ethiopia, January 2020 (n=327)

| Variable | Categories | Cases n (%) | Controls n (%) |
|---|---|---|---|
| Age of mothers, years | 20–29 | 71 (65.1%) | 124 (56.9%) |
| | 30–39 | 27 (24.8%) | 76 (34.8%) |
| | 40–49 | 11 (10.1%) | 18 (8.3%) |
| Age at which mothers gave their first birth, years | 15–19 | 15 (13.8%) | 16 (7.3%) |
| | 20–29 | 92 (84.4%) | 201 (92.2%) |
| | 30–39 | 2 (1.8%) | 1 (0.5%) |
| Total child born earlier | 1–3 | 71 (65.1%) | 136 (62.4%) |
| | >3 | 38 (34.9%) | 82 (37.6%) |
| Extra food taken during pregnancy and lactation | Yes | 69 (63.3%) | 154 (70.6%) |
| | No | 40 (36.7%) | 64 (29.4%) |
| Antenatal Care (ANC) | Yes | 91 (83.5%) | 191 (87.6%) |
| | No | 18 (16.5%) | 27 (12.4%) |

## DISCUSSION

The nutritional status of children under 5 years of age can be affected by different factors. Factors contributing to wasting are multilayered. Identifying the determinants of wasting in the study area can be very important for implementing an effective intervention. Most of the previous studies were cross-sectional and facility-based which might show bias. Children whose mothers did not participate in decision-making on the use of household money were 3.04 times more wasted than their counterparts (AOR=3.04, 95% CI 1.08 to 7.83). This result was in line with the study conducted in the Libo Kemekem district of the Amhara region[54] and southern Ethiopia.[49] This could be explained by the fact that empowering women's decision-making autonomy is crucial for maternal health service utilisation. It also enables mothers to discuss with health professionals about their child's growth, infant, and young child feeding. Moreover, this might ensure women's equality in decision-making with men and lead to applying nutritional information obtained from health facilities.

Moreover, this study described that the probability of wasting was 3.02 times more likely among children who started complementary feeding at <6 and >6 months duration than those who had started complementary feeding at 6 months (AOR=3.02, 95% CI 1.097 to 6.97). This result was consistent with studies conducted in North Ethiopia,[34] South Ethiopia[55] and Nigeria.[56] This might be due to starting complementary feeding early and lately has an impact on child growth and mental development as well as it might decrease the immunity of child to protect against ARI and other childhood illnesses.

The odds of children with less than four food diversity scores were 2.64 times higher to be wasted than the odds

**Table 5** Environmental health characteristics of the study participants in Meket district, North Wollo zone, North-East Ethiopia, January 2020 (n=327)

| Variable | Categories | Cases N (%) | Controls N (%) |
|---|---|---|---|
| Households water consumption per day, litres | <40 | 37 (34.0%) | 54 (24.8%) |
| | 40–50 | 41 (37.6%) | 90 (41.3%) |
| | >50 | 31 (28.4%) | 74 (33.9%) |
| Time taken to fetch water in round trips, min | <15 | 67 (61.5%) | 130 (59.6%) |
| | 15–30 | 18 (16.5%) | 46 (21.1%) |
| | >30 | 24 (22.0%) | 42 (19.3%) |
| Doses households use water chemical | Yes | 66 (60.6%) | 128 (58.7%) |
| | No | 43 (39.4%) | 90 (41.3%) |
| Have latrine | Yes | 87 (79.8%) | 169 (77.5%) |
| | No | 22 (20.2%) | 49 (22.5%) |
| Handwashing practice of mothers/caregivers | Yes | 40 (36.7%) | 122 (56.0%) |
| | No | 69 (63.3%) | 96 (44.0%) |
| Method of households waste disposal | Burning | 67 (61.5%) | 126 (57.8%) |
| | Open field | 42 (38.5%) | 92 (42.2%) |
| Source of households drinking water | Protected | 87 (79.8%) | 177 (81.2%) |
| | Unprotected | 22 (20.2%) | 41 (18.8%) |

of children who had four and above daily consumption of food diversity scores (AOR=2.64, 95% CI 1.64 to 5.23). This was consistent with a previous study conducted in Ghana.[27] This could be explained by the fact that a dietary intake below the minimum requirement leads to nutritional inadequacy and reduces the immune response. It exacerbates the chance of childhood illness and, ultimately, acute malnutrition.

**Table 6** Determinants of wasting among children aged 6–59 months in Meket district, North Wollo zone, North-East Ethiopia, January 2020 (n=327)

| Variable | Categories | Cases N (%) | Controls N (%) | COR (95% CI) | AOR (95% CI) |
|---|---|---|---|---|---|
| Number of children under 5 years of age in households | <2 | 9 (8.2%) | 32 (14.7%) | 1 | 1 |
| | 2 | 38 (34.9%) | 78 (35.8%) | 1.73 (0.74 to 6.30) | 2.35 (0.93 to 4.87) |
| | ≥3 | 62 (56.9%) | 108 (49.5%) | 2.04 (1.05 to 6.01) | 1.96 (0.74 to 5.89) |
| Maternal decision-making on use of household money | Yes | 35 (32.1%) | 106 (48.6%) | 1 | 1 |
| | No | 74 (67.9% | 112 (51.4%) | 2.01 (1.68 to 4.51) | 3.04 (1.08 to 7.83)* |
| Complementary feeding started | At 6 months | 59 (54.1%) | 171 (78.4%) | 1 | 1 |
| | Before or >6 months | 50 (45.9%) | 47 (21.6%) | 3.08 (1.13 to 8.49) | 3.02 (1.097 to 6.97)* |
| Dietary diversity score (food groups) | <4 | 91 (83.5%) | 129 (59.2%) | 3.47 (1.36 to 4.87) | 2.64 (1.64 to 5.23) * |
| | ≥4 | 18 (16.5%) | 89 (40.8%) | 1 | 1 |
| Frequency of complementary feeding | ≤2 times | 51 (46.8%) | 46 (21.1%) | 3.29 (1.62 to 6.87) | 6.68 (3.6 to 11.25)* |
| | 3–5 times | 58 (53.2%) | 172 (78.9%) | 1 | 1 |
| Immunised | Yes | 93 (85.3%) | 174 (79.8%) | 1 | 1 |
| | No | 16 (14.7%) | 44 (20.2%) | 1.47 (1.05 to 3.97) | 1.19 (0.74 to 3.01) |
| Knowing and practising critical handwashing time | Yes | 40 (36.7%) | 122 (56.0%) | 1 | 1 |
| | No | 69 (63.3%) | 96 (44.0%) | 2.19 (1.19 to 2.571) | 1.46 (0.57 to 1.84) |
| Households water consumption per day, litres | <40 | 37 (34.0%) | 54 (24.8%) | 1.64 (1.28 to 2.99) | 0.41 (0.91 to 1.87) |
| | 40–50 | 41 (37.6%) | 90 (41.3%) | 1.09 (1.31 to 2.97) | 1.21 (0.56 to 2.63) |
| | >50 | 31 (28.4%) | 74 (33.9%) | 1 | 1 |
| ARI | Yes | 37 (33.9%) | 35 (16.1%) | 2.69 (1.93 to 9.73) | 2.21 (1.07 to 7.86)* |
| | No | 72 (66.1%) | 183 (83.9%) | 1 | 1 |

*Variable significant at p<0.05, 1 = reference, n=frequency.
AOR, adjusted odd ratio; ARI, acute respiratory infection; COR, crude odd ratio.

Wasting was 2.21 times higher among children affected by ARI 2 weeks before the survey than their counterparts (AOR=5.21, 95% CI 1.07 to 7.86). This finding was supported by a study conducted in the Somali region,[28] North-West Ethiopia[26] and western Amhara.[36] This was because infection makes it difficult to maintain an optimal nutritional status by decreasing the appetite of children.

According to the finding of this study, children who had history of less than two times frequency of complementary feeding were 6.68 times more likely to be wasted than those children having three or more times frequency of complementary feeding (AOR=6.68, 95% CI 3.6 to 11.25). This result was consistent with the study conducted in southern Ethiopia.[49] The finding of this study also supports one of the health sector policies of strengthening infant and young child feeding practices to prevent child mortality.[50] This was because having frequent complementary feeding practices could lead to optimal growth and development of the child as well as increase their chances of survival.

## CONCLUSION

Our result implies that the right time to introduce complementary foods, the frequency of feeding and also the amount of food consumed were some of the crucial factors that needed to be changed in child nutrition to reduce wasting. Furthermore, within the framework of our study, the empowerment of women in the decision-making process and the prevention of ARI should be seen as a necessary benchmark for preventing acute malnutrition.

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