Stunting and Associated Factors Among 6-23 Month Old Children in Drought Vulnerable Kebeles of Demba Gofa District, Southern Ethiopia

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Abstract

Background

Stunting is impaired linear growth of children that they experience it in the first 1000 days after conception and indication of chronic malnutrition. It is caused by poor maternal nutrition and other interrelated factors.

Objective

This study conducted to assess the magnitude and associated factors of stunting among 6–23 month old children in drought vulnerable kebeles of Demba Gofa district.

Methodology:

A cross-sectional study with stratified multistage sampling was conducted. Semi-structured questionnaire and anthropometric measurements were used to collect the data. Bivariate and multivariable logistic regression models were fitted using SPSS 20.0 for Windows. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were used to measure the strength of the association between dependent and associated variables at a p value < 0.05.

Result

From the total study population (362), 79 (21.82%) of the children were stunted. Household dietary diversity [AOR = 0.45, 95% CI, 0.78, 0.966], exclusive breast feeding [AOR = 3.54, 95% CI, 1.33, 9.41], early initiation of complementary feeding [AOR = 0.08, 95% CI, 0.044–0.174] and not feeding animal source food during complementary feeding [AOR = 0.061, 95% CI, 0.016–0.226] were significantly associated with child stunting.

Conclusions

The extent of stunting in the study area is relatively lower than national and regional average. However, based on the findings awareness creation on exclusive breast feeding, complementary feeding and dietary diversification strategies suggested to lessening the problem.

Introduction

Stunting is impaired linear growth of children that they experience it in the first 1000 days after conception. A stunted child has low height or length to their age. Height-for-age equal to -2 standard errors or below as compared with reference group (Z-score = < -2) are considered to be stunted. It is an indication of chronic malnutrition of early childhood [1]. Mostly 70% of stunting occurs in the period between conception to the first 2 years of life (0–23 months) [2]. Stunting mainly associated with poor maternal nutritional status and other interrelated problems such as dietary intake, infectious diseases, micronutrient deficiencies and the environment [1–4]. Furthermore, socioeconomic, demographic and environmental factors concomitantly have significant effect in determining stunting [5]. Besides, food insecurity reduces food consumption dietary energy intake, compromise diet quality and diversity. Deprivation of calories or essential nutrients can erode both physical and mental health, which lead to less economically productive populations [6, 7].

Stunted individuals will earn an average of 22% less than their non-stunted counterparts [8]. Study findings shows that young children who were stunted are 33 % less likely to escape poverty as adults resulting to overall GDP loss of 4 to 11 percent in Africa and Asia [9, 10]. In Ethiopia cost of hunger as a result of malnutrition estimated up to 16.5% of GDP annually [11]. According to UNICEF, globally, 21.9% (149 million) under-fives are stunted and out of these, 33.6% accounts for East Africa [12]. In Ethiopia, also stunting is major public health concern and 37% of children below five years are stunted. Regionally, the magnitude of stunting in Southern Nations and Nationalities is close to national average and recent data indicates that 36%, of children below 5 years of age in the region are stunted [13]. Severe food insecurity of households in Bangladesh and Ethiopia has increased risk of being stunted [7].

Food insecurity, poor complementary feeding, lack of potable water, poor housing conditions and high burden of illness that accompanies chronic poverty create an environment that can negatively affect children's educational attainment and economic security in the long term on dwellers of low/middle income countries [8, 14]. Communities in food insecured areas are susceptible to insufficient access to nutritionally adequate, safe food and inadequate utilization of food. Consequently, it reduces dietary variety, nutrient intake, and affects nutritional status of inhabitants. In addition, unsanitary environment that exposes children to repeated infections leading to poor absorption or utilization of the nutrients consumed [7]. Some kebeles of Demba Gofa district are identified as drought vulnerable, food insecure and incorporated in safety net programs by legislative body of the district and obtain humanitarian emergency supports.

Additionally, environmental sanitation is also deprived and lacks of clean drinking water problems are evident in food insecured areas of the district and they are likely to raise frequency of stunting in the area. Stunting often goes unrecognized in communities where short stature is so common that it is considered normal. The difficulty in visually identifying stunted children and the lack of routine assessment of linear growth in primary health care services explain why it has taken so long to recognize the magnitude of this hidden scourge [15]. Also once established stunting is irreversible and that is why this study specifically focuses on stunting. Furthermore, there is limited evidence on magnitude of stunting among under-five children in the proposed study area. Besides, in identifying determinants of stunting in the drought vulnerable areas of the district, there is also paucity of evidence regarding determinants of stunting.

Therefore, this study conducted to analyze the extent and determinants of stunting among children between 6–23 months of age in drought vulnerable kebeles of Demba Gofa district.

Methods

Study design and Area description

Community-based cross sectional study was conducted from February to March, 2021. Demba Gofa district is one of eight districts located in Gofa Zone in Southern Nations Nationalities and Regional State. It lies between 8º71’81” North and 43º89’85” East. Found in 305 km away from regional capital Hawassa and 525km south west from Addis Ababa. Figure 1 shows map of study area.

Data Collection

The required data for this study was collected both from primary and secondary sources. Primary data were collected by semi structured questionnaires developed to collect information of sociodemographic, child, maternal health and environmental characteristics, household dietary diversity and anthropometric measurement of children in the age of 6–23 months old. Secondary data was collected from Demba Gofa district agricultural and natural resource department and from the district health office.

Data Quality Management

Pretest of the questionnaires was conducted on 5% of the households before the actual data collection process, to check things need to be modified before the actual assessment and the ability of the questionnaire to collect the type of data desired to collect. A questionnaire was translated into Amharic for common understanding and to check consistency of the meaning, the Amharic version was also translated back to English. Training for data collectors was given, how to collect the data. Furthermore, supervision was done during data collection by investigators.

Sampling and Sample size determination

Study population size was determined by having the total number of children below 2 years of age from each kebeles by using Epi Info software version 7.2.2.6 based on the following assumptions.

Confidence interval (CI) – 99%, total number of children 6–23 month of age in selected kebeles was 713, for expected frequency, regional stunting average 44% is taken, acceptable margin of error is 5%, design effect was 1 and cluster number is also 1. Total sample size determined by using Epi info software is 345 and 5% ($17.25 \approx 17$) was added for non-response. Totally 362 children from 6–23 months of age and their respective mothers or caregivers were selected as study populations. The determined sample size was allocated for those five selected kebeles as per their total number of under-two children share. Finally, infant-mother/caregivers pairs were selected from each kebele by using simple random sampling methods after giving code for each household which has child from 6–23 months. The flow diagram below on Fig. 2 shows the sampling and sample selection method.

Data Collection Methods and Measurements

Data were collected through face-to-face interview with mothers/care givers who have one child below 24 months from each household. One health extension worker and one nurse per kebele were allocated for data collection. One day training was given for data collectors on anthropometric measurement. Length was measured in recumbent position using sliding board by two data collectors and taken to the nearest 1mm.

Inclusion and Exclusion Criteria

Mothers/care givers who has children from 6–23 month old and who lived in the selected kebele for at least 6 months were included in the study. Those who had mental illnesses interfering with the interview were not considered in the study. Children above 23 month and below 6 month were also excluded from this study.

Study design for Sociodemographic characteristics analysis

Cross sectional survey was conducted through home to home visit by using a structured and pretested interviewer-administered questionnaire. The questionnaire consists of questions that could measure sociodemographic characteristics of study population.

Study design for child, maternal health and environmental characteristics analysis

To assess further independent variables such as child-care practices (breastfeeding, complementary feeding practices), maternal characteristics (number of children, feeding practice during pregnancy and lactation), and facilities (drinking water), a pretested semi structured questionnaire was used.

Study design for Household dietary diversity study

House hold dietary diversity data were collected according to FAO [16] guideline by using semi-structured questionnaires and micro-level data drawn from repeated 24 hours diet recall survey for daily dietary intake of the house hold members. An individual who was responsible to prepare food or serve food for the family members was used as source of household dietary diversity data. Household dietary diversity was assessed with a scale of seven food groups, cereals and grains, vegetables, fruits, dairy products, oil and fat, protein-rich and discretionary calorie foods. Finally the score (HDDS) was found to be optimal when a child was fed foods greater than four food groups per day [17].

Study design for Anthropometric data

Anthropometric data were collected according to the method designed by Gibson [18] the child health card or birth certificate was used to ascertain and record the age of the index child. In situations where the mother/care giver did not have the documents to ascertain the age of the child, they were asked to identify a child from the neighborhood who was born almost the same time. Height of the children was measured in a recumbent position, by using free standing height/length standiometer by checking that the children was bare foot and the heels, buttocks, shoulders, and the back of the head touched the standiometer. Each measurement was taken twice and the average result was taken to ensure accuracy [18].

The height-for-age index of children was calculated by using growth standards published by the World Health Organization (WHO) in 2006. These growth standards were generated through data collected in the WHO Multicentre Growth Reference Study [19] and expressed in standard deviation units from the Multicentre Growth Reference Study median. The height-for-age index is an indicator of linear growth retardation and cumulative growth deficits in children. Children with height-for-age Z-score below minus two standard deviations (− 2 SD) from the median of the WHO reference population were considered to be stunted or chronically malnourished while children who are below minus three standard deviations (− 3 SD) from the reference median were considered severely stunted.

Data analysis

The data collected from sociodemographic, child, maternal health and environmental characteristics and dietary diversity were coded, entered, and documented electronically using EpiData version 3.1 and exported to SPSS version software 20.0 for data analysis. First, frequencies and proportions were computed to describe the study results. For anthropometric data analysis WHO anthro v.3.2.2 software was utilized to convert raw nutritional data into Z-scores. Data recorded in WHO Anthro was transferred to SPSS version 20. Binary logistic regression analysis was carried out to assess the predictors of stunting by explanatory variables and to determine predictor variables, significantly associated with the outcome variable at 0.25. Variables with less level of significance in the bivariate analyses, were candidate variables for multivariate logistic regression. To display strength of association between dependent and independent variables, odds ratio at 95% CI were computed. Variables with *p* value at 0.05 in multivariate analyses were used to state statistical significance.

Results

Sociodemographic characteristics

Sociodemographic characteristics of the study population indicated on Table 1. As depicted on the table, all of the study participants are ethnically Gofa and regarding their religion, 73.7% are Protestant religion follower and the rest 26.3% are Orthodox religion followers. Mothers participated in this study are in the age range of 16–45, almost all of them are married and 98% of the households headed by the husband. In terms of family size, 59.5% of study participants have 3–5 family members, 38% of them have 6–9 family members and 2.5% of the households contain 10–12 family size. Half of the mothers participated in study followed formal education and 49.7% are not. Whereas, 56.4% of husbands followed formal education and the remaining 43.6% are not. Occupationally, significant proportions (93.1%) of mothers in this study are housewife and in case of husbands 88.1% are farmer, 8.3% merchant and 3.6% are employee. Majority (93.4%) of the households earns 100–500 ETB per month, 3.3% of the households have monthly income of 500–1000 ETB and similarly 3.3% households have monthly income more than

1000 ETB. Regarding livestock 73.8% of the households participated in this study rare livestock, even though majority of the study participants and dwellers in the study area are farmers, 52.2% of farmers have their own agricultural land and the rest 47.8% does not have their own agricultural land.

Table 1
Sociodemographic characteristics of the study population

Variables	Response variables	Frequency	Percent
Ethnicity	Gofa	362	100
Religion	Protestant	267	73.7
	Orthodox	95	26.3
Mothers age	16–25	122	33.7
	26–40	236	65.2
	> 41	4	1.1
Marital status	Married	360	99.4
	Single	1	0.3
	Widowed	1	0.3
Head of the household	Husband	355	98
	Wife	7	2
Family size	3–5	216	59.5
	6–9	137	38
	10–12	9	2.5
Children below 5 years of age per household	1	144	39.8
	2	187	51.6
	3	31	8.6
Formal education Status of women	Followed formal education	182	50.3
	Not followed formal education	180	49.7
Formal education status of husband	Followed formal education	204	56.4
	Not followed formal education	158	43.6
Occupation of the women	Housewife	356	98.3
	Employee	2	0.6
	Merchant	4	1.1
Occupation of the husband	Farmer	319	88.1
	Merchant	30	8.3
	Employee	13	3.6

Variables	Response variables	Frequency	Percent
Monthly income of the household	100–500	338	93.4
	501–1000	12	3.3
	> 1000	12	3.3
Livestock	Households with livestock	267	73.8
	Households does not have livestock	95	26.2
Agricultural farm land	Households with agricultural farm land	189	52.2
	Households without farm land	173	47.8

Child, Maternal Health and Environmental Characteristics

Tabel-2 provides data on child, maternal health and environmental characteristics of the study population. A total of 362 children, 37.5% aged from 6–11 months old and 62.5% are 12–23 months old. Out of them 53.6% are male and 46.4% are females. Regarding antenatal care of mothers, 54.1% of mothers participated in this study followed antenatal care and the remaining 45.9% mothers not followed antenatal care during their pregnancy period. Seventy five percent of the mothers delivered their children at home and 24.9% of the mothers give delivery of their children in health institutions. Significant amount (80.4%) of study participants not fed breast milk exclusively for 6 month. The pattern of complementary feeding shows resemblance with that of exclusive breast feeding. Only 3.9% of the mothers initiated complementary feeding timely and 23.8% began complementary feeding at 3rd months of age. Less than half of the children (44.5%) fed fruit, vegetable source foods and 38.4% get animal source foods. Most of the children (91.2%) did not get any deworming treatment. Sixty percent of the households have more than one child below age of five years. Three quarters (75.1%) of household's get drinking water from public stand pipe and 15.2% uses unprotected spring water as source drinking water. Concerning availability of hand washing facilities, 51.9% of households have partially functional and 16.9% have fully functional hand washing facility in their campus.

Table 2
Child, maternal health and environmental characteristics of study population

Variables	Response variables	Frequency	Percent
Age (months)	6–11	136	37.5
	12–23	226	62.5
Gender of the child	Male	194	53.6
	Female	168	46.4
Antenatal care	Yes	196	54.1
	No	166	45.9
Extra meal during pregnancy	Yes	173	47.8
	No	189	52.2
Extra meal during breast feeding	Yes	258	71.3
	No	104	28.7
Place of delivery	Health institution	90	24.9
	Home	272	75.1
Squeezed out first milk	Yes	114	31.5
	No	248	68.5
Breast milk initiation	In the first one hour after delivery	295	81.5
	After an hour	56	15.5
	After days	11	3.0
Daily breast feeding rounds	5–8	273	75.3
	9–12	86	23.7
	> 12	3	0.9
Exclusive breast feeding	Exclusively fed	71	19.6
	Not fed exclusively	291	80.4
Initiation of complementary feeding	At 3rd Month	86	23.8
	At 4th Month	167	46.1
	At 5th Month	95	26.2
	At 6th Month	14	3.9

Variables	Response variables	Frequency	Percent
	Other	1	0.3
Feeding the child fruit and vegetables	Yes	161	44.5
	No	201	55.5
Feeding the child animal source food	Yes	139	38.4
	No	223	61.6
The child received deworming drug	Yes	32	8.8
	No	330	91.2
Source of drinking water	Protected spring water	12	3.3
	Unprotected spring water	55	15.2
	Public stand pipe (tap) water	272	75.1
	Runny water	23	6.4
Availability of hand washing facility	Fully functional	61	16.9
	Partially functional	188	51.9
	Not available	113	31.2
Children have diarrhoea in the last two weeks	Yes	122	33.7
	No	240	66.3
Vaccination status of the children	Completed	132	36.5
	Not completed	116	32.0
	Not vaccinated at all	9	2.5
	Being vaccinating	105	29.0

Household dietary diversity score of selected kebeles

The household dietary diversity score reflect the economic ability of a household to access a variety of foods. According to the result on Table 3, 84% households have low dietary diversity score with a dietary diversity score for less than 4 food groups. Whereas 16% of households scored highest household dietary diversity score with more or equal to four food groups.

Table 3
Household dietary diversity score of study population

Variables	Frequency	Percent
< 4 food groups	304	84
≥ 4 food groups	58	16
Total	**362**	**100**

Anthropometric data

According to the output indicated on Fig. 3 and Table 4, 21.82% of children height-to-age equal to – 2 standard errors or below as compared with WHO reference group (Z-score = < 2). The magnitude of stunting is more prominent in males (62 %) than female counterparts.

Table 4
Height-to-age of study children

Height-for-age	Male		Female		Both Sexes		Total
	6–11 month (n = 72)	12–23 month (n = 122)	6–11 month (n = 64)	12–23 month (n = 104)	6–11 month (n = 136)	12–23 month (n = 226)	**21.82%**
< -3 SD %	8.3	3.3	3.1	1.9	5.9	2.7	
< -2 SD %	20.8	27.9	15.6	20.2	18.4	24.3	

Factors associated with child stunting

Multivariate logistic regression analysis presented on Table 5 demonstrates household dietary diversity, exclusive breast feeding, months of complementary feeding initiation and feeding animal source food for the child were independently associated with child stunting. Children those from households with high dietary diversity score are 0.4 times [Adjusted odds ratio (AOR) = 0.415, 95% CI, 0.78–0.966] more resistant against stunting as compared to those from households with low household dietary diversity score. Concerning exclusive breast feeding, children those feed breast milk exclusively for six months were 3.5 times [AOR = 3.54, 95% CI, 1.33–9.41] more likely to escape stunting as compared to their counterparts. Early initiation of complementary feeding before 6 months of age was also 0.08 times [AOR = 0.08, 95% CI, 0.044–0.174] responsible for stunting of the children. Furthermore, lack of animal source food in the complementary feeding of the children was accountable for stunting of children. Children those who does not get animal source food during complementary feeding were 0.06 times [AOR = 0.061, 95% CI, 0.016–0.226] more prone to stunting in relation to those consumed animal source food.

Table 5
Multivariate logistic regression analysis of associated factors with child stunting

Variables		Nutritional status		Crude OR (CI 95%)	Adjusted OR (CI 95%)
		Normal	**Stunted**		
Household dietary diversity	Low HDDS (< 4 foods) (n = 304)	247	57	0.378 (0.207–0.691)*	0.415 (0.78–0.966)*
	High HDDS (≥ 4 foods) (n = 58)	36	22		
Exclusive breast feeding	Not feed breast exclusively (n = 291)	219	72	3.0 (1.318–6.85)*	3.47 (1.31–9.15)*
	Exclusively feed breast milk (n = 71)	64	7		
Months of complementary feeding initiation	At 3rd month (n = 86)	35	51	0.116 (0.069–0.193)*	0.08 (0.044–0.173)*
	At 4th month (n = 167)	140	27		
	At 5th month (n = 95)	94	1		
	At 6th month (n = 14)	14	0		
Animal source food	Feed animal source food (n = 139)	136	3	0.043 (0.013–0.138)*	0.060 (0.016–0.222)*
	Not feed animal source food (n = 223)	147	76		

*Significant at *p* value < 0.

Discussion

The magnitude of stunting in the study area is relatively lower than that of national and regional average. From the total stunted (21.82%) children, majority (62%) were male and a study finding by Forsido *et al.* [20] also found parallel result and identified that male children were 2.6 times [AOR = 2.601, 95% CI (1.681, 4.025)] more likely to become stunted than females [20]. It is attributed that male children are more vulnerable to environmental stress as compared to their counterparts [21, 22].

Household dietary diversity score of the study subjects was one of the variables that significantly ($p <$ 0.041) attributed for child stunting. From the total households 84% scored low dietary diversity and majorities (72.15%) of the total stunted children were from those households. This finding of our study supported by community based cross-sectional survey in 42 countries among 6–23 months old children that found presence of positive association (Adjusted risk ratio = 1.15; 95% CI 1.01, 1.31) between dietary diversity and stunting [23]. Similarly, another cross-sectional survey conducted in Nigeria that intended to assess dietary diversity score and its association with nutritional status and socioeconomic characteristics of children below five years of age. The researchers identified that dietary diversity score has significant ($p < 0.03$) association with height-to-age of study participants [24].

Conversely, a study finding from Ghana on children 6–36 months of age come up with different conclusion. The study assessed the link between dietary diversity and the nutritional status of children depicted lack of association between high, medium and low household dietary diversity score categories and stunting (AOR = 1.18, 95% [CI] = 0.79, 1.76, $p = 0.409$) [25]. But present study area is primarily identified as drought vulnerable, food insecure and gets humanitarian emergency supports from the district and being food insecured might be the main reason behind low household dietary diversity score of majority of the households. Yang *et al*. [26] also reported the existence of strong association between food insecurity of household with lower dietary diversity score and increased prevalence of stunting. Food insecurity of households significantly ($p < 0.0001$) lowered dietary diversity as compared to food secured households. Moreover, food insecurity of the households associated with low dietary diversity and stunting [26]. Additionally, in our study area the community depends on limited dietary sources particularly maize, cassava and sorghum only.

The other independent predictor that significantly ($p < 0.012$) associated with child stunting is not feeding breast milk exclusively. Out of 362 study subjects, 80.4% not feed breast milk exclusively and attributed for 91% of stunted children. Children those feed breast milk exclusively are 3.5 times [AOR = 3.54, 95% CI, 1.33, 9.41] more likely to escape stunting as compared to the child that not feed breast milk exclusively for six months. In another way, early introduction of complementary feeding before 6 months of age is also found as a major factor that significantly ($p < 0.000$) related with child stunting [AOR = 0.08, 99% CI, 0.044, 0.174]. Majority (93.37%) of the study participants started complementary feeding before six months of age and 100% of stunted children are among those who started complementary feeding before 6 months of age. Only 6.63% children initiated complementary feeding timely at 6 month and none of them stunted.

A recent cross-sectional study from Indonesia also found similar result with this finding and portrays that untimely introduction of complementary food associated with stunting of children. Children those get their first food before six months of age are two times more likely become stunted as compared to their counterparts [27]. Likewise, more recent study from Ethiopia also strengthened the idea that early initiation of complementary feeding before six months of age significantly (AOR = 1.58; 95%, CI, 1.07, 2.34) attributed for stunting of children [28].

Eating animal source food during complementary feeding is significantly ($p < 0.000$) correlated with stunting of the children. Children those not feed animal source food like milk, egg are 0.06 times [AOR = 0.061, 95% CI, 0.016, 0.226] more prone to stunting as compared to those consumed animal source food. In the present study 61.6% of the children not get animal source food during complementary feeding and 96.2% of stunted children are among them. While, only 3.8% of stunted children are from children those get animal source food during their complementary feeding (38.4%). According to Headey *et al*. [29] intake of animal source food reduced stunting by 3.7–3.8 percentage points. The study conducted on 130,432 children between 6–23 months old from 49 countries on animal source food consumption and its association with stunting. The finding shows that not consuming animal source food significantly increased the magnitude of stunting. Moreover, consuming animal source food significantly ($p < 0.047$) improved height-for-age of 12–36 months old children [29].

Conclusion

In this study we identified the prevalence and determinants of stunting among 6−23 month old children in food insecured kebeles of Demba Gofa district in Southern Ethiopia. The magnitude of stunting in the study area is relatively less than national and regional averages. However, variables like household dietary diversity, exclusive breast feeding, early initiation of complementary feeding found to be significantly attributed with prevalence of stunting among children in the study area. Potential awareness creation education necessitate in the study area on exclusive breast feeding, timely initiation of complementary feeding, provision of children with appropriate composition of complementary feeding and dietary diversification strategies.

Declarations

Ethics approval and consent to participate

Ethical approval for the study was obtained from the Ethical Review Board of Arbaminch University Sawla campus [R/SC/843/31/2013]. Permission to undertake the research was obtained from every relevant authority in Demba Gofa district. All participants were informed about the voluntary and anonymous nature of the study and were told that they could terminate their participation at any time during the survey and thus informed consent was obtained. Furthermore, the research procedures were conducted in accordance with the principle expressed in the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

The datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Author's contribution

TTT, UMM and LFE designed the questionnaire, and conducted data collection process. CGC, TTT, UMM and LFE contributed in data acquisition, analysis and interpretation. All the authors critically reviewed, edited the manuscript. Finally read and approved the final manuscript

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Figures

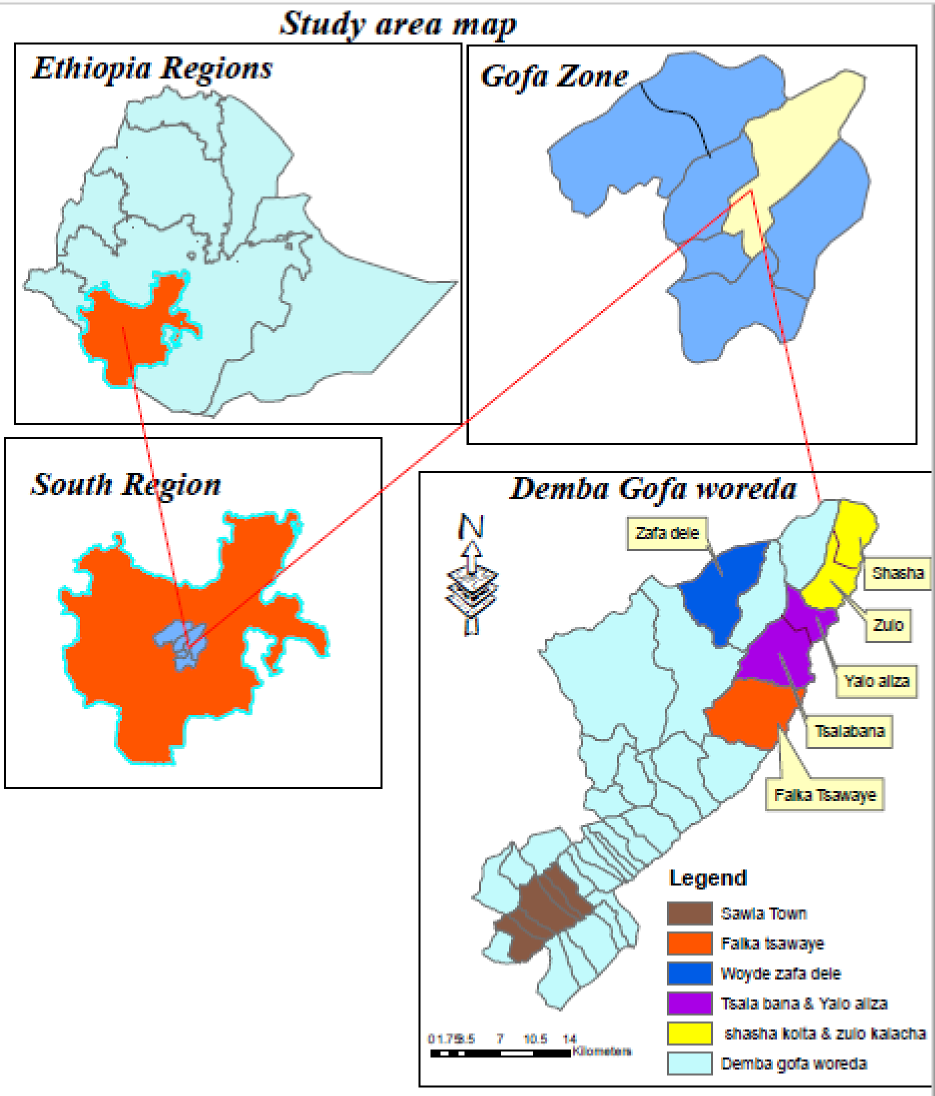

Figure 1

Map of study area

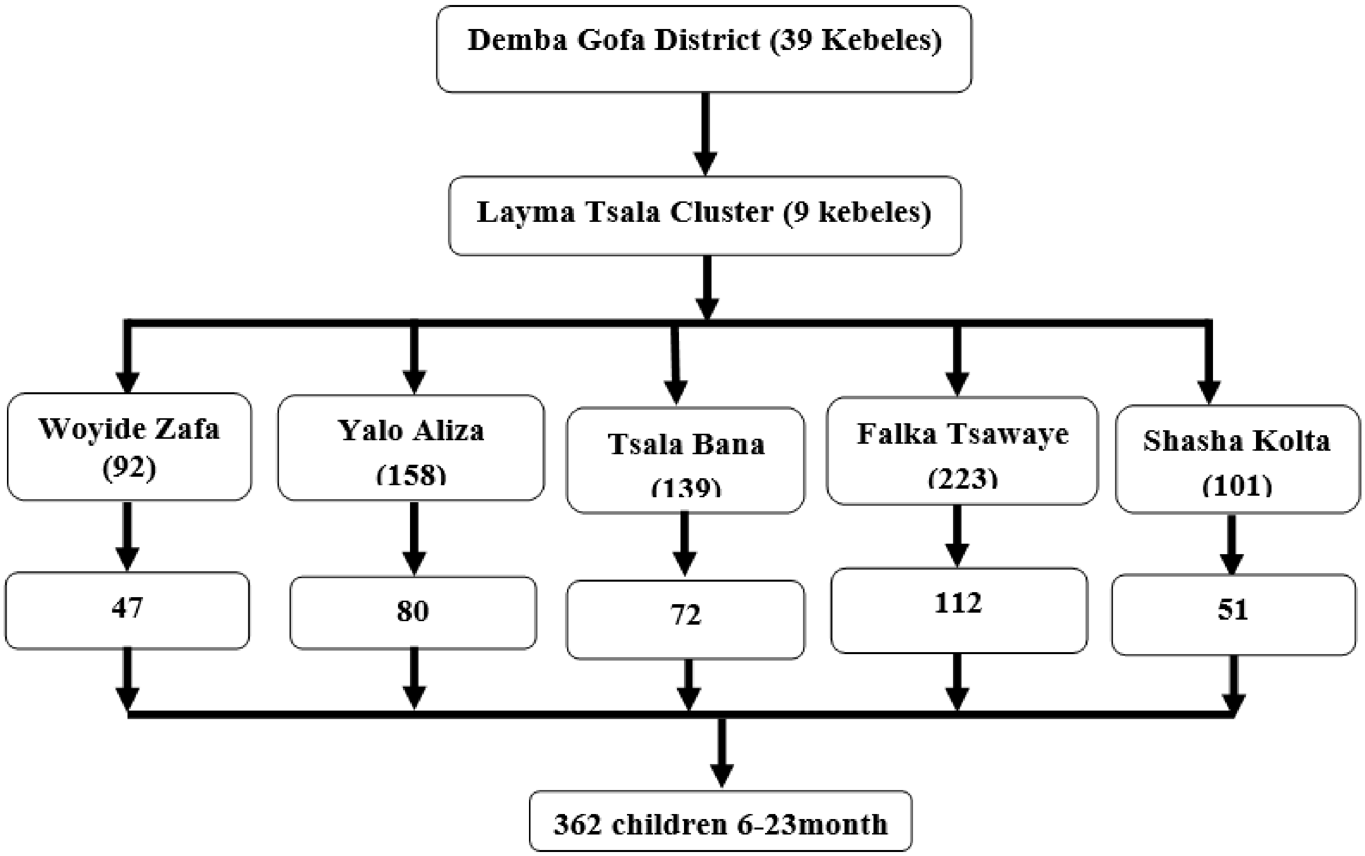

Figure 2

Sampling and sample selection method

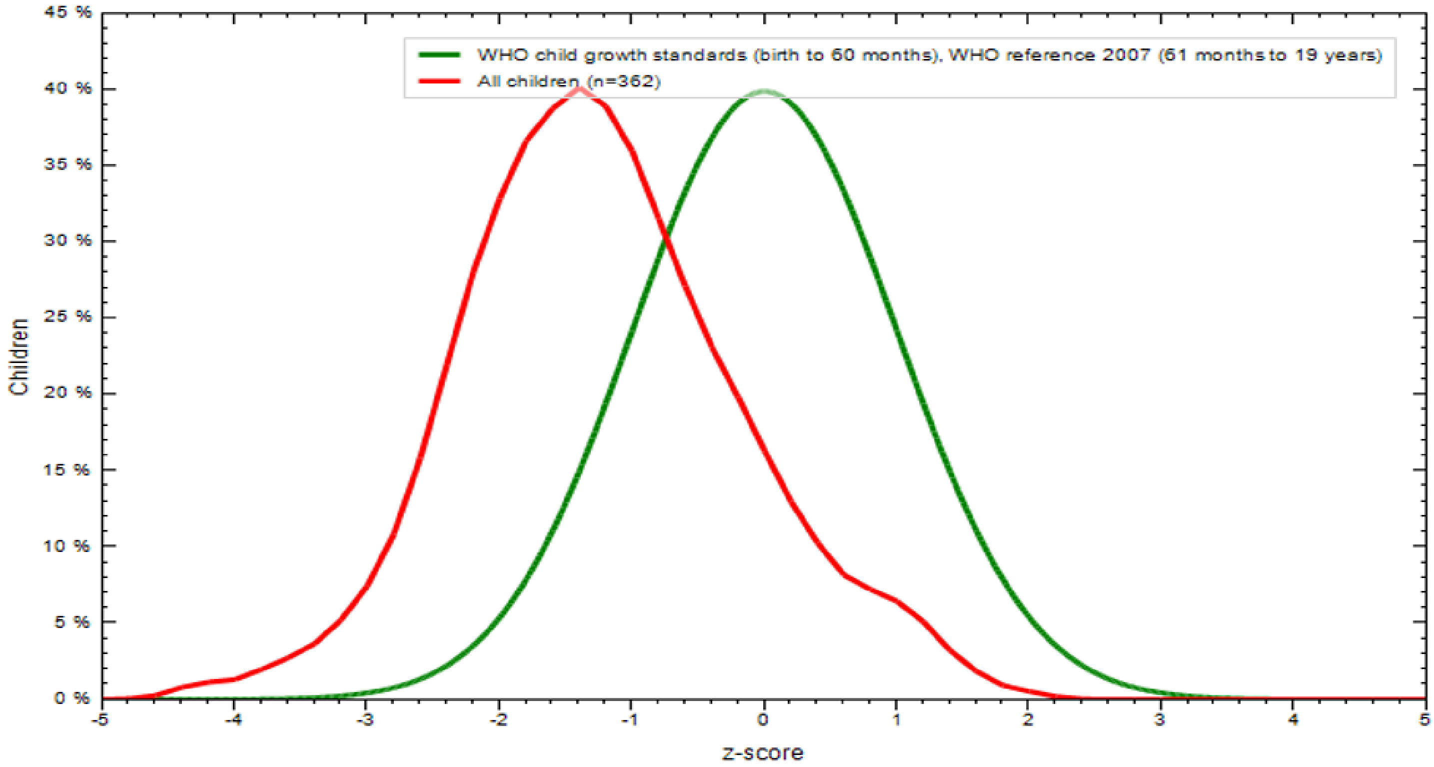

Figure 3

Height-to-age of study children in relation with WHO reference group

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- HDDquestionnaire.docx
- Semistructuredquestionnaireforstuntingstudy.docx