Risk Factors of Stunting Among Children Aged 6-59 Months In Bensa District ISTRICT, Sidama Region, South Ethiopia: Unmatched Case-Control Study

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Abstract

Background: Stunting remains one of the most common under-nutrition problems among children in the Ethiopia. Children aged 6-59 months share for 35–45% of the burden in endemic areas. Identifying the causes of stunting assists health planners to prioritize prevention strategies, and is a fundamental step for intervention. However, evidence scarce about risk factors of stunting among children aged 6-59 months in study area. Therefore, this study aimed to assess risk factors of stunting among children aged 6-59 months in Bensa district, South Ethiopia; 2019.

Methods: A facility-based unmatched case-control study was conducted from January 10 to March 10, 2018 on a sample of 237(79 cases and 158 controls) children aged 6-59 months with their respective mothers. Data were collected using a structured, face-to-face interviewer-administered questionnaire and standard physical measurements. The data were entered using EPINFO version 7 and WHO Anthro software version 3.0.1 and analyzed using SPSS version 20. Chi-square(X^2) test was used to determine the overall association between explanatory and outcome variables. The variables were entered to the multivariable model using the backward stepwise regression approach. Multivariable logistic regression analysis was used to identify factors associated with stunting. Adjusted odds ratios (AORs) with a 95% confidence interval (CI) were computed to evaluate the presence and strength of associations.

Results: Diarrhea in past two weeks (AOR = 2.71, 95% CI: 1.42-5.16) and male sex (AOR = 2.37, 95% CI: 1.224-4.59) were positively associated with stunting. The odds of stunting increased 2.7 times for children who had inappropriate exclusive breast feeding (AOR =2.07, 95%CI: 1.07-4.01) as compared to those who had the appropriate exclusive breast feeding. Having less than or equal to three under five children in the household (AOR = 2.18, 95%CI: 03-4.64), and mothers had no formal education (AOR =3.28, 95%CI: 1.56-6.924) were positively associated with stunting.

Conclusions: Male sex, diarrhea in past two weeks, inappropriate exclusive breast feeding, number of the under five children in the household and mothers had no formal education were major predictors of the stunting. Educating mothers/care takers on Infant and Young Child Feeding practice. Findings support a focus on prevention of diarrhea as part of an overall public health strategy for improving child health and nutrition.

Background

Malnutrition refers to both under-nutrition and over-nutrition. Under-nutrition is “an imbalance between nutrient requirement and intake, resulting in cumulative deficits of energy, protein or micronutrients that may negatively affect growth, development and other relevant outcomes. It is often characterized as acute or chronic [1].

Chronic under-nutrition or stunting reflects a process of failure to reach linear growth potential. It is defined as a height/length for age is less than – 2 SD of the median of the NCHS/WHO international reference [2].

Worldwide, the prevalence of stunting is very high. Its implication in terms of public health is serious. According to the WHO/UNICEF joint report, it was estimated that 154.8 million children had stunted, 15 million children were suffering from the most severe form of stunting and 3.5-5 million annual deaths occurred among children aged 6-59 months [3]. The economic cost of stunting is high which leads to total loss of 15% disability-adjusted life years [4]. It has also resulted in loss of adult height by 1%. Consequently, childhood stunting might end up with 1.4% losses in productivity [5].

The burden of under-nutrition is a major public health problem in developing countries (Africa and South Asia) which accounts two-thirds of the burden [6]. It is also a highly prevalent problem in Ethiopia. According to the Ethiopian DHS 2016 report, 38 % of under-five children were stunted. Similarly, high prevalence was reported in the South Region, Ethiopia 38.6 % [7].

Under-nutrition is responsible for more than one-third of child deaths and 11 % of the global total diseases burden [8]. It is also responsible for more than half of all deaths among children in developing countries [9]. Whereas 42 % of deaths occur in Africa, and an additional 29 % occur in Southeast Asia [10]. In Ethiopia it is estimated that 28 % of all causes of child mortality are associated with under-nutrition [11].

Health consequences of stunting are delay in physical growth and motor development; lower intellectual quotient (IQ), greater behavioral problems and deficient social skills, and susceptibility to contracting diseases. Later in life it increases risk of being overweight and developing associated chronic diseases such as cardiovascular disease, diabetes, cancer, and mental health disorders [12, 13].

Under-nutrition is the result of a long sequence of interlinked events. The most frequently suggested causes of under-nutrition are: Immediate cause, underlying cause and basic cause [14].

Twelve of the 17 Sustainable Development Goals contain indicators that are highly relevant for nutrition, reflecting nutrition's central role in sustainable development. Global nutrition target for 2025 is to reduce the number of stunted children by 40% [15].

Ethiopia has established rural development extension strategies and related programs to address under-nutrition problem. The outcomes of initiatives are encouraging but, not sufficient due to lack of coordination among the relevant sectors. In addition, Ethiopia launched an ambitious and revised National Nutrition Plan (NNP) primarily focused on the first 1000 days and accelerated stunting reduction actions. It was also targeted to reduce the prevalence of stunting from 44.4–20% [16]. However, under-nutrition remains one of the child health problems and poses a significant obstacle to achieving better child health outcomes [17].

While the problem of stunting at national and regional level is relatively well-documented. There is limited information on the presence of chronic diarrhea associated with stunting among children aged 6–59 months in Bensa district, Sidama Region, South Ethiopia. In addition, information is also important because of the target for GTP 2 in 2020 and the preparation for the third Growth and transformation plan in

Ethiopia are fast approaching. Moreover, assessing and identifying the predictors for stunting is important to guide public health planners, policymakers and implementers to plan and design appropriate intervention strategies in order to enhance nutritional status of the children. Therefore, the main aim of this study is to assess presence of chronic diarrhea associated with stunting among children aged 6–59 months in Bensa district, Sidama Region, South Ethiopia.

Methods

Study area

The study was carried out in Bensa district, Sidama region, South Ethiopia. The district is located 400 km from Addis Ababa, the capital of Ethiopia. It is also 131 km from Hawassa, the capital of Sidama Region. According to the central statistical agency report of Ethiopia, the total population of the district was estimated to be 310,952 (8.1 % urban and 91.9% rural). Of these, 13.94 % were children in the age group of 6-59 months. The district has consists of 03 urban and 34 rural Kebeles (smallest administrative unit of Ethiopia). The health service coverage of the district was 94%. There are one-government primary hospital, 11 health centers and 37 health post. It has also consists of 4 private clinics and 12 pharmacies in the districts. According to the health department report, the distribution of stunting affects almost all Kebeles of the district. Agriculture is the main source of income in the district; inhabitants of the district mainly produce enset, cash crops (coffee) and livestock. The total area of the districts is 732.74 . Astronomically, the district is situated between 6.23-6.88 degrees to the north of equator and 38.74-39.09 degrees to the east. The altitude of the district is 1001-2650 meters above sea level. The climatic conditions of district are 47% highland, 35% midland and 18% lowland. Annual temperature is estimated to be between 12.6 -22.5 degree centigrade. Annual temperature is estimated to be between 12.6 -22.5 degree centigrade. Annual range of rainfall is 900-1450 mm with average of 1125 mm [18].

Study design and population

A facility-based unmatched case control study was carried out in Bensa district from January 10 to March 10, 2018. The source population of this study were all children in age group of 6-59 months and mothers/caregivers who utilized EPI and under-five OPD service in all health facilities. The study population were all selected children in age group of 6–59 months and mothers/caregivers in selected health facilities who have lived with the child at least for 6 months. Those children whose family lived less than 6 months and children who were very sick requiring emergency treatment were excluded from this study.

Sample size determination and sampling technique

The sample size was calculated by using a double population proportion formula in consideration of the following assumptions. The proportion of control in exposure 14.6% and cases in exposure 32.4%, level of confidence 95%, power of the study 80%, ratio of controls over cases 2:1($r=2$). Thus, the final sample size after adding a 10% non-response rate is 237 (79 cases and 158 controls). In Bensa district, there is 1

primary hospital and 11 health centers. One primary Hospital and three Health centers were selected out of eleven health centers by simple random sampling technique (lottery method). The calculated sample size (237) was proportionally allocated to the selected health facilities. A consecutive sampling technique was used to select the study participants until the calculated sample size attained. All children aged 6 to 59 months visiting hospital and health centers during the data collection period were measured for their height. Then, children were categorized as stunted or non-stunted based on calculated z-score value. First, stunted children were identified and then selected as cases. The controls were children aged 6 to 59 months without stunting from the same facility cases where selected.

Study variables and data collection technique

The outcome variable was stunting. The independent variables were: socio-demographic variables such as marital status, residence, ethnicity, religion, number of under-five children, family size, parent's education status, occupation, and economic status: Child characteristics like age, sex, birth order, birth interval, place of delivery, types of birth, and morbidly status (fever, diarrhea and ARI): Child caring practices; such as feeding and immunization: maternal characteristics such as age, mothers' age during first child, number of children ever has born, ANC visits, use of extra food during pregnancy or lactation and family planning: environmental Health condition like water, hygiene and sanitation.

The data collection was administered by 9 Bsc nurses. One health officer and the principal investigator intensively supervised the data collection process. The anthropometric data of children were collected by using the measurement of age and height/length. Height was measured using a measuring board by appropriately trained nurses and the child's head, shoulders, buttocks, knees and heels touched the board. Data collection was conducted in a stepwise manner in each health facility in their respective schedule. Measurement of height was done without shoes; to the nearest 0.1 cm. The raw anthropometric data of the studied children were converted to nutritional indicators using WHO Anthro Software (HFA) by taking sex into consideration. Accordingly, a low height for age, less than -2 SD of the reference population indicates stunting, while less than -3SD indicates severe stunting [3].

Operational definitions

Stunting (chronic malnutrition): means HFA is below -2 SD of the reference population while below -3 SD indicates severe stunting.

Acute Respiratory illness: child with cough and fast breathing or difficulty in breathing.

Duration of breastfeeding: the number of months of breastfeeding among children.

Pre-lacteal feeding: a child had given anything to drink other than breast milk in the first three days after delivery.

Complementary foods: are foods which are required by the child, after six months of age, in addition to sustained breastfeeding.

Diarrhea: a child with loose stools for three or more times in a day.

Family size: refers total number of people living in a house during the study period.

Fever: a child with elevated body temperature than usual.

Data quality control

Data were collected using a structured, face-to-face interviewer-administered questionnaire and standard physical measurements. Firstly, the questionnaire was prepared in English. Secondly, it was translated into Sidama language. Finally, it was retranslated back to English to keep its consistency. The comparison was done to assess the inconsistency and non-accuracy between the two versions of the questionnaire. It was pre-tested on 5% of samples in health facility other than actual study area. Then, any inconsistency and non-accuracy was corrected accordingly. Training was given for data collectors and supervisors by the principal investigator for two days. The training was focused on the objective, methods and data collection process. Regular checkup for completeness and consistency of the data were made on a daily basis.

Data processing and analysis

The data were entered into EPINFO version 7 and WHO Anthro software and analyzed using SPSS version 20. Wealth index was constructed by using Principal Components Analysis in SPSS. All required variables recoding and computations were done prior to the main analysis. Descriptive analyses were conducted to obtain descriptive measures for the socio-demographic characteristics and other variables. Chi-square(X^2) test was used to determine the overall association between explanatory and outcome variables. Cross tabulation was used to test the assumption of X^2 .

Binary logistic regression was used to identify predictors of stunting. The bi-variable logistic regression analysis started with unadjusted analysis in which each potential predictor was assessed separately for its association with stunting. Variables with p-values < 0.25 on the unadjusted analysis were entered into a multivariable logistic regression model to find out independent predictors of stunting adjusting for other factors in the model. The variables were entered into the multivariable model using the backward stepwise regression approach. The main assumptions of the logistic regression model (absence of outlier, multicollinearity and interaction among independent variables) were checked to be satisfied. Accordingly, none of the interaction terms was statistically significant indicating absence of a significant effect modification. Multicollinearity between the independent variables was also assessed using multiple linear regression. No evidence of multicollinearity was found as the variance inflation factor (VIF) for all variables was less than 5 and the tolerance statistic was greater than 0.1. The fitness of the logistic regression model was also evaluated in the model using the Hosmer-Lemeshow statistic and greater than 0.05. The presence and strength of association between stunting and the predictors were assessed using adjusted odds ratios (AORs) with a 95% CIs. A statistically significant association was declared when the 95% CI of the AOR did not contain 1.

Ethical considerations

Ethical clearance was obtained from the Institutional Review Board (IRB) at the College of Medicine and Health Sciences of Hawassa University before commencing data collection (Ref. No: IRB/145/11). An official letter of permission was obtained from the Department of Public Health to the respective district health office. Informed written permission was also obtained from district health office. Informed written consent and child assent was also obtained from each study participant after explaining the objectives, risks/benefits, rights, confidentiality, nature of the study and the scope of their involvement in the study.

Results

Socio-demographic characteristics of the parents

Socio-demographic characteristics of the parents have been summarized in Table 1.

A total of 237 participants were participated in the study with a response rate of 100%. The majority of study subjects were Sidama in both group; 75 (94.9%) of cases and 154 (97.5%) of controls. Similarly 74 (93.7%) mothers of children in cases and 151 (95.6%) in controls were protestant in religion. Mothers of 45 (57.0%) of cases and 48 (30.4%) controls had no formal education. There was significant variation between cases and controls in relation to maternal educational status ($P = 0.001$). Household who had less than or equal to three under five children were 40 (50.6%) and 47 (29.7%) of cases and controls respectively. There was significant difference between cases and controls in relation to the number of under five children in the household ($P = 0.002$). Similarly family size was five and above for 46 (58.2%) of cases and 70 (44.3%) of controls. There was significant variation among cases and controls in relation to the household family size ($P = 0.043$) (Table 1).

Table 1
Comparison of socio-demographic characteristics between cases and controls in Bensa district, South Ethiopia, 2019

Variables Category		Cases(n = 79)		Controls(n = 158)		P-value
		Frequency	%	Frequency	%	
Religion	Protestant	74	93.7	151	95.6	.530
	Others	5	6.3	7	4.4	
Ethnicity	Sidama	75	94.9	154	97.5	.309
	Others	4	5.1	4	2.5	
Residence	Rural	66	83.5	120	75.9	.180
	Urban	13	16.5	38	24.1	
Household head	Father	52	65.5	72	45.6	.360
	Mother	27	34.2	86	54.4	
Marital status	Married	73	92.4	150	94.9	.436
	Others	6	7.0	8	5.1	
Family size	< 5	33	41.8	88	55.7	.043
	≥ 5	46	58.2	70	44.3	
Number of < 5 year children	1	39	49.4	111	70.3	.002
	2–3	40	50.6	47	29.7	
Educational status of mother	Has no formal education	45	57.0	48	30.4	.001
	Can read and write	9	11.4	11	7.0	
	Primary (1–8)	13	16.4	72	45.6	
	Secondary & above	12	15.2	27	17.1	
Educational status of father	Has no formal education	14	17.7	18	11.4	.130
Mother's occupation	Can read and write	12	15.2	15	9.5	
Father's occupation	Primary(1–8)	34	43.0	67	42.4	
	Secondary & above	19	24.0	58	36.7	
	House wives	66	83.5	134	84.8	
	Others	13	16.5	24	15.2	

Economic status of families	Farmers	57	72.2	96	60.8	.084
	Others	22	27.8	62	39.2	
	Poor	41	51.9	53	33.5	.008
	Medium	17	21.5	32	20.3	
	Rich	21	26.6	73	46.2	

Child characteristics

The mean age of cases and controls was 27.35 (± 12.71) and 28.70 (± 13.27) months respectively. The largest proportion of cases (30.4%) and controls (27.8%) of the children were found in 12–23 months age groups. The difference between cases and controls were not significant in relation to child age ($P = 0.993$). Among the cases, 65.8% were male and 45.6% were females. There was significant variation among cases and controls in relation to their child sex ($P = 0.003$). More than half (54.4%) of cases and 67.1% controls were delivered at the health facility. There was no significant variation among cases and controls in relation to the place of delivery ($P = 0.057$). Among the study participants 44 (55.7%) of cases and 51 (32.3%) of controls had diarrhea in the past 2 weeks before the survey. There was significant difference between cases and controls in relation to diarrhea ($P = 0.001$) (Table 2).

Table 2
Comparison of children characteristics between cases and controls in Bensa district, South Ethiopia, 2019

Variables	Category	Cases (n = 79)		Controls (n = 158)		P-value
		Frequency	%	Frequency	%	
Sex of children	Male	52	65.8	72	45.6	.003
	Female	27	34.2	86	54.4	
Age in months	6–11	7	8.9	16	10.1	.993
	12–23	24	30.4	44	27.8	
	24–35	20	25.3	40	25.3	
	36–47	19	24.1	40	25.3	
	48–59	9	11.4	18	11.4	
Birth order	1	19	24.1	61	38.6	.003
	2–3	27	34.2	63	39.9	
	≥ 4	33	41.8	34	21.5	
Place of delivery	Home	36	45.6	52	32.9	.057
	Health facility	43	54.4	106	67.1	
Home delivery by	TBA	6	16.7	7	13.5	.677
	Neighbors	30	83.3	45	86.5	
Birth type	Single	78	98.7	155	98.1	.721
	Multiple	1	1.3	3	1.9	
Birth interval	< 2 year	19	24.1	25	15.8	.013
	≥ 2	47	59.5	79	50.0	
	No previous birth	13	16.5	54	34.2	
Diarrhea, last 2wks	No	35	44.3	107	67.7	.001
	Yes	44	55.7	51	32.3	
Fever, last 2wks	No	47	59.5	113	71.5	.062
	Yes	32	40.5	45	28.5	
ARI, last 2wks	No	72	91.1	134	84.8	.173
	Yes	7	8.9	24	15.2	

Child care practices

Of all mothers of children in the cases group, 50 (63.3%) and in the controls group, 118(74.7%) started breastfeeding within the first one hour after birth. The exclusive breast feeding rate for 6 months were 34 (43.0%) and 106 (67.1%) for cases and controls respectively. There was significant variation between cases and controls on duration of exclusive breast feeding ($P = 0.001$). Meanwhile, the duration of breast feeding was less than 2 years for 46 (58.2%) and 86 (54.4%) of cases and controls respectively. Concerning immunization status 67 (84.4%) of cases and 146 (92.4%) of controls were vaccinated, and 35(44.3%) of cases and 90(57.0%) of controls were received deworming services. There was no significant difference between cases and controls in relation to being immunized ($P = 0.066$) (Table 3).

Table 3

Comparison of child care practices between cases and controls in Bensa district, South Ethiopia, 2019

Variables	Category	Cases(n = 79)		Controls(n = 158)		P-value
		Frequency	%	Frequency	%	
Breast milk initiated after delivery	Immediately	50	63.3	118	74.7	.069
	After 1 to 24 hr	29	36.7	40	25.3	
Pre-lactation food/fluid	No	69	87.3	136	86.1	.788
	Yes	10	12.7	22	13.9	
Type of pre-lactation food/fluid	Water	5	50	10	45.5	.811
	Others	5	50	12	54.5	
Duration of EBF	< 6 or > 6months	45	57.0	52	32.9	.001
	6 months	34	43.0	106	67.1	
Complimentary Feeding	< 6 or > 6months	45	57.0	52	32.9	.001
	6 months	34	43.0	106	67.1	
Frequency of feeding/day	2 times	13	16.5	20	12.7	.607
	3 times	36	45.6	69	43.7	
	≥ 4 times	30	38.0	69	43.7	
Method used for feeding	Bottle	21	26.6	28	17.7	.274
	Hand	19	24.1	40	25.3	
	Spoon and Cup	39	49.4	90	57.0	
Duration of B/F	< 24 months	46	58.2	86	54.4	.579
	≥ 24 months	33	41.8	72	45.6	
Immunization	No	12	15.2	12	7.6	.068
	Yes	67	84.4	146	92.4	
VAS	No	15	19.0	17	10.8	.081
	Yes	64	81.0	141	89.2	
Deworming	No	44	55.7	68	43.0	.066
	Yes	35	44.3	90	57.0	

Maternal characteristics

The mean age for mothers of the cases was 29.25 ($\pm$ 5.88) while it was 27.30 ($\pm$ 5.17) for the mothers of the controls. Mothers of 33 (41.8%) of cases and 40 (25.3%) of controls had given birth of 4 and above children. There was significant difference between cases and controls regards to the parity ($P = 0.01$). Mothers of 52 (65.8%) of cases and 82 (51.9%) of controls didn't consume extra food during pregnancy and lactation. There was significant difference between cases and controls in relation to maternal extra food consumption during pregnancy and lactation ($P = 0.041$). About 62 (78.5%) and 132 (83.5%) of mothers visited health facilities for antenatal care during their pregnancy period for both cases and controls respectively. Concerning family planning, mothers of 61 (77.2%) of cases and 125 (79.1%) of controls were every used family planning (Table 4).

Table 4
Comparison of maternal characteristics between cases and controls in three Bensa district, South Ethiopia, 2019

Variables	Category	Cases (n = 79)		Controls (n = 158)		P-value
		Frequency	%	Frequency	%	
Mothers age	< 20 years	7	8.9	17	10.8	.127
	20–35 years	60	75.9	130	82.3	
	> 35 years	12	15.2	11	7.0	
Mothers age during first child	< 21 years	60	75.9	110	69.6	.308
	$\geq$ 21 years	19	24.1	48	30.4	
Number of children	< 4	46	58.2	118	74.7	.010
	$\geq$ 4	33	41.8	40	25.3	
Extra food during pregnancy and lactation	No	52	65.8	82	51.9	.041
	Yes	27	34.2	76	48.1	
ANC for this child	No	17	21.5	26	16.5	.340
	Yes	62	78.5	132	83.5	
F/P every used	No	18	22.8	33	20.9	.737
	Yes	61	77.2	125	79.1	

WASH condition of study participants

Children of households who used unprotected source of water for drinking accounts 32 (40.5%) and 43 (27.2%) in cases and controls respectively. There was significant variation between cases and controls in relation to sources of water ($P = .038$). Those children households who didn't treat water by any means was found to be 61 (77.2%) in cases and 113 (71.5%) in controls. There was no significant difference between cases and controls regards to water treatment method at home ($P = 0.349$). Majority children of HHs, 73 (92.4%) of cases and 148 (93.7%) of controls have a latrine. There was no significant variation between cases and controls in relation to latrine availability ($P = 0.714$) (Table 5).

Table 5

Comparison of WASH conditions between cases and controls in Bensa district, South Ethiopia, 2019

Variables	Category	Cases(n = 79)		Controls(n = 158)		P-value
		Frequency	%	Frequency	%	
Drinking water source	Unprotected	32	40.5	43	27.2	.038
	Protected	47	59.5	115	72.8	
Treat water by any means	No	61	77.2	113	71.5	.349
	Yes	18	22.8	45	28.5	
Having latrine	No	6	7.6	10	6.3	.714
	Yes	73	92.4	148	93.7	
Wash hand after toilet	No	15	19.0	39	24.7	.324
	Yes	64	81.0	119	75.3	
Material used to wash hands after toilet	Using water only	34	53.1	55	46.2	.096
	Water and soap	20	31.2	54	45.4	
	Water and ashe	10	15.6	10	8.4	
Flush toilet	No	58	73.4	96	60.8	.054
	Yes	21	26.6	62	39.2	
Method used for disposal of HHs waste	Open field	16	20.3	18	11.4	.113
	In pit	16	20.3	46	46	
	Composting	41	51.9	74	74	
	Burning	6	7.6	20	20	

Predictors of stunting among children aged 6–59 months

Multivariable model revealed that children living in households less than or equal to three under-five children were 2.18 times more odds of developing stunting as compared to those living in households with one under-five child (AOR = 2.18, 95% CI: 1.03–4.64). The odds of stunting in male children were 2.4 times higher as compared to female (AOR = 2.37, 95%: 1.224–4.59).

This model also showed that children whose mothers have no formal education were 3.28 times more odds of stunted as compared to mother with formal education (AOR = 3.28, 95%CI :1.56–6.924). Moreover, inappropriately exclusive breast feeding (AOR = 2.07, 95% CI: 1.07–4.01) and exposure to diarrhea in past 2 weeks (AOR = 2.71, 95%CI:1.42–5.16) were positively associated with stunting (Table 6).

Table 6

Bi-variable and multivariable logistic regression analysis of the factors associated with stunting among children aged 6–59 months in the Bensa district, South Ethiopia.

Variables	Cases	Controls	COR(95%CI)	AOR(95%CI)
Sex of children				
Male	52	72	2.300(1.313–4.029)**	2.369(1.224–4.586)*
Female	27	86	1	1
Total family size				
≥ 5	46	70	1.752(1.015–3.036)*	.492(.174-1.389)
<5	33	88	1	1
Number of < 5 year children				
2–3	40	47	2.422(1.387–4.230)**	2.182(1.027–4.635)*
1	39	111	1	1
Maternal educational status				
Has no formal education	45	48	3.712(2.041–6.753)***	3.279(1.553–6.924)**
Can read & write	9	11	3.240(1.211–8.669)*	2.752(.897-8.446)
Has formal education	25	99	1	1
Wealth Index				
Poor	41	53	2.689(1.427–5.068)**	1.169(.538-2.539)
Medium	17	32	1.847(.861-3.959)	.906(.360-2.281)
Rich	21	73	1	1
Diarrhea, preceding 2wks				
Yes	44	51	2.638(1.514–4.596)**	2.706(1.418–5.162)**
No	35	107	1	1
Duration of EBF				
< 6 or > 6 months	45	52	2.698(1.548–4.702)	2.068(1.065–4.011)*
6 months	34	106	1	1

*: P < .05; **: P < .005;***P < .001; COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval;

1: Reference category.

Variables	Cases	Controls	COR(95%CI)	AOR(95%CI)
Source of drinking water				
Unprotected	32	43	1.821(1.030–3.219)	1.446(.738-2.833)
Protected	47	115	1	1
*: P < .05; **: P < .005;***P < .001; COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval;				
1: Reference category.				

Discussion

In this study factors associated with stunting were having less than or equal to three under-five children in the household, male sex, mothers who had no formal education, inappropriate exclusive breast feeding, and exposure to diarrheal diseases in the last 2 weeks preceding of the survey.

In this study households with less than or equal to three under-five children is more odds of developing stunting as compared to one under-five child in the house hold. This finding is similar with the studies conducted in south Ethiopia, Mozambique [19, 20]. This might be the fact that as the number of under-five children increases in the household the care given to the children decreases, mothers unable to optimally breastfeeding children, causes competition on family resources and increases the risk of infectious diseases[21].

The odds of stunting are significantly higher in male children than female. This result is consistent with studies done in Lasta district, and Korahay Zone, Ethiopia, Mozambique and Southwest Uganda [20, 22–24]. The cause of this difference in sex requires further study, but variation might be due to sex preference of family. Additionally, it is believed that boys to be biologically more vulnerable to morbidity [25].

Children whose mothers had no formal education were more likely to be stunted as compared to have formal education. This study is in line with studies conducted in Padang city, Indonesia, India, Nairobi, Kenya and Ethiopia [23, 26–28]. Mother's education affects the knowledge and attitude of parents which in turn affect their fertility behavior, use of health service and access of nutrition related information. The cumulative effect of these can have impact on prevention of stunting [29].

Inappropriate exclusive breastfeeding significantly associated with stunting. This result is agreed with study conducted in Nepal, and South Ethiopia [19, 30]. This could be child's digestive and immune systems are not mature before 6 months, and early introduction of complimentary food in unhygienic condition increases diarrheal disease. Furthermore, after 6 months breast milk alone is not sufficient to meet the nutritional requirements. Both earlier and delayed introduction of complementary food predisposes the child to increased risks of growth faltering [31].

Children with diarrhea exposure are at increased risk of stunting compared to those with no exposure. This finding is in line with the finding of studies conducted in South Ethiopia, Kenya [32, 33]. This might be due to children with diarrhea may have reduced dietary intake, poor absorption of nutrients and increased nutrient loss.

Limitation Of The Study

This study had a number of strengths. Among these, many variables considered to be risk factors of stunting were assessed, valid adapted questionnaires from other studies, and pre-tested questioner was used to collect information, and the case control nature of this study is stronger than cross-sectional study in assessing risk factors which is important to develop relevant policy strategy for efficient prevention of stunting. Regardless of its strengths, our study has some basic limitations that might be considered while interpreting the findings. First, the study might be prone to recall bias because, the study was questionnaire based require a good memory of mother's/care giver. Second, the study is predisposed to errors of anthropometric measurement that might lead to misclassification of children's nutritional status.

Conclusion

Number of under-five year old children in the household, sex of child, mother's educational status, inappropriate exclusive breast feeding and diarrhea in past 2 weeks were significantly associated factors with stunting. Therefore, prevention and control of stunting through improving family planning service utilization should be considered. In addition, intervention should focus on health education for the promotion of appropriate exclusive breast feeding. Moreover, preventing and controlling childhood disease like diarrhea through health extension programs is recommended.

List Of Abbreviations

AOR.....	Adjusted odd ratio
CI.....	Confidence Interval
GTP 2.....	Growth and transformation plan
SD.....	Standard Deviation
OR.....	Odd ratio
SPSS.....	Statistical packages for social science
WASH.....	Water, sanitation and hygiene
WHO.....	World Health Organization

Declarations

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Authors' contributions

TT- Involved in initiation of the research question, prepared the research proposal, carried out the research, did the data entry and analysis and wrote the manuscript. TG- conducted edition, advising, cooperatively prepared research tools with PI and revised the manuscript. KM- conducted edition, advising and reviewed the manuscript. AY- Did the data entry, analysis, prepared and reviewed the manuscript. All authors have read and approved the final manuscript.

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Availability of data and materials

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

Ethics approval and consent to participate

Ethical clearance was obtained from Hawassa University College of Medicine and Health Sciences Institutional Review Board (IRB) and written permission letter was obtained from Bensa Woreda Health Office before official start of the study. The purposes and importance of the study was explained at all levels and written informed consents were secured from each mothers/care takers. All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable

Competing interests

All authors declare that they have no conflicts of interests.

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