

Determinants of Stunting Among Children Age 6-59 Months, Siraro District, West Arsi Zone, Oromia Region, Ethiopia

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Abstract

Background: High level child stunting, Height for age measurement less than negative two standard deviation is 38%. It has significant effect on schooling, productivity, physical fitness, human resources and Loss of National economy. Children ages 6-59 month are the most affected groups due to child hood infections, maternal health condition, in adequate dietary intake and poor child caring practice. However, there is insufficient information on determinant factors contributing for stunting. Therefore, identifying determinants of stunting among children aged 6-59 month would help to set priorities for action and to the design of stunting reduction plan at a grass roots level. **Objectives:** To identify determinants of stunting among Children aged 6-59 months in Siraro District. **Methods:** The unmatched Facility based case control study design was conducted in randomly selected 5 health facilities of Siraro District from August 01, 2019 to October 30, 2019. From 357 study subjects which 119 are cases and 238 controls were chosen by using anthropometric measurement based on the median of WHO 2006 reference population. Anthro-plus software was used to identify the anthropometric measurements of the child and a structured questionnaire which was primarily developed in English and translated to Afan Oromo was used for data collection. The collected data were entered using Epi-deta version 3.1 and exported to SPSS version 20 for analysis. Logistic regression was used to determine the association between dependent and independent variables. In bi-variable analysis co-variate with P-value of less than 0.25 was included in multivariable analysis. The final model was interpreted using AOR with 95% CI at P-value of less than 0.05. **Results:** Age started supplementary feeding at 6 months with (AOR=2.54 95% CI ((1.01-6.42)), Childs mother has no Antenatal visit (AOR=2.39(95%; (1.15-4.97)), Children with poor Food Consumption Score were (AOR=3.48; 95 %; (1.82-6.65)), Children's with poor protein rich food Frequency Score were 3.74 times (AOR=3.74; 95%; 2.10-6.75)) were significantly associated with stunting. **Conclusion;** Factors like Age started supplementary feeding at less than six month, mother has no antenatal visit, poor food consumption score, poor protein rich food frequency score could be used to set priorities for action and design of stunting reduction. Therefore, zonal health department and Siraro Woreda health office should promote the importance of supplementary feeding at age of 6 months. Strengthening antenatal care service at a grass root level and promote antenatal visit of mothers. Enhance an appropriate complementary feeding practice and providing sufficient energy and protein reach food is important.

Keywords: Stunting; Malnutrition; Determinants; among under five children

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Acronyms

ANC	Ante Natal Care
BMI	Body Mass Index
CSA	Central Statistics Agency
DPPC	Disaster Prevention, Preparedness and Control
EDHS	Ethiopian Demographic Health Survey
FCS	Food Consumption Score
FFS	Food Frequency Score
HAZs	Height for Age Z score
HC	Health Center
NCHS	National Centre for Health Statistics
RHB	Regional Health Bureau
SCN	Standing Committee on Nutrition
SD	Standard Deviation
SPSS	Statistical Package for Social Science
UNICEF	United National International Children's Fund
ZHD	Zonal Health Department

1. Introduction

1.1. Background

Stunting is a pathological state resulting from the consumption of an inadequate quality and quantity food over an extended period of time. It reflects an inadequate food intake, one that is deficient in energy, protein, and or vitamins and minerals or poor biological utilization of the nutrients consumed, mostly as a result of frequent infections (Abuka, Jember and Tsegaw, 2017). Nearly half of all deaths in under 5-year-old children are attributable to under nutrition, which is interpreted into the preventable loss of about three million young lives a year (Pal *et al.*, 2017).

Stunting is one type of under nutrition which is the most important causes of children's abnormal physical and mental development. The nutritional status of under-five children is an important outcome measure of children's health. Ethiopian nutrition profile indicated that; Prevalence of stunting have decreased over the past decade but remain high, with 38 percent of children under 5 years stunted 2018 (<https://www.unicef.org/appeals/ethiopia.html>, 2018).

Poor nutrition in the first 1,000 days of a child's life can also lead to stunted growth, which is irreversible and associated with impaired cognitive ability and reduced school and work performance (FAO, IFAD, UNICEF, 2017). According to Ethiopian Demographic and Health Survey, there is a substantial variation of under nutrition in Ethiopia. For instance, there is regional variation in the prevalence of stunting in children; the estimated prevalence of chronic malnutrition is above the national average in Affar (49%), Tigray (44%), South Nation and National People (44%) and Amhara (42%) compared with a national average of 40 % (Report, 2016). Mainly Ethiopia is one of sub-Saharan Africa countries having huge number Stunted (Health Sector Transformation Plan, 2015).

Mostly the common causes of stunting are in adequate food stuff production and lack of knowledge about the balanced diet and less attention and poor feeding habit of children. Poverty and rate of literacy significantly contributes to the prevalence of under nutrition which hinder physical growth and mental development of under five children (Pal *et al.*, 2017)

The prevalence of stunting that can occur due to lack of required quantity and quality of food can lead to chronic nutrition problems. Nutrition based consequence is inter-generational, the offspring can acquire effect of nutrition from close relative and the mal-nutritional history of Parents can have a serious impact on physical growth and mental developments of their children. The biggest issue that we are dealing with is the determinants of under nutrition problems which most of the time many complaints made frequently to the drought affected and moisture stress areas of Siraro from west Arsi zone. The impact of under nutrition contributes about 50% of under-five death, decrease productivity at large and increase dependency instead. Under nutrition is thus seen to have been affecting the growth of children physical and mental development in spite the fact that it is compulsory for mental growth. The data show that 38 percent of children under 5 are considered short for their age or stunted (below -2 SD), Among which 18 percent are severely stunted (below -3 SD) after being fairly stable in the first 6-8 months of life, the prevalence of stunting increases steadily from age 9 months through the first 4 years of life, before declining slightly in the fourth year of life (Guled *et al.*, 2001). Children age 24-35 months have the highest proportion of stunting (48 percent) and Stunting is slightly higher among male than female children (41 percent Vs 35 percent) (ENCU/EWRD/MOARD Addis Ababa, 2012)

1.2. Problem statement

Stunting is a cumulative process that can begin in utero and continues to about three years after birth and its risk increases with age. Over a third of all deaths of children under the age of five are directly or indirectly caused by under nutrition (Shashemene *et al.*, 2017)

Growth faltering begins immediately after birth with height for age dropping sharply from birth to 24 months to almost 3 years of age and not recovering thereafter with most of those malnourished at ages 3 to 5 already presenting anthropometric deficits in height at the end of the first year of life, a pattern that is consistent across different developing countries (Batiro *et al.*, 2017).

Studies show that stunting is associated with deprived attention, memory impairment, reduced learning, and memory in children, low school enrolment, and decreased higher cognitive functioning with a slowing in the rate of cognitive development. These finally result in low adult wages and lost productivity (Fikadu, Assegid and Dube, 2014) Children in the age group 13-24 months were at significantly higher risk of stunting compared with children in the youngest age category (<7 months) (Teshome *et al.*, no date).

The importance of sufficient nutrition is not questioned but stunting extends ahead of food availability and starvation. It had wide ranging consequences that avert community and nation from achieving their social and economic development desire (Batiro *et al.*, 2017).

Stunting is mainly caused by consumption of an inadequate food, deficient in energy, protein, and or vitamins and minerals. Other factors include poor biological utilization of the nutrients as a result of infections, poor child feeding practice, maternal nutrition and environmental conditions (Fikadu, Assegid and Dube, 2014).

Stunting remains a big concern in Ethiopia because of High level of both maternal and child under nutrition

(BMI <18.5) ~22%. High level child stunting (HAZ < -2SD) ~38% significant effect on schooling, productivity, physical fitness, human resources and Loss of National economy.

Levels of nutritional indices (stunting, wasting and underweight) and micronutrient deficiencies are high but showing improving trends. However, the feeding practices of Ethiopian families remain sub-optimal. According to EDHS 2011, only half of children under 2 living with their mothers are exclusively breastfed. Only 4.3 percent of children consumed the recommended four food groups and just 13 percent of children under 2 consumed iron-rich foods (National Nutrition Programme June, 2015).

In Oromia 2.1 million of < 5 years children stunted, 1.2 million of < 5 years children under weight, half million of < 5 years children wasted (National Nutrition Programme June, 2015).

The information of stunting among children age 6-59 months in the specific locality remains poor and its analysis and identification of the scope and consequences is of interest to the ZHD, RHBs and other partners. There is the need of information on major local based risk factors contributing for stunting in the District.

Thus identifying determinants of stunting among children age 6-59 month at Siraro district would help the health department to set priority for action. Moreover, this study could add to the literature by providing additional information about determinants of stunting in the specific locality.

1.3. Objectives:

1.3.1. General Objective:

To describe the determinants of stunting among Children aged 6-59 months in Siraro District, West Arsi zone, Oromia region 2019

1.3.2. Specific objectives:

To identify the most important factors associated with stunting among children aged 6-59 months in Siraro District.

1.4. Scope of the study

The study representation covers Siraro woreda and its adjacent woredas of similar climatic condition and socio economic characteristics which are located in the division of Rift Valley area in west Arsi Zone.

The target groups are all children of Siraro woreda age between 6-59 months and their mother or primary caregiver. In this study the most important associated factors of stunting are identified. Standard measurement indices of height for age Z-score is used to identify case and control. A structured questioner containing socio economic, maternal characteristics, child caring practice and environmental condition was used. Unmatched case control study was conducted on randomly selected health facilities by lottery method. The study subjects were allocated by population proportion based on annual under-five OPD attendants from August, 1/ 2019 to September, 30/ 2019.

1.5. Operational Definition

Primary caregiver is the person responsible for the day to day care and wellbeing of a child between the age of 6 and 59-months, including biological mothers, grandparents, aunts, and others in cases where the biological parents were deceased or unavailable.

Stunting: normally an indicator of chronic or long-term insufficient energy or micronutrient intake although it has many non-nutritional causes such as helminthes infestation and frequent or chronic infection. Results in a child who is very short (i.e. they have a very short height for their age). Stunted children were; children 6-59 months of age with their anthropometric measurements of WHZ-score < -2SD

Underweight: an indicator assessing adequacy of weight for age. And the causes which can be short term or long term and are difficult to define.

Wasting: Wasting: normally the result of acute or short-term insufficient food intake often combined with frequent illness. Results in a child who is dangerously thin (i.e. they have a very low weight for their height).

Cases: The cases are children 6-59 months of age with their anthropometric measurements of WHZ-score < -2SD.

Control: Child Height for age ≥ -2 SD Z score median of WHO Growth measurement Standards.

Food consumption score; is used to identify the most food insecure households (Note and Edition, 2015).

Poor & good Food consumption score; Comprehensive questions on food Variety taken by the child within 24 hours was asked and computed for those who scored below the mean (<4.2) was considered as poor FCS & above the mean (≥ 4.2) is good FCS.

Food frequency score; The frequency of consumption of each food group over the past seven days (how many days each food group has been consumed in the last 7 days (Sareen S. Gropper and Groff, 2015)

Poor & Acceptable Food Frequency Score: comprehensive Question on food quantity and Frequency of the consumption of specific food items or dishes within 24 hours was asked and computed for those who scored below the mean (<4.2) was considered as poor FFS & above the mean (≥ 4.2) is Acceptable FFS.

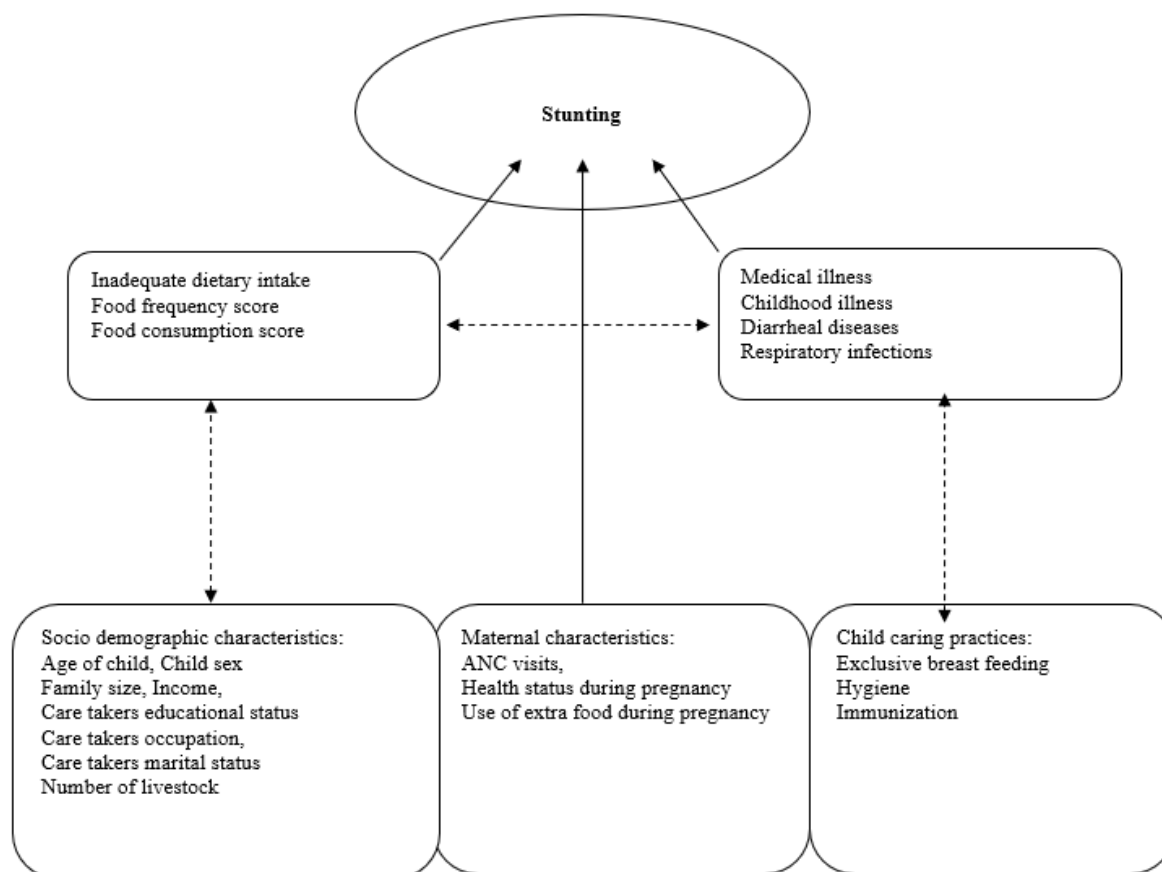


Figure 1 Conceptual frame work adapted from different literatures.

2. Methods and materials

2.1. Study area and period

The study was conducted in Siraro district, one of 15 districts of West Arsi Zone. The West Arsi zone is one from 20 administrative zones within Ethiopia's Oromia State. The Zone where established in 1998 EC with 13 rural and two town administration District comprising 324 and 36 rural and urban kebeles respectively. West Arsi Zone is one of the administrative zone of Oromia regional state which was established in 1998, E.C with 13 rural and two town administrative Woredas comprising 324 and 36 rural and urban kebeles respectively and located in the south central parts of the country in a distance 250 Km from Addis Ababa, capital of Ethiopia (West Arsi Zone Health Department, 2018). Siraro is one of the Woredas' of west Arsi zone which is located in the Great Rift Valley with a distance of 314 and 64 KM from the capital Addis Ababa and shashemene respectively. Data was collected from August, 1/2019 to September, 30/ 2019 using a structured questionnaire and anthropometric measurement to determine the nutritional status children aged 6-59 months.

The capital city of the zone is shashemene with five in and out let roads, 250 Km distance from AA at the southern parts of Oromia region. Eighty-five percent of population lives in rural areas. The urban population is involved in private business, government employment or farming. The major agricultural products comprise Maize, Teff, potato, small millet and bean (Agriculture office, 2019). Drought is a common phenomenon in the area. The district has 30 (26 rural and 4 town) kebeles (smallest administrative units) with a total population of 200,856 which 33,002 are under five children as estimated in 2007 census. The total households in the district is 41, 845.

A health facility based unmatched case control study was conducted from August, 1/ 2019 to September, 30/ 2019. Regarding to a health facility, there were 28 health posts with two health extension workers at each health post, 06 health centers and 01 primary hospital under government ownership providing health services for the community.

Health facilities involved in the study were Loke siraro primary hospital, Senbete sinkile health center, Basa Health center, Ropi Health center and Alemtene Health center.

2.2. Source population

The source populations are all children age 6-59 months who live in the woreda and their mother /primary care

giver.

2.3. Study population

Children age 6- 59 month and their mother /care giver visited selected health facilities during the study period.

2.4. Inclusion and Exclusion criteria

2.4.1. Inclusion Criteria

Children of age 6-59 month visited the randomly selected health facility with their mother or primary care giver with Childs Anthropometric measurement of Height for age Z score $<-2SD$ were included in the study as Case. And children of age 6-59 month visited the randomly selected health facility with their mother or primary care giver with Childs Anthropometric measurement of Height for age Z score ≥ -2 were included as control.

2.4.2. Exclusion criteria

A child of age 6-59 month visited the randomly selected health facility with a physical disability and having structural congenital abnormality was excluded for both case and control in the study.

2.5. Study Design

Health Facility based unmatched 1:2 case control study was conducted

2.6. Study variables

2.6.1. Dependent variable:

Stunting

2.6.2. Independent Variables

Socio-economic and demographic variables: Age of child, age of mothers, child sex, family size, income, maternal or paternal education and occupation, marital status of the mother and number of livestock owned.

Child characteristics: height, childhood illness, health care practice.

Child caring practice: Exclusive breast feeding, immunization and complementary feeding practice.

Maternal characteristics: Number of children ever had born, ANC visits, health status during pregnancy and use of extra food during pregnancy.

Environmental Health condition: Water supply, latrine utilization, sanitation hygiene and housing conditions.

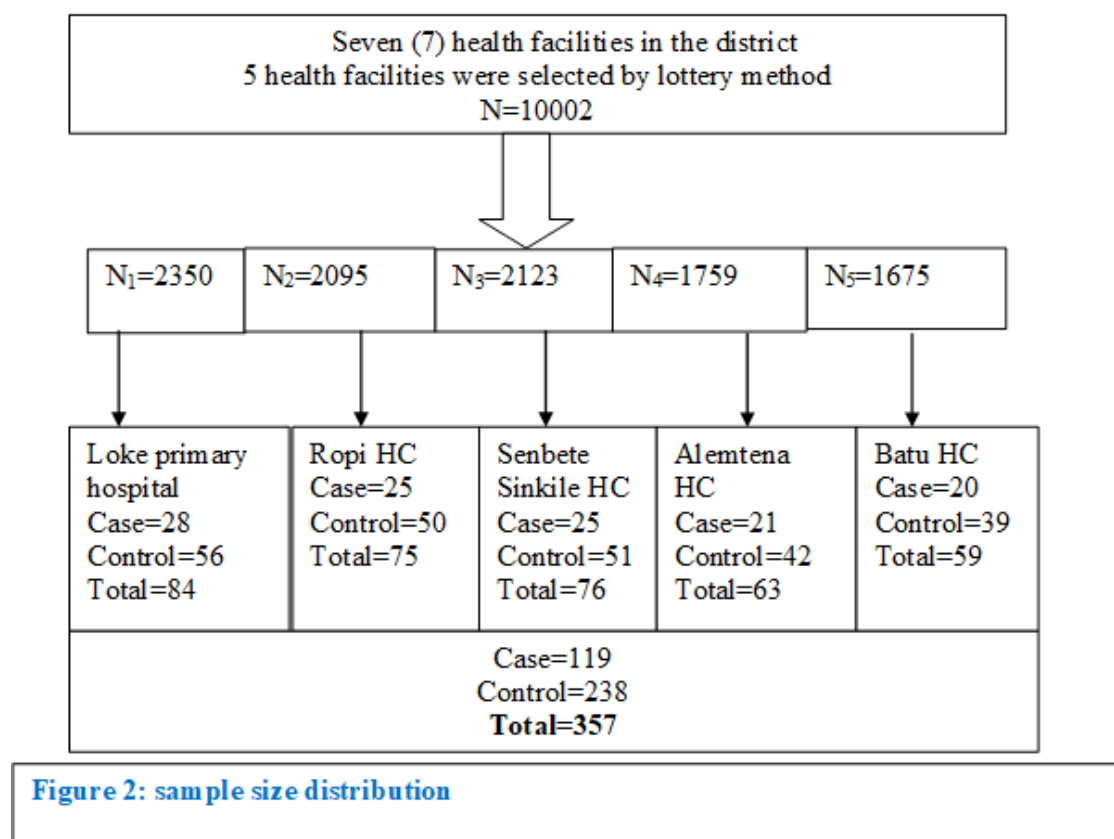
2.7. Sample size determination

The required sample size was calculated by using two population proportions formula and calculated by using EPINFO7. Mother education is taken as major associated factor. Assumptions: the proportion of illiteracy among the mothers of the controls to be 56.1% and of the cases 71.0%, 5% type I error, 80.0% power of the study, control to case ratio of 2: 1 to detect an odds ratio of 2.2. based on a case control study done in Gedio zone, Ethiopia (Abuka, Jember and Tsegaw, 2017) from the above assumptions, the total sample size is 357 the final sample size was 357 (119 cases and 238 controls).

Associated variables	% of controls exposed	% of cases exposed	% CI	Power	AOR	Ratio of Controls to Case	Case	Controls	Total	Reference
Mother education	56.1	71	95	80	2.0	2	119	238	357	(Abuka, Jember and Tsegaw, 2017)
URTI	39.7	60.3	95	80	3.04	2	45	90	135	(Batiro <i>et al.</i> , 2017)

2.8. Sampling technique

Five health facilities were selected by using simple random method. For each selected health facilities the numbers of study subjects were allocated by population proportion based on annual <5 OPD attendants. Finally all cases and controls from each selected health facilities were included in the study till the calculated sample size reached.



2.9. Data collection tool

Quantitative data were collected by qualified health care professional using pretested inter viewer administered structured questionnaire adapted from different literatures for all eligible children mothers/care giver. A UNICEF recommended measuring instruments of wooden board inserted with a tape calibrated was used to collect the anthropometric data from all children aged 6-59month and their mothers/care givers who lived for more than six months in the study area. A structured questioner contains socio demographic and economic characteristics, environmental factors, child health and caring practice, child vaccination history, dietary diversity and maternal characteristics.

2.10. Data collection Methods

Ten qualified professionals divided in to five data collection team including two principal investigators are involved in the data collection. The data collectors were nurses, supervisors were also professionals working in the hospital and district health office. Face to face interview was made with mothers (care givers) using structured questionnaire. A structured questionnaire which is developed in English was translated into Afan Oromo and used for actual data collection. The questionnaire has six subsections; the first subsection consists of socio-demographic variables of parent and child. The second section consists of child characteristics, child's medical conditions etc. The third section consists of child caring practice. The fourth sub section contains child health, feeding practice and related variables. The fifth sub section contains environmental condition. The sixth section consists of dietary diversity assessment questionnaire and child's anthropometric measurement data.

Anthropometric measurement was used to ascertain the case (Height for age Z score <-2SD) and control (Height for age Z score >-2SD). Length/height was measured without shoes, socks, hair/head scurf, and ornaments and positioning the subject at the Frankfurt plane by using wooden board inserted with a tape calibrated to read the nearest 0.1cm. Length of the infants (6-23months) was measured in a recumbent (lying) position using a horizontal wooden length board and movable headpiece. Height was measured in children older than two years of age in standing position into the nearest 0.1 cm using a vertical wooden height board by placing the child on the measuring board, and child standing upright in the middle of board and head held erect such that the external auditory meat us and the lower boarder of the eye were in one horizontal plane (Frankfurt plane). Anthropometric measurement was taken twice and a difference 0.1 cm in length was accepted as normal. However, repeated measurement was carried out upon significantly larger differences. The child's five contact points (head, shoulders, buttocks, knees and heels) were adjusted to touch the board.

2.11. Data Quality Management

The questioner was developed in English and translated to Afan Oromo and Both the data collector and supervisors were trained for one day on objective and methodology of the research, data collection and interviewing approach, anthropometric measurement and data recording. Pretest of anthropometric measurement was made in 10 children before the actual data collection and systematized based on the result to ensure the accuracy of anthropometric measurement. Two days before the actual study begins, the questionnaire was pre-tested and validated in 5% of mothers/care givers (not included in sample) selected from the health facility and some modifications were made based on response categories on maternal characteristics (weight of mothers before pregnancy) were omitted. Data completeness was checked every day by supervisors.

2.12. Data Analysis

Data was entered using the WHO Anthro-plus v1.0.4 version, to calculate Height for age anthropometric indices. The study subjects were categorized as cases and controls based on WHO Height for Age z-scores. The used cut-off with Height for Age Z-scores is -2 standard deviation (SD). This means children with HAZ-score below -2 SD are considered as stunted. The collected data was coded and entered in to Epi-deta version 3.1 and exported to SPSS software for statistical analysis. Descriptive summary using frequencies, proportions are used to present study results. In bi-variable analysis co-variates with P-value of less than 0.25 was included in multivariable analysis. The final model was interpreted using AOR with 95%; CI at P-value of less than 0.05 was considered to be significant.

2.13. Ethical consideration

College of Health Sciences and Medicine Ethical committee at Madda Walabu University approved this study and provided ethical clearance letter. In addition to this, the university wrote letter of cooperation to Oromia Regional Health Bureau (ORHB) and permission letter was obtained from RHB and ZHD to siraro Woreda in order to conduct the study in the local area. Written consent was obtained from each participant mothers/caregivers before starting the interview. Participation in the study was voluntary and those who are not voluntary were not participated. However, data collectors were informed that their involvement was important to their health and health of their community. Mothers/care givers who had children with Moderately Acute Malnutrition (MAM) and Severely Acute Malnutrition (SAM) lined with the health facilities.

2.14. Dissemination of results

The final report will be presented and submitted to Madda Walabu University, department of public health and Siraro district health office. Finally attempts will be done to present finding at various professional conferences and publish on peer reviewed journal

3. Results

A total of 357 study participants, 119 cases and 238 controls were participated in this study with a response rate of 96.7 %. The mean age of cases were 22.3 months with SD of ± 13.3 and the mean age of controls were 21.9 months with SD of ± 16 .

Socio demographic factors associated with stunting in bi variable analysis

Among 357 studies subject's majority of them 69(60.0%) cases and 141(61.3%) controls were male. From 357 study participants 11(9.6%) cases and 41(17.8%) controls mothers educational status were primary while majority of them cases 68(59.1%) and controls 115(50%) were unable to read & write. Of 238 controls 32(13.9%) children's family size were < 5 while among 119 stunted children 34(29.6%) family size were ≥ 5 . From socio demographic factors in bi variable analysis; Childs mothers educational status being primary with $COR=2.20$; $P=0.03$, having family size ≥ 5 with $COR=1.68$; $P=0.03$, mothers has no autonomy in decision making with $COR=1.58$; $P=0.09$ were nominated for multivariable analysis. Among the respondents 44(38.3%) cases family and 111(48.3%) controls family were participated on poultry production. From 115 cases 68(59.1%) families sell their products at farm land, of 238 controls 65(28.3%) families were sell their products at market. During bivariate analysis from socio economic factors; children whose family not participated on poultry production with ($COR=1.5$; $P=0.08$), sell their product at farm lands with ($COR=1.75$; $P=0.08$), children whose family has live stoke < 5 with ($COR=2.21$; $P=0.04$) were factors associated with stunting (table 1).

Table 1 Socio demographic factors associated with stunting among 6-59 month children at Siraro district, West arsi zone, oromia region 2019

Variables	Category	Case (%)	Controls (%)	COR	P value	95%;CI
Childs sex	male	69(60.0)	141(61.3)	1.06	0.81	(.66-1.67))
	female	46(40.0)	89(38.7)	1		
Sex of Head HH	Male	71(61.7)	166(72.2)	1.6	0.05	(1.001-2.58)
	Female	44(38.3)	64(27.8)	1		
Care giver marital status	married	89(77.4)	191(83.0)	1		
	divorced	15(13)	22(9.6)	0.68	0.29	(.34-1.38)
	widowed	11(9.8)	17(7.4)	0.72	0.42	(.32-1.60)
Mothers educational status	un able to read& write	68(59.1)	115(50)	1		
	able to read & write	31(27.0)	57(24.8)	1.09	0.76	(.64-1.85)
	Primary	11(9.6)	41(17.8)	2.2	0.03	(1.06-4.57)
	Secondary & above	5(4.3)	17(7.4)	2.01	0.19	(0.71-5.69)
Fathers educational status	un able to read& write	56(48.6)	94(40.9)	1		
	able to read & write	29(25.20)	53(23.0)	1.08	0.77	(.62-1.90)
	Primary	15(13.0)	51(22.2)	2.02	0.04	(1.04-3.93)
	Secondary & above	15(13.0)	32(13.9)	1.27	0.5	(.63-2.55)
Family size	Family size <5	80(69.4)	96(41.7)	1		
	Family size >=5	34(29.6)	134(58.30)	1.68	0.03	(1.04-2.72)
mothers occupational status	House wife	68(59.1)	128(55.7)	1		
	Merchant	19(16.5)	44(19.1)	1.23	0.51	(.66-2.27)
	government employ	5(4.3)	9(3.9)	0.95	0.94	(.31-2.97)
Mothers autonomy in decision making	Daily laborer	23(20.0)	49(21.3)	1.13	0.67	(.64-2.01)
	Yes	82(71.3)	183(79.6)	1		
	No	33(28.7)	47(20.4)	1.58	0.09	(.93-2.62)
Do you participate in small agricultural activities	Yes	87(75.7)	180(78.3)	1		
	NO	28(24.3)	50(21.7)	1.18	0.53	(.69-2.01)
Participate on poultry production	Yes	44(38.3)	111(48.3)	1		
	NO	71(61.7)	119(51.70)	1.5	0.08	(.95-2.40)
Where you sell your product	From farm land	68(59.1)	165(71.7)	1.75	0.02	(1.09-2.81)
	Market	47(40.9)	65(28.3)	1		
gate food aid	yes	57(49.6)	148(64.3)	0.54	0.01	(.34-.85)
	no	58(50.4)	82(35.7)	1		
Do you have livestock	yes	87(24.3)	165(71.7)	1		
	no	28(24.3)	65(0.83)	0.83	0.83	(0.49-1.38)
Number of live stoke you have	<5	37(41.6)	92(54.8)	2.21	0.04	(1.02-4.79)
	10-May	36(40.4)	58(34.5)	1.43	0.37	(0.65-3.16)
	>10	16(13.6)	18(10.7)	1		

Maternal & Child health factors associated with stunting

A total of 66 children 29(25.2%) cases and 37(16.1%) controls were not vaccinated during the study period. Of 115 cases 50(43.5%) children were attacked by diarrhea in the last three months while from controls 83(36.1%) of them were affected by diarrhea. Thirty three (28.7%) cases 27(11.7%) controls mothers had no ANC follow up during their pregnancy period. From Maternal & Child health factors; being not vaccinated with COR=1.76; P=0.04, not received Vitamin A with COR=1.55; P=0.07, History of diarrheal attack with COR=1.36; P=0.08, having respiratory disease with COR=1.4; P=0.14 is factors associated with stunting. From respondents 26(22.6%) cases and 36(15.7%) controls households have no latrine and 57 (49.6%) cases and 108(47.0%) controls households dispose solid waste on open field. Among study participants 81(70.4%) cases and 142(61.7%) controls house were not separated from domestic animals.

Children's live in house without window with (COR=1.78; P=0.01), children live in house not separated from kitchen with (COR=1.5; P=0.08), care takers not wash their hands during food preparation for child with (COR=1.82; P=0.02) as factors associated with stunting (table 2).

Table 2 Care giver hygiene, Environmental sanitation, Maternal & Child health factors associated with stunting among 6-59 month children at Siraro district, West arsi zone, oromia region 2019

Variables	Category	Case (%)	Controls (%)	COR	P-value
Child immunization	Yes	86(74.8)	193(83.9)	1	
	No	29(25.2)	37(16.1)	1.76	0.04
Received Vit A	Yes	72(62.6)	166(72.2)	1	
	No	43(37.4)	64(27.8)	1.55	0.07
Diarrhea	Yes	50(43.5)	83(36.1)	1.36	0.08
	No	65(56.5)	147(63.9)	1	
Respiratory problem	Yes	55(47.8)	91(39.6)	1.4	0.14
	No	60(52.2)	139(60.4)	1	
Have you ever gave pre-lactation food or flood	Yes	29(25.2)	40(17.4)	1.6	0.08
	No	86(74.8)	190(82.6)	1	
Have you ever squeezed breast pre-lactation age started supplementary feeding	Yes	30(26.1)	40(17.4)	1.67	0.06
	No	85(73.9)	190(82.6)	1	
	<6month	98(85.2)	214(93.0)	2.21	0.06
	>/=6month	17(14.8)	16(7.0)	1	
Have you ever visited ANC during your pregnancy	Yes	82(71.3)	203(88.3)	1	
	No	33(28.7)	27(11.7)	2.84	<0.01
Number of ANC visit	<4 times	58(50.4)	124(53.9)	0.63	0.69
	>/=4times	25(21.7)	85(37.0)	1	
Food consumption score	Poor	28(24.3)	119(51.7)	3.33	<0.01
	good	87(75.7)	111(48.3)	1	
CHO rich FFS	Poor	105(91.3)	218(94.8)	1.73	0.22
	acceptable	10(8.7)	12(5.2)	1	
Protein rich FFS	Poor	56(48.7)	171(74.3)	3.05	0.01
	acceptable	59(51.3)	59(25.7)	1	
Latrine availability	Yes	89(77.4)	194(84.3)	1	
	No	26(22.6)	36(15.7)	1.57	0.11
How you dispose solid waste	Open field	57(49.6)	108(47.0)	1.09	0.89
	Pit	40(34.8)	87(38.2)	1.26	0.73
	Common pit	6(5.2)	15(6.5)	1.43	0.65
	Composting	8(7.0)	11(4.8)	0.78	0.76
	Burning	6(5.2)	7(3.0)	1	
Presence of window	Yes	60(52.2)	152(66.1)	1	
	No	55(47.8)	78(33.9)	1.78	0.01
Separate room for kitchen & house	Yes	45(39.1)	113(49.1)	1	
	No	70(60.9)	117(50.9)	1.5	0.08
Animals separated from house	Yes	34(29.6)	88(38.3)	1	
	No	81(70.4)	142(61.7)	1.47	0.11
Wash hand during food preparing for child	No	34(29.6)	43(18.7)	1.82	0.02
	Yes	81(70.4)	187(81.3)	1	
Wash hand during serving food	No	35(30.4)	60(26.1)	1.25	0.38
	Yes	80(69.6)	169(73.5)	1	

The most important determinates of Stunting among 6-59 month children

Candidate Variables in bivariate analysis like Childs mothers educational status being primary, family size ≥ 5 , mothers has no autonomy in decision making, family not participated on poultry production, families whom sells their product at farm lands, children whose family has live stoke < 5 , children being not vaccinated, not received Vitamin A, History of diarrheal attack, having respiratory disease, children live in house not separated from kitchen, care takers not wash their hands during food preparation for child, Animals not separated from living house, those not wash their hand during food preparing for child, Food Consumption Score and Food Frequency Score were collectively interred in to multivariate analysis. Finally age started supplementary feeding at < 6 month, mother has no ANC visit, poor FCS, poor protein rich FFS were the independently determinants of stunting. age started supplementary feeding at < 6 month with (AOR=2.54 95% CI ((1.01-6.42)), Childs mother has no ANC visit were 2.39 times (AOR=2.39(95%; (1.15-4.97)) more likely stunted as compared to their counter parts, Children with poor FCS were 3.48 times (AOR=3.48; 95%;(1.82-6.65)) more likely stunted as compared to good FCS, Children's with poor protein rich FFS were 3.74 times (AOR=3.74; 95%; 2.10-6.75)) more likely stunted as compared to good protein rich FFS (table 3).

Table 3 Determinates of Stunting among 6-59 month children at Siraro district, West arsi zone, oromia region Ethiopia 2019

Variables	Category	Case (%)	Controls (%)	COR	P-value	AOR	95%; CI
Mothers educational status	un able to read& write	68(59.1)	115(50)	1		1	
	able to read & write	31(27.0)	57(24.8)	1.09	0.76	0.84	(.41-1.72)
	Primary	11(9.6)	41(17.8)	2.2	0.03	1.86	(.72-4.73)
	Secondary & above	5(4.3)	17(7.4)	2.01	0.19	1.81	(.39-8.33)
Family size	Family size < 5	80(69.4)	96(41.7)	1.68	0.03	1.23	(0.61-2.51)
	Family size ≥ 5	34(29.6)	134(58.30)	1		1	
Participate on poultry production	Yes	44(38.3)	111(48.3)	1		1	
	NO	71(61.7)	119(51.70)	1.5	0.08	1.56	(.81-3.03)
Where you sell your product	From farm land	68(59.1)	165(71.7)	1.75	0.02	1.76	(.95-3.21)
	Market	47(40.9)	65(28.3)	1		1	
Number of live stoke you have	< 5	37(41.6)	92(54.8)	2.21	0.04	2.21	(0.86-5.6)
	10-May	36(40.4)	58(34.5)	1.43	0.37	1.70	(0.64-2.86)
	> 10	16(13.6)	18(10.7)	1		1	
immunization	Yes	86(74.8)	193(83.9)	1		1	
	No	29(25.2)	37(16.1)	1.76	0.04	1.20	(0.51-2.82)
Received Vit A last 6 month	Yes	72(62.6)	166(72.2)	1		1	
	No	43(37.4)	64(27.8)	1.55	0.07	1.02	(.65-2.89)
Diarrhea	Yes	50(43.5)	83(36.1)	1.36	0.08	1.22	(.63-2.38)
	No	65(56.5)	147(63.9)	1		1	
RTI	Yes	55(47.8)	91(39.6)	1.4	0.14	1.6	(0.89-2.87)
	No	60(52.2)	139(60.4)	1		1	
age started supplementary feeding	< 6 month	98(85.2)	214(93.0)	2.21	0.06	2.54	(1.01-6.42)**
	≥ 6 month	17(14.8)	16(7.0)	1		1	
ANC visited during preg	Yes	82(71.3)	203(88.3)	1		1	
	No	33(28.7)	27(11.7)	2.84	< 0.01	2.39	(1.15-4.97)**
Wash hand during food preparing	No	34(29.6)	43(18.7)	1.82	0.02	1.21	(0.54-2.73)
	Yes	81(70.4)	187(81.3)	1		1	
FCS	Poor	28(24.3)	119(51.7)	3.33	< 0.01	3.48	(1.82-6.65)**
	Good	87(75.7)	111(48.3)	1		1	
CHO rich FFS	Poor	105(91.3)	218(94.8)	1.73	0.22	1.33	(0.46-3.82)
	acceptable	10(8.7)	12(5.2)	1		1	
Protein rich FFS	Poor	56(48.7)	171(74.3)	3.05	0.01	3.74	(2.10-6.75)**
	acceptable	59(51.3)	59(25.7)	1		1	

4. Discussion

The odds of developing stunting was 2.39 times (AOR=2.39(95%; (1.15-4.97)) more likely among Children whose mother has no ANC visit as compared to controls. The result is supported by determinants of the Nutritional Status of Children in Ethiopia (Genebo, 2013). The result of Ethiopian research and development institute also indicates antenatal care, was the most consistent predictors of stunting (FAO, IFAD, UNICEF, 2017). The justification for this could be child care practice started from pregnancy, and mothers who obtain ANC visit during their pregnancy had access to get iron foliate supplementation and more awareness about child care practice.

The odds of developing cases was 4.86 (AOR=4.86 (1.65-14.31) times more likely seen among Children's started supplementary feeding at <6 months as compared to controls. The result was consistency with study done at Kindo Didaye woreda, Wolaita Zone, Southern Ethiopia (Batiro *et al.*, 2017). The result was also in line with study done at Lalibela Town Administration, Northern Ethiopia which indicates that; children's who eat additional food like honey before 6 month were more likely stunted (Ther, Town and Wollozone, 2014). This could be under six month children's can't digest extra foods which leads to diarrhea, the immediate cause of malnutrition.

The odds of developing cases among poor FCS were 3.48 times (AOR=3.48; 95 %; (1.82-6.65)) more likely as compared to controls. Justifications for this could be energy food is intermediates in the biosynthesis of other basic biochemical entities (fats and protein) and it is participated in biological transport, cell to cell recognition, activation of growth factors and modulation of immune system (Sareen S. Gropper and Groff, 2015) there for a house hold food availability, mainly of high energy foods are essential.

The odds of developing stunting was 3.74 times (AOR=3.74; 95%; 2.10-6.75)) more likely among Children's with poor protein rich FFS as compared controls. The justification for this could be protein is one of important nutrient for child growth and maintenance. The body must have Amino Acids in order to synthesize its own variety of proteins and nitrogen-containing molecules to make life possible. If child can't gate enough protein they face failure to thrive and their final outcome could be stunting.

Vaccination status is the determinants of stunting in other literatures (Batiro *et al.*, 2017). In this study it is also the determinant factor during bi variable analysis but not in multivariate analysis. Results of Gimbi district, Oromia region indicates that maternal lack of decision making on use of money was associated with chronic malnutrition. Even though this variable has significant during bivariate analysis in this study it is not significant during multivariate analysis. Different studies subjects that stunting was more related with families' income status like study done in Nepal (Pravana *et al.*, 2017), Study conducted at Holeta Town, West Shoa Zone, Oromia Region also supports this finding low income is determinants of stunting ('Kokeb Tesfamariam, 2017', 2017) ('Kokeb Tesfamariam, 2017', 2017). In this study socio economic status like (livestock) was also the determinants of stunting in bi variable analysis. This could be children's in low socioeconomic status were unable to gate enough food. Study done at Southern Ethiopia (Batiro *et al.*, 2017) and Gondar northwest Ethiopia (Ahmed and Alam, 2011) indicates that; children infected by ARI in the past two weeks were more developing stunting. Bivariate analysis of this finding is also indicates that ARI is the determinants of stunting but not in multivariate analysis. The reason could be during illness metabolic demand increases and appetite loss which leads to malnutrition.

5. Conclusion and Recommendations

In this study multivariate analysis revealed that; age started supplementary feeding at <6 month, mother has no ANC visit, poor FSC, poor protein rich FFS were positive determinants of stunting. Based on this finding;

The national public health intervention programmer and stakeholder working on improving child nutrition should focus on these determinants to re-duce stunting. Health extension workers shall educate mothers/caretakers on the importance of exclusive breast feeding and age at supplementary feeding started and methods of complementary feeding, consumption and benefits of feeding protein rich food, ANC visit and care during pregnancy.

Siraro district Health extension workers and Health work force in the health facilities should have to give health education for mothers about the impact of stunting factors like; age started supplementary feeding at <6 month, ANC visit.

Stake holders and government should have to design policies on protein rich containing foods for children's growth and maintenance. Program planner and policymakers should consider & strengthen collaboration on nutritional program that aimed to alleviate stunting by improving house hold food availability.

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Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

Not applicable. All the data supporting the findings is contained within the manuscript,

Consent to publish

Not applicable.

Ethics approval and consent to participate

Ethical clearance was obtained from IRB of Madda-Walabu University, Goba Referral Hospital. Official letter of permission was also obtained from respective administrative district office.

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