UNDERNUTRITION PREVALENCE AND ITS DETERMINANTS AMONG CHILDREN BELOW FIVE YEARS OF AGE IN SHABELLE ZONE, SOMALI REGION, EASTERN ETHIOPIA

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ABSTRACT

Introduction: Malnutrition is a major public health problem worldwide. More than half of under-five child deaths are due to undernutrition, mainly in developing countries. Ethiopia is among the highest in Sub-Saharan Africa. While, Somali region is the worst in Ethiopia. **Objection**: This study aims to assess the prevalence and determinants of undernutrition among under-five children living in Gode and Adadle districts of Shabelle Zone, Somali region.
Methods: A cross sectional study was carried out in August, 2014 among 415 child-mothers/caregivers. Face-to-face interview using a standard questionnaire, scales and stadiometer measurements of children's weight and height were done. Bivariate analysis to identify candidate variable for multivariable analysis were done. Multivariable linear regression were used to determine predictors for undernutrition.**Results:** Out 415 children, 30.4% were stunted, 21.0% underweight, and 20.2% wasted, out of which 17.3%, 9.9% and 8.0% were severely stunted, wasted, and underweight, respectively. The prevalence of undernutrition significantly increased with the age of child. Male children were chronically malnourished (P=0.016), compared to females. Early initiation of breastfeeding after delivery (within one hour) decreases the number of chronic malnutrition (P<0.001). Insecticide treated nets (ITNs) users are less stunted and underweight (P=0.010 and P=0.049), respectively. The higher the number of under-five children in the family (β=-0.4, P=0.001) the lower z-score for weight for age, and being urban/semi-urban residence decreases the z-score for height for age and weight for age (β= -1.132, P=0.001, and β=-0.355, P=0.025), respectively. **Conclusion**: Undernutrition was high in the study area. The main predictors of undernutrition were age and sex of the children, initiation of breastfeeding, and ITNs uses. It is important to focus on awareness creation using behaviour change communication (BCC) on sustainable nutrition education programs for parents, youths, elders, teachers, and school children. Besides that, health workers and health extension workers capacity building are also necessary.

Key words: Undernutrition, Stunting, Wasting, Underweight, Z-score

INTRODUCTION

Worldwide, malnutrition is one of the serious public health problems. Nearly half of all child deaths are due to undernutrition (Ahmed, Elkady, Hussein, & Abdrbou, 2011; Amsalu & Tigabu, 2008; Gulati, 2010; Mekonnen, Tefera, et al., 2005). Lack of exclusive breastfeeding during first six months of life leads to the death of 1.4 million children (Black et al., 2008). In 2016, 159 million and 50 million children below five years were stunted and wasted, respectively. In developing countries there is an unacceptable rate of undernutrition in children (Black et al., 2008; IFPRI, 2016). One in every three children below five years of age is undernourished. More than 90% of stunted and underweight children live in Asia (36%, and 27%) and Africa (40%, and 21%), respectively (Mekonnen, Tefera, et al., 2005; UNICEF, 2009).

The first two years of life is crucial, which needs special attention. Undernutrition leads to high under five morbidities and mortalities. Malnutrition rapidly impairs the health, and brain development, lowers the intelligence (IQ), and decrease the educability of the children. It will also reduce the productivity of the child, and working capacity during adulthood, which lead to 10% loss of lifetime earnings per malnourished child. This can also lead to irreversible physical and mental problems. Children born with low birth weight have a three-fold increase in infant mortality. Food insecurity at household level, low access to health care, and sanitation services, improper child caring practice, inadequacy of knowledge and practice of the caregivers/mothers on IYCF behaviours are the main contributing factors for under-five malnutrition (CSA, 2012; IFPRI, 2016; Kliegman, Behrman, & Station, 2011; Mekonnen, Tefera, et al., 2005; WFP, 2009).

Ethiopia is one of the poorest among the developing countries and highest undernutrition rate within the sub-Saharan African countries. About 38% of children below five years are stunted, 24% underweight, and 10% wasted, of which 18%, 7%, and 3% are severely stunted, underweight, and wasted, respectively (CSA, 2016). One in every twelve children die before he/she celebrate their fifth birthday. The stunting rate of children below five years of age varies from 21.8% to 56.6%, underweight varies from 20.9% to 57%, and wasting ranges from 4.1% to 34.6% (Alemayehu et al., 2014; Brhane & Regassa, 2014; CSA, 2012, 2016; Mulugeta et al., 2010; WHO, 2014), with a severity rate of underweight, stunting and wasting of 23.2%, 22% and 12%, respectively (Alemayehu et al., 2014; Chotard & Mason, 2007). Study conducted in Southern Nations Nationalities and Peoples' Region (SNNPR) showed that younger

children below three years of age were more affected with stunting (Brhane & Regassa, 2014).

The main predictors of stunting and underweight include; age of the child, bottle feeding, rural residence, less educated mother, and low wealth index (Brhane & Regassa, 2014; CSA, 2016). While, low maternal nutritional status, and food insecurity increased the risk of stunting for children (Christiaenoen & Alderman, 2001). Over 90% of child deaths are due to malnutrition, neonatal problems, pneumonia, diarrhoeal diseases, malaria, Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) infections and sometimes the combination of two or more of these conditions (MOH, 2010).Therefore, the main objective of this study was to assess the nutritional status and contributing factors among children below five years of age in Gode and Adadle districts, Shabelle Zone of Somali Region, Eastern Ethiopia.

METHODS AND MATERIALS

Study setting

Shabelle zone is one of the eleven administrative zones of the Region. The zone is located in the southern part of the region. According to Ethiopia population census 2007, the population of the zone is estimated about 550,000, with 55.7% males, and 44.3% females (CSA, 2008; SRHB, 2010). The majority (86.1%) of the population are pastoralist, and agro-pastoralist, their life depends mainly on livestock and small scale agriculture (Ayele, 2005; CHF International, 2006; CSA, 2008; SRHB, 2010).

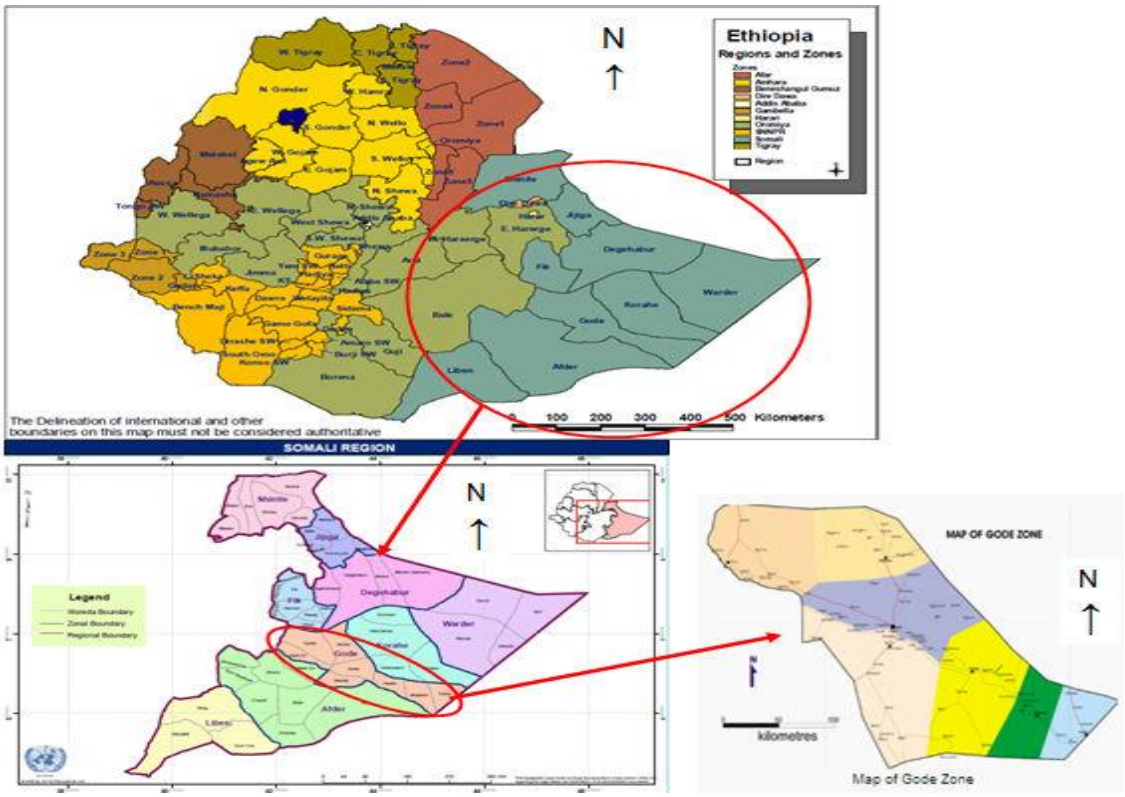

Figure 1. Map of Ethiopia

Source: https://commons.wikimedia.org/wiki/Atlas_of_Ethiopia.

Study Design, period, and population

A cross sectional study was conducted in August, 2014 using quantitative data collection methods to identify the nutritional status and its predictors among children less than five years. A total of 415 children 0-59.9 months and their mothers/caregivers were interviewed and assessed. The sample size was calculated using a single population proportion formula. Stunting of 33% was the highest prevalence reported in Somali Region (CSA, 2012), to get a larger and representative sample size, the 95% confidence level, 5% margin of error (Bluman AG., 2009), and 20% none response rate were considered. Thus, the total sample size was 408 participants.

Data collection and measurement

A pre-tested semi structured Somali language questionnaire was used. The questionnaire was prepared in English and translated into Somali language, and again back to English, and checked by other person who speaks both languages to ensure its consistency. The information collected were socio-economic,

demographic characteristics of both children and mothers/caregivers, and anthropometric measurements; weight and height of the children.

All measurement scales were calibrated periodically, and whenever we change the location. All children were weighed using hanging scale, with weighing pant after adjusting the scale to zero with empty pant and undressed or with minimal cloth of the child. If minimally clothed, the clothes were subtracted and recorded to the nearest of 100g (Gibson R, 2005; Lee R & Nieman D, 2010; UN, 1986).

For children ≥2 years, height was measured standing without shoes, legs straight and heels touching the back of the stadiometer, with relaxed shoulders and straight arms alongside of the body, looking straight forward. However, for those children <2 years, length was measured in recumbent position using wooden board, head was levelled to the headboard and flexed heel against the end of the measuring board to ensure an accurate length measurement. In both measurements, the reading was recorded to the nearest of 0.1cm (Gibson R, 2005; Lee R & Nieman D, 2010; UN, 1986).

Data were collected by degree and diploma nurses, after two days training and one day pre-test which was conducted in a village that was not included in the actual study. Modifications/corrections were made in the questions depending on the findings of the pre- test. Continuous checking for completeness were done every night during data collection, any missing information was retrieved.

Data Analyses

Data were coded, checked, double entered, cleaned, and analysed using SPSS (SPSS Inc. version 20, Chicago, Illinois). A descriptive statistical analysis was done, mean and standard deviation (SD), percentage were used to describe the social and demographic characteristics, and prevalences of nutritional status. WHO AnthroPlus Software was used to calculate weight for height z-score, weight for age z-score and height for age z-score. All children <–2 SD (z-score) from the reference population median were considered malnourished, and <-3SD (z-score) severely malnourished (WHO, 2009). Chi-square and independent t-test were used to identify the candidate variables for multivariable analysis. Multivariable logistic regression analyses were used to isolate the independent predictors of different types of undernutrition among children <5 years of age.

Ethical clearance was obtained from the International Islamic University Malaysia (IIUM) Research, and Ethical Committee (IREC). A written approval letter were also obtained from Federal MOH, Somali Regional Health Bureau, and Shabelle zone administrator. The informal verbal consent were obtained

from the mothers/caretakers prior to the data collection. The interviewers/data collectors were given a written statement to read and sign after participant acceptance. The participants were encouraged to be honest, and confidentiality were assured. If somebody sick seen, the team sent him/her to the nearest health facility for assistance.

RESULTS

Out of the calculated 408 pair child-mothers/caregivers, a total of 415 were secured, which makes the response rate 101.7%. The mean age of the mothers/caregivers were 28.70 ± 7.88 years, while the mean age of children were 24.03 ± 13.82 months. The majority (87.5%) of the mothers/caregivers were illiterate, and (85%) were housewives by occupation. The mean family size was 5.76 ± 2.1 persons. About 81.9% of the participants reported using ITNs, while, 87.7% of the participants uses unprotected water for all purposes (

As shown in

Figure 2 **&** **3** the height for age Z-score average deviation, from the WHO standard reference population median of the same age group -0.81 ± 2.35. The stunting prevalence was 30.4%, out of which 17.4% were severely stunted. The stunting rate were higher in the age groups, 24 – 35 (43.9%), 36 – 47 (40.4%) and 48 – 59 (42.1%) months.

The weight for height Z-score average deviation, from the WHO standard reference population median of the same age group for male and female children was -0.53 ± 1.87. The wasting prevalence was 20.4%, out of which 9.9% were severely wasted (
Figure 3). The wasting rate were higher in the age group 36 – 47 (29%) and 48 – 59 (30.4%) months.

The weight for age Z-score average deviation, from the WHO standard reference population median of the same age group was -0.82 ± 1.58. The underweight prevalence was 21.0%, out of which 8.0% were severity underweight (
Figure 3). The underweight rate were higher in the age group 48 – 59 (38.6%) months.

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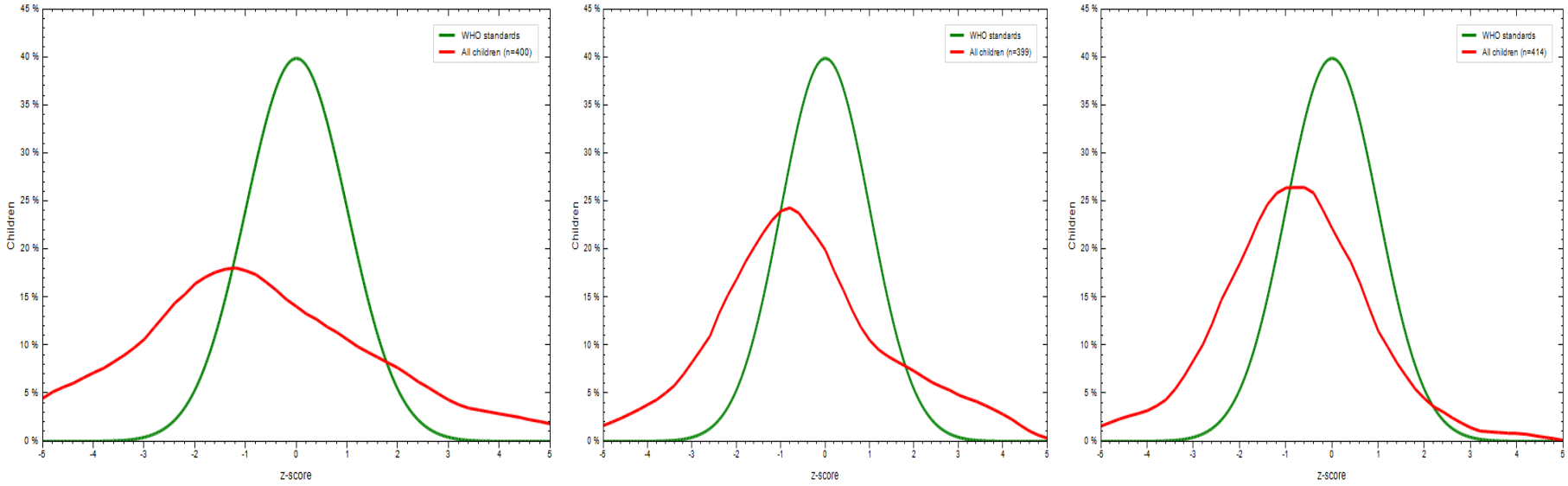
Table 1. Distribution of socio-demographic and economic characteristics of the studied population in Gode and Adadle

Characteristics	Variable description	Number (%)
District	Adadle	205(49.4)
	Gode	210 (50.6)
Residence	Urban/Semi-urban	127(30.6)
	Rural	288 (69.4)
Age of the children (months)	<24	286 (68.9)
	≥24	129 (31.1)
Mean child age (months)	24.03 ± 13.82	
Sex of the child	Male	223 (53.7)
	Female	192 (46.3)
Family size	1-3	57 (13.7)
	4-6	223 (53.7)
	≥7	135 (32.5)
Mean family size	5.76 ± 2.1	
Number of under five children in the family	1	101 (24.3)
	2	234 (56.4)
	≥3	80 (19.3)
Mean <5 children number	1.96± 0.692	
Mother/care giver age (years)	< 18	20 (4.8)
	19 – 35	334 (80.5)
	>35	61(14.7)
Mean age	28.70 ±7.88	
Religion	Muslim	415 (100)
Ethnicity	Somali	415 (100)
Mother/care giver education	Illiterate	363 (87.5)
	Literate	52 (12.5)
Mother/care giver occupation	House wife	351(84.6)
	Farmer	56 (13.5)
	Others	8 (1.9)
Insecticide Treated Nets use of <5 children	Ye	340 (81.9)
	No	75 (18.1)
Source of drinking water	Protected	51 (22.3)
	Unprotected	364 (87.7)
Disease during last two weeks	Yes	323 (77.8)
	No	92 (22.2)
Time Start anything except breast milk	Correct time	63 (15.2)
	Incorrect time	352 (84.8)
Dietary Diversity Score (DDS)	≤3 food items	220 (53.0)
	≥4 food items	195 (47.0)



Height for Age (Stunting) **Wieght for Height (Wasting)** **Weight for Age (Underweight)**

Figure 2. Height for age Z-score, **weight for height Z-score, and Weight for age Z-score** distribution of the children compared to the WHO standard reference population median in Gode and Adadle districts

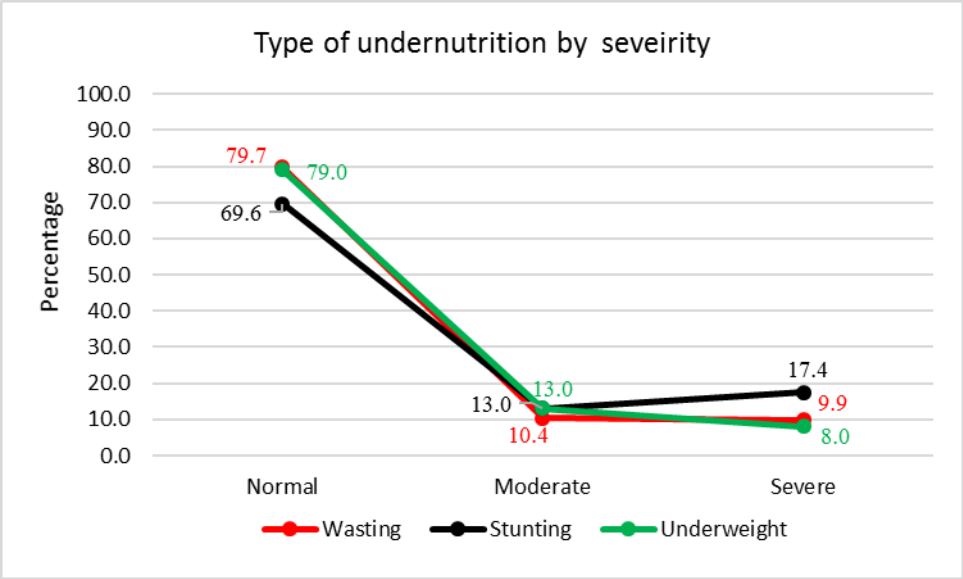


Figure 3. Nutritional status of the children aged 0 -59 months living in Gode and Adadle districts, Somali region

Nutritional status with background characteristics

Male children were more stunted then their female counterparty (X^2= 5.85, P= 0.016). Children breastfeed within one hour after delivery were less wasted compared to those who started after one hour (X^2=10.3, P <0.001). ITNs user was less stunted and less underweight (X^2=5.56, P= 0.010, and X^2=3.9, P= 0.049) compared to non-users, respectively. The independent t-test analysis showed as the age of the child increases the occurrence of undernutrition increases (P <0.05, CI= 1.3, 8.4; CI= 3.9, 3.6, and CI= 4.9, 11.56 of wasting, stunting and underweight, respectively). As number of children in the family increases the tendency of being chronically malnourished increased (P= 0.01, CI= 0.04, 0.33). While wasting rate increases when number meals decreases (P= 0.04, CI= -0.262, -0.006).

Factors associated with wasting (WHZ), Stunting (HAZ), and Underweight (WAZ)

In the multivariable linear regression model of weight for height (WHZ) showed a unit increase of family wealth index, and number of meals child served per day, there was an increase of WHZ-score by β= 0.509, P <0.001,

and β= 0.596, P= 0.003, respectively. On the contrary, as the age of the child increases, there is a decline of WHZ-score by β= -0.021, P= 0.008.

Regarding height for age Z-score (HAZ); rural area residence, age increment of the child, and higher number of under five children in the family, there was a decrease of HAZ-score by β= -0.845, P= 0.003, β= -0.058, P <0.001, and β= -0.572, P= 0.01), respectively. Concerning weight for age Z-score (WAZ), it was found that as age of mother/caregiver increased WAZ-score also increased by β= 0.038, P <0.001. Nevertheless, being Gode residing participants, rural area dwellers, increase age of the child, and increase number of under five children in the family, WAZ-score decreases by β= -0.698, P <0.001, β= -0.369, P= 0.018, and β= -0.374, P <0.001, respectively (**Table 2**).

Table 2. Multivariable linear regression model predicting Weight for height Z-scores, Weight for age Z-score, and Height for age Z-score among under-five children in Gode and Adadle Districts

Model	WHZ			WAZ			HAZ		
	β	Std. Error	P (95% CI)	β	Std. Error	P (95% CI)	β	Std. Error	P (95% CI)
(Constant)	-1.97	0.98	0.04 (-3.9, -0.05)	0.8	0.47	0.09 (-0.13, 1.7)	4.4	1.45	0.003(1.51, 7.2)
District									
Adadle (ref)									
Gode				-0.7	0.15	<0.001 (-1, -0.4)			
Residence									
Urban/semiurban (ref)									
Rural	-0.16	0.23	0.5 (-0.6, 0.3)	-0.37	0.16	0.018 (-0.7, -0.06)	-0.85	0.32	0.008 (-1.5, -0.22)
Sex of the child									
Female (ref)									
Male	-0.04	0.21	0.8 (-0.5, 0.4)				0.61	0.28	0.028 (0.07, 1.2)
Age of the child(months)	-0.02	0.008	0.008 (-0.04, -0.01)	-0.04	0.01	<0.001(-0.05, -0.03)	-0.06	0.01	<0.001 (-0.08, -0.04)
No <5 children family				-0.37	0.11	<0.001 (-0.6, -0.17)	-0.57	0.22	0.010 (-1.07, -0.14)
Mother/caregiver age				0.038	0.01	<0.001 (0.02, 0.06)			
No meals child eat/day	0.6	0.2	0.003 (0.21, 0.99)				-0.47	0.26	0.074 (-0.99, 0.05)
ITNs use <5 children	0.17	0.29	0.56 (-0.4, 0.7)	0.08	0.19	0.67 (-0.29, 0.46)	-0.19	0.38	0.6 (-0.9, 0.6)

No (ref)											
Yes											
Wealth Index	0.51	0.11	<0.001	(0.3, 0.7)					- 0.15	0.15	0.3 (-0.44, 0.15)
Family size									0.05	0.08	0.54 (-0.1, 0.2)
TIBF									0.14	0.28	0.6 (-0.4, 0.7)
Mother occupation											
Others (ref)											
Housewife									- 0.59	0.40	0.14 (-1.4, 0.2)
Maximum Variance Inflation Factor (VIF)=1.159, Adjusted R^2 = 0.078					Maxim VIF =1.153, AdjustedR^2= 0.22				Maximum VIF=1.387, Adjusted R^2 =0.124		

DISCUSSION

In this study, the overall prevalence of stunting was 30.4%, which is lower than the stunting rate obtained from many studies in developing countries, including Ethiopia (Alemayehu et al., 2014; Arthur & JB Baliddawa, 2012; Brhane & Regassa, 2014; CSA, 2016; Mahgoub, Nnyepi, & Bandeke, 2006; Mulugeta et al., 2010; Olack et al., 2011; Ramli et al., 2009). In contrast, it is higher than the study carried out in some African and Asian countries, including Malaysia, where stunting rate ranging from 11.59% - 27.8% (Janevic, Petrovic, Bjelic, & Kubera, 2010; Khor et al., 2009; Miyoshi, Hawap, Nishi, & Yoshiike, 2015; Seedhom, Mohamed, & Mahfouz, 2014; Zhang et al., 2011). This difference could be socioeconomic, cultural differences, and also seasonal variation.

Furthermore, sex and age of the child were associated with stunting. A male children were chronically malnourished more than females ($P<0.016$). This is in coherence with other studies (Agedew & Chane, 2015; Alemayehu et al., 2014; Asfaw, Wondaferash, Taha, & Dube, 2015; Khor et al., 2009).

Underweight rate in this study area was 21.0%, this result was lower than studies conducted in Vietnam (44.3%) (Hien & Kam, 2008), Kenya (27%) (Arthur & JB Baliddawa, 2012), and many other studies conducted in other regions of Ethiopia ranging from 28% - 57% (Alemayehu et al., 2014; Chotard & Mason, 2007; CSA, 2014; Mulugeta et al., 2010). The result is similar to the result obtained from study done in Tigray Region (Brhane & Regassa, 2014). However, it is higher compared to studies in different countries which ranges from 2% - 15.6% in Egypt, Ghana, Serbia, Malaysia, New Guinea, Kenya and Botswana (Anderson, Bignell, Winful, Soy, & Steiner-asiedu, 2010; Janevic et al., 2010; Khor et al., 2009; Miyoshi et al., 2015; Olack et al., 2011; Seedhom et al., 2014). This can be explained by social-demographic and economic factors including maternal factors.

In this study the wasting rate of the children was 20.4%, these were worse than reports from studies in developing countries, including study in northern Ethiopia, ranging between 1.85 % - 15.6% (Anderson et al., 2010; Arthur & JB Baliddawa, 2012; CSA, 2012; Janevic et al., 2010; Miyoshi et al., 2015; Mulugeta et al., 2010; Olack et al., 2011; Seedhom et al., 2014). Whille, the result of this study were better than the study done in Tigray region 34.6% (Alemayehu et al., 2014). This could be explained by the early cessation of exclusive breastfeeding, the majority 85% of the children started additional feed before six months, and improper weaning, which may lead to

infection(s). More than 77% of the children had reported having illness (Fever, Cough, Diarrhoea etc.) within the last two weeks prior to the study day. Therefore, this may be the reason why acute malnutrition was higher in these communities.

In this study, we have seen that, as child age increases the prevalence of the three types of undernutrition increases. Male children were more chronically malnourished, compared to female. This is comparible with studies done in Indonesia, and Northern Ethiopia (Alemayehu et al., 2014; Brhane & Regassa, 2014; Miyoshi et al., 2015).

In our study family wealth index was positively associated with WHZ, similar result were seen in other study conducted in Oromia region (Tamiru, Tolessa, & Abera, 2015). Age of the child was predicted for wasting, stunting and underweight; this was similar with study conducted in Tigray Region (Alemayehu et al., 2014), and rural residence was predicted for stunting and underweight; this was comparable with other study in SNNPR (Medhin et al., 2010).

The strengths of this study were that, we used a validated questionnaire and qualified degree and diploma nurses with very comprehensive two days training and pre-test before actual data collection. As a cross-sectional study design, this could not establish cause-effect relationship, and could not also capture the seasonal differences of child feeding behaviours, possibility of recall bias during 24 hours child diet report, and social desirability bias, because of high dependency on food aid. Although an effort was made to minimize it, these are some of the limitations.

CONCLUSION

The rate of undernutrition prevalence in the study area with regard to stunting, underweight and wasting were 30.4%, 21.0% and 20.4%, respectively. The major contributing factors for stunting (HAZ) were area of residence, sex and age of the child, number of meals given to child per day, mothers/caregivers occupation. Whereas, the main contributing factors for wasting (WHZ) were found to be wealth index, age of the child and number of meals child eat per day. The contributors for underweight (WAZ) was district, area of residence, age of the child, number of under-five children, and age of the mother/caregiver.

Therefore, focusing these areas is very crucial for awareness creation using behaviour change communication (BCC) on sustainable nutrition education

programs for parents, youths, elders and school teachers and children's, as well as giving due attention to proper breastfeeding (exclusive and nonexclusive) and complementary feeding, type of nutrient foods and sex feeding pattern. On top of that, health service utilization; like child immunization, Vitamin A supplementation, de-worming and ITNs utilization should be also included. Beside, health worker, health extension capacity building could be underlined as well.

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Competing Interest:

The authors declare that they have no competing interest

Authors Contribution:

RAG brought the inception of the study, designed the proposal, managed data collection, analysis and write up. NM, TB, WM and NA worked closely with RAG in the refinement of the proposal, fieldwork, analysis, and write up. All authors read and approved the submission of this paper.

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