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RESEARCH ARTICLE

The Magnitude of Nutritional Underweight and Associated Factors Among Children Aged 6-59 Months in Wonsho Woreda, Sidama Zone Southern Ethiopia

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Abstract:

Background:

Childhood under-nutrition is a major global health problem. Although the rate of under-nutrition in southern Ethiopia has substantially declined in the last decade, but it still remains the major causes of morbidity and mortality of children under-five years. Unfortunately, there was no study in this study area with respect to this topic of interest and therefore, this study was carried out to assess the magnitude of underweight and associated factors among children aged 6-59 months.

Methods:

A community based cross sectional study was conducted in Wonsho Woreda, Southern Ethiopia. A total of 595 randomly selected child mother pairs were selected using cluster sampling method. Data were collected using a face-to-face interview and children anthropometric measurements. Child Dietary Diversity Score (DDS) was determined. World Health Organization Anthro software was used to convert anthropometric measurements into Z-scores. The data was analyzed using Epidata version 3.1 and SPSS version 20. Bivariate and multivariable logistic regression model was used. A statistical significance was declared at p-value less than 0.05.

Result:

The overall prevalence of underweight was 122(20.5%) (95% CI, 17.3-23.8%), meanwhile, the prevalence of severe and moderate underweight was 7.1% and 13.4% respectively. Male children were 1.78 times more likely to be underweight than female children (AOR=1.78; 95%CI=1.17, 2.70). Unimmunized, children were 2.45 times more likely to be underweight (AOR=2.45; 95%CI=1.41, 4.24).

Conclusion:

Prevalence of nutritional underweight was high in the study area. Driving factors of underweight were investigated and therefore, strong stakeholders' collaboration is compulsory to address the future public health burden.

Keywords: Under-nutrition, Nutrition, Under weight, Wonsho Woreda, Ethiopia.

BACKGROUND

Child under-nutrition is the term that encompasses malnutrition and it is a condition in which the body is unable to get enough amount and essential food type; macronutrient (proteins, carbohydrates and fats) and micronutrient (vitamins and minerals) to meet its energy needs. Even though children have enough food to meet their energy requirements, under-nutrition can also be the case if the food lacks important micronutrients [1]. Malnutrition implies

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both a state of under and over nutrition. It is the failure of the body to get the proper amounts of nutrients to maintain healthy tissues and organ function [2]. In the crucial days (childhood), the body is quickly laying down its fundamental building blocks for brain development and future growth. Any nutritional disorder leaves long lasting marked damage in early life. It will result in stunted physical and mental capability; also lower work capacity and productivity in adulthood. Later in life, there is an increased likelihood of being overweight and developing non communicable diseases (NCDs) such as cardiovascular disease, diabetes mellitus, cancer and suffer from mental health issues [3, 4]. In addition, babies born from undernourished mothers are at risk of fetal growth restriction and death. Girls that survive are also likely to remain stunted through childhood and adolescence and transmit their poor nutritional status to the next generation [5, 6].

Child under-nutrition is a major global health problem, estimated to be accountable for 2.2 million annual deaths of children under the age of five [7]. In 2010, an estimated, 16% (104 million) of children under the age of five years were underweight worldwide. The overall prevalence of underweight is fairly similar in Africa and Asia which was 19% and much higher than in Latin America and the Caribbean (3%) [8]. In developing countries nearly one third of children are underweight. Consequently, it is the most important risk factor for the burden of disease and the risk of death is directly correlated with the degree of under-nutrition [6]. Although nutrition and diets in this region are changing rapidly, under-nutrition is still a wide spread problem [9]. Half of the world's undernourished children live in three South Asian countries: Bangladesh, India, and Pakistan, in the mean time in Sub Saharan Africa 40 percent of children under the age of five were chronically undernourished [10]. A study done in children nutritional status revealed that the prevalence of underweight in Qazvin, Iran in 2010 was 11.7% [11], 4.7% in Mongolia in 2012 [12] and 35% in 2010 in Khartoum, Sudan [13].

The rate of under-nutrition in Ethiopia as well as in Southern Nations, Nationals and Peoples Region of Ethiopia (SNNPR) remains the major cause of morbidity and mortality of children under five years [9]. According to 2014 Ethiopian Mini Demographic Health Survey (EMDHS) 25 percents of children under the age of five was underweight. This shows a reduction from Ethiopian Demographic Health Survey (EDHS) 2011 that was 29 percent for underweight. In SNNPR 25.7% of children was underweight [14, 15]. As studies done in different parts of Ethiopia, the prevalence of under-nutrition varies in the country. Study conducted in 2015 in Haramaya District, Eastern Ethiopia showed that the prevalence of underweight among children was 22% [16], 37.4% in Tahtay Adiyabo Woreda, Tigray regional state in 2015 [17] and 10.8% in Butajira in 2010 [18].

Male children were at increased risk of becoming stunted and underweight than female children [19, 20]. There was a significant correlation between parent's education and being underweight [17, 19]. Families with poor socioeconomic status were found at risk for both stunting and underweight [21]. Paternal occupation was a contributing factor for child underweight [22, 23]. Large family size highly affects the nutritional status of children in household. A study showed that having more than 2 children within the household was more likely to be undernourished [22] and underweight [16]. Children from large family size (>4 members in the household) were at increased risk of underweight [24]. Feeding practice such as breast milk for less than 12 months leads to more undernourishment [25], children who were fed on non-breast milk were more likely to be underweight [26]; children who received butter as pre-lacteal feeding were more likely to be underweight as compared to those who received water with sugar as per-lacteal feeding [27].

Children who had diarrhoea than their counterpart in the last two weeks were more at risk of underweight [17, 19, 28]. A child whose mother had never visited antenatal clinic Antenatal Care Clinic (ANC) during her pregnancy [16, 25] and did not follow family planning [17] was more likely to become underweight. Children in the households using water from unprotected source of drinking water were more likely to be underweight [16, 24]. Children of mothers who wash their hand only after using of latrine were more likely to have under-nutrition as compared to those who wash their hands at critical times (before food preparation, after latrine use, before and after feeding and after cleaning of child feces) [29]. A good understanding of child under-nutrition and its associated factors provides many important public health implications. To the level of authors knowledge, there has been no study documented in the study area concerning nutritional status of children. To overcome the shortcoming of local research gap, laying baseline information for further research and to design new strategies associated with under-nutrition in the study area; the current study was aimed to determine the magnitude of nutritional underweight and associated factors among children aged between 6-59 months in Wonsho Woreda, Sidama zone Southern Ethiopia.

METHODS

Study Design and Participants

A community based cross-sectional study was conducted in Wonsho Woreda, Sidama zone, Ethiopia from April 1st to 27th 2016. The study participants were randomly selected mothers having children aged between 6-59 months in the Woreda. Mothers having children aged between 6-59 months and living in the area for at least six months, while mothers having a child who was seriously ill or hospitalized during data collection were excluded from the study.

The study area is located at 334 km from Addis Ababa, the Capital of Ethiopia. The Woreda has estimated total population of 112, 254 of this 17,290 are under five years. There are 17 health posts and 5 health centers. The Woreda has two climatic zones: the highlands and midlands. In the Woreda, agriculture is the main livelihood of most of the population. For the most parts cultivated agricultures were coffee, Khat and Enset as a cash crop while Khat, *sorghum and maize* are the common grains in highland and midland area in the Woreda, respectively.

Sample Size and Sampling Procedure

Sample size determination of children's household was calculated by using a single population proportion formula with the assumptions of proportion was taken from Ethiopian Mini Demographic Health Survey (EMDHS) report of under-nutrition for southern nations for proportion of stunting=44%, underweight= 25.7% and wasting=6.6% [14], with a 95% Confidence Interval and marginal error= 5% and finally, the calculated sample size was 595 study participants. Among 18 rural Kebeles (the smallest administrative structure) of the Woreda, eight Kebeles were selected by simple random sampling method. The calculated sample size was proportionally allocated to each selected Kebeles. The participant's household was selected by simple random sampling technique using current list of under five children in Woreda health department.

Assessment of Underweight

Socio-economic and demographic variables, Child characteristics and feeding practices, morbidly status, age, sex, birth order, immunization, dietary diversity, pre-lactation food/fluid, vitamin-A supplementation and de-worming, maternal characteristics: mothers age, education and occupation, ANC visits, place of delivery, ever used of family planning methods, gestational age at birth and use of extra meal during pregnancy or lactation and hygiene and sanitation conditions were assessed using interviewer administered and structured questionnaire. The questionnaire was first prepared in English and translated into local language and then translated back to English by language expert to check for its equivalency. The data was collected by face-to-face interview of mothers and anthropometric measurement of their child taken by trained clinical nurses and two health officer supervisors. Pretest was done to check the consistency of the questionnaire.

Age of child was determined by asking mothers using a certain local event/calendar. To identify past morbidity status of children, mothers were asked about any occurrence of disease. Enumerators probe to confirm nature of illness based on operational case definition. Vaccination status of children was also checked by observing immunization card, if the card was not available mothers were asked to recall it and Bacillus Calmette-Guerin (BCG) vaccination was checked by observing scar on the arm of a child.

Anthropometric Measurements

Weight was measured with minimum clothing and taking off shoes, using calibrated portable scale (UNICEF electronic scale) to the nearest of 0.1 Kilogram (kg). Children aged less than two years (couldn't stand by themselves) were measured by taking the mother's and children's weight together, then the weight of mother alone was measured, and then the difference of the two measurements was taken. Children aged two and older (could stand by themselves) were measured on their own. Measurement of length and height was done using wooden board with no shoes, head scarf and other height interfering materials to the nearest 0.1 centimeter (cm). For children of age less than two years (couldn't stand in a proper position) length was taken while lying down, and for children above two years (could stand straight) height was measured while standing. The child's head, shoulders, buttocks, knees and heels touched the board. Each measurement was taken two times for both weight and height by different data collectors. If there was a difference in readings, the average of the two readings was taken. Standardization of height weight measurements was done to minimize the intra and inter-observer variations and instruments were calibrated in each measurement.

Operational Definitions

Under-nutrition:

A deficit (Z-score below -2SD) from the WHO reference of the median of the standard curve in any one of WAZ, HAZ and WHZ reflects under-nutrition. Underweight: Weight-for-age (WAZ) was found to be (Z-score below -2SD). Stunting: Height/length for age (HAZ) index was found to be (Z-score below -2SD). Wasting: Weight-for-height/length (WHZ2) was found to be (Z-score below -2SD) [1].

Dietary diversity:

The number of food items consumed by the children/household from recommended food groups. For household 12 food groups were included (cereals), (roots and tubers), (vegetables), (fruits), (meat, poultry, offal), (eggs), (fish and seafood), (pulses/legumes/nuts), (milk and milk products), (oils/ fats), (sugar/honey) and (miscellaneous). For children 8 food groups were included (grains, roots or tuber), (vitamin A-rich plant foods), (other fruits or vegetables), (meat, poultry, fish, seafood), (eggs), (pulses/legumes/nuts), (milk and milk products) and (foods cooked in oil/fat).

Dietary diversity score:

It is the sum of food groups eaten in a 24 hour period, serves as a proxy indicator of nutrient adequacy and quality for children and economic ability of household to get variety of food items. Low score (The proportion of children aged 6-59 months who received three and less than three food groups of the eight food groups), medium score (4 and 5 food groups) and high score (greater than 6 and more food group).

Statistical Analysis

Data was cleaned, coded, and entered into Epidata software version 3.1 and then exported to SPSS, version 20.0 for further analysis. Anthropometric data was exported to WHO Anthro software version 2.0.2 to convert anthropometric measurements into Z-scores indices. The wealth index (indicator of living standard of household) was constructed through principal component analysis (PCA). Household and child DDS were calculated based on different food groups recommended by Food And Nutrition Technical Assistance (FANTA) guideline and using WHO guidelines for measuring household and individual dietary diversity. For household and a child 12 and 8 food groups were included, respectively [30, 31]. Frequencies and cross tabulations were used to check for missed values and variables. Errors was identified and corrected after revising the original questionnaires. Descriptive statistics frequencies, proportions and measures of central tendency and measures of variation were used to describe the descriptive findings and the regression outputs of SPSS were given by Crude Odds Ratio (COR) and Adjusted Odds Ratio (AOR) with their 95% Confidence Interval (CI). Chi-square test and multicolinearity tests were done to check cells adequacy and relation between independent variables, respectively. Multicollinearity was checked using cutoff point variance inflation factor (VIF) < 10 and tolerance test > 0.1. Normality test was checked for continuous data and Hosmer and Lemeshew goodness of fit test to assess the fitness of the model. The logistic regression model was used to assess the relation between dependant and explanatory variables. The bivariate analysis was done for stunting, underweight and wasting separately. The independent variables with p-value ≤ 0.25 during bivariate analysis were entered in to multivariate analysis model. Association between dependent and independent variables was assessed using AOR with 95% CI. Statistical association was declared significant when p-value was less than 0.05.

RESULTS

Participants and Household Characteristics

Five hundred and ninety five respondents responded the interview successfully and a response rate of 100% was recorded. The majority of households were headed by males 576 (96.8%), Sidama ethnic group 574 (96.5%) and protestant in their religion 498 (83.7%). About 439(73.8%) of the respondents used protected water sources (spring and public tap) as the main source of drinking water supply, while the rest 156 (26.2%) used unprotected water sources (pond, river, private well). About 562 (96.6%) of respondents had latrine and majority of them used simple pit latrine 531(89.3%) (Table **1**).

Table 1. Household characteristics of study participants, Wonsho Woreda, Ethiopia, 2016.

Characteristics (n=595)	Categories	Frequency	Percent (%)
Head of household	Male	576	96.8
	Female	19	3.2
Paternal educational status	Can't read and write	74	12.4
	Primary	427	71.8
	Secondary	56	9.4
	Diploma and above	38	6.4
Occupation of husband	Farmer	383	64.4
	Government employee	40	6.7
	Merchant	144	24.2
	Other (Private employee, daily labor)	28	4.7
Family size	≤ 5	444	74.6
	> 5	151	25.4
Wealth index	Poor	238	40
	Middle	119	20
	Rich	238	40
Household DDS	Low	82	13.8
	Medium	480	80.7
	High	33	5.5
Source of drinking water	Unprotected	156	26.2
	Protected	439	73.8
Having latrine	Yes	573	96.3
	No	22	3.7
Method to dispose garbage	Open field	439	73.8
	In a privet pit	101	17
	Burning	39	6.6
	Other (common pit, composting)	16	2.6
Hand washing with soap (at critical times)	Yes	583	98
	No	12	2

Maternal Characteristics

The mean (± SD) age of mothers was 27.02 (± 3.71) years. About 207 (34.8%) and 352 (59.2%) mothers were illiterate and attended primary school, respectively. About 563 (96.6%) of the mothers were married, 561(94.3%) had visited health institution for ANC and 195 (32.8%) had delivered their last baby at health institution (Table **2**).

Table 2. Maternal characteristics of the study participants, Wonsho Woreda, Ethiopia, 2016.

Maternal Characteristics (n=595)	Categories	Frequency	Percent
Age in years	15-24	136	22.9
	25-34	434	72.9
	35 or above	25	4.2
Maternal educational status	Can't read write	207	34.8
	Primary	352	59.2
	Secondary	25	4.2
	Diploma and above	11	1.8
Maternal occupation	House wife only	437	73.4
	Farmer	45	7.6
	Merchant	98	16.5
	Others	15	2.5
Marital status	Married	563	96.6
	Others	32	3.4

(Table 2) contd.....

Maternal Characteristics (n=595)	Categories	Frequency	Percent
Additional meal	Yes	484	81.3
	No	111	18.7
ANC frequency (n=561)	< 4	330	55.5
	4 and above	231	38.8
Place of delivery	Home	195	32.8
	Health institution	400	67.2
Ever used family planning	Yes	550	92.4
	No	45	7.6

Child Characteristics and Caring Practice

The median (IQR) age of children was 24 [23] months. About 558 (95.9%) of children's mother gave first milk (colostrums) to their child, 107 (18.4%) received pre-lacteal food, of this 95 (16.3%) were given locally known "healer" "Amesa", which is prepared from plant leaf and root, while 440 (75.6%) of children received vitamin A supplementation (Table **3**).

Table 3. Child characteristics and caring practice of Wonsho Woreda, Ethiopia, 2016.

Child Characteristics	Categories	Frequency	Percent
Child age in month	6-23	243	40.8
	24-59	352	59.2
Sex of child	Male	299	50.3
	Female	296	49.7
Birth order	≤ 4	544	91.4
	> 4	51	8.6
Colostrums	Yes	570	95.8
	No	25	4.2
Ever breast feed	Yes	578	97.1
	No	17	2.9
Pre-lacteal	Yes	111	18.7
	No	484	81.3
Immunization	Not vaccinated	24	4
	Partially vaccinated	118	19.8
	Fully vaccinated	453	76.2
Vitamin A supplement	Yes	448	75.3
	No	147	24.7
De-worming supplement	Yes	384	64.5
	No	211	35.5
Separate food preparation (n=565)	Yes	470	79
	No	95	16
Child DDS	Low	413	69.4
	Middle	172	28.9
	High	10	1.7
Diarrhea last two weeks	Yes	160	26.9
	No	435	73.1

Prevalence of Underweight

From the total study participants, the prevalence of underweight, stunting and wasting were 122(20.5%) (95% CI, 17.3-23.8%), 272(45.7%) (95% CI, 41.7-49.7%) and 84(14.1%) (95% CI, 11.3-16.9%) respectively. The prevalence of severe and moderate underweight was 7.1% and 13.4%, respectively (Table **4**).

Table 4. Proportion of under-nutrition among children aged 6-59 months, Wonsho Woreda, Sidama Zone, April, 2016.

Indicators	Classification	Frequency	Percent
Underweight (WAZ)	Normal (≥ -2 SD)	473	79.5
	Moderate (≥ -3 < -2 SD)	80	13.4
	Sever (< -3 SD)	42	7.1
	Overall Underweight (< -2 SD)	122	20.5
Stunting (HAZ)	Normal (≥ -2 SD)	323	54.3
	Overall Stunting (< -2 SD)	272	45.7
Wasting (WHZ)	Normal (≥ -2 SD)	511	85.9
	Overall wasting (< -2 SD)	84	14.1
Both under-nutrition	Underweight and stunting	87	14.6
	Underweight and wasting	52	8.7
	Stunting and wasting	18	3.0

Factors Associated with Underweight of Child Aged 6-59 Months

During Bivariate analysis, family size, birth order, sex of child, pre-lacteal food, vitamin A supplementation, immunization, place of delivery and source of drinking water were have a p-value ≤0.25 hence, considered for multivariate analysis.

During Multivariable analyses child sex and immunization were the two explanatory variables that were significantly associated with underweight. Male children were 1.78 times more likely to be underweight than female children (AOR=1.78; 95%CI=1.17, 2.70). As compared to children who had been immunized, children who had not been immunized were 2.45 times more likely to be underweight (AOR=2.45; 95%CI=1.41, 4.24) (Table **5**).

Table 5. Factors associated with underweight of child under-nutrition, Wonsho Woreda, April, 2016.

Variables	Categories	Normal	Underweight	COR (95%CI)	AOR (95%CI)
Family size	≤ 5	81	363	1	1
	>5	41	110	1.67(1.08, 2.57)	0.69(0.41, 1.15)
Birth order	≤ 4	106	438	1	1
	> 4	16	35	1.89(1.01, 3.54)	0.63(0.30 1.33)
Sex of child	Male	74	225	1.69(1.13, 2.55)	1.78(1.17, 2.70)*
	Female	48	248	1	1
Pre-lacteal food	Yes	35	76	2.10(1.32, 3.34)	1.23(0.69, 2.18)
	No	87	397	1	1
Vitamin-A supplementation	Yes	81	367	1	1
	No	41	106	1.75(1.34, 2.70)	1.10(0.63, 1.95)
Immunization	Yes	73	380	1	1
	No	49	93	2.74(1.79, 4.20)	2.45(1.41, 4.24)*
Place of delivery	Home	55	140	1.95(1.29, 2.94)	1.51(0.95, 2.42)
	Health Inst.	67	333	1	1
Source of drinking water	Unprotected	42	114	1.65(1.08, 2.57)	1.06(0.63, 1.78)
	Protected	80	359	1	1

*P-value significant at p< 0.05.

DISCUSSION

This study investigated the prevalence of nutritional underweight and associated factors among children aged 6-59 months in Wonsho Woreda. The research finding revealed the prevalence of underweight, stunting and wasting to be 20.5%, 45.7% and 14.1%, respectively. Compared to WHO classification scheme for degree of under-nutrition was very high, specially stunting. Therefore, children were affected through poor earlier and recent nutritional status, which can lead to high morbidity and mortality.

Underweight may indicate both acute and chronic form of under-nutrition. This study revealed that the prevalence of underweight was 20.5%. Compared to EMDHS of national and regional report, the present study had a lower prevalence. This study also had lower rate of underweight than the previous studies done in different regions of

Ethiopia: in Dollo Ado, Ethiopia-Somali region 47.7% [32], Ginbi, Oromia region (23.5%) [20], Hidabu Abote, Oromia region (30.9%) [27], Bule Hora, Oromia region 29.2% [19], Tahtay Adiyabo, Tigray region (37.4%) [17] and South-West Ethiopia [33]. Probable reason of the variation may be due to most of the underweight children in the area were wasted, but relative to the prevalence of stunting most stunted children were not underweight. But this study was similar with study conducted in Haramaya, Ethiopia that was 21% and Shire Endaselassie, Ethiopia 20.9% [23].

In this study, many variables (large family size, big birth order, being male, pre-lacteal food, Vitamin A supplementation, fully immunization, home delivery and using unprotected drinking water source) were significantly associated with underweight in bivariate logistics association, but later most of the variables lost their significance in multivariate logistics analysis. Fortunately, fully immunized children were less likely to be being underweight than their counter parts. Study conducted in Indonesia showed a similar finding that being immunized has decreased risk of underweight than not being immunized [34].

The studies found in different parts of the country showed male children were highly affected by poor nutritional status than female. This study also witnesses the same finding that males were more likely to be underweight. A study found in Bule Hora, Ethiopia [19] and Dollo Ado, Ethiopia-Somali region [32] had consistence finding with the present study.

In the present finding maternal age group was not associated underweight, but it had an association in previous findings like, study done in Kemba Woreda, Southern Ethiopia [35] and Nepal that reveled maternal age more than 35 years were increased risk of underweight and maternal age less than 20 years had a protective effect for stunting and underweight [21]. In the current study, the reason that maternal age group was not associated with any of the three dependent variables might be due to the number of mothers aged more than 35 years in the study area was very low.

CONCLUSION

As compared to WHO criteria of under-nutrition categorization, this study revealed that the prevalence of underweight, was very high. Many factors contributed to this under-nutrition problem, namely large family size, big birth order, being male, pre-lacteal food, vitamin-A supplementation, fully immunization, home delivery and using unprotected drinking water source, but most of these factors were lost when adjusted except being male and fully immunization. Therefore, strong stakeholders' collaboration is compulsory to improve family income, to address family planning needs, strengthen prevention and controlling of diarrheal diseases, ensure child immunization. Intervention initiatives should be focused on improving child and household dietary intake through agricultural diversification, encouraging proper feeding practice for locally available foods and improve access of safe water supply. Further research is recommended to explore why males are more vulnerable to under-nutrition than female children.

FINANCIAL DISCLOSURE

Ethical clearance was obtained from Ethical Review Committee (ERC) of Wolaita Sodo University College of Health Sciences and Medicine. The official letter from Wolaita Sodo University was taken to Wonsho Woreda health office for permission. Verbal consent was obtained from each randomly selected participant mothers to confirm willingness to participate in the study. Confidentiality was ensured throughout the process. Prior to enrolling any of the eligible study participants, the purpose, the benefits and the confidential nature of the study was described and discussed for each participant. Only those consented and proved their willingness to take part in the study was enrolled in the study. The private information collected from this research project was kept confidential and it was not revealed to anyone. Health and nutritional advice was also given to mothers/care-givers by the data collectors during data collection period.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

AUTHORS' CONTRIBUTIONS

RG conceptualized the research idea, study design, analysis, interpretation of the data, and. TD and AA provided guidance for study design, analysis, and interpretation of the data. AA drafted the manuscript. RG and AA provided input on early drafts. All authors have read and approved the final version of the manuscript.

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