Correlation between Agricultural Biodiversity, Dietary Diversity, Household Food Security and Associated Factors of Wasting among 6-59 Months old Children in Ambassel Woreda, North East Ethiopia

Sisay Eshete Tadesse (sisliyu21@gmail.com)
Wollo University
Tefera Chane Mekonnen
Wollo University
Yitbarek Wasihun Feleke
Wollo University
Metadel Adane Mesfine
Wollo University
Nigus Cherie Bekele
Wollo University
Hafiza Ali
Wollo University

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Abstract

Background

Worldwide there are up to 300,000 known plant species. But, only 2% are consumed by human. Under nutrition among under five children is still a public health problem. There is an information gap on the importance of agricultural biodiversity in relation to dietary intake and nutritional status. Objective to assess the correlation between agricultural bio-diversity, dietary diversity, household food insecurity and associated factors of wasting among 6-59 months old children.

Method

A community based cross-sectional study was employed among 367 systematically selected children aged 6-59 months from January to April 2018. The sample size was determined by Epi Info 7.2.5.1. Data were collected by open data kit. Height and weight were measured using height measuring board and SECA Germany. Data entry and analysis was done using Epi Data version 3.1 and STATA version 14. Descriptive statistics was computed and reported using frequency and percentage. Anthropometric measurements were analyzed using WHO Anthro 2005 software. Linear regression and correlation were done. A p-value of < 0.05 and 95% confidence intervals were used to see the statistical significance.

Result

The prevalence of wasting was 7.3%(95% C.I; 4.6, 10.0). Dietary diversity score is found to be correlated with height for weight Z score (r=-0.11, p-value=0.04) of children. Mother who are unable to read and write (B=-.126, 95% CI: -1.02, -.034) and dietary diversity score (B=.143, 95% CI: .14, 1.86) were factors associated with wasting.

Conclusion and Recommendation

Wasting is higher than the national target of Ethiopia. Educational status of mother and DDS were factors associated with wasting among children aged 6-59 months. Prevention of nutritional problem should include reducing illiteracy rate among mother/care-givers and promote diversified intake of diet among 6-59 months old.

Introduction

Globally 7.5% (50.5 million) under five children were affected by wasting. In all regions, except Africa, there is a decrease in the prevalence of under nutrition (1). Under nutrition in early childhood may lead to physical growth deficit, morbidity, mortality, cognitive impairment, reproduction, and decrease in physical work capacity and may cause similar shortfalls in future generations (2–4).

There are up to 300,000 plant species are known worldwide. But, only 1.5- 2% are consumed by human being (5). now days 75% of the world’s food is obtained from 12 plants and 5 animal species only (6).

Lack of diversified diet is a severe problem among poor populations in the developing world (7).These diets are mainly starchy staples and are low in protein and a number of micronutrients with their low bioavailability (8). Changes in agricultural systems from diversified to simple, cereal based cropping systems have contributed to poor dietary diversity, micronutrient deficiencies and malnutrition (9).

Despite strides made to reduce global hunger through increased cereal production, both under nutrition and over nutrition are still a public health problems at a global level and in Ethiopian context (10). A decrease in agricultural biodiversity and change in dietary pattern may be one of the contributor for wasting (11).The decrease in agricultural biodiversity to some extent, places considerable strain on the ease with which households are able to enjoy diversified and balanced diet, rather they stick to a limited number of energy food sources that may not provide specific micronutrients, essential amino acids and essential fatty acids (12). Similarly, agricultural biodiversity interventions have an impact on the nutritional status of a society living in low income countries (13). Declining agricultural biodiversity has been one of the reasons for the increasing attention to dietary diversity and household food insecurity (14). There are major information gaps on the importance of agricultural biodiversity in relation to dietary intake and nutritional status of under five children. In the study area, including the national level, there is limited evidence linking agricultural biodiversity, dietary diversity, and household food security with nutritional status. Therefore, the aim of this study was to assess the correlation between agricultural biodiversity, household food insecurity, dietary diversity and associated factors of wasting among children aged 6–59 months old in Ambassel Woreda.

Methods And Materials

Study area, design and period

A community based cross-sectional study design was employed in Ambassel district from January to July 2018. It is found at 460 km away from the capital of Ethiopia, Addis Ababa. It has 1 urban and 23 rural Kebeles. The estimated population of the district is 165,000. Of these 77,480 (54%) were males and 66039 (46%) were females. Based on the reports of the district health office report in 2015/16, there are 11,669 children aged 6–59 months old. The major agricultural products cultivated in the district were grains, cereals, fruits vegetables and animal reared include ox, cow sheep, goat and hens.

Source and Study population

All mothers/care-givers having a child in the age range of 6–59 months who have been living in the district were the source population. All mothers/caregivers having a child in the age range of 6–59 months who have been living in the selected Kebeles were the study population.

Sample size calculation

The sample size was calculated using Epi Info version 7.1.5.2 by considering 95% confidence interval, 80% power, 5% margin of error and the estimated prevalence of wasting 18.6% (15) and design effect of 1.5. Thus, considering 5% non-response rate, the total number of study participants was 367.

Sampling procedure

One Kebele from better rainfall and geographic assets and one from low rain fall and geographic assets were randomly selected and included in the study. The sample size was proportionally allocated to each Kebeles. Before the actual data collection, list of the households from each Kebele was prepared with the help of health extension workers. Then, study participants were included in the study through random number tables. Apart from the rainfall distribution the two divisions were regarded as being very similar with regard to socio-demographic characteristics. Study participants were selected using systematic sampling technique.

Operational definition

Food security: if the household didn't experience any of the questions from FAO/FANTA

Dietary diversity: is defined as the number of different food groups that are consumed over a given period of time (16). Dietary diversity is considered optimal, if an individual consumed diet at least the mean from food groups

Agricultural biodiversity: include the variety and variability of plants and animals that are necessary for food production and accessibility. It is the basis for food chain which contributes to food and livelihood security (8). Agricultural biodiversity is considered as good, if the household has edible plant or animal species above the mean

Data collection methods

Data were collected by open data kit (ODK) software through face to face interview with mothers/care-givers having a child aged from 6–59 months old using a structured questionnaire. The collected data were sent to the common server which was created before the start of data collection. Data collectors were Health extension workers and development agents. One MPH student who has training or experience on anthropometric measurement was recruited as a supervisor.

The age of the child was ascertained through reviewing the child health card, birth certificate, or baptism card. In situations where the mother/care-giver did not have the documents to ascertain the age of the child, they were asked to identify a child from the neighborhood who was born almost at the same time. In cases where there was more than one child in this age group, only one child was randomly selected and included in the survey.

Height was measured in a standing position, using a free standing height stadiometer. Height measurement was taken when a child was in a bare feet and heels, buttocks, shoulders and the back of the head touched the stadiometer. Two measurements were taken to the nearest 0.1 cm and the average was recorded to ensure data accuracy (17). The head was held comfortably erect with the lower border of the orbit of the eye being in the same horizontal plane as the external canal of the ear. The head piece of

the measuring board was then pushed gently, crushing the hair and making contact with the top of the head.

Weight was measured using an easily portable weighing scale (SECA Germany). The scale was adjusted after weighing every five child by setting it to zero. The child dressed light cloth during weight measurement. Two measurements were taken to the nearest 0.1 kg for each child and the average was recorded.

Dietary diversity was taken by a repeated 24-hour recall. The 24-hour recall was administered to each child and repeated on a separate day. No prior notice of the repeat visit was given to care givers in case they altered their intake. The repeated 24 hour dietary recall was internationally used and validated (18). DDS was calculated by summing the number of food groups consumed by the child as reported over the 24-hour recall period. All the foods and the liquids consumed a day before the study were categorized into 7 food groups. Consuming a food item from any of the groups was assigned a score of 1 and if no food item taken a score of 0 was given. Accordingly, a DDS of 7 points was computed by adding the values of all the groups. Then it was categorized as low (≤ 3), medium (4–5) and high (6–7)(19).

The household food insecurity access scale (HFIAS) is a continuous measure of the degree of food insecurity in the household in the past four weeks (30 days). The nine item scale were constructed to capture three larger dimensions of household food insecurity: anxiety and uncertainty about household food access (item 1); insufficient quality (items 2–4) and insufficient food intake and its physical consequences or hunger (items 5–9). First, a HFIAS score variable was calculated for each household by summing the codes of each frequency of occurrence question. The maximum score for a household is 27 (the household response to all nine frequency of occurrence questions was often coded with response code of 3; the minimum score is 0 (the household responded not to all occurrence questions, frequency of occurrence questions was skipped by the interviewer and subsequently coded as 0). The higher the score, the more food insecurity the household experienced. The lower the score, the less food insecurity a household experienced.

Agricultural biodiversity was assessed by a questionnaire adapted from different literatures (12, 19). It was measured by determining the variety of food plants grown, animals reared for food and food items obtained from natural habitats. A list of all food items grown, all animals reared, hunted and other food items obtained from natural habitats through gathering or trapping was established for each household.

Data quality assurance

The questionnaire was translated to Amharic and back to English for consistency. Pre-test was conducted on 5% of the sample size out of the study area to check for clarity prior to the actual data collection. Data collectors and supervisors were selected based on their interest and experience on data collection. Three day’s training was given on the overall data collection procedure for data collectors and a supervisor to minimize systematic error. On spot checking and correction was made for incomplete questionnaire by a supervisor. Overall data collection process was controlled by principal investigator. Anthropometric

measurements were conducted by two data collectors. Calibration of height and weight measurement scale was done at every five measurement.

To minimize bias of respondent memory lapses, an interview was held following a standardized schedule. First, mothers/care-givers were asked to mention all the foods and drinks that a child had consumed during the previous day, including snacks and drinks. Then they were asked to describe the foods and beverages consumed in more detail, including ingredients, cooking methods of mixed dishes and the place and time of consumption. Finally, the amounts of all foods, beverages, ingredients of mixed dishes consumed were estimated using the food photo manual which contained photos of life sized food portions.

Data analysis

First data were down loaded from the common server in csv form and transported to SPSS version 23 for analysis. After cleaning, descriptive statistics was computed and frequencies, proportions, percentages, mean and standard deviations were report. By checking the normality of the data, correlation between two continuous variables was analyzed with regression analysis and the strength of the correlation was measured with the Pearson correlation coefficient. To identify predictor variables for wasting, multiple linear regression models were computed by considering the Z-score values as a continuous outcome of interest. A p-value of < 0.05 and adjusted odds ratio with its 95% confidence intervals were used to represent the statistical significance. The assumptions of linearity and model fitness were checked by scatter plot of standardized residuals against standardized predicted value and the normality probability plot (P-P plot). Multi-collinearity diagnosis was checked by using variance inflation factor (VIF) and all variables have a variance of < 10. Anthropometric measurements were analyzed using WHO Anthro 2005 software.

Ethical clearance

An ethical approval letter was obtained from the Ethical Review Committee of College of Medicine and Health Sciences, Wollo University. A support letter was obtained from Wollo University, which in turn was issued a support letter to Ambassel district health office and the respective selected Kebeles in order to conduct the study. After the purpose and objectives of the study has been informed, written informed consent was obtained from each mother/care-givers. Participants were informed as participation is on voluntary basis. All the information was kept confidential, and no individual identifiers were used during data collection.

Result

The mean age of children was 32.6±0.82 months. Nearly half 183 (48.74%) of the study participants were males. Almost three-fourth 260 (73.24%) of mothers/care-givers were unable to read and write. Majority 339 (94.96%) of mothers/care-givers were married. The mean age of mothers/care-givers was 33±.30 years. The mean monthly income of the study participants was 1265.91±50.23 (Table1).

Table 1
Socio-demographic and economic characteristics of study participants, 2018

Variables		Frequency	Percent
Sex	Male	174	48.74
	Female	183	51.26
Under five	2	295	82.63
	> 2	62	17.37
Marital status	Single	5	1.4
	Married	339	94.96
	Divorced	13	3.64
Educational status of mother	Not read & write	260	73.24
	Read & write	79	22.23
	Above High school	16	4.53
Family Size	< 3	55	15.4
	3–5	216	60.5
	> 5	86	24.1

Child Feeding and Health Related Characteristics

Nearly three-fourth 259 (72.55%) of study participants were food secured. The mean score of dietary diversity score is 3.05±.40. The minimum score is 1 and the maximum score is 5. With respect to child illness, 62 (17.34%) and 57 (15.97%) were affected by diarrheal disease and fever respectively in the last two weeks. Only 33 (9.24%) of the study participants were initiated breast feeding within one hour after birth. Fifty one (14.97%) of mother/care-givers was practiced prelacteal feeding (Table 2).

Table 2
Child Feeding and Health Related Characteristics of Study Participants, 2018 G.C

Variables		Frequency	Percent	Remark
Food security	Secured	259	72.55	
	Insecure	98	27.45	
PNC	Yes	339	94.96	
	No	18	5.04	
Child illness	Diarrhea	62	17.34	
	Fever	57	15.97	
	No	238	66.67	
Initiation of breast feeding	< 1 hours	33	9.24	
	1–3 hours	324	90.76	
Colostrum	Yes	343	96.08	
	No	14	3.92	
Prelacteal feeding	Yes	51	14.29	
	No	306	85.71	
frequency of feeding	< 8 times	166	46.49	
	> 8 times	191	53.51	
Start CF	At 6 month	57	15.07	
	< or > 6 month	300	84.03	

Prevalence of Wasting among children aged 6–59 months old

The prevalence of wasting among children aged 6–59 months old was 7.3% (95% C.I; 4.6, 10.0), of this 5.3% (95% C.I; 3.0, 7.7) were affected by severe acute malnutrition (Fig. 1).

Correlation between Dietary diversity score, food security and agricultural biodiversity with wasting among children aged 6–59 months old

This study tried to assess the correlation between dietary diversity score, food security and agricultural biodiversity with WHZ score among children aged 6–59 months old. Dietary diversity score was found to be correlated with wasting among 6–59 months old children. An increase in DDS appeared to reflect a decrease in wasting among children (Pearson correlation coefficient, r=-0.11, p-value = 0.04). No significant correlation was found between agricultural biodiversity and household food insecurity access scale with WHZ scores. Agricultural biodiversity has a significant positive association with Household food security (r = 0.31, p-value = 0.000), and dietary diversity (r = 0.13, p = 0.014) (Table 3).

Table 3
Correlation of AB, DDS, and HFIAS with each other and anthropometric variables, 2017

Variables	Pearson correlation coefficient	p-value
AB & WHZ	0.01	0.84
DDS & WHZ	-0.11	0.04
HFSAS & WHZ	0.004	0.99

Table 4
Factors Associated with Under Nutrition among Children Aged 6–59 Months old, 2017

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% CI for B	
	B	SE	Beta			Lower Bound	Upper Bound
Constant	− .549	1.213		− .453	.651	-2.94	1.84
DDS	− .527	.251	− .126	-2.105	.036	-1.02	− .03
Number of Under five children	− .396	.261	− .090	-1.516	.131	− .910	.12
Sex of child	− .219	.202	− .065	-1.08	.280	− .618	.18
Educational status (Illiterate)	.998	.437	.143	2.28	.023	.137	1.86
Mean of agricultural diversity	.209	.300	.049	.696	.487	− .382	.80

Factors associated with wasting among 6–59 months old children

The result of multivariable linear regression model showed that dietary diversity score of a child and maternal educational status were factors associated with wasting among 6–59 months old children. One unit increase in the dietary diversity score of a child decreases weight for height z score of a child by 0.13 (B=-.126, 95% CI: -1.02, − .034). Unable to read and write among mothers increases wasting among children by 0.14 as compared to mother who were literate (B = .143, 95% CI: .14, 1.86).

Discussion

The aim of this study was to assess the correlation between agricultural biodiversity, dietary diversity score; household food security with wasting among children aged 6–59 in Ambassel district. Based on the result of this study, the prevalence of wasting (acute malnutrition) in the study area was 7.3%. The result of this finding is similar with studies conducted in Ethiopia and Benin(20–22). But it was lower than studies done in Tigray (23), Gojjam (24), Belesa District (25) and Bangladesh(26). This difference might be due to partially explained by the difference in socio-economic and food security status of the study areas.

This study revealed that agricultural biodiversity has a significant positive association with Household food security (r = 0.31, p-value = 0.000), and dietary diversity (r = 0.13, p = 0.014). This implies diet obtained from agricultural biodiversities improves household food security and dietary diversity among children. A more diversified diet has the potential to provide a more abundant supply of essential nutrients. Food based strategies were the first priority to meet nutritional requirements of the body (27). Therefore, improving agricultural biodiversity is a key to ensure diversified intake of diets and promote food and nutritional security of children aged 6–59 months old.

The result of multiple regressions showed that dietary diversity score is found to affect the nutritional status of children. One unit increase in dietary diversity score decreases wasting among children by 0.11. This finding is similar with a study conducted in Kenya, which indicates dietary diversity score has a positive association with wasting of children aged 6–59 months old (28). This might be dietary diversity is a proxy indicator for diet quality of individuals(29) and provide all nutrients required to maintain the normal physiological functions of the body. This will maintain the normal nutritional status of children and play a significant role in reducing child wasting.

This finding revealed that educational status of mother/care-givers was found to be a significant contributing factor for wasting among children. Mother/care-givers who were unable to read and write increases wasting in children aged 6–59 months old by .14 as compared to mothers who can read and write. This is in line with studies done in other parts of the world (30). This might be because; educated mother will have good exposure on the promotion of good feeding practices of their children. But, this finding disagree with a study done in East rural Ethiopia, which states that educational status of mother had no any association with child under nutrition (31). This difference might be mother/care-givers in the rural parts of Ethiopia will have good access for nutrition education on appropriate feeding practices

through health extension programs. The finding of this study might be affected by seasonal variation and recall bias.

In conclusion, the prevalence of under nutrition in the study area was higher than the national and international target. Only dietary diversity score has correlation with wasting among children aged 6–59 months old. Dietary diversity score and maternal educational status were factors associated with wasting of children. So, wasting prevention strategy should include encouraging diversified of foods production through agricultural biodiversity and work with education sector to address information reduce maternal illiteracy rate through adult education.

Declarations

Ethics approval and consent to participate

Written consent was obtained from study participants.

Consent for publication

Written consent for publication was secured from study participants.

Availability of data and materials

All the required data has been included in the manuscript.

Competing interest

Authors declare that there is no conflict of interest.

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Author contribution

SE: participated in the conceptualization, proposal development, data collection, data curation, data analysis, writing the manuscript and submitting the manuscript.

GM: participated in conceptualization, proposal development and data collection.

TC: participated in proposal development, data curation, data analysis and editing the manuscript.

All authors read and approved the manuscript

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References

1. Prendergast AJ, Humphrey JH. The stunting syndrome in developing countries. Paediatrics and international child health. 2014;34(4):250-65.
2. Pelletier DL, Frongillo EA. Changes in child survival are strongly associated with changes in malnutrition in developing countries. The Journal of nutrition. 2003;133(1):107-19.
3. Ogle BM, Hung PH, Tuyet HT. Significance of wild vegetables in micronutrient intakes of women in Vietnam: an analysis of food variety. Asia Pacific Journal of Clinical Nutrition. 2001;10(1):21-30.
4. Organization WH. Mortality and burden of disease estimates for WHO Member States in 2004. Geneva: World Health Organization. 2009.
5. Cromwell E. Agricultural Biodiversity and Livelihoods: issues and entry points. 1999.
6. Zedan H. Loss of plant diversity: a call for action. Collecting plant genetic diversity. 1995.
7. Charrondière UR, Stadlmayr B, Rittenschober D, Mouille B, Nilsson E, Medhammar E, et al. FAO/INFOODS food composition database for biodiversity. Food chemistry. 2013;140(3):408-12.
8. Wispelwey P, Deckelbaum R. Preventive nutrition, eco-nutrition: prevention malnutrition with agro diversity. New York. 2009.
9. Burchi F, Fanzo J, Frison E. The role of food and nutrition system approaches in tackling hidden hunger. International journal of environmental research and public health. 2011;8(2):358-73.
10. Ruel MT, Levin CE. Food-based approaches for alleviating micronutrient malnutrition: an overview. Journal of crop production. 2002;6(1-2):31-53.
11. Kuhnlein HV. Micronutrient nutrition and traditional food systems of indigenous peoples. Food Nutrition and agriculture. 2003(32):33-9.
12. Ekesa B, Walingo M, Abukutsa-Onyango M. Influence of agricultural biodiversity on dietary diversity of preschool children in Matungu division, Western Kenya. African journal of food, agriculture, nutrition and development. 2008;8(4):390-404.
13. Mendez MA, Monteiro CA, Popkin BM. Overweight exceeds underweight among women in most developing countries. The American journal of clinical nutrition. 2005;81(3):714-21.
14. Toledo Á, Burlingame B. Biodiversity and nutrition: A common path toward global food security and sustainable development. Journal of food composition and analysis. 2006;19(6):477-83.
15. Motbainor A, Worku A, Kumie A. Stunting is associated with food diversity while wasting with food insecurity among underfive children in East and West Gojjam Zones of Amhara Region, Ethiopia. PloS one. 2015;10(8):e0133542.
16. Arimond M, Wiesmann D, Becquey E, Carriquiry A, Daniels MC, Deitchler M, et al. Simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse, resource-poor

settings. The Journal of Nutrition. 2010;140(11):2059S-69S.
17. Gibson RS. Principles of nutritional assessment: Oxford university press, USA; 2005.
18. Steyn N, Nel J, Nantel G, Kennedy G, Labadarios D. Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy? Public health nutrition. 2006;9(5):644-50.
19. Kennedy G, Berardo A, Papavero C, Horjus P, Ballard T, Dop M, et al. Proxy measures of household food consumption for food security assessment and surveillance: comparison of the household dietary diversity and food consumption scores. Public health nutrition. 2010;13(12).
20. George-Adré S, Fanzo J. Thesis: Agricultural Biodiversity, Dietary diversity, and child. 2011.
21. Indicators K. Mini Demographic and Health Survey. 2019.
22. Yisak H, Gobena T, Mesfin F. Prevalence and risk factors for under nutrition among children under five at Haramaya district, Eastern Ethiopia. BMC pediatrics. 2015;15(1):212.
23. Mulugeta A, Hagos F, Kruseman G, Linderhof V, Stoecker B, Abraha Z, et al. Child malnutrition in Tigray, northern Ethiopia. East African medical journal. 2010;87(6):248-54.
24. Teshome B, Kogi-Makau W, Getahun Z, Taye G. Magnitude and determinants of stunting in children underfive years of age in food surplus region of Ethiopia: the case of west gojam zone. Ethiopian Journal of Health Development. 2009;23(2).
25. Fentahun W, Wubshet M, Tariku A. Undernutrition and associated factors among children aged 6-59 months in East Belesa District, northwest Ethiopia: a community based cross-sectional study. BMC public health. 2016;16(1):506.
26. Ali D, Saha KK, Nguyen PH, Diressie MT, Ruel MT, Menon P, et al. Household food insecurity is associated with higher child undernutrition in Bangladesh, Ethiopia, and Vietnam, but the effect is not mediated by child dietary diversity. The Journal of nutrition. 2013;143(12):2015-21.
27. Allen LH. To what extent can food-based approaches improve micronutrient status? Asia Pacific Journal of Clinical Nutrition. 2008;17.
28. Nungo RA, Okoth MW, Mbugua SK. Nutrition status of children under-five years in cassava consuming communities in Nambale, Busia of Western Kenya. Food and Nutrition Sciences. 2012;3(06):796.
29. Penafiel D, Lachat C, Espinel R, Van Damme P, Kolsteren P. A systematic review on the contributions of edible plant and animal biodiversity to human diets. EcoHealth. 2011;8(3):381-99.
30. Emina J, Kandala N-B, Inungu J, Ye Y. The effect of maternal education on child nutritional status in the Democratic Republic of Congo. Nairobi, Kenya: African Population and Health Research Center. 2009.
31. Egata G, Berhane Y, Worku A. Seasonal variation in the prevalence of acute undernutrition among children under five years of age in east rural Ethiopia: a longitudinal study. BMC Public Health. 2013;13(1):864.

Figures

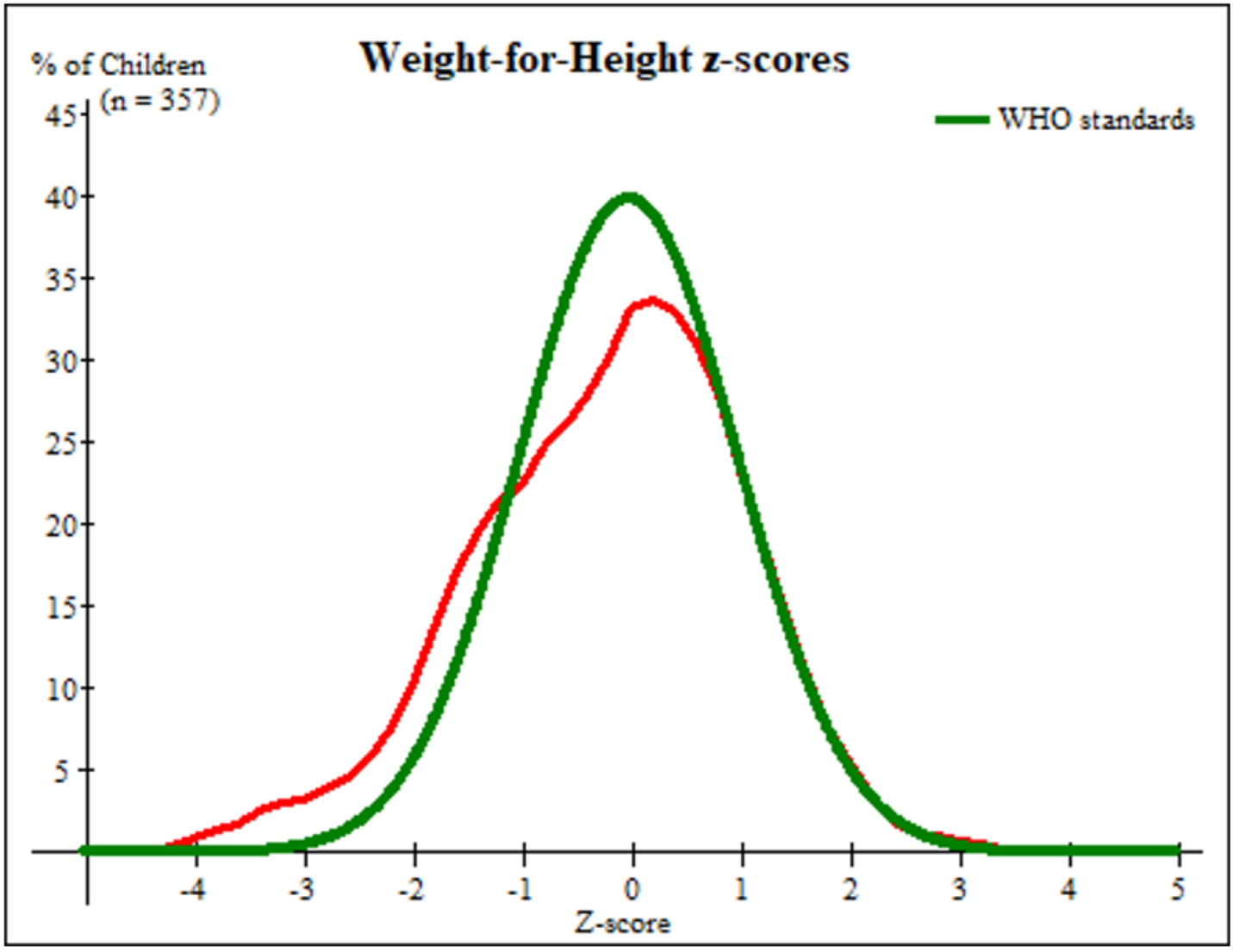

Figure 1

Weight for Height Z score of children aged 6-59 months old, Ambassel District, 2017