

Community Based Case Control Study on Effect of Nutrition Education Intervention on Nutritional Status and Contributing Factors Among Under Five Children In Pastoralist And Agro-Pastoralist Community of Somali Region, Eastern Ethiopia.

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Abstract

Background: Undernutrition is most common public health problem in developing world. It is responsible for more than three million global deaths of under five children every year. Severe wasting and stunting are the major contributors of this problems. Hence, this study was designed to document the effect of nutrition education intervention (NEI) on nutritional status of the children in pastoralist and agro-pastoralist community of Somali regional state, Eastern Ethiopia.

Methods: A group randomized controlled trial was carried out among 404 paired child to mothers/caregivers in two phases. A chi-square for categorical variables, t-test and for continuous variables were used. In addition, World Health Organization (WHO) AnthroPlus software were also used.

Results: After NEI this has shown statistically significant improvement, in all three types of malnutrition compared to control. The malnutrition prevalence has been significantly decreased within the group from baseline to post intervention; wasting (19% to 9.4%, $p = 0.005$), underweight (18.5% to 7.4%, $p = 0.029$), and stunting (31.2% to 21.7%, $p = 0.001$). Whereas, the control group showed no significant difference ($p > 0.05$) in all three types. The overall mean Z-score difference of the difference (DOD) of wasting and underweight between groups from pre and post intervention were shown better off, compared to control group, with mean DOD wasting of (-0.738, $p < 0.001$) and underweight of (-0.615, $p < 0.001$). But, this was not seen in stunting (-0.239, $p > 0.05$).

Conclusion: The NEI using behaviour change communication (BCC) showed promising outcome, and need to be further scaled up and adapted to other districts in the zone or other areas in the region.

Background

Undernutrition is responsible for more than three million global deaths of children below five years of age every year (45% of total child deaths). Severe wasting and stunting are the major contributors of this problems (Bhutta et al., 2013; Black et al., 2008, 2013). In 2015 there were 156 and 50 million of stunted and wasted children below five years of age, respectively (IFPRI, 2016; UNICEF/WHO/THE WORLD BANK, 2016). Hence, an effective and comprehensive health and community level nutrition intervention programs are mandatory to tackle this serious problem (Bhutta et al., 2013; Heikens, Amadi, Manary, Rollins, & Tomkins, 2008; Lemma & Matji, 2013; Victora et al., 2008).

A systematic review has reported the effectiveness of community based nutrition education programme on improvement of nutritional status of the children below five years of age in developing countries (Majamanda, Maureen, Munkhondia, & Carrier, 2014). Nutrition intervention strengthening can reduce 15% of under five deaths. If this increased by 90% more than half of severe wasting and one fifth of stunting prevalence in children below five years of age can be averted (Bhutta et al., 2013).

Other study showed that nutrition education with complementary feeding increased the mean HAZ and WAZ, which reduce the stunting and underweight prevalence. While, no effect were seen in wasting (Lassi,

Das, Zahid, Imdad, & Bhutta, 2013). Likewise, health education on hygiene & sanitation with iron supplementation has shown mean HAZ and WAZ increment and better child growth (Keshani et al., 2016; Sanou D., Turgeon-O'Brien H., & Desrosiers T., 2011). Inversely, WHZ mean improvement after NEI, low wasting prevalence and high stunting rate were reported (Walsh, Dannhauser, & Joubert, 2002). Whereas nutrition education intervention had a positive impact on mean WAZ z-score, but not mean WHZ and HAZ z-score. The reason they give was may be because of short time intervention. It was only for five months (Sukandar, Khomsan, Anwar, Riyadi, & Mudjajanto, 2015).

In Ethiopia, studies in other parts of the country reported stunting, underweight, and wasting of children less than five years of age ranging from 22.9%, to 67.8%, 19.5–46.1% and 13.8–17.5%, respectively. The main predictors for wasting and underweight rates were inappropriate breastfeeding practices and incidence of diarrhoeal diseases. While, high stunting rate were contributed by bottle feeding. However, decreased or improved stunting rate were contributed by timely starting of complementary feeding at the age of six months (Fekadu, Mesfin, Haile, & Stoecker, 2015; Fentaw, Bogale, & Abebaw, 2013; Liben, Abuhay, & Haile, 2016). Literacy rate (literate) and area of residence (urban) were predictor for good nutritional status (Fentaw et al., 2013). Finally, such studies are scanty in this community. While, in this specific area no such study has been conducted. Therefore, this study was designed to document the effect of NEI on nutritional status of the children in Shabelle zone of Somali regional state eastern, Ethiopia.

Methods

Study design and period

A group randomized controlled trial conducted in August, 2018 in Gode and Adadle Districts, Shabelle zone, Somali regional state from 415 paired child to mothers/caregivers. After eight months of nutrition education intervention (NEI) in Adadle district. While, Gode district remain control, getting only the routine activities. A post interventional study was conducted in August, 2019 from 404 paired child to mothers/caregivers, with retention rate of 97.3%.

A nutrition education intervention was designed and conducted using social cognitive theory (SCT), this theory “plays in the adoption, initiation, and maintenance of health behaviours” (LUSZCZYNSKA & SCHWARZER, 2005). The NEI program was intended to improve the knowledge, attitude and skills of mothers/caregivers regarding child feeding practices, with the end result of improving the child nutritional status. The intervention group were given scheduled health education sessions. Topics related to nutrition were taught to intervention group by presentation, role play, and demonstrations by trained nurses, health extension workers, and primary health care workers for over eight months, two sessions per week. In addition, display of key messages on the health centres, clinics, and health posts were done. Community social mobilizers and religious leaders were also involved. The main topics given were; nutrition for pregnant mother, delivery, correct breastfeeding (initiation, EBF, and duration), positioning and attachment, feeding of low birth weight, complementary feeding (initiation, type, food hygiene & safety,

and preparation), including snacks and feeding during sickness, food pyramid including fruits and vegetable, and specific health services like; vaccination, de-worming, vitamin A, ITNs usage, and environmental sanitation. Each topic was taught for at least sixty minutes.

Data Collection And Measurement

A pre-tested semi structured Somali language questionnaire was used. The questionnaire was prepared in English and translated in to Somali language and again back to English, and checked by other person who speaks both languages to ensure its consistency. Weight and height of children below five years of age was measured to indicate the nutritional status of the child in terms of weight for age (W/A), weight for height (W/H) and height for age (H/A), using WHO standard classifications of z-score (WHO, 2006). This makes easy to signpost the nutritional status of the children. Data were collected by degree and diploma health professionals, after two days training and one day pilot test. To ensure the data clarity and completeness, during data collection period, a continuous monitoring and checking on daily bases were done by the principal investigator.

Data analysis

The data were coded, entered in double, checked for missing values & outliers, and analysed using SPSS (SPSS Inc. version 20, Chicago, Illinois) and WHO AnthroPlus software (WHO, 2009).

A descriptive and inferential statistics were used. The specific statistical analysis used here include; Chi-square and fishers exact tests for categorical variables, t-test for continuous variables (independent t-test and dependent (paired) repeated measure t-test), and repeated measure ANOVA, after checking the assumptions. In addition, WHO AnthroPlus software was used to calculate weight for height z-score (wasting or acute malnutrition), height for age z-score (stunting or chronic malnutrition), and weight for age z-score (over all malnutrition). All children below -2 SD (z-score) from WHO reference population median were considered malnourished. While, children below -3 SD (z-score) were considered severely malnourished (WHO, 2009).

Ethical Considerations

Ethical clearance was obtained from the international Islamic University Malaysia research ethical committee (IREC). A written supporting letter was also obtained from Ethiopia federal Ministry of health (FMOH) Somali regional health bureau (SRHB) and Shabelle zone administrative office. The informal verbal consent was obtained from the mothers/caregivers, prior to the data collection. This type of consent were presented, discussed with ethical, and supervisory committees, and agreed upon. These was due to the fact that the majority of the mothers/caregivers in the study area were illiterate (cannot read and write). The interviewers/data collectors were given a written statement to read and sign after the acceptance of the participants. The purpose of the study was clearly explained to the participants and the

informal consent was obtained from the mothers/caregivers of each respondent prior to the data collection. Since, our data collection method has no an evidence to harm the participants. It was only interview to the mothers/caregivers, weight and height measurement of the children, and minimal peripheral capillary blood sample by finger brick for anaemia detection. The participants were encouraged to be honest as much as possible. Since the information given by them is useful and very important to the district, to the region, and to the country. Confidentiality was assured by keeping all information in a proper place. In addition, if a sick and/or malnourished child is seen, the team would send to the nearest health facility for assistance.

Results

A total of 404 caregivers and one of their under five children from 415 participants at baseline were included in the study. Only 9 children in control and 2 children in intervention groups were not included in the post intervention study, due to lost to flow up and age become above the intended age groups. Most of the socio-demographic and economic variables were not different at baseline and post intervention between the two groups. The mean age of the mothers/caregivers at post intervention were 29.2 ± 5.9 and 29.9 ± 9.1 in intervention and control groups, respectively. The main source of income was from livestock and farm in intervention group and from salary, daily labourer, and trade in control group. At post intervention time, the dietary diversity score (DDS), ITNs utilization, protected drinking water, disease incidence, de-worming, and Vitamin A supplementation has been improved in intervention population then did control group (**Table 1**).

Table 1

Baseline and post intervention distribution of socio-demographic and economic characteristics of the study population in Gode and Adadle districts

Variables		Baseline		Post intervention	
		Intervention (n = 205)	Control (n = 210)	Intervention (n = 203)	Control (n = 201)
		(%)	(%)	(%)	(%)
Residence	Urban/Semi-urban	27.3	33.8	27.6	33.8
	Rural	72.7	66.2	72.4	66.2
Child Sex	Male	54.1	53.3	54.2	52.7
	Female	45.9	46.7	45.8	47.3
Child age	< 12	8.3**	12.9	0.0	0.0
	12–23	42.9	27.1	8.4	13.4
	24–35	27.8	23.8	43.3	28.4
	36–47	10.2	19.5	28.1	24.9
	48–60	10.7	16.7	20.2	33.3
	Mean ± SD	22 ± 12.3	26 ± 14.9	33.7 ± 11.96	36.6 ± 13.5
Family size	1–3	12.2	15.2	9.4	6.5
	4–6	57.1	50.5	53.2	55.2
	≥ 7	30.7	34.3	37.4	38.3
	Mean ± SD	5.64 ± 1.91	5.87 ± 2.26	5.95 ± 1.91	6.2 ± 2.15
Number < 5 children family	1	21.5	27.1	22.2	17.4
	2	61.5	51.4	59.1	61.2
	≥ 3	17.1	21.4	18.7	21.4
	Mean ± SD	1.98 ± 0.67	1.95 ± 0.72	1.98 ± 0.68	2.1 ± 0.65

*** P < 0.001, ** P < 0.01, * P < 0.05, ^Merchant and Government employee, f = fisher's exact test, #Trade and Daily labourer

Variables		Baseline		Post intervention	
		Intervention (n = 205)	Control (n = 210)	Intervention (n = 203)	Control (n = 201)
		(%)	(%)	(%)	(%)
caregiver's age	≤ 18	4.9	4.8	0.5 [†]	1.5
	19–25	29.8	38.1	25.6	33.3
	26–35	52.7	40.5	57.1	43.3
	> 35	12.7	16.7	16.7	21.9
	Mean ± SD	28.2 ± 5.9	29.2 ± 9.4	29.2 ± 5.9	29.9 ± 9.1
caregiver's education	Illiterate	82.0 ^{**}	92.9	81.8 ^{**}	92.5
	Literate	18.0	7.1	18.2	7.5
caregiver's occupation	House wife	84.4	84.8	84.2	84.6
	Farmer & others [^]	15.6	15.2	15.8	15.4
Source of income	Livestock/farm	52.2 ^{**}	36.7	67.0 ^{***}	36.8
	Salary & others [#]	47.8	63.3	33.0	63.2
Source of drinking water	Protected	0.5 ^{***}	23.8	12.8 ^{**}	23.4
	Unprotected	99.5	76.2	87.2	76.6
Dietary Diversity Score (DDS)	≤ 3 food items	51.7	54.3	39.0 [*]	51.0
	≥ 4 food items	48.3	45.7	61.0	49.0
Disease during last two weeks	Yes	81.5	74.3	59.6 [*]	69.7
	No	18.5	25.7	40.4	30.3
ITNs use of < 5 children	Yes	75.1 ^{***}	88.6	88.7 ^{**}	76.1
	No	24.9	11.4	11.3	23.9
Child Immunized	Yes	98.5 ^{***}	89.5	97.5 [*]	92.5
	No	1.5	10.5	2.5	7.5

*** P < 0.001, ** P < 0.01, * P < 0.05, [^]Merchant and Government employee, ^f = fisher's exact test, [#]Trade and Daily labourer

Variables		Baseline		Post intervention	
		Intervention (n = 205)	Control (n = 210)	Intervention (n = 203)	Control (n = 201)
		(%)	(%)	(%)	(%)
Child Dewormed	Yes	26.6	33.0	53.7	46.8
	No	73.4	67.0	46.3	53.2
Child Vit A supplement	Yes	31.0 ^{***}	48.5	55.2	49.8
	No	69.0	51.5	44.8	50.2

*** P < 0.001, ** P < 0.01, * P < 0.05, ^Merchant and Government employee, f = fisher's exact test, #Trade and Daily labourer

The overall prevalence of undernutrition in the intervention phase was 27.1%, 18.4% and 18.2% of stunting, wasting, and underweight, respectively. At baseline the nutritional status of the children between the two study areas were not statistical significantly different. However, after NEI this has shown statistically significant improvement, in all three types of malnutrition compared to control. The malnutrition prevalence has been significantly decreased within the group from baseline to post intervention; wasting (19–9.4%, $X^2 = 7.8$, $p = 0.005$), underweight (18.5–7.4%, $X^2 = 4.8$, $P = 0.029$), and stunting (31.2–21.7%, $X^2 = 11.2$, $p = 0.001$). Whereas, the control group, there was no significant difference ($p > 0.05$) in all types (**Table 2**).

Table 2

Baseline and post intervention WHZ, HAZ, WAZ Z-score among children below five years of age in Gode and Adadle districts

Variables	Baseline		Post intervention	
	Intervention (n = 205)	Control (n = 210)	Intervention (n = 203)	Control (n = 201)
Wasting (WHZ)	%	%	%	%
≥-2Zscore	81.0	78.4	90.6 ^{***}	72.6
-3 to <-2Zscore	9.3	11.5	7.4	13.0
<-3Zscore	9.7	10.1	2.0	14.4
Stunting (HAZ)				
≥-2Zscore	68.8	70.5	78.3 [*]	67.2
-3 to <-2Zscore	10.7	15.2	10.9	16.4
<-3Zscore	20.5	14.3	10.8	16.4
Underweight (WAZ)				
≥-2Zscore	81.5	76.7	92.6 ^{***}	71.1
-3 to <-2Zscore	13.6	12.4	7.4	15.4
<-3Zscore	4.9	10.9	0.0	13.5
*** P < 0.001, * P < 0.05 Intervention = Adadle, Control = Gode				
≥-2Zscore = Normal, -3 to <-2Zscore = Moderate malnutrition, <-3Zscore = Severe malnutrition				

The baseline and post intervention mean Z-score of wasting, stunting, and underweight of children below five years within groups are reported. A significant change of improvement were seen in wasting ($p < 0.001$) and underweight ($p < 0.01$) status in intervention group, but not in stunting, which was almost similar at baseline and post intervention. Nonetheless, control group showed a significant decline mean Z-score of wasting, underweight, and stunting ($p < 0.05$) that indicates a worsening of children nutritional status. The overall mean Z-score difference of the difference (DOD) of wasting and underweight between groups from pre and post intervention were shown better off, compared to control group, with mean DOD wasting of (-0.738, $p < 0.001$) and underweight of (-0.615, $p < 0.001$). But, this was not seen in stunting (-0.239, $p > 0.05$) (**Table 3**).

Table 3

Baseline and post intervention WHZ, HAZ, WAZ mean Z-score and mean z-score difference among children below five years of age in Gode and Adadle districts

Variable	Paired sample t-test		Independent sample t-test
	Intervention	Control	
	Mean Z-score (\pm SD)	Mean Z-score (\pm SD)	Mean Z-score difference of the differences (95% CI) @
WHZ	-0.129 (2.31)***	-0.867 (2.06)*	-0.738 (-1.098, -0.378)***
Pre-test	0.313 (1.47)	-1.163 (1.83)	
Post-test			
WAZ	-0.379 (1.66)**	-1.147 (1.44)***	-0.615 (-0.858, -0.372)***
Pre-test	-0.104 (0.98)	-1.487 (1.34)	
Post-test			
HAZ	-0.437 (3.11)	-0.888 (2.79)**	-0.239 (-0.587, 0.108)
Pre-test	-0.597 (2.04)	-1.287 (2.01)	
Post-test			
*** P < 0.001, ** P < 0.01, * P < 0.05 Intervention = Adadle, Control = Gode			
@calculated using pre test - post test of intervention group minus pre test - post test of control group			

As shown in Fig. 1 before and after NEI comparison of weight for height Z- score (WHZ) \pm (SD) average deviation from the median WHO standard reference population of the children below five years of age, which stipulates same improvement of z-score from $-0.53 \pm (1.87)$ to $-0.31 \pm (1.67)$. This indicates that there is an improvement of wasting status of the children after NEI. The different is seen in intervention group, but not in control group.

Before and after NEI comparison of weight for age Z- score (WAZ) \pm (SD) average deviation from the median WHO standard reference population of the children below five years of age shows same improvement of z-score from $-0.82 \pm (1.58)$ to $-0.79 \pm (1.36)$. This indicates that there is a little improvement of underweight status of the children after NEI. The different is also seen in intervention group, but not in control group (Fig. 2).

Regarding height for age (HAZ), before and after NEI comparison of Z- score \pm (SD) average deviation from the median WHO standard reference population of the children below five years of age. The result indicates worsening of Z-score from $-0.81 \pm (2.35)$ to $-0.97 \pm (1.91)$. This shows that there is a worsening pattern of stunting status of the children even after NEI in both groups (Fig. 3).

Discussion

In this study we have conducted nutrition education intervention (NEI) programme in one of the two districts focusing nutritional status of the children below five years of age. While, in other district the data at baseline and post intervention were collected without any intervention except the routine health services. The outcome were compared before and after eight months within and between districts. At baseline study, all the three types (stunting, wasting, and underweight) of undernutrition in children less than five years of age were not seen statistically significant different between the two groups. Though, after NEI within the intervention group has shown statistically significant improvement, in all the three types of undernutrition. The undernutrition prevalence significantly declined from pre and post intervention. For example, stunting were decreased from 31.2–21.7%, wasting from 19–9.4%, and underweight from 18.5–7.4%. In the control group there were no significant different finding between baseline and post intervention. This was in coherent with other studies that showed improvement in nutrition status after intervention (Lechtig, Cornale, Ugaz, & Arias, 2014; Majamanda et al., 2014; Roy et al., 2007).

The mean Z-score \pm SD of WHZ, HAZ and WAZ was checked. In this study as described in table 3, the WHZ and WAZ, Z-score \pm SD had shown statistically significant improvement in intervention group from -0.13 ± 2.3 to 0.31 ± 1.47 and -0.38 ± 1.66 to -0.1 ± 0.98 at pre and post intervention, respectively. But, the mean Z-score \pm SD of HAZ were not shown statistical different. Yet, the control group had shown statistically significant difference of worsening status in all the three types of undernutrition from pre to post intervention assessment.

At pre and post intervention mean Z-score \pm SD of HAZ (stunting) had not shown improvement or difference between pre and post intervention. While, significant worsening were seen in control group. Similar findings were reported from studies carried out in South Africa and Indonesia (Sukandar et al., 2015; Walsh et al., 2002). Conversely, significant improvement of HAZ mean Z-score were reported in a systematic review of study in developing countries and study conducted in Burkina Faso (Lassi et al., 2013; Sanou D. et al., 2011). These differences could be due to design, age of the children studied, and sample size difference. The systematic review was from studies that focused on complementary feeding and from food insecure areas, which studied children aged 6 to 24 months. While, the other study, sample size was small only 33 participants and age of the children was from 1 to 6 years.

In our study, the WHZ (wasting), mean Z-score \pm SD were statistical significantly improved after intervention. Contrasting, in control group the status were worsened within the same period. This was alike to result obtained from study conducted in South Africa, that showed the mean Z-score of weight for height improvement after intervention (Walsh et al., 2002). However, this was different in result obtained from other study that reported non-significant improvement of mean Z-score of weight for height (Sanou D. et al., 2011). The difference could be because of sample size and different participant characteristics. Similarly, Sukandar et al., (2015) has reported an improvement of mean Z-score of weight for height after NEI. This difference is probably because of short intervention duration. It was only for five months and

only two nutrition education sessions per month, which makes only ten session for all study period, which may not bring the desired effect.

The underweight status of the children below five years of age in this study showed a significant increment of mean Z-score \pm SD of WAZ in intervention group, but not in the control group. This is comparable with other studies (Lassi et al., 2013; Sanou et al., 2011; Sukandar et al., 2015; Walsh et al., 2002) in different countries. This indicates that the NEI has been conducted effectively. It is therefore, important to maintain/sustain the effort for improvement of nutritional status of the children.

Conclusion

A nutrition education intervention (NEI) targeting nutritional status and its contributing factors of the children below five years of age were performed. This strategic NEI was found effective in improving the nutritional status of the children. The NEI to words mothers/caregivers behaviour related to child feeding practices with optimal IYCF approach using the accessible, available and affordable resources; such as breast milk, animal source foods, indigenous fruits and vegetable etc. In addition, promoting child immunization, de-worming, vitamin A, iron supplementations, proper ITNs utilization, DDS, and health seeking behaviour has worked and improved the nutritional status of the target children.

Finally, this NEI using mainly religious leaders showed promising outcome, if further scaled up and adapted to other districts in the zone and the region as well. It may therefore, bring dramatic change in improving the health and growth of the children below five years of age. It also decrease the morbidity and mortality caused by this deadly problem. A behaviour change communication (BCC) using locally available, accessible and affordable nutritious foods and other resources can be used as a main tool. We strongly suggest to strengthen the community based nutrition programme (CBN), which is already practiced in some highland areas of the country and to extend to the needed community including Somali region. We also recommend refresher training to the health workers on CBN and on optimal IYCF strategy. Furthermore, the relationship between the health professionals and community should be strengthen, especially religious leaders. They are highly influential and respectful by the community. Mobilizing them and involving them on CBN activities has been effective and fruitful. Others that can also be utilized include; mother to mother, one to five developmental arm networks, women and youth associations, teachers, school children etc.

Abbreviations

ANOVA Analysis of Variance

BBC Behaviour change communication

CBN Community Based Nutrition

DDS Dietary Diversity Score

DOD Difference of the Difference

EBF Exclusive Breast Feeding

EHDS Ethiopia Health and Demographic Survey

FMOH Federal Ministry of Health

HAZ Height for Age Z-Score

H/A Height for Age

ITNs Insecticide Treated Nets

IREC IIUM Research and Ethical committee

IYCF Infant and Young Child Feeding

NEI Nutrition Education Intervention

PEM Protein Energy Malnutrition

SD Standard Deviations

SPSS Statistical Package for Social Science

SRHB Somali Regional Health Bureau

UNICEF United Nations Children Fund

W/A Weight for Age

WAZ Weight for Age Z-Score

WHZ Weight for Height Z-Score

W/H Weight for Height

WHO World Health Organization

Declarations

Ethical approval

Research approval was obtained from international Islamic University Malaysia Ethical Committee, Ref. number: IIUM310/G20/4/14-37, Dated: 26th December 2013/22 Safar 1435H. Informed consent was obtained from the mothers/caregivers, prior to the data collection.

Consent to publish

Not applicable

Availability of data and materials

The datasets used in this study are available from the corresponding author on reasonable request

Competing Interest

The authors declared that there are no any competing interest

Funding

No specific funding agent/affirm for this study

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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Figures

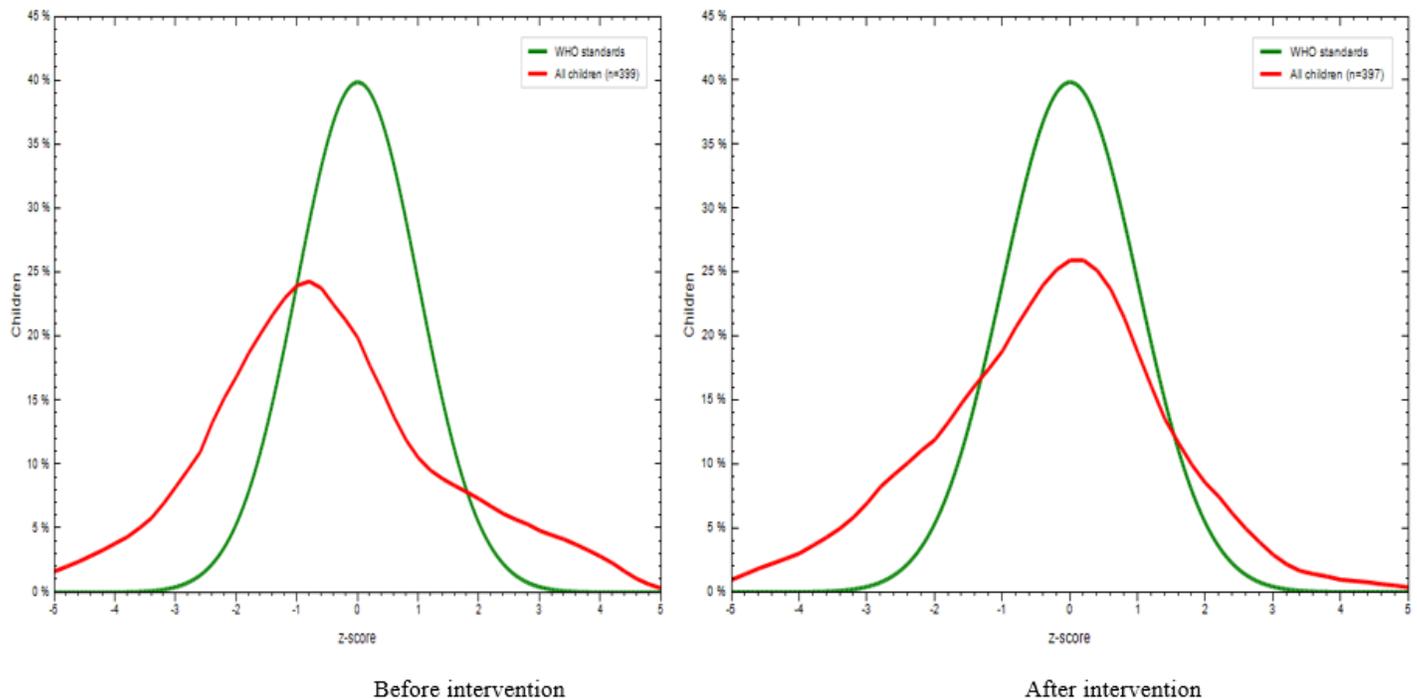


Figure 1

Before and after intervention comparison of weight for height Z-score (WHZ) distribution of the wasted children compared to the median WHO standard reference population in Gode and Adadle Districts

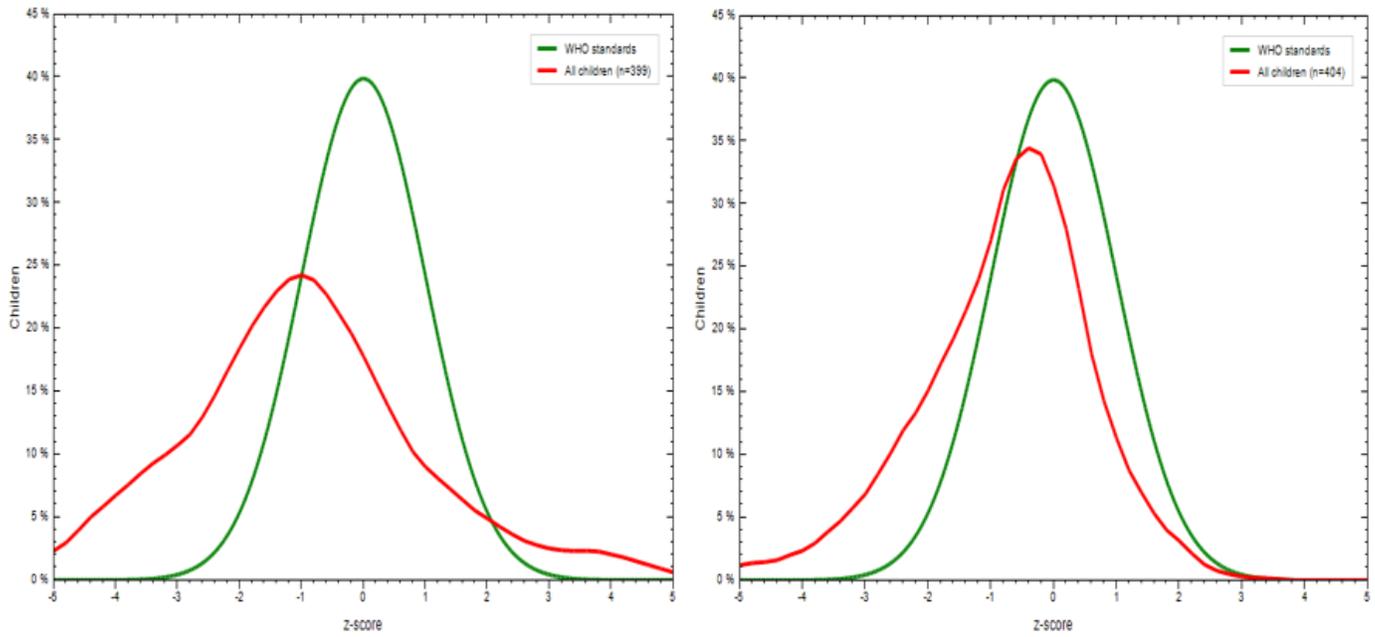


Figure 2

Before and after intervention comparison of weight for age Z-score (WAZ) distribution of the underweight children compared to the median WHO standard reference population in Gode and Adadle Districts

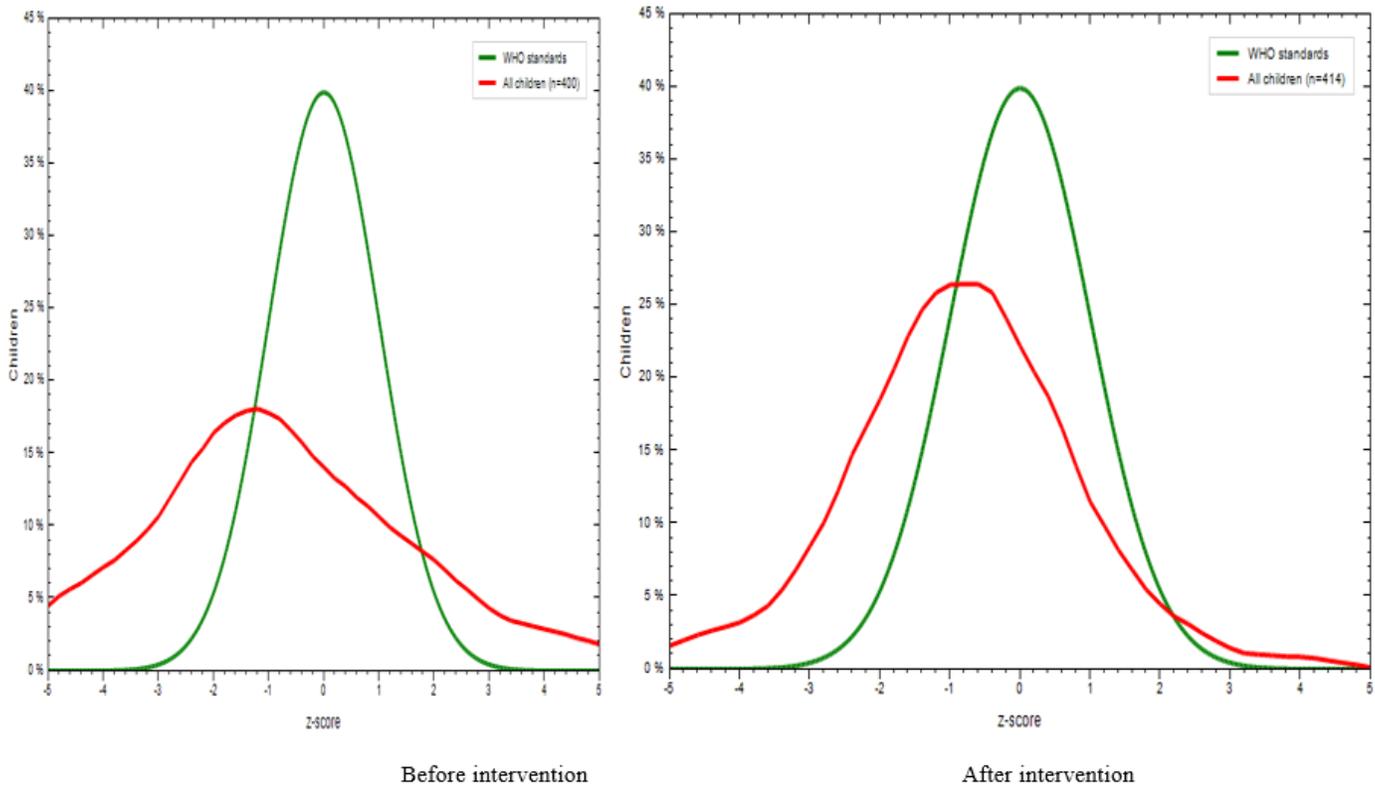


Figure 3

Before and after intervention comparison of height for age Z-score (HAZ) distribution of the stunted children compared to the median WHO standard reference population in Gode and Adadle Districts