Effect of Nutrition Education Intervention on Anaemia Among Children aged 6 to 59 Months in Pastoralist and Agro-Pastoralist Community of Somali Region, Eastern Ethiopia: Community Based Case Control Study

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Abstract

Background: Anaemia is one of the major public health problems. It affects over 1.6 billion individuals of all age groups globally. About 273.2 million children below five years of age were affected by anaemia, of which around two-thirds (62.3%) occur in Sub-Saharan Africa. The overall global anaemia prevalence rate reported was 24.8%, of which almost half (47.4%) of it occurs in preschool children. Ethiopia is one of the seriously affected countries. The Ethiopia Demographic and Health Survey (EDHS), 2016 report showed, 56% and 82.6% of preschool children in Ethiopia and the Somali region, respectively, were affected by some degree of anaemia. Hence, this study aims to assess the effect of nutrition education intervention (NEI) on anaemia prevalence in preschool children in the Pastoralist and Agro-pastoralist communities of the Somali Region, Eastern Ethiopia.

Methods: A community based case control study was conducted among 404 paired children 6 – 59 months to mothers/caregivers in two phases. Adadle district was used as an NEI group and Gode district as a control group. A face-to-face interview for mothers/caregivers using a semi-structured questionnaire and haemoglobin measurement of the children was done. The same procedure was repeated after eight months of NEI. The blood haemoglobin (Hb) level of the children was measured using Hemocue 301. SPSS version 20 was used, a chi-square test for categorical and t-test (independent and repeated paired) for continuous variables were performed.

Results: the overall anaemia prevalence was decreased from 72% at baseline and 51% at post-intervention. The majority of this change had occurred in the intervention group (79.3 - 44.8%). The mean Hb level score difference of the difference (DOD) was significantly improved (-1.163, $p<0.001$) after NEI. While, the intervention group showed a significantly higher increment of Hb level (9.4g/dl – 10.6g/dl, $p<0.001$).

Conclusion: The NEI has been shown effective and significant improvement in the mean haemoglobin level and decreased the anaemia prevalence in the intervention group. Therefore, behaviour change communication, using religious leaders and other potential people. Advocating the use of locally available, accessible, and affordable nutritious foods, with proper infant and young child feeding and basic health services, are highly effective to tackle the children's anaemia status.

Background

Anaemia is defined as a low level of haemoglobin concentration in the blood. It's one of the major public health problems that affect over one and half billion individuals of all age groups, every year all over the world. The overall global anaemia prevalence in preschool children reported 47.4%. While in Africa it is reported 67.6% (1, 2). In 2011 about 273.2 million children below five years of age were affected by anaemia, of which around two-thirds (62.3%) occurs in Sub-Saharan Africa. Anaemia in children alters

the motor, cognitive, and growth development, and impairs the health, and socio-economic improvement of the community (3–6).

Despite the effort of Sub-Saharan countries including Ethiopia to decrease the child mortality rates, the anaemia prevalence of children below five years is still more than 40%, ranging from the lowest Swaziland 42% to the highest Burkina Faso 91% (7–14). The government of Ethiopia put a lot of efforts to decrease the undernutrition problem including anaemia in preschool children, tailoring different strategies such as enhanced outreach strategy (EOS), community-based nutrition (CBN) and health facility-based nutrition service, targeted supplementary food programme, infant and young child feeding (IYCF) strategy, essential nutrition action (ENA), and others like micronutrient interventions (15–17).

However, the majority of these nutrition intervention programs are not well established and disseminated to the lower level health facilities and community as well. The health system is too weak and not well armed in terms of supplies and staffs. The health professionals including health extension workers (HEWs) are not well trained on maternal and child health-related issues (18). The Somali region is one of the highest affected, underdeveloped, poorest infrastructure, lowest socioeconomic status, and highest under-five anaemia prevalence compared to other regions of the country(13, 19).

The main predictors of anaemia in preschool children in Ethiopia were the age of the child, wealth index, child nutritional status (13, 20, 21), maternal education (20, 22, 23), maternal health status (20, 22), maternal occupation (housewife and/or daily labourer), low family income, inadequate food intake (23), low vitamin A supplementation, de-wormed, area of residence (rural), mother's age (younger) (20), un-safe water supply, and poor environmental sanitation (22).

In Somali Region, the anaemia prevalence is higher than the national level accounting for 82.6% (13). The nutrition education, Iron supplementation, de-worming and targeting other cause of anaemia is important after six months of life to maintain the normal growth and development of the child and reduce the high child morbidity and mortality (24–26). Such information is little or unavailable in this community. Therefore, this study was designed to document the effect of NEI on the anaemia status of the children 6 – 59 months in Shabelle Zone of Somali Regional State, Eastern Ethiopia

Methods

Study design and period

A community based case control study was conducted in August 2017 from 404 paired child-mothers/caregivers in the Gode and Adadle districts of Shabelle zone, Somali regional state. Two districts were randomly selected from ten districts in the Shabelle zone and then kebeles (the second smallest administrative unit in Ethiopia) were stratified into urban and rural. From each district, one urban and two rural kebeles were randomly selected. A total of six kebeles were included in the study. In each kebele, households with at least one under-five child were randomly selected and the mothers/caregivers who fulfil the inclusion criteria were interviewed, where at least one child in the selected household was

weighed and a drop of blood from the finger was taken. After eight months of NEI in the Adadle district, a post interventional study was conducted in August 2017 from 404 paired child-mothers/caregivers.

Sample population and sample size determination

This step was the continuation of the baseline study, the sample population was the same as that of the baseline, except some of the children below 6 months at baseline were included and become above the age range of 6 – 59 months were excluded at this time. To calculate the sample size for the second phase of this study, a two population proportion formula was used, using **G-Power software.** To get the maximum sample size we assumed 50% prevalence rate, with 95% confidence interval, α = 0.05 (type I error), and β (power) = 84% (type II error). On the basis of this assumptions, the required sample size for this study was (n1= 56 + n2 =56) = 112 participants times 3 design effect, plus 10% for non-response rate. Thus, the total sample size was (112*3=336+34= 370) participants (185 participants from each group). Therefore, after calculating the sample size using the appropriate formula, we realized that the baseline sample size is higher than that for the post-intervention. Hence, we decided to use the eligible participants from the first phase sample size, which become 404 participants (**203** participants from Adadle district and 201 participants from Gode district) and gives as more confidence for representativeness.

The NEI programme was designed and conducted using social cognitive theory (SCT). This theory “plays in the adoption, initiation, and maintenance of health behaviours” (27). The NEI programme was intended to improve the knowledge, attitude, and skills of mothers/caregivers regarding the child feeding practices, with the expected outcome of improvement of the child anaemia status. The intervention group was given scheduled health education sessions. Topics related to nutrition were taught to the 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 for 45 minutes, under the responsibility and supervision of the principal investigator. Besides, the display of key messages on the health centers, clinics, and health posts was done. Community social mobilizers and religious leaders were also involved. The main topics given was; 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, rewarming, vitamin A, ITNs usage and environmental sanitation, treating sick child, each topic was taught for at least sixty minutes. While Gode district (control group) remains getting only the routine health service activities.

Data collection procedure and measurement

A semi-structured questionnaire was prepared in English and translated into Somali language and again back to English, and checked by another person who speaks both languages to ensure its consistency. Haemoglobin level of the children's age was measured using Hemocue301, this makes it easy to signpost the anaemia status of the children. Data were collected by degree and diploma nurses after two days of

training and a one-day pilot test, in both pre and post-intervention study periods. To ensure data clarity and completeness, during data collection continuous monitoring and checking daily were done by the principal investigator and the team supervisors.

Data analysis

The data were coded, double entered, checked for missing values and outliers, and analyzed using SPSS (SPSS Inc. version 20). Descriptive and inferential statistics were used. The specific statistical analysis used here includes; Chi-square and Fisher exact tests for categorical variables and t-test for continuous variables (independent t-test and paired -repeated measure- t-test), after checking the assumptions.

Ethical considerations

Ethical clearance was obtained from the International Islamic University Malaysia Research Ethical Committee (IREC). A written support letter was also obtained from the Ethiopia Federal Ministry of Health (FMOH), Somali Regional Health Bureau (SRHB), and Shabelle Zone administrative office. The purpose of the study was clearly explained to the participants and informed consent was obtained from the mothers/caregivers, before the data collection day. This type of consent was presented, discussed with ethical, and supervisory committees, and agreed upon. This was because the majority of the mothers/caregivers in the study area were illiterate (cannot read and write). Since our data collection method has no evidence to harm the participants. It was only an interview with the mothers/caregivers, and minimal peripheral capillary blood sample by finger brick for anaemia detection. The participants were encouraged to be honest as much as possible. The interviewers/data collectors were given a written statement to read and sign after the acceptance of the participants. Confidentiality was assured by keeping all information in a proper place. In addition, if a sick and/or anaemic child is seen, the team would send it to the nearest health facility for assistance.

Results

A total of 404 children between the ages of 6 – 59 months and their mothers/caregivers in pre and post-intervention respectively, were enrolled in the study. The mean (±SD) age of the children in intervention and control groups from pre and post-intervention was 22.2(12) & 33.7(12) and 28(14) & 36.6(13.5) months, respectively. The male to female ratio of the children was 1:1.15. The majority of the participants were rural residents. More than 80% of the mothers/caregivers were illiterate and housewives, with mean (±SD) age group of mothers/caregivers in intervention and control groups from pre and post-intervention, was 28(6) & 29(6) and 29.5(9.5) & 30(9) years, respectively. All respondents were Muslim by religion and Somali by Ethnic group. The mean (±SD) family size, and the number of under-five children in the family were 6(2), and 2(0.7) persons, respectively. The main source of income in the intervention group was from farm and livestock, whereas trade and daily laborer was in the control group (Table 1).

Effect of NEI on anaemia in children

The overall anaemia prevalence in children 6 – 59 months of age was 72% at baseline, this was declined after eight months of NEI to 51%. The majority of this change had occurred in the intervention group, which makes a big improvement from 79.3% of anaemia prevalence at baseline to 44.8% at post-intervention. Unlike, the control group had only shown a minimal decrease of anaemia prevalence from 64.9% at baseline to 57.2% at the post-intervention. This was a statistically significant difference ($p < 0.01$) between pre and post-intervention. Regarding the severity of the problems, the moderately and severely anaemic children were dramatically decreased by more than half in the intervention group from 54.7% & 5.4 - 22.7% & 1.5%, respectively (Table 2).

Table 1
Socio-demographic and economic characteristics among children 6-59 months by district between pre and post-intervention

Variables		Baseline		Post-intervention	
		Adadle (n=203)	Gode (n=194)	Adadle (n=203)	Gode (n=201)
		(%)	(%)	(%)	(%)
Residence	Urban/Semi-urban	25.1	32.5	25.1	33.48
	Rural	74.9	67.5	74.9	66.2
Child Sex	Male	53.7	53.1	54.2	52.7
	Female	46.3	46.9	45.8	47.3
Child age	<12	7.4	5.7	0	0
	12 – 23	43.3	29.4	7.5	5.9
	24 – 35	28.1	25.8	43.8	30.8
	36 – 47	10.3	21.1	28.4	27.0
	48 – 60	10.8	18.0	20.4	36.2
	Mean ± SD	22.2±12.2	27.8±14.1	33.7±12	36.6±13.5
Family size	1-3	9.4	5.2	11.3	10.4
	4-6	49.8	50.2	49.8	44.6
	≥7	53.7	49.7	38.9	45.0
	Mean ± SD	5.9±1.9	6.2±2.1	6.1±1.96	6.4±2.2
Number <5 children family	1	22.2	18.6	25.6	20.9
	2	59.1	60.3	53.2	59.7
	≥3	18.7	21.1	21.2	19.4
	Mean ± SD	1.98±0.67	2.0±0.66	2.0±0.79	2.0±0.69
caregiver's age	≤18	4.9	3.1	0.5	1.5
	19 – 25	29.6	37.9	25.6	33.3
	26 - 35	53.2	41.5	57.1	43.3
	>35	12.3	17.4	16.7	21.9
	Mean ± SD	28.2±5.9	29.5±9.5	29.2±5.9	29.9±9.1

Variables		Baseline		Post-intervention	
		Adadle (n=203)	Gode (n=194)	Adadle (n=203)	Gode (n=201)
		(%)	(%)	(%)	(%)
caregiver's education	Illiterate	81.8	93.3	81.8	92.5
	Literate	18.2	6.7	18.2	7.5
caregiver's occupation	Housewife	84.2	85.1	84.2	84.6
	Farmer & others^	15.8	14.9	15.8	15.4
Source of income	Livestock/farm	52.2	38.1	67.0	37.0
	Salary & others[#]	47.8	61.9	33.0	62.2
Source of drinking water	Protected	0.5	23.2	12.3	19.9
	Unprotected	99.5	76.8	87.7	80.1
Disease during last two weeks	Yes	79.8	75.8	59.1	70.1
	No	20.2	24.2	40.9	29.9
ITNs use of <5 children	Yes	74.9	89.2	87.7	75.1
	No	25.1	10.8	12.3	24.9
Child Immunized	Yes	86.7	93.8	98.0	92.4
	No	13.3	6.2	2.0	7.6
Child Dewormed	Yes	17.2	35.6	54.2	50.3
	No	82.8	64.4	45.8	49.7
Child Vit A supplement	Yes	19.2	49.5	55.7	53.5
	No	80.8	50.5	44.3	46.5

Adadle= intervention, Gode = control [#]Trade & daily labourer, ^merchant, farmer, daily labourer, employee

Table 2
Anaemia prevalence and severity status of children 6 – 59 months comparing pre and post-intervention of intervention and control groups in Gode and Adadle Districts

Variables	Baseline		Post-intervention	
	Intervention (n=203)	Control (n=194)	Intervention (n=203)	Control (n=201)
HB level (g/dl)	%	%	%	%
≥11	20.7**	35.1	55.2*	42.8
10 – 10.9	19.2	20.6	20.7	19.9
7 – 9.9	54.7	36.6	22.7	31.8
< 7	5.4	7.7	1.5	5.5
Anaemia prevalence				
No	20.7	35.1	55.2	42.8
Yes	79.3**	64.9	44.8*	57.2
** p <0.01, * p <0.05Intervention= Adadle, Control= Gode				
≥ 11g/dl = Normal, 10 to 10.9g/dl = Mild, 7 to 9.9g/dl =Moderate, < 7g/dl = Severe				

The anaemia overall mean score of paired t-test were showed statistically significant improvement (p <0.001) in both intervention and control groups. But, the independent t-test between intervention and control groups at pre and post-intervention, the intervention group showed statistically significant improvement of mean Hb level (-1.163, p <0.001) (Table 3).

Table 3
Mean and mean differences of pre and post-intervention anaemia of children 6 – 59 months between intervention and control groups in Gode and Adadle districts

Variable	Paired sample t-test		Independent sample t-test
	Intervention (n=201)	Control (n=185)	Mean Hb level score DOD (95% CI)
	Mean Hb level score ± (SD)	Mean Hb level score ± (SD)	
Anaemia	9.399 (1.58)	9.897 (1.87)	-1.163(-1.263,-1.062)***
Pre-test	11.607 (1.89)***	10.943 (1.91)***	
Post-test			
*** p <0.001,Intervention= Adadle, Control= Gode, DOD= difference of the difference			

Discussion

In this study, the overall prevalence of anaemia in children 6 – 59 months was dramatically dropped after eight months of NEI from 72% at baseline (28) to 51% at post-intervention. The majority of this change was contributed by the intervention group that showed marked deference at pre and post-intervention, while the percentage of children without anaemia increased from 20.7% at baseline to 55.2% at post-intervention. Unlike the control group, which showed a minimal decrease of prevalence from 64.9–57.2% at the same period. This was matched with the results obtained from other studies, which showed a decrease in anaemia prevalence after nutrition intervention (29–34).

In the present study, the mean haemoglobin concentration level score was significantly increased after NEI in both intervention and control groups. However, the increment were more than twice higher in the intervention group (i.e. 2.21g/dl mean score increase), compared to the control group of only (1.0g/dl mean score increase) between pre and post-intervention periods. This marked improvement of mean haemoglobin level score in the intervention group was parallel with other studies in a different parts of the developing countries (24, 29, 35–37). This indicates that the NEI has been conducted effectively. It is, therefore, important to maintain/sustain the effort of NEI for the improvement of the anaemia status of the children. The strength of this study was using different people for data collection and implementation of the NEI. This helps to prevent information bias, which could happen if the two groups, the outcome evaluator and the programme implementers were the same. Extensive training and continuous monitoring and quality control measurements by the principal investigator. Whereas, the small scale of this study, covering only covered 6 kebeles in two districts, the possibility of social desirability and recall bias were some of the limitations.

Conclusion

A Nutrition Education Intrvenrion (NEI) targeting nutritional status including anaemia and its contributing factors for the children below five years was performed. This strategic NEI was found effective in improving the anaemia 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. Besides, promoting child immunization, de-worming, vitamin A, and Iron supplementations, and proper ITNs utilization has worked and improved the anaemia status of the target children. A combination of these was significantly improved the Hb level of the children.

Finally, this intervention showed promising outcomes, if further scaled up and adapted to other districts in the zone, as well as other areas in the region. It may, therefore, bring a dramatic change in improving the health and growth of children below five years of age and decrease the morbidity and mortality caused by this deadly problem. It also showed that the problem can be tackled by behaviour change communication (BCC) using locally available, accessible, and affordable nutritious foods and other resources. We strongly suggest strengthening the community-based nutrition programme (CBN), which is commonly practiced in the highland areas of the country and extending this CBN to this community and other districts of the Somali region in general. We also recommend refresher training to the health workers on

CBN and optimal IYCF strategy. Furthermore, the relationship between the health professionals and the community should be strengthened. Religious leaders play a key role in NEI and the utilization of other basic health services because they are highly influential and respectful of the community. Mobilizing them and involving them in CBN activities has been effective and fruitful. Others that can also be utilized include; mothers/caregivers (mother to mother, and one to five developmental arm networks), women and youth associations, teachers, and schoolchildren.

Abbreviations

ANOVA	Analysis of Variance
BBC	Behaviour change communication
CBN	Community Based Nutrition
DDS	Dietary Diversity Score
DOD	Difference of the Difference
EHDS	Ethiopia Health and Demographics Survey
FMOH	Federal Ministry of Health
g/dl	Gram per decilitre
Hb	Haemoglobin Level
ITNs	Insecticide Treated Nets
IREC IIUM	Research and Ethical committee
IYCF	Infant and Young Child Feeding
NEI	Nutrition Education Intervention
SD	Standard Deviations
SPSS	Statistical Package for Social Science
SRHB	Somali Regional Health Bureau
UNICEF	United Nations Children Fund
WHO	World Health Organization

Declarations

The research protocol and proposal were approved by International Islamic University Malaysia Ethical Committee, Ref. number: IIUM310/G20/4/14-37, Dated: 26th December 2013/22 Safar 1435H. Verbal informed consent was obtained from the mothers/caregivers, before 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

Guideline

We confirm that all methods were carried out following the guidelines and regulations.

Competing Interest

The authors declared that there is no competing interest

Funding

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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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