Dietary diversity interventions and its impact on iron status of preschool children 36-59 months in Emali, Kenya

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ABSTRACT

Background: Dietary diversity is considered crucial in ensuring adequate micronutrient intake, especially among children since they have increased nutrient requirements. Iron deficiency is the most common nutrient deficiency in the world and a major public health risk particularly in the developing countries. This study assessed the impact of dietary diversity interventions on iron status of preschool children in Emali, Kenya.

Methods: A non-randomized pre-post intervention trial involving 495 pre-school children aged 36-59 months in Early Childhood Development (ECD) schools was conducted. Dietary diversity of the children was enhanced by establishing school gardens in the early-childhood education centers and innovative home-gardening techniques in the homes of selected children’s caregivers. Poultry houses for rearing chicken were also constructed at the ECD centers to provide the children with good sources of protein and minerals. Structured nutrition education on appropriate child feeding was also offered to the children’s caregivers. Children were clustered in two communities the Kamba and Maasai to represent the different ecological settings.

Results: Dietary diversity score improved significantly in the Kamba community which recorded a high uptake of the dietary diversity intervention programs. Only 9.1% of the children did not meet the minimum acceptable dietary diversity after the intervention from the 48.1% pre-intervention. The intake of iron-rich foods also improved considerably (77.5%) after the intervention with the prevalence of anemia reducing to 3.4%. Prevalence of anemia among the Maasai children remained high (58.3%) due to low intake of iron-rich foods such as green leafy vegetables (34.6%) and meat (21.8%).

Conclusion: Anemia is a matter of public health concern among preschool children. Dietary diversity interventions such as; kitchen gardening, nutrition education (enhancement of food nutritional value through better food preparation methods) and implementation of other nutrition-sensitive agriculture interventions can significantly enhance dietary diversity score and iron status of children.

Keywords
Anemia, Dietary Diversity, Iron Status, Preschool Children.

Abbreviations
DDS: Dietary diversity score; ECDs: Early Childhood Education Centers; FAO: Food and Agriculture Organization; MDDS: Minimum Dietary Diversity Score; WHO: World Health Organization.

Background information
Child micronutrients deficiency continues to be a major public health concern globally, contributing to poor child growth and development. The problem has resulted in substantial increases in overall child morbidity and mortality, causing long-term adverse consequences for child development and life-long health [1,2]. Undernutrition particularly micronutrients deficiency is not only linked to child morbidity and mortality but also to poor functional
needed development agenda. Therefore, this study will contribute to the much-
international development agenda, both as a maker and marker of
malnutrition is gaining momentum and high priority on the
impact on iron status of pre-school children (36-59 months) in
assessment of dietary diversity interventions and its
Furthermore, available literature suggests that the evidence to date
links between nutrition-sensitive agricultural interventions and
dietary diversification strategies is scanty and inconclusive
and cognitive development of children [3]. The school performance
of undernourished children is reported to be below potential. They
are also reported to have lower work capacity and productivity as
adults later in life [4].
Global statistics reveal that approximately 171 million children
are chronically undernourished (stunted), 60 million are acutely
undernourished (wasted) and 100 million are overweight [5]. The
burden of child under-nutrition is high in developing countries with
many cases of under nutrition being reported in sub-Saharan Africa
and Asia. Kenya has had its fair share of this burden. According
to the recent Kenya demographic and health survey report, about
26 %, 11% and 4% of Kenyan under five children are stunted,
underweight and wasted respectively [6]. Similarly, micronutrient
deficiencies are prevalent in many developing countries and are
mostly due to inadequate food intake and poor dietary quality
[7]. In Africa, the estimated prevalence of anaemia in preschool
children is 67.6 percent [8]. In Kenya, the prevalence of anaemia
among pre-school children is estimated to be at 26.3% [9].
Iron deficiency is the most common nutritional deficiency
worldwide particularly affecting infants and children [10-12].
Globally, the most significant contributor to the onset of anaemia
is iron deficiency [13,14]. Iron deficiency is most prevalent among
preschool children and women of childbearing age, in Africa due
to poor access of iron-rich foods [15]. Children are particularly
vulnerable to iron deficiency anaemia because of their increased
iron requirements in the periods of rapid growth, especially in
the first five years of life [16]. Children who have iron deficiency
have been linked to increased childhood morbidity and mortality.
They are also at risk of long-lasting cognitive developmental
disadvantages [16,17]. In Kenya, iron deficiency is a matter of
public health concern, especially among preschool children [18].
In light of this, there is a critical need for a better understanding
of the public health dimensions of child under nutrition in order to
provide targeted high impact interventions in local contexts that
effectively address it [3]. It is documented that nutrition-specific
interventions if globally implemented, could eliminate many cases
of morbidity and mortality in children. Therefore, there have been
numerous efforts currently in developing countries and globally to
address the problem of child malnutrition [19]. Given these efforts,
answers to the question of how to overcome child malnutrition are
yet to be addressed sufficiently [4].
Furthermore, available literature suggests that the evidence to date
on the links between nutrition sensitive agricultural interventions
and dietary diversification strategies is scanty and inconclusive
[20]. In that regard, this study contributes to the discussion by
assessing the impacts of dietary diversity interventions and its
impact on iron status of pre-school children (36-59 months) in
Emali Kenya. It has also been reported that reducing childhood
malnutrition is gaining momentum and high priority on the
international development agenda, both as a maker and marker of
development [4]. Therefore, this study will contribute to the much-
needed development agenda.

Objectives of the study
To determine the impact of Dietary diversity interventions on the
iron status of preschool children 36-59 months in Emali Kenya

Methods
Study design
A non-randomized pre-post intervention trial was conducted to
determine the impact of Dietary diversity interventions on the iron
status of preschool children 36-59 months in Emali Kenya

Study location
This study was conducted in Emali Kenya. The town of Emali
located in the southern region of Kenya, is situated in the county
of Makueni, and on the border of Kajiado County. The study
targeted preschool children 36-59 months in two communities the
Kamba community of Makueni County and Maasai Community
of Kajiado County. The two populations were selected due to the
soaring levels of food insecurity and malnutrition caused by frequent
droughts. The majority of the Kamba community
engage in subsistence farming. Dairy farming and beekeeping are
also common agricultural activities in this area. Majority of the
Maasai community on the other hand are mainly agro-pastoralist,
predominantly cattle herders.

Study population and sampling
Pre-school children aged 36-59 months in early Childhood
Development (ECD) schools were the target population for
this study. This age category of children is most vulnerable to
micronutrient deficiencies. A total of 495 children aged 36-59
months were recruited from 23 purposively selected ECD centers.
Probability proportional to size sampling method was employed in
the present study to determine the number of children to be
recruited in each of the selected ECD centers. Children who were
aged 36-59 months who were free from chronic illness were
recruited in the study using a simple random sampling technique.

Description of the intervention
The nutritional value of the children’s diet was enhanced by
establishing school gardens in the early-childhood education
centers and innovative home-gardening techniques in the homes
of selected children’s caregivers. This was done to enhance the
dietary diversity of the children both at the ECD center and at
their respective homes. At the ECD centers, the children were
provided with enriched porridge and Githeri (boiled maize and
beans meal) by adding extra micronutrient-rich ingredients such
as oil and green vegetables. To enhance the bioavailability of
micro-nutrients (iron) soaking of the maize and beans was done
before their cooking. Standardized recipes for preparing children
feeds were also developed to ensure that all the children consumed
them at the same consistency. Poultry houses for rearing chicken
were also constructed at the ECD centers. The chicken provided
a cheap source of animal source protein and micronutrients every
day in at least one of the children’s meals each day. The children
were fed with eggs and meat from the chicken. Nutrition education
was conducted to increase the knowledge, skills and to influence a
positive behavioral change of caregivers of the children. Aspects
such as, selection of a diverse diet, food preparation, food handling and hygiene were also included in the education sessions.

Data collection
Researcher administered semi-structured questionnaire was used in this study. The intervention base-line and end-line assessments were conducted. The children’s caregivers were interviewed to elicit information on socio-demographic, economic and child feeding practices such as breastfeeding, meal frequency, dietary diversity, use of supplements among others. A pilot study was conducted before the actual study and the tools adjusted appropriately.

Dietary assessment
The children dietary diversity score and meal frequency was assessed using repeated 24-hour dietary recalls. Mothers/caregivers and the ECD supervisors were asked to list all the foods and drinks that the child ate and drank in the previous day at school, at home and outside the home. Food and Agricultural Organization’s (FAO) dietary diversity food groups and their standard procedure for assessing individual dietary diversity was employed for assessing each child dietary diversity. In this study, nine (9) food groups were used for tabulation of the children dietary diversity. These included: starchy staples; dark green leafy vegetables; vitamin A-rich fruits and vegetables; other fruits and vegetables; meat and fish/eggs; pumpkin, yellow yams, carrot; legumes, nuts and seeds; sour milk and milk products and oils, fat, butter. A score of 1 was allocated to each food group consumed and a score of 0 if the food group was not consumed. The sum total for each child was computed to establish each child dietary diversity score. Children who had consumed a minimum of four food groups were considered to have met the minimum acceptable dietary diversity recommended for micronutrient intake adequacy.

Assessment of iron status
A HemoCue was used to determine the concentrations of hemoglobin (hb) in the children blood. Blood Samples were collected by a laboratory technician, put in the microcuvette and analysed immediately for hemoglobin concentration using the HemoCue. The blood was obtained through the vein after cleansing the antecubital area with 70.0% alcohol.

Statistical Analysis
Data was entered and analysis performed using Statistical Package for the Social Sciences (S.P.S.S) version 20 software for windows. Frequencies, means, standard deviations and ranges were used to determine the prevalence of anemia and to describe the study population. T-Test and ANOVA were used to test for significant differences on the different means pre and post intervention. Association between categorical variables was determined using Chi-square test at the bivariate level. An association was considered statistically significant in cases where the p value was < 0.05. Children with hemoglobin (hb) values of ≤ 11.0g/dl were considered to be anemic [21].

Ethical considerations
Ethical clearance and research permit were sought from Kenyatta University Ethical Review committee and the National Commission for Science, Technology and Innovation (NACOSTI) respectively. Permission was also sought from the county directors of education, agriculture, health and public health, local county leaders and head teachers. Participation in this study was voluntary and the caregivers of the children gave a signed informed consent before data collection was undertaken.

Results
Table 1 presents the socio-demographic and economic characteristics of the households in the study sample. Majority of the caregivers in both communities were aged between 20-39 years. The distribution of mother’s age by the community showed a higher proportion of younger Maasai mothers as compared to Kamba mothers. More than half (55.3%), of the caregivers in the Kamba community engaged in farming activities while 56.8% of the Maasai community were engaged as agricultural labourers. The majority (65.2%) of the participants in the Kamba communities reported having attained primary school education as their highest level of education while 49.4% of the Maasai community said they had no any form of education. Furthermore, most participants in both communities were married at the time of data collection [Kamba (80.6%) and Maasai (90.5%)].

Children characteristics
Slightly more than half (51% and 52.3%) of the children were females from both Kamba and Maasai community respectively. Majority (54%) of children in the Kamba community were aged 36-48 months while majority (62.5%) of the Maasai community were aged between 49-59 months.

Deworming and micronutrient supplementation of the children
Nearly three-quarters (68%) of Kamba children had been given de-wormers in the six months prior to the study. In contrast, 55.6% from the Maasai community had not de-wormed their children in the same period. The majority of both Kamba (73.9%) and Maasai (95.5%) respondents reported that their children had received supplements in the past one year. Of the Kamba respondents, 69.3% reported that their children had received vitamin A supplements, 68.7% reported that their children were using iodized salt and 11.5% had received iron supplements. Comparatively, of the Maasai children, 63.4% reported that their children had received vitamin A supplements, 97.9% were using iodized salt and 1.6% had received iron supplements.

Dietary diversity scores pre and post-intervention
Frequency of food groups consumption by the children pre-intervention
Table 4 shows that below half of the children consumed iron rich foods before the intervention such as dark green leafy vegetables (Kamba 36.5%, Maasai, 28%) and meat (Kamba 8.3%, Maasai, 24.7%) in both communities. The most consumed food group was the starchy staples by 99.6% among Kamba children and 98.4% among Maasai children.
Frequency of food groups consumption by the children after the intervention.

The main food group consumed daily by both communities were foods from the starchy staples (cereals and grains, rice and potatoes). Most children from both communities consumed food from all food groups after the intervention. Iron rich foods such as dark green leafy vegetables were also highly consumed by the children especially by the Kamba children (77.5%).

Table 5 below presents the percentage of consumption based on each food group. About half (Kamba, 48.1%, Maasai, 43.2%) of the children in both communities did not achieve the minimum acceptable dietary diversity before the intervention. Notably, only about nine percent (9%) of the Kamba children did not achieve the minimum dietary diversity as compared to 33% of Maasai children after the intervention (Table 6).
Characteristics | Kamba | Maasai
---|---|---
**De-wormed** | | 
No | 80 | 135 | 55.6 |
Yes | 172 | 108 | 44.4 |
**Ever received supplements** | | 
(vitamin A, iodine, iron or any other dietary supplement) | | 
No | 65 | 11 | 4.5 |
Yes | 187 | 232 | 95.5 |
**Vitamin A supplement in the last six months** | | 
No | 77 | 89 | 36.6 |
Yes | 175 | 154 | 63.4 |
**Iodized salt** | | 
No | 79 | 5 | 2.1 |
Yes | 173 | 238 | 97.9 |
**Iron supplements in the last six months** | | 
No | 223 | 239 | 98.3 |
Yes | 29 | 4 | 1.6 |

Table 3: Deworming and micronutrient supplementation status of Children

| Food | Food group | Kamba (n (%) consuming) | Maasai (n (%) consuming) |
| --- | --- | --- | --- |
| 1 | Starchy Staples | 251 (99.6) | 239 (98.4) |
| 2 | Dark green leafy vegetables | 92 (36.5) | 68 (28.0) |
| 3 | Other vitamin A rich fruits and vegetables | 22 (8.7) | 10 (4.1) |
| 4 | Other fruits and vegetables | 109 (46.8) | 116 (47.7) |
| 5 | Meat and fish/eggs | 21 (8.3) | 60 (24.7) |
| 6 | Pumpkin, yellow yams, carrot | 14 (5.6) | 5 (2.1) |
| 7 | Legumes, nuts and seeds | 9 (3.6) | 182 (74.9) |
| 8 | Sour milk and milk products | 12 (4.8) | 4 (1.6) |
| 9 | Oils, fat, butter | 124 (49.2) | 221 (90.9) |

Table 4: Frequency of food groups consumption by the children pre-intervention.

| Food | Food group | Kamba (n (%) consuming) | Maasai (n (%) consuming) |
| --- | --- | --- | --- |
| 1 | Starchy Staples | 250 (98.8) | 243 (100) |
| 2 | Dark green leafy vegetables | 196 (77.5) | 84 (34.6) |
| 3 | Other vitamin A rich fruits and vegetables | 66 (26.1) | 5 (2.1) |
| 4 | Other fruits and vegetables | 164 (64.8) | 127 (52.3) |
| 5 | Meat and fish/eggs | 50 (19.8) | 53 (21.8) |
| 6 | Pumpkin, yellow yams, carrot | 41 (16.2) | 3 (1.2) |
| 7 | Legumes, nuts and seeds | 20 (60.6) | 180 (74.1) |
| 8 | Sour milk and milk products | 32 (12.6) | 17 (7.0) |
| 9 | Oils, fat, butter | 222 (87.7) | 227 (93.4) |

Table 5: Frequency of food groups consumption by the children after the intervention

| Kamba | Maasai |
| --- | --- |
| No. of food groups consumed | % Pre-intervention | % post-intervention | % Pre-intervention | % post-intervention |
| **Unmet-MDDS** | | | | |
| 1 | 3 (1.1) | 8 (3.2) | 6 (2.5) | 12 (4.9) |
| 2 | 6 (2.4) | 40 (15.9) | 9 (3.7) | 17 (7.0) |
| 3 | 14 (5.5) | 73 (29.0) | 64 (26.3) | 76 (31.3) |
| **Total** | 121 (48.1) | 23 (9.1) | 105 (43.2) | 79 (32.5) |
| **Met-MDDS** | | | | |
| 4 | 51 (20.2) | 63 (25.0) | 61 (25.1) | 65 (26.7) |
| 5 | 44 (17.5) | 79 (31.3) | 44 (18.1) | 53 (21.8) |
| 6 | 31 (12.3) | 53 (21.0) | 21 (8.6) | 29 (11.9) |
| 7 | 5 (2.0) | 20 (7.9) | 9 (3.7) | 16 (6.6) |
| 8 | 0 (0) | 10 (4.0) | 3 (1.2) | 1 (0.4) |
| 9 | 0 (0) | 4 (1.6) | 0 (0) | 0 (0) |
| **Total** | 131 (52.0) | 229 (90.8) | 138 (56.7) | 164 (67.5) |

Table 6: Number of food groups consumed by the children pre and post the intervention
Iron status of the children pre and post-intervention

**Kamba children**

![Prevalence of anemia among Kamba children pre and post intervention](image)

As reflected in Figure 1, the prevalence of anemia reduced from 9.4% pre-intervention to 3.6% post-intervention.

| Hemoglobin (g/dl) | Pre-intervention | Post-intervention | P value |
|------------------|------------------|-------------------|---------|
| 12.01            | 12.52            | 0.02              |

Table 7: Average Hemoglobin levels pre and post intervention among Kamba children

Table 7 shows that the mean haemoglobin levels at pre-intervention and post-intervention among Kamba children were significantly different (p value = 0.02).

**Maasai children**

As reflected in Figure 2, the prevalence of anemia reduced from 36.3% pre-intervention to 58.3% post-intervention.

| Hemoglobin (g/dl) | Pre-intervention | Post-intervention | P value |
|------------------|------------------|-------------------|---------|
| 11.39            | 10.23            | 0.001             |

Table 8: Average Hemoglobin levels pre and post intervention among Maasai children

Table 8 shows that the mean haemoglobin levels at pre-intervention and post-intervention among Maasai children were significantly different (p value = 0.001).

**Discussion**

In this study, the dietary diversity of the children was assessed using multiple 24-hour dietary recalls. The individual dietary diversity score gives a reflection and an estimate of nutrient adequacy of one’s diet. It has been observed that improving dietary diversity of children increases the likelihood of meeting their daily energy and nutrient requirements which ultimately leads to improved nutrition status. Jomaa et al. [22] in their study revealed a positive outcome of school feeding program on energy intake and micronutrient status of children.

After the intervention, almost all (91%) of the children in the Kamba community met the minimum dietary diversity score. This is attributed to the high uptake of the dietary intervention program as compared to the Maasai community. This reveals the role dietary diversity interventions would play in enhancing children and other vulnerable groups’ dietary diversity, this findings agree with those by Christian et al. [23] which reported that interventions involving a school gardening were effective in increasing daily consumption of fruit and vegetable in children which could result in enhancing dietary diversity. Work done by Gibbs et al. [24] also reported an increased willingness of children to try new foods following two year of school gardening and cooking programme.

The Maasai community which is largely a pastoralist community had many children (33%) not meeting the minimum dietary diversity because their uptake of the dietary intervention programs was poor. This was attributed to their cultural practice of livestock keeping as their main livelihood and thus the kitchen gardening strategy was not well accepted. This further reveal that cultural practices are key determinants of the dietary practices of populations, this result agrees with those of a study by Chege et al. [25] that concluded that, culture influences the dietary practices among Maasai children under five years.

The high prevalence of anemia and especially among the Maasai children (36.3% & 53.8%) confirms that indeed anemia among preschool aged children in Kenya is an important public health problem. Notably, the relatively high and worsening prevalence of anaemia among Maasai children could be explained by their poor dietary diversity, low intake of iron rich foods and poor uptake of nutrition interventions. Their cultural nomadic practice led to poor uptake of the nutrition interventions such as kitchen gardening initiated by this study.

Comparatively with other studies, a study conducted in Ethiopia reported anemia prevalence of 41.1% among under children aged 6-59 months [26]. Another study conducted in western Kenya reported an anemia prevalence of 25% among preschool children [27]. The differences in these prevalence’s could be attributed to different access to iron rich foods among the participants. This study observed a significant decline in prevalence of anaemia among Kamba children whose caregivers had commendable uptake of the nutrition interventions initiated by this study. A similar observation was reported in a study conducted in Jordan where the prevalence of anaemia in pre-school children declined from 40.4% to 33.9%.
after implementation of wheat flour fortification with multiple micronutrients program [28]. This demonstrates the important role of nutrition specific interventions in enhancing child nutrition and health.

Conclusion
Anemia remains a matter of public health concern among preschool children. Further and based on findings from this study, dietary diversity interventions such as kitchen gardening, nutrition education on good dietary sources of nutrients and enhancement of food nutritional value through better food preparation methods and implementation of other nutrition sensitive agriculture interventions can significantly enhance dietary diversity score and nutritional status of children and other vulnerable groups. There is also a need for urgent and practical efforts to change the behaviour of communities through appropriate community mobilisation to enhance the uptake of high impact nutrition interventions that would impact on improved iron status of children.

Limitations of the study
This study focused mainly on dietary practices and its effect on iron status of the children, it did not however include the morbidity factors and other confounding factors such as food and nutrition security indices and seasonality in the analyses. There was also a lapse of one year between pre and post-intervention assessments which could also have had some impact on the outcomes.

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Availability of data and materials
The data supporting the conclusions of this article are included within the manuscript. Additional data is available on upon reasonable request.

Authors’ contributions
JK– conceived the idea and supervised the study. CL and WK helped in conducting the research, data analysis and writing the manuscript. All authors read and approved the final manuscript.

References
1. Black R E, Allen L H, Bhatta Z A, et al. Maternal and child undernutrition: global and regional exposures and health consequences. The Lancet. 2008; 371: 243-260.
2. De Onis M. Measuring nutritional status in relation to mortality. Bulletin of the World Health Organization. 2000; 78: 1271-1274.
3. Matanda D J, Mittelmark M B, Kigaru, et al. Child undernutrition in Kenya: trend analyses from 1993 to 2008-09. 2014.
4. Smith L C, Haddad L. Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era. World Development. 2015; 68: 180-204.
5. deOnis, Mercedez, Blössner M, et al. Prevalence and trends of stunting among pre-school children, 1990-2020. Public Health Nutrition. 2012; 15: 142-148.
6. KNBS. Kenya National Bureau of Statistics (KNBS) and ICF international. 2014. KDHS Key Findings. Rockville, Maryland, USA. KNBS and ICF International. 2015.
7. Ramakrishnan U. Prevalence of micronutrient malnutrition worldwide. Nutrition Reviews. 2002; 60: S46-S52.
8. WHO. “World Malaria Report” Geneva Switzerland. WHO/HTM/GMP. 2008.
9. MoH. The Kenya National Micronutrient Survey. Nairobi: Division of nutrition ed. 2011.
10. Cogswell M E, Looker A C, Pfeiffer C M, et al. Assessment of iron deficiency in US preschool children and nonpregnant females of childbearing age: National Health and Nutrition Examination Survey 2003-2006. The American Journal of Clinical Nutrition. 2009; 89: 1334-1342.
11. Soliman A T, Al Dabbagh M M, Habboub A H, et al. Linear Growth in Children with Iron Deficiency Anemia Before and After Treatment. Journal of Tropical Pediatrics. 2009; 55: 324-327.
12. Lisbôa M B M de C, Oliveira E O, Lamounier J A, et al. Prevalence of iron-deficiency anemia in children aged less than 60 months: A population-based study from the state of Minas Gerais, Brazil. Revista de Nutrição. 2015; 28: 121-131.
13. World Health Organization, De Benoist, B., & Centers for Disease Control and Prevention (U.S.) Worldwide prevalence of anaemia 1993-2005 of: WHO Global Database of anaemia. World Health Organization. 2008.
14. Baker R D, Greer F R, Nutrition T C. Diagnosis and Prevention of Iron Deficiency and Iron-Deficiency Anemia in Infants and Young Children (0–3 Years of Age). Pediatrics. 2010; 126: 1040-1050.
15. Roganović J, Starinač K. Iron Deficiency Anemia in Children. Current Topics in Anemia. 2018.
16. World Health Organization, Nutrition for Health and Development, & World Health Organization Guideline. 2016.
17. Lozoff B, Jimenez E, Wolf A W. Long-term developmental outcome of infants with iron deficiency. The New England Journal of Medicine. 1991; 325: 687-694.
18. Kisiani I, Mbakaya C, Makokha A, et al. Assessment of iron status among preschool children (6 to 59 months) with and without malaria in Western Province, Kenya. The Pan African Medical Journal. 2015; 21: 62.
19. Lutter C K, Peña-Rosas J P, Pérez-Escamilla R. Maternal and child nutrition. The Lancet. 2013; 382: 1550-1551.
20. Abadi Mistru N. Nutrition -Sensitive Agricultural Intervention and Dietary Diversity: Empirical Evidence from Sweet Potato production in Northern Ethiopia (2018 Conference, July 28-August 2, 2018, Vancouver, British Columbia No. 275992). International Association of Agricultural Economists. 2018.

21. World Health Organization. Preventing and controlling anaemia through primary health care: a guide for health administrators and programme managers. Geneva: World Health Organization. 1989.

22. Jomaa L H, McDonnell E, Probart C. School feeding programs in developing countries: Impacts on children’s health and educational outcomes. Nutrition Reviews. 2011; 69: 83-98.

23. Christian, Evans, Conner, et al. Can a school gardening programme improve children’s diets? BMC Public Health. 2012; 12: 304.

24. Gibbs L, Staiger P, Johnson B, et al. Expanding children’s food experiences: the impact of a school-based kitchen garden program. Journal of Nutrition Education and Behavior. 2013; 45: 137-146.

25. Chege, Kimiywe, Ndungu. Influence of culture on dietary practices of children under five years among Maasai pastoralists in Kajiado, Kenya Int J Behav Nutr Phys Act. 2015; 12: PMC4597609.

26. Gebreweld A, Ali N, Ali R, et al. Prevalence of anemia and its associated factors among children under five years of age attending at Gugufu health center, South Wollo, Northeast Ethiopia. PLoS ONE. 2019; 14: 7.

27. Kisiangani I, Mbakaya C, Makokha A. Prevalence of Anaemia and Associated Factors Among Preschool Children (6-59 Months) in Western Province, Kenya. 2015; 1: 6.

28. Rifai R A, Nakamura K, Seino K. Decline in the prevalence of anaemia among children of pre-school age after implementation of wheat flour fortification with multiple micronutrients in Jordan. Public Health Nutrition. 2016; 19: 1486-1497.