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The magnitude and determinants of anaemia among refugee preschool children from the *Kebribeyah* refugee camp, Somali region, Ethiopia

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Background: Anaemia is a global public health problem affecting children from both industrialised and developing countries with major consequences for health, social and economic development. Although the burden of anaemia is high among refugee children due to their living conditions, its determinants are not yet clearly identified and documented in Ethiopia.

Objective: To assess the magnitude and contributing factors of anaemia among refugee preschool children of the *Kebribeyah* refugee camp.

Methodology: A cross-sectional study with an analytic component was conducted in the *Kebribeyah* refugee camp during March 2010. A total of 399 refugee children aged between 6 and 59 months were randomly selected and assessed for anaemia status using HemoCue® devices.

Results: The prevalence of anaemia was 52.4%. Most of the anaemic children, 36.6%, were classified as having moderate (Hb 7–9.9 gm/dL), followed by severe, 10.5%, (Hb < 7 gm/dL) while the remaining 5.3% had mild anaemia (Hb 10–10.9 gm/dL). The age of the child, paternal educational level, number of children younger than five years of age in the household, sharing/selling part of ration, inadequacy of ration stock, presence of diarrhoea, personal hygiene of the child, stunting and underweight were significantly associated with anaemia.

Conclusion: The purpose of this study was to demonstrate that anaemia is a severe public health problem among young refugee children and to document its major predisposing factors. In the *Kebribeyah* refugee camp, these included inadequate food rations, insufficient micronutrient composition, lack of provision of non-food items, selling and sharing of food rations, poor environmental sanitation, poor housing conditions, lack of nutrition/health education and disease (diarrhoea). A comprehensive nutrition service together with a holistic public health-focused approach to empower refugees to prevent the onset of anaemia by engaging in homestead small-scale food production for income generation and improving the integration and collaboration between beneficiaries, food donors and humanitarian aid organisations would be crucial in addressing the consequences of anaemia in the *Kebribeyah* refugee camp.

Keywords: anaemia, determinants, Ethiopia, Kebribeyah, magnitude, preschool, refugee

Introduction

Micronutrient deficiencies contribute about 7.3% of the total global burden of diseases. Deficiencies, particularly of iron and vitamin A, are frequently the major public health threat and are the main forms of micronutrient malnutrition, which collectively affect more than 4.5 billion people worldwide.¹

Anaemia is a global public health problem that affects populations in both rich and poor countries with major consequences for human health, as well as social and economic development. It affects all age groups, but is more prevalent in pregnant women and young children.² Dizziness, loss of appetite, weakness and fatigue (tiredness), negative effect on cognitive and psychomotor development, poor academic performance, and lethargy are among the adverse health effects of anaemia.³ Anaemia is estimated to affect more than 2 billion individuals worldwide (one in three children).¹ According to the WHO review of nationally representative surveys from 1993 to 2005, an estimated 47.4% of preschool children worldwide suffer from anaemia.²

Children in refugee camps and emergency areas are extremely vulnerable to iron deficiency anaemia and other micronutrient deficiencies.³ This is due to the inadequate food rations, insufficient micronutrient composition, limited access to health

services, unhealthy environment, poor feeding and caring practices, and lack of other specialised services needed by displaced individuals.⁴ In refugee camps of sub-Saharan Africa, especially in Kenya and Ethiopia, the prevalence of anaemia is among the highest in the world.⁵ A study done in Kakuma Refugee camp, Kenya, revealed an anaemia prevalence of 61.3% in children aged 6–59 months.⁶

A cross-sectional study (2003) conducted in a Burmese refugee camp among similar age groups reported that the prevalence of iron deficiency (ID), anaemia, and iron deficiency anaemia (IDA) was 85.4%, 72.0% and 64.9%, respectively.⁷ The 2008 UNHCR annual report on public health and HIV also showed that the prevalence of anaemia among refugee preschool children in the Dadaab camp of Kenya, and Nayapara and Kutupalong camps of Bangladesh was 71.7% and 47.5%, respectively.⁸ Another study carried out in 2001–2002 on protracted refugee camp dwellers in North and East Africa also documented levels of anaemia that ranged from 12.8% to 72.9% in children among the different camps.⁹

Several studies conducted in Ethiopia also showed high anaemia prevalence among refugee preschool children. For example, a study in the Fugnido, Shimelba and Teferiber refugee camps, Ethiopia, in 2008 reported a prevalence of 38.6%, 36.0% and 35.6%, respectively.¹⁰

However, the predisposing factors to anaemia have not been clearly identified or documented for refugee populations. This study aimed to identify the possible factors that predispose towards the onset and development of anaemia in order to support appropriate intervention strategies that would target refugee populations in the *Kebribeyah* refugee camp, Somali region, Ethiopia.

Methodology

A cross-sectional study with an analytic component was employed in the *Kebribeyah* refugee camp. Refugee children aged between 6 and 59 months were targeted, during March 2010. The camp is located in the *Kebribeyah* town and was established in 1991 in the Somali region, Ethiopia, after the fall of the Siad Barre regime. The area is situated approximately 685 km east of the capital city, Addis Ababa. The camp is located between longitude 9°6'N and latitude 43°10'E and at an altitude of 1686 metres above sea level. The climatic condition of the camp is characterised as arid and semi-arid. The refugee camp has one primary school and high school, respectively. It has also one health centre and piped water facility. The camp is arranged into nine sections and has 1 791 households, all of which are occupied, in houses that are made of plastic sheeting or other covering such as ragged bed sheets/clothes. An estimated 16 354 refugees resided in the camp at the time of the study. Of these, 8 355 (51.1%) and 7 999 (48.9%) were females and males, respectively. Approximately 3 272 (20.0%) of the entire refugee population were under 5 years of age, of which girls constituted 1672 (51.1%) and the remaining 1 600 (48.9%) were boys. The majority of the refugees had been in the camp for nearly 18 years.¹¹

The sample size was calculated based on two assumptions. Based on the first assumption, the prevalence of underweight, estimated at 47%¹² with a 95% confidence level and with a 3% precision, yielded a sample size of 1 063 households. The second assumption, based on an anaemia prevalence of 36%¹⁰ with a 95% confidence level and with a 3% precision, gave a total of 983 households. However, the sample size calculated based on the first assumption was considered as a representative sample size for this study. Nonetheless, as the total number of households was less than 5 000 it required some finite population correction; adding an estimated 10% non-response yielded a final sample size of 734 individuals. In order to obtain the representative sample from the *Kebribeyah* refugee camp, these 734 individuals were selected from 734 households by considering only one child from each household.

These 734 households with under-five-year-old children were sampled randomly using a random number table. The selected under-five-year-old children were enrolled for various nutritional assessments. Anthropometric (weight and length/height) measurements were performed on all children, whereas, due to budgetary constraints, haemoglobin was measured only in every other child (thus 60%; $n = 440$) of the sampled children were recruited for the anaemia study.

Households with under-five-year-old children who lived in the camp during the time of the study, and had families/caregivers who were mentally and physically capable of being interviewed, were randomly selected through simple random sampling. Since newcomer/new arrival refugees were not allowed to live in the camp and were taken to other newly established camps, no discrimination was made in selecting households in terms of the duration that the individuals had lived in the camp as most of the families had resided in the camp for about 18 years, and all

under-five-year-old children were born and had grown up in the camp. However, the refugees who were resident in the camp but unavailable, for whatever reason(s), were included in the study if they came back to the camp during the data-collection period and after their identity was confirmed by the Administration for Refugee and Returnee Affairs (ARRA) workers. Where households had more than one under-five-year-old child, only one child was randomly selected, using the lottery method, to exclude duplication of results. A total of 399 refugee preschool children who were present at the time of the study were assessed for various socio-demographic, maternal, child care and environmental health characteristics, as well as anthropometric measurements and anaemia status using a purpose-designed and pre-tested questionnaire.

Forty-two field enumerators were recruited from the health staff of *Kebribeyah* refugee camp and from the community health agents of the camp. All field workers received training on data-collection techniques for two days. The actual data collection was carried out for five consecutive days following the training. Data collectors were responsible for interviewing caregivers, filling in the questionnaire, and measuring and recording of anthropometric and haemoglobin measurements as well as calibrating the instruments. The enumerators collected data under close supervision of the team supervisors and principal investigator. Analysis for prevalence and severity of anaemia was done on a daily basis by the team supervisors and principal investigator, as was the checking of each completed questionnaire for the quality and completeness of the recorded information.

Weight was measured to the nearest 100 g, using Salter spring-type hanging scales (Zhezhong Weighing Apparatus Factory, Yongkang, China) with the child in minimal clothing. Prior to taking each measurement, the weighing scale with the culottes was adjusted to zero. When the child was restless and the pointer was oscillating, the midpoint of the oscillation was taken as the weight of the child by the measurer reading aloud the midpoint value on the scale. The measurements were then repeated by the data recorder for verification of the value. The average value was calculated and taken as the weight of the child. As a quality check, the weighing scales were tared using a standard 10 kg weight. Height/length was measured to the nearest 0.1 cm using a locally made length-board. Prior to data collection, the weight and height measuring instruments were subjected to quality tests in order to ensure their precision and accuracy.

The health workers among the trained enumerators were responsible for measuring haemoglobin using a HemoCue® photometer (HemoCue America, USA) in which finger prick blood samples were processed and the result explained to the caregivers immediately. The calibration of the HemoCue® machine was done on a daily basis using control cuvettes.

For enhanced data quality control, the HemoCue® was maintained and standardised by strictly following all manufacturer's instructions and recommended procedures. Prior to taking blood samples, the child's finger was cleaned with a disinfectant wipe and the first 2–3 drops of blood were wiped away, before filling the micro cuvettes in one continuous process to ensure that there were no air bubbles in the micro cuvettes. Excess blood was wiped off of the micro cuvettes before placing them into the cuvette holder to take the readings. If contaminated with blood, the analyser was turned off (for at least 15 min before reusing) and cleaned, pulling the cuvette holder out of the loading position before cleaning. Replacing the batteries

immediately upon indication that they were running low was another measure taken as part of the quality control protocol.

Data were cleaned manually and then entered into Epi Info™ (CDC, Atlanta, GA, USA) software version 3.5.1. The nutritional data (height and weight measurements) were converted into nutritional indices using the WHO 2006 child growth standards.¹³ The presence of stunting, underweight or wasting was denoted using height-for-age, weight-for-age, and weight-for-height, where z-scores below minus 2 served as cut-off point. The data were then exported to SPSS® version 16.0 (SPSS Inc, Chicago, IL, USA) for further analysis. Basic descriptive statistics were reported to give a situational overview, bivariate analysis identified the factors associated with anaemia while multivariate logistic regression analysis was performed to control for the potential confounding effects of the various factors. The bivariate and multivariate analyses were expressed as crude odds ratio (COR) and adjusted odds ratio (AOR), respectively. A *p*-value of < 0.05 was considered statistically significant. The principal investigator conducted the statistical analysis of the data.

Ethical issues

The ethical review committee of the School of Public Health, Addis Ababa University, approved the study for ethical and scientific merit. The United Nations High Commission for Refugees and the ARRA also provided their written support for undertaking the study. In addition, informed consent was obtained with a thumbprint or signature on the consent form from the respective caregiver, after the nature of the study was fully explained to them in their local languages. The rights of families/caregivers to withdraw from the study at any time was explained and respected.

Results

Of the 440 subjects recruited for anthropometric and haemoglobin measurement, 399 had finger-prick blood testing and complete data, giving a 90.7% response. Lack of interest, fear of pain and unavailability of the refugees during the data-collection period were the common reasons for non-response.

For each month, all family members, including children, received food rations with wheat constituting the primary staple food for all households. The households also received blended food, vegetable oil, pulses, sugar and salt. An average ration size of 16 kg wheat, 1.5 kg blended food, 1.5 kg of pulses, 900 g vegetable oil, 450 g of sugar and 150 g of salt was given per person per month. The blended food given to the refugees was not fortified. The amount and composition of the daily ration (Table 1) were derived from both self-reports of the quantity of

specific commodity received during the last distribution and from the camp statistics sheet. Nutritional values were derived using calculating sheets developed by Médecins Sans Frontières: Nutrition guidelines, 1st edition, Paris, February 1995.¹⁴

The mean haemoglobin level among children was 10.7 g/dL (standard deviation pSD] ± 1.9), with a range of 5.3–14.6 g/dL, while the percentage of children with a haemoglobin level that was below 11 g/dL was 52.4% (*n* = 209). The prevalence of stunting, underweight and wasting among those children who had a haemoglobin measurement were 29.3%, 26.8% and 10.3%, respectively (Figure 1). Anaemia was prevalent in all age groups but was highest among children aged 18–29 months; it was divided into mild (8.5%), moderate (48.1%) and severe (16.3%), the latter two categories being significant (*p* < 0.05; Table 2). There was no gender difference in the severity of moderate and severe anaemia.

The factors that were associated with anaemia (Table 3) included the age of the child, paternal education, number of under-five-year-old children in the household, not consuming the entire ration by the household, inadequacy of food ration stock, presence of diarrhoea, personal hygiene of child (number of baths a child took), stunting and underweight. However, child gender, family size, exclusive breast feeding, duration of breast feeding, tea consumption, use of cows milk, weight-for-height (wasting), antenatal care, use of family planning methods, acute respiratory infection (ARI), toilet facility and household water consumption were not associated with anaemia.

The prevalence of anaemia among children of fathers with no education was almost two times higher than of those children with

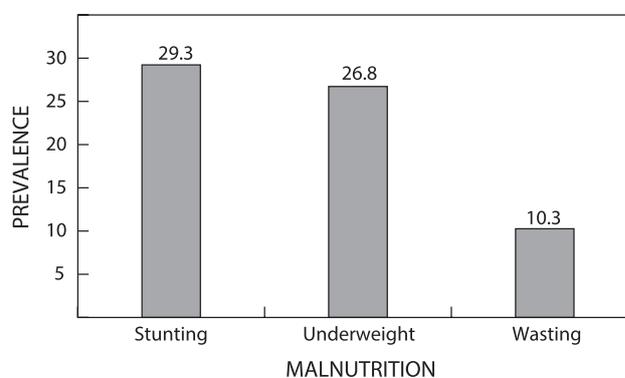


Figure 1: Prevalence of under-nutrition among refugee preschool children in the Kebribeyah refugee camp, Somali region, Ethiopia

Table 1: Food ration estimates and components distributed to refugees in Kebribeyah Refugee camp, Somali Region, Ethiopia

Ration component	Monthly ration (kg/person/month)	Daily ration (g/person/day)	Energy (kcal)	Protein (grams)	Fat (grams)
Wheat	16	533	1758.9	65.6	8.0
Blended food	1.5	50	180	8	0.65
Vegetable oil	0.9	30	265.5	0	30
Pulses	1.5	50	167.5	11	0.75
Sugar	0.45	15	60	0	0
Iodised salt	0.15	5	0	0	0
Total	20.5	683	2431.9	84.6	39.4
Minimum requirements			2100	52.5	40
Percentage supplied by ration			115.8%	161.1%	98.5%

Table 2: Prevalence of anaemia among refugee preschool children by sex and age in the *Kebribeyah* refugee camp, Somali region, Ethiopia

Child characteristics	No. (%)	Mild anaemia (Hb 10–10.9 gm/dL)		Moderate anaemia (Hb 7–9.9 gm/dL)		Severe anaemia (Hb < 7 gm/dL)	
		No (%)	OR (95% CI)	No (%)	OR (95% CI)	No (%)	OR (95% CI)
		Sex					
Male	216 (54.1)	12 (5.6)	0.9 (0.5, 1.9)	84 (38.9)	1.0 (0.9, 2.1)	24 (11.1)	0.9 (0.7, 1.9)
Female	183 (45.9)	9 (4.9)	1	62 (33.9)	1	18 (9.8)	1
Age (in months)							
6–17	74 (18.5)	5 (6.8)	3.1 (0.7, 33.1)	30 (40.5)	1.1 (0.8, 2.3)	10 (13.5)	6.4 (0.8, 52.0)
18–29	129 (32.3)	11 (8.5)	3.5 (1.0, 46.9)	62 (48.1)	1.3 (1.1, 3.7)*	21 (16.3)	8.0 (1.1, 61.2)*
30–41	86 (21.6)	3 (3.5)	2.3 (0.9, 31.3)	25 (29.1)	1.9 (0.7, 3.1)	9 (10.5)	4.8 (0.6, 39.2)
42–53	68 (17.0)	1 (1.5)	0.6 (0.1, 11.0)	24 (35.3)	1.0 (0.6, 3.0)	1 (1.5)	0.6 (0.0, 10.1)
54–59	42 (10.5)	1 (2.4)	1	5 (11.9)	1	1 (2.4)	1

*Significant at $p < 0.05$.

fathers who had basic education (OR = 1.8, 95% CI 1.1–2.8); two times higher among children who had diarrhoea than their counterparts (OR = 2, 95% CI 1.2–3.3); three times higher among children who took baths once per week than those who took baths daily (OR = 3, 95% CI 1.6–5.8); and 1.5 times higher in households having two or more under-five-year-old children (OR = 1.5, 95% CI 1.1–2.3) than their counterparts. Similarly, the prevalence of anaemia was 1.6 times higher in households that did not consume the entire ration (either shared their ration with neighbours/other families or sold part of it) than those households that consumed the entire ration (OR = 1.6, 95% CI 1.1–2.5); and 1.9 times higher in households where the duration of the ration lasted 15–20 days compared with those in which the ration lasted longer, 26–30 days (OR = 1.9, 95% CI 1.2–3.1). Stunted and underweight children were also, respectively, 2.2 times (OR = 2.2, 95% CI 1.4–3.4) and 2.5 times (OR = 2.5, 95% CI 1.5–3.9) more likely to be anaemic than those who were well nourished.

However, in the multivariate analysis, only child age, number of under-five-year-old children in the household and underweight (weight-for-age) retained their association with anaemia. Regression analysis including the subject characteristics demonstrated that the risk of anaemia was higher for children who were underweight and in lived households that had two or more under-five-year-old children. Underweight children were 2.2 times more likely to be anaemic than their counterparts (AOR = 2.2, 95% CI 1.2–4.1). Results of the adjusted odds ratio showed the factors associated with anaemia by controlling for confounding factors.

Discussion

Iron deficiency anaemia is considered to be the most prevalent micronutrient deficiency worldwide, especially among refugee populations.⁷ According to WHO's classification, anaemia levels of $\geq 40\%$ ¹⁵ are an indication of a severe public health problem. The study thus revealed anaemia as a severe public health problem in *Kebribeyah* refugee camp. The overall prevalence of anaemia observed among the study participants was 52.4%, which, when further disaggregated by degree of severity into mild, moderate and severe, that is, 5.3%, 36.6% and 10.5%, respectively, indicate lower prevalence of mild anaemia at the population level.

The low prevalence of mild anaemia established in this study is likely to be due to anaemia's asymptomatic nature; often it escapes detection. Second, the family or caregivers, in an effort to gain better medication and additional benefits for their children, probably prefer to present, for haemoglobin

assessment, the child/children who appear sick (to them) rather than those who look healthy. This is consistent with findings of a study done in Tanzania which found a similar distribution, with lower prevalence of mild anaemia: mild (16.5%), moderate (33%) and severe (27.7%) anaemia.¹⁶

The prevalence of anaemia from this study is higher when compared with that reported in studies conducted in Fugnido (38.6%), Shimelba (36%) and Teferiber (35.6%) refugee camps in Ethiopia¹⁰ as well as in other camps, Nayapara and Kutupalong in Bangladesh, where the prevalence was 47.5%, respectively.⁸ On the other hand, the prevalence of anaemia in the present study was lower when compared with the prevalence in Burmese camps (72%) and the Kakuma and Dadaab refugee camps in Kenya, which were 61.3% and 71.7%, respectively, and Palestinian refugee camps (67%).^{6–8,16} Overall, the findings of this study are within the range of those reported for protracted refugee camp surveys in 2001 from North and East Africa, where prevalence ranged from 12.8% in *Kebribeyah*, Tindouf (35.3%), Kakuma (61.3%), Fugnido (62.9%), to 72.9% in Acholpii.⁹

The increasing prevalence of anaemia from 12.8% in 2001 to 52.4% in the current study might be attributable to insufficient food ration, sharing/selling part of food ration, presence of diarrhoea, poor personal hygiene of the child, nutritional problems such as stunting (29.3%) and underweight (26.8%). The other important factors were child age and the presence of high number of under-five-year-old children in households that increase food competition or sharing among young children.

The study also found that 8.5%, 48.1% and 16.3% of children aged 18–29 months had mild, moderate and severe anaemia, respectively, suggesting that late infancy and early childhood (particularly children between 6 and 36 months) are high-risk periods for iron deficiency. This might be due to rapid growth spurts leading to increased iron requirements that are not met by dietary intake.^{7,17}

The present findings are consistent with the Palestinian refugee camp findings, where anaemia was associated with occurrence of diarrhoea, stunting, and child age.¹⁸ Other comparable study findings in Burmese refugee camps show that anaemia was significantly and consistently associated with child age, short duration of ration stock (does not last until the next ration delivery), and paternal illiteracy,⁷ underlining the importance of providing adequately iron-fortified rations and paternal education.

Table 3: Factors associated with anaemia among refugee preschool children in the Kebribeyah refugee camp, Somali region, Ethiopia

Factor	Anaemia No. (%)	Crude OR (95% CI)	Adjusted OR (95% CI)
Child sex			
Male	120 (55.6)	1.3 (0.9, 2.0)	1.3 (0.9, 2.0)
Female	89 (48.6)	1	1
Child age (in months)			
6–17	45 (60.8)	7.8 (3.0, 19.8)*	6.4 (2.3, 17.4)*
18–29	94 (72.9)	13.4 (5.5, 33.0)*	13.5 (5.3, 34.1)*
30–41	37 (43)	3.8 (1.5, 9.4)*	3.9 (1.5, 9.9)*
42–53	26 (38.2)	3.1 (1.2, 8.0)*	3.4 (1.3, 8.9)*
54–59	7 (16.7)	1	1
Mother had formal education			
Yes	19 (39.6)	1	1
No	188 (55.6)	1.8 (1.0, 3.3)	0.2 (0.0, 3.0)
Father had formal education			
Yes	42 (42)	1	1
No	161 (56.5)	1.8 (1.1, 2.8)*	0.6 (0.4, 1.0)
Number of under-5 children			
1	79 (45.7)	1	1
2	102 (56.4)	1.5 (1.1, 2.3)*	1.7 (1.1, 2.6)*
>= 3	28 (62.2)	2.0 (1.1, 3.8)*	2.3 (1.1, 4.7)*
Mother had antenatal care (ANC) visit			
Yes	204 (52.3)	1	1
No	3 (50)	0.9 (0.2, 4.6)	1.0 (0.2, 5.1)
Household consumed all the ration			
Yes	108 (47.2)	1.6 (1.1, 2.5)*	1.4 (0.9, 2.2)
No	101 (59.4)	1	1
Duration ration lasted			
15–20 days	93 (57.8)	1.9 (1.2, 3.1)*	1.6 (1.0, 2.8)
21–25 days	72 (54.1)	1.6 (1.0, 2.7)	1.4 (0.8, 2.5)
26–30 days	44 (44.1)	1	1
Child received Vitamin A Supply (VAS)			
Yes	180 (53.6)	1	1
No	8 (50)	0.9 (0.3, 2.3)	0.9 (0.3, 2.8)
Child consumed tea			
Yes	115 (53.5%)	0.9 (0.6, 1.3)	1.0 (0.6, 1.4)
No	94 (51.1%)	1	1
Child had diarrhoea			
Yes	55 (65.5)	2.0 (1.2, 3.3)*	1.0 (0.6, 1.7)
No	142 (50.5)	1	1
Child had Acute Respiratory Infection (ARI)			
Yes	24 (63.2)	1.7 (0.8, 3.3)	1.5 (0.7, 3.3)
No	165 (49.4)	1	1
Amount of water household consumed			
< 20 L	6 (50)	1.0 (0.2, 5.2)	1.0 (0.2, 5.3)
20–40 L	62 (61.4)	1.6 (1.0, 2.6)	1.6 (1.0, 2.5)
>40 L	144 (49.3)	1	1

(Continued)

Table 3: (Continued)

Factor	Anaemia No. (%)	Crude OR (95% CI)	Adjusted OR (95% CI)
Number of baths child took per week			
Once	54 (70.1)	3.0 (1.6, 5.8)*	1.7 (0.8, 3.6)
Twice	44 (47.8)	1.2 (0.7, 2.1)	0.7 (0.4, 1.4)
Every other day	73 (51.0)	1.3 (0.8, 2.3)	0.9 (0.5, 1.7)
Daily	38 (43.7)	1	1
Stunting			
Yes	77 (65.8)	2.2 (1.4, 3.4)*	1.5 (0.9, 2.6)
No	132 (46.8)	1	1
Underweight			
Yes	73 (68.2)	2.5 (1.5, 3.9)*	2.2 (1.2, 4.1)*
No	136 (46.6)	1	1
Wasting			
Yes	23 (56.1)	1.2 (0.6, 2.3)	0.8 (0.3, 1.7)
No	186 (52)	1	1

Note: Antenatal care (ANC); Vitamin A Supply (VAS); Acute Respiratory Infection (ARI)

*Significant at $p < 0.05$.

The study results are also consistent with those of a study that was conducted in the rural areas of Indonesia, which documented that current diarrhoea or recent history of diarrhoea was significantly associated with anaemia. Those considered anaemic were more likely to be younger, stunted, underweight, and from families with low paternal/ maternal education,¹⁹ which underscores the need for appropriate nutrition service and public health intervention measures. The study results also indicate that the food ration that is consumed at the household level is inadequate in terms of affording protection to the majority of young refugee children against developing iron deficiency anaemia.

Iron deficiency anaemia is a significant public health problem and is amongst the most prevalent micronutrient deficiencies in most refugee populations including children. This is due to their living conditions, which predisposes them to different micronutrient deficiencies.^{7,9,15,20} In addition, anaemia is a nutritional disorder that is compounded by insufficient micronutrient supply in food rations, inadequate food ration, poor nutrition services, high burden of communicable diseases and poor environmental sanitation.^{3,6,8,21,22} Thus the situation requires both nutrition-specific and nutrition-sensitive interventions, hence the need for due attention by food aid agencies and camp management in ensuring adequate iron and overall nutrient content in food ration and optimising nutrient utilisation through prevention of conditions such as diarrhoea and other illnesses. A combination of food ration fortification with micronutrients, especially iron, iron supplementation for special cases, and early diagnosis of anaemia to mitigate against onset of anaemia would be a good composite strategy, particularly if supported by early treatment. Other indirect interventions, such as empowering refugees to engage in homestead small-scale food production by providing suitable lands (soils), and the introduction of cash transfer interventions to stimulate income generation such as trade would help in reducing shortages of food supply among refugee populations.

The achievement of these aims requires a supportive policy environment and collaboration amongst key stakeholders who should include beneficiaries (refugees), food aid agencies and refugee camps' management. Responsible utilisation of food rations for improved nutrition should be instilled and tracked through implementation research.

Improving environmental health conditions (such as provision of adequate supply of safe and adequate water, prevention of contamination of food and water, personal hygiene and use of toilet) to prevent diarrhoea, and provision of non-food items (such as shoes, blankets and clothes) to curb selling part of rations would most likely contribute towards reduced anaemia prevalence. Improved multi-sectoral collaboration among different organisations involved in refugee camps is also likely to be useful in militating against the multi-faceted causes of anaemia.

The study was restricted to the under-five-year-old children in the refugee camp, and as such anaemia of varying severity among refugee school-aged children in this setting needs to be investigated. Other limitations of the study include the cross-sectional study design, which does not address seasonality; neither does it establish causal relationship. Furthermore, an assessment that would explore why the prevalence of mild anaemia occurred with the lowest frequency might also lead to a better understanding of social and environmental factors that predispose to anaemia.

In conclusion, the present study confirms that anaemia among young refugee children is a significant public health problem in the *Kebribeyah* refugee camp in Ethiopia and that it basically coexists with underweight. A number of factors are associated with anaemia among young refugee children but the three key contributing factors are the age of the child, the number of children under the age of five years in a household and being underweight. Direct nutrition interventions to address deficits in dietary intake and optimisation of nutrient utilisation, propped up with nutrition-sensitive interventions are recommended. Application of appropriate well-designed implementation research to assess utilisation of rations by households and to establish ways of detecting anaemia at the earliest stages of onset for pre-planned effective action is also recommended.

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