Review article

Common micronutrient deficiencies among food aid beneficiaries: Evidence from refugees in Ethiopia

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Abstract

Background: Ethiopia is amongst the African countries that have received significant food aid. Nonetheless, the common micronutrient deficiencies among food aid beneficiaries are not well documented.

Objective: To find out the common micronutrient deficiencies among food aid beneficiaries in the country based on available data.

Methods: Literature search was made from the Internet, peer-reviewed journals, various agency reports, national survey data, books, handouts and Masters in Public Health (MPH) theses since the year 2000. Micronutrient status information for food aid beneficiaries came mainly from studies in refugee/emergency settings, with very few published studies found documenting the nutritional status of non-emergency situations. The information obtained from the above mentioned sources was grouped under the major common micronutrient deficiencies in tabular forms that included the site where the study was conducted, subjects included in the assessment, sample size used, indicators used (clinical, biochemical and dietary) and the findings.

Results: Vitamin A and iron deficiencies were the most prevalent micronutrient deficiencies among food aid beneficiaries. Other probable deficiencies prevailing were zinc, vitamins thiamine, riboflavin, niacin folate, cyano-cobalamine, ascorbic acid vitamin D and calcium because of the low intake of dairy products and meat. In some cases, food aid rations provided insufficient quantity and quality of micronutrients, particularly when food aid was a major food source. Some logistic and budgetary constraints were reported as an impediment to assess the micronutrient status of the beneficiaries in field settings.

Conclusion: Although the most important deficiencies are identified, the information cannot be generalized to all beneficiaries as their conditions and the types of food donated in emergencies could vary from place to place and therefore the findings should be interpreted contextually. The logistic problem documented underlines the need for seeking collaboration with research institutes and other government agencies whose interests fall in such undertakings. Furthermore, simple dietary assessment, anthropometric measurements and examination of clinical signs need to be considered in the future to assess the major micronutrient deficiencies. [*Ethiop J Health Dev.* 2011;25(3):222-229]

Introduction

Most sub-Saharan African (SSA) countries including Ethiopia suffer from both macro- and micronutrient deficiencies, caused by the interaction of poor or inadequate diets and infectious diseases. These factors stem from poverty, low agricultural production, deeply entrenched food habits, and recurrent droughts and associated famine (1–3). In nearly all SSA countries, deficiencies in vitamin A (VA), iron, iodine, and other micronutrients such as zinc and calcium are common in the general population. VA deficiency is endemic throughout Africa and is the leading cause of childhood preventable blindness, and contributory factors to child morbidity and mortality from infectious disease (4). Iron deficiency may be the most prevalent micronutrient deficiency in emergencies because organic iron is seldom part of cereal-based food aid diets and such aid foods are high in fiber content (5). Other causes of anemia commonly reported may be due to other nutrient deficiencies as well as parasitic infestations. Zinc deficiency is assumed to be widespread in areas where diets lack animal based foods (6). Less than a quarter (20.0%) of the world's population is at risk for zinc deficiency (ZnD), and most of them are from the south-east Asian countries (7). Risk for ZnD is likely in most developing countries as the staple foods often supply inadequate bio-available dietary zinc (8).

In most SSA countries information on macronutrients and selected micronutrient deficiencies are available. Likewise the status of both macro and micronutrient deficiencies that include VA, ID, iodine and folic acid is available among vulnerable groups countrywide; nonetheless, there is little or hardly any information on the status of major micronutrient deficiencies status among food aid beneficiaries (i.e people in shelters reported to be receiving food aid from any source during emergencies) in Ethiopia. An understanding of the micronutrient status of food aid beneficiaries is important since a large proportion of food aid is channeled through emergency programs in which food aid is often serving as primary sources of food with frequently limited access to other source of food or essential micronutrients. Micronutrient deficiency is more likely among those beneficiaries mainly depending on food aid to meet their nutritional needs (8). According to the very recent national survey report on food aid, the proportion of household members benefiting from emergency food rations was 12.0% while that of those from a safety net program and targeted supplementary food programs (TSF) were 17.0% and 7.0% respectively, with slightly higher proportion of beneficiaries for rural areas. Almost

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half (45.0%) of the rural households reported a member participating in a public works program. The proportion of households that reported a member receiving direct support was 7.0% only (9).

Generally, food aid rations tend to consist primarily of some grains with a small portion of fortified food like a corn-soya blend. On the basis of the very extensive review made by Natalie and several other authors, food aid rations provide insufficient micronutrients like riboflavin, vitamin C and calcium in part due to the insufficient total quantity of food (10-12). While in non-emergency food aid programs like food for work, the food provided is a supplement to the normal diet and essentially does not fulfill all nutrient needs (11, 12). This literature review was therefore undertaken to fill the gap through literature searches and provide evidence based information on common micronutrient deficiencies among food aid beneficiaries.

Methods

A retrospective review was made to identify the common nutrient deficiencies among food aid beneficiaries in Ethiopia based on the search of the available literature. In this over 40 documents were reviewed during the period of January to June 2011. The documents reviewed ranged from cross-sectional surveys, Randomized Controlled Trials (RCT), observational/case studies, prevalence data for common micronutrient deficiencies from the Demographic and Health Survey reports-2005, recent national nutrition survey reports, MPH theses and articles published in peer reviewed journals and magazines.

A number of agencies identified involved in food aid distribution were the World Food Program, World Vision, Catholic Relief Secretariat, Africare, Save the Children, Micronutrient Initiative (MI), UNICEF, and other nongovernmental and governmental agencies. Books, the Internet (PubMed) and handouts that have addressed the issue in both developed and developing countries were also reviewed. Journal articles were accessed using databases, references cited in reports and other published sources.

The information obtained from these various sources were grouped under the major common micronutrient deficiencies in tabular forms that included the site where the study was conducted, the design employed in the assessment, the subjects enrolled during the assessment, sample size used, indicators used including the findings and presented in subsequent sections. The indicators used in the assessment of the common micronutrient status were clinical, biochemical and in some cases dietary and are summarized in the tables and discussed here after.

Results

The available data reviewed suggest significant deficiencies in the major micronutrients (MND) that included vitamin A, iron and other minerals but not iodine among the food aid beneficiaries/refugees. The mean serum retinol concentration status among preschool children aged 6-59 months in Fugnido and Kebribeyah camps was 0.74 (±0.2) and 0.88 (±0.2) µmol/L, respectively. Likewise the prevalence rates among Somali refugee children were also higher than the aforementioned 2 camps and exceeded the WHO cutoff points set to declare the presence of public health problems (Table 1). Anemia appears to be a severe public health problem among the food aid beneficiaries' children with prevalence rates ranging from 12.8-62.9%. Prevalence varies from camp to camp making it difficult to generalize to all food aid beneficiaries. Anemia represents a severe public health problem among children under the age of five years for the general population as well as the food aid beneficiaries. Available information on iron deficiency anemia (IDA) of reproductive age women showed a mild public health problem (Table 2).

The 2001 surveys conducted among adolescent refugees in camps revealed a high median urinary iodine concentration (UIC) of 1074 µg/L in Fugnido and 254 µg/L in Kebribeya suggesting that iodine deficiency (ID) is not a public health problem. The converse was found in school children and reproductive women of the general population who had a severe public health problem in this regard (Table 3).

Table 1: **Vitamin A deficiency among food aid beneficiaries' children (refugees) and the general population in Ethiopia, 2000-2011**

Study sites	Study design	Study Subjects	Sample Size	Indicators (SRC)	Prevalence (%)
Refugee Camps					
• Fugnido	CSS	6-59 months	124	<0.7µmol/L <0.35-0.70	43.6 40.3
• Kebribeyah	CSS	6-59 months	151	<0.7µmol/L <0.35-0.70	20.5 19.9
Country wide	CSS	6-59 months	23, 148	Night blindness Bitot's Spots	4.3-7.3 2.2
• Children (general)		6-59 months	996	<0.7 µmol/L	37.6

CSS=Cross-sectional study; SRC=Serum retinol concentration

Table 2: **Anemia among food aid beneficiaries' children (refugees) and general population in Ethiopia, 2000-2011**

Study sites	Study design	Study Subjects	Sample Size	Indicators	Prevalence (%)
Fugnido refugee camp					
• Children	CSS	6-59 months	202	Hb<11.0g/dL	62.9
				Hbs<7.0 g/dl	9.4
				sTfR (cut-off>8.5 mg/L)	65.0
• Adolescent	CSS	10-19 years old	157	Hb<11.0 g/dL	62.9
• Non-pregnant women	CSS	20-55 years old	98	Hb<11.0 g/dL	14.2
Kebribeyah refugee amp					
• Children	CSS	6-59 months	210	Hb<11.0 g/dL Hb< 7.0 g/dL	12.8 1.0
				sTfR cut-off>8.5 mg/L	22.6
Country wide	CSS	6-59 months	4139	Hb<11.0 g/dL	54.0
• Children (general population)				Hb<7.0 g/dL	4.0
• Women (general population)	CSS	15-49 years	970	Hb<11.0 g/dL	30.4
				SF (<50µ/L)	50.1
				IDA (Hb<11 g/dl+(SF<50µ/L)	18.1

CSS=Cross-sectional study; Hb=Hemoglobin; SF=serum ferritin; sTfR=Receptor-soluble transferrin

Table 4 shows the other MNDs prevailing among refugees and internally displaced persons in the country and neighboring countries. The main deficiencies were the B-group vitamins; ascorbic acid, vitamin D, zinc, calcium and selenium. Although no data were found on folic acid deficiency among refugees in Ethiopia, a recently published report by the author indicated two-third of the reproductive aged women had either severe or marginal folate deficiencies with significant regional variations. Zinc deficiency is documented as a prevailing problem as it is evidenced from stunted mothers from Arsi zones. Likewise low plasma zinc concentrations in 72.0% were documented among pregnant women in rural Southern Nations Nationalities and People region and the refugees cannot be exceptional. In 1993, 40 cases of beriberi were reported among refugees in the country. The number of refugees at risk is unclear, making it difficult to assess the magnitude of the public health problem. Although riboflavin deficiency is more prevalent in areas where few animal sources of food are consumed, no reports of riboflavin deficiency among refugees were found in the literature searched. Pellagra has been reported in refugee and internally displaced persons exclusively reliant upon maize in a neighboring country, but no recent reports to this effect were found in Ethiopia. Although low plasma B_{12} concentrations have been documented in rural Kenyan schoolchildren and in Zimbabwe, no information was found in Ethiopia during the review. Though cases of scurvy were reported in 1993 and 1994 there were no recent reports found during the review period. Even though no published reports of rickets in refugees were found, there were sporadic cases of rickets in children from the southern region of the country. In the same region, risk of inadequate dietary intake of calcium in 74.0% of 99 pregnant women was documented. On the basis of the cross-sectional Kenyan study, serum selenium deficiency (<85 µg/L) was reported in 11.0% women living with HIV Type 1 in the general population, and similar problems could also exist in the country when considered the current prevalence of HIV.

Table 5 provides the summary regarding the nutritional properties of common food aid commodities. As shown in the table, the food aid content is wheat seed, wheat flour, corn-soya blended, vegetable oil, dried skimmed milk and lentils. Prevalence of deficiencies in vitamin A and iron are likely among those depending exclusively on food rations to meet their nutritional needs given that animal source foods and fresh fruits and vegetables are lacking.

Table 3: **Urinary iodine excretion and goiter status of food aid beneficiaries' (refugees) and general population in Ethiopia, 2000-2011**

Study sites	Study design	Study subjects	Sample size	Indicators	
				(mean UIE)	Goiter rate
Refugee camps	CSS	Adolescents (11-15 years)	124	1074	1.3 (VGR)
• Fugnido					
• Kebribeyah	CSS	Adolescents (11-15 years)	151	254	1.3 (VGR)
Country wide					
• Children (GP)	CSS	6-59 months	10,998	-	35.8 (TGR)
• Women (GP)	CSS	15-49 years	11,101	-	27 (TGR)

CSS=cross-sectional study; GP=General population; UIE=urinary iodine excretion; VGR=visible goiter rate; TGR=Total goiter rate

Table 4: **Other micronutrient deficiencies documented in food aid beneficiaries (refugees)/general population in Ethiopia and some neighboring countries, 2000-2011**

Study sites	Type of deficiency	Study design	Study Subjects	Sample Size	Indicators	Prevalence (%)
Country wide • Ethiopia	Folic acid	CSS	WCB	1155	SFA ≤ng/ml (severe) SFA ≤ng/ml (marginal)	46.0 21.2
Pocket studies • SNNPR	Zinc	CSS	Pregnant Women	20	Plasma zinc Dietary zinc	72.0
• Arsi zone	Zinc	RCT	5-11 months	200	Breast Milk zinc (low zinc concentration)	NI
• Kenya & cote D'Ivore	Beriberi	Observational	Refugees	Outbreak Cases (n=40)	Presence of single case suggests PHB	Unclear recurrent status
• Kenya	Riboflavin	CSS	School children	555	Clinical (Presence of cases)	No information in Ethiopia
• Zimbabwe in maize staple zones	Niacin	NI	Refugees	NI	Clinical >>	1.5%
• Kenya	Vitamin B_{12}	NI	School children	NI	Serum B12 (pmol/L) <12 pmol/L (severe) 125 NI 221 pmol/L(marginal)	No information in Ethiopia 30.5 37.7
• Ethiopia	Scurvy	NI	Refugees	NI	Clinical	No recent figures among prisoners (0.2%)
• Kenya	>>	NI	Refugees	NI	Clinical	No recent figures
• Ethiopia	Rickets	NI	Children	NI	Clinical	No recent figures
• Ethiopia (SNNPR)	Calcium	CSS	WCB	99	Dietary (<800 mg)	74.0
• Nigeria	Selenium	NI	WCB	318	Serum selenium (<85µ/L)	11.0

CSS=Cross NI sectional study; WCB=women of childbearing age; RCT=Randomized placebo controlled study; SFA=serum folic acid; SNNPR=South Nation and Nationalities people Region; PHB=public health problem; NI=No information

Table 5: **Nutritional content per 100g for commonly distributed food aid commodities in Ethiopia, 2000-2011**

Food aid commodities	Energy (kcal)	Protein (g)	Fat (g)	Ca (mg)	Iron (mg)	Vitamin A (µg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Folate (µg)	Vitamin C
Wheat	330	12.3	1.5	36	4	0	0.3	0.07	5	51	0
Wheat flour	350	11.5	1.5	29	3.7	0	0.28	0.14	4.5	U	0
Corn Soya	380	18	6	513	18.5	500	0.65	0.5	6.8	U	40
Vegetable Oil	885	-	100	0	0	0	0	0	0	0	0
Dried skimmed milk	360	36	1	1257	1	1500	0.4	1.55	1	50	0
Lentils	340	20	0.6	51	9	0	0.5	0.25	2.6	U	0

U=Unknown;
Sources: UNHCR, 1999 (38);FAO 199(39)

Discussion

In the present review, the results obtained are not readily comparable due to use of different indicators and sampling frames and study populations with dissimilar local circumstances. Many agencies have not been documenting the micronutrient status of refugees/internally displaced persons because of the impediment coming from a number of logistical and budgetary constraints in field settings (6-8). Data on the nutritional status of refugee populations are often limited to anthropometric data and obvious clinical signs, making it difficult to assess the micronutrient status of these populations. On the other hand, reports of some agencies like WFP/UNHCR contain information on the annual nutritional status of refugees but these are limited to anthropometry and rarely assesses micronutrient status as such (6-9). Likewise NGOs providing food aid collect data on anthropometry and morbidity but they lack the assessment of the MN status of the beneficiaries while some GOs include in their assessment process anthropometric data screening for anemia and night blindness in some beneficiaries, and rarely assess other MND and seldom share their findings with stakeholders. Most nutritional surveys usually targeted the general public and preschool children who may or may not be receiving food support (6-15) and the results are not commonly published or widely disseminated. Despite the limited data available, it was possible to identify the major MN deficiencies among the beneficiaries.

According to the review, vitamin A deficiency (VAD) is generally high and indicates significantly higher levels of deficiency in refugee camps (16, 17). Food aid beneficiaries' children seem to manifest higher figures than the general population based on night blindness, though caution should be used in comparing prevalence rates from the two populations (18-20). Anemia represents a severe public health problem among children under the age of five years, for the general population as well as the food aid beneficiaries (21-24). Available information on iron deficiency anemia of reproductive age women showed a mild public health problem (23-27). Although no data were found on folic acid deficiency (FD) in the beneficiaries, the national study conducted by the author among women of reproductive age, 46.0% had severe FD (≤ 4 ng/mL) while 21.2% had marginal FD (> 4–6.6 ng/mL) with unequal prevalence across the country (28). On the other hand, excessive iodine intake appears to be problematic based on high urinary levels in the food aid beneficiaries suggesting ID is not a major public health problem in the two camps (29). This finding however needs to be interpreted cautiously as the picture in the general population is quite the converse (30-32). Other probable micronutrient deficiencies prevailing among refugees and internally displaced persons dependent on food aid are the B-group vitamins, ascorbic acid, vitamin D, calcium and selenium, as these mineral and vitamins are largely found in animal based foods (12). It is apparent that food rations distributed are often low in animal source foods and the situation calls for some consideration by the food aid agencies. Although it would be somewhat difficult to draw definitive conclusions regarding the MN status of the beneficiaries due to the limited data available, it appears that VAD and anemia are the major problems but not ID. Another MND prevalent is zinc deficiency as pointed out by Umeta et al (33) and Abebe et al (34) and these were attributed to low dietary intake of zinc and animal source food (33, 34). Although one might expect the presence of beriberi among refuges, no recent evidence of it was documented in the country; however, there were some cases from a neighboring country among displaced population in 2000 (4, 35) and the presence of at least one confirmed clinical case is considered a mild public health problem (36). Riboflavin deficiency is more prevalent in areas where few animal sources of food are consumed (37) and in most displaced persons and refugees, such a problem however was not found in the reviewed documents. On the other hand, pellagra has been reported among refugee and internally displaced persons exclusively reliant upon maize (4, 38) but no single case was documented in the country during the review process. Likewise, there was no information found on vitamin B_{12} in the country during the review though low plasma B_{12} concentrations have been documented in some of the neighboring African countries like in rural Kenyan schoolchildren and Zimbabwe (38, 39). Scurvy is documented in populations reliant on food aid for long periods of time without access to fresh vegetables and fruit (4, 37). Nonetheless, in the current review there are no recent evidences documented other than the 1993 and 1994 incidents (39). Rickets occurs mainly from inadequate vitamin D intake and lack of exposure to sunshine and the available evidence showed rickets to prevail in children and was attributed to inadequate dietary intake of calcium, and the condition could either be similar or worse among the food aid beneficiaries as well (40). Serum selenium deficiency was reported in Kenyan women who were sero-positive for HIV Type 1 (41). The problem could likely prevail in the country given the magnitude of HIV, and underlines the need for some more studies to prove the assertion.

Conclusion and Recommendations

- Although some important information on the MNDs were generated, the data cannot be generalized to all beneficiaries as their conditions differ and the food donated also varies from place to place and therefore, the findings should be interpreted contextually.
- The ongoing practice of WFP in conducting annual surveys among food aid beneficiaries using anthropometric indicators is a good practice that has to be encouraged even though it has some limitations.
- While some NGOs collect anthropometric data and screen for anemia and night blindness, very few assess deficiencies of other major micronutrients. One practical solution to solve this issue it to seek

collaboration of government agencies and universities to resolve their financial and logistic constraints.

- Other important practical actions to consider include to doing simple dietary assessment like food frequency questionnaires which can help to estimate intake of both macro and micronutrients and share the outcome of the assessment with all stakeholders.

References

1. Haidar J, Haile Mariam D, Demisse T, Kloos H. Food, diet and nutrition. In Berhane Y, Haile Mariam D, Kloos H (eds).The Epidemiology and Ecology of Health and Disease in Ethiopia. Addis Ababa, Shama Books 2006; 90–109.
2. Haidar J, Demissie T, Helmut C. Profile of vitamin A deficiency in Ethiopia during the last 50 years. Sight and life magazine (International) 2008; 1: 25-31.
3. Berhane Y, Haile Mariam D, Kloos H (eds). The Epidemiology and Ecology of Health and Disease in Ethiopia. Addis Ababa, Shama Books 2006.
4. Weise P, Benoist B. Meeting the challenges of micronutrient deficiencies in emergency-affected populations. *Proc Nutr Soc* 2002; 61: 251-257.
5. Kennedy G, Nantel G Shetty P. The scourge of "hidden Hunger": global dimensions of micronutrient deficiencies. Food Nutrition and Agriculture 2003; 32: 8-16.
6. Wuehler SE, Peerson JM, Brown KH. Use of national food balance data to estimate the adequacy of zinc in national food supplies: Methodology and Regional Estimates. *Public Health Nutr* 2005; 8(7): 812-819.
7. Gibson RS. Zinc Nutrition in Developing Countries. Nutr Res Rev 1994; 7:151-173.
8. World Food Program United Nations High Commission for Refugees. Acute malnutrition in protracted refugee situations: A Global strategy. Rome: UNHCR/WFP 2006.
9. Ethiopian Health and Nutrition Research Institute. Nutrition Baseline Survey Report for the National Nutrition Program of Ethiopia, Ethiopian Health and Nutrition Research Institute, Addis Ababa 2010.
10. WFP. Food Assistance to Sudanese, Somali, and Eritrean Refugees. Available at: http://www.wfp.org/operations/current_operations/project_docs/101272.pdf. Accessed 18 July 2010.
11. WFP and UNHCR. Report of the Food Consumption Survey in Dadaab and Kakuma Refugee Camps. Nairobi: World Food Program 2004 March.
12. Natallie D, Neuman CG. Micronutrient deficiencies in food aid beneficiaries: A review of seven African countries. African Journal of Food, Agriculture, Nutrition and Development 2009;9(4)990-1018.
13. WFP. Outcome evaluation study of targeted supplementary food (TSF) program in Ethiopia, World Food Program, Ethiopia, June 2009.
14. WFP. Outcome evaluation study of targeted supplementary food (TSF) program in Ethiopia, World Food program, Ethiopia, 2008.
15. World Vision Canada Vitamin A Add-on Program: Final Survey and Program Report. Mississauga, Ontario: World Vision Canada; 2005.
16. WHO. Indicators for Assessing vitamin A deficiency and their application in monitoring and evaluating intervention programs. Geneva: World Health Organization; 1996.
17. Seal AJ, Creeke PI, Mirghani Z, Abdalla F, McBurney RP, Pratt LS, et al. Iron and vitamin A deficiency in long-term African refugees. *J Nutr* 2005; 135(4): 808-813.
18. Administration for Refugee and Returnee Affairs, United Nations High Commission for Refugees and World Food Program 2003 Joint Assessment Mission. Rome: World Food Program; 2003 7 to 14 July 2003.
19. Sommer A, Davidson FR. Assessment and Control of vitamin A deficiency: The Annecy Accords. *J Nutr* 2002; 132(9 Suppl): 2845S-2850S.
20. Demissie T. Ahmed A. Yared M. Haidar J, Melaku U. Demographic and health related risk factors of sub-clinical vitamin A deficiency in Ethiopia. *Journal of Population Health and Nutrition* 2009; 5(4):666-679.
21. Haidar J, Nelson M, Abiud M,Gonfa A. Daily versus weekly iron supplementation and prevention of iron deficiency anemia in lactating women. *East Afr Med J* 2003; 80(1):11-16.
22. Haidar J, Nelson M, Abiud M, Gonfa A. Malnutrition and iron deficiency anaemia in urban slum communities form Addis Ababa, Ethiopia. *East Afr Med J* 2003; 80(4):191-94.
23. Haidar J, Rebeca P. Iron deficiency anemia is not a rare problem among women of reproductive ages in Ethiopia: A community-based cross-sectional study. *BMC Blood Disorder* 2009; 9:7doi:10.1186/1471-2326-9-7.
24. Haidar J. Prevalence of anemia, deficiencies of iron, folic acid and their determinants in Ethiopian women. *J Health Popul Nutr* 2010;28(4):359-368.
25. WHO. Iron deficiency anemia: Assessment, prevention, and control: A guide for program managers. Geneva: World Health Organization; 2001.
26. Central Statistical Agency, ORC Macro Ethiopia Demographic and Health Survey 2005. Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro; 2006.
27. Mason J, Bailes A, Beda-Andourou M, Copeland N, Curtis T, Deitchler M, et al. Recent trends in malnutrition in developing regions: Vitamin A deficiency, anemia, iodine deficiency, and child underweight. *Food Nutr Bull* 2005; 26(1): 59-108.
28. Haidar J. Melaku U. Rebecca P. Prevalence of Folate deficiency in Ethiopia. *S Afr J Clin Nutr* 2010; 23(3):132-137.

29. Seal AJ, Creeke PI, Gnat D, Abdalla F, Z Mirghani. Excess dietary iodine int*ake in long-term African refugees.* Public Health Nutr 2006; 9(1): 35-39.
30. WHO, UNHCR, International Federation of Red Cross and Red Crescent Societies and WFP. The Management of Nutrition in Major Emergencies. World Health Organization, Geneva. 2000.
31. WHO. Assessment of iodine deficiency disorders and monitoring their elimination: A guide for program managers. 2nd edition. World Health Organization, Geneva. 2001.
32. Abuye C, Urga K. Determinants of Iodine Deficiency in School Children in Different Regions of Ethiopia. *East Afr Med J* 2000; 77(3): 133-137.
33. Abebe Y, Bogale A, Hambidge KM, Stoecker BJ, Arbide I, Teshome A, et al. Inadequate intakes of dietary zinc among pregnant women from subsistence households in Sidama, Southern Ethiopia. *Public Health Nutr* 2007: 1-8.
34. Umeta M, West CE, Verhoef H, Haidar J and JG Hautvast. Factors associated with stunting in infants aged 5-11 months in the Dodota-Sire District, Rural Ethiopia. *J Nutr* 2003; 133(4): 1064-1069.
35. WHO. Thiamine deficiency and its prevention and control in major emergencies. Geneva: World Health Organization; 1999.
36. United Nations Administrative Committee on Coordination/Sub-Committee on Nutrition (ACC/SCN) Third Report on the World Nutrition Situation. Geneva: ACC/SCN; 1997.
37. WHO and FAO. United Nations guidelines on food fortification with micronutrients. World Health Organization, Geneva. 2006.
38. Siekmann JH, Allen LH, Bwibo NO, Demment MW, Murphy SP Neumann CG. Kenyan school children have multiple micronutrient deficiencies, but increased plasma vitamin B-12 is the only detectable micronutrient response to meat or milk supplementation. *J Nutr* 2003; 133(11 Suppl 2): 3972S-3980S.
39. United Nations ACC/Sub-Committee on Refugee Nutrition Information System (Rnis), Report No. 25 on the nutrition situation of Refugee and displaced populations. Geneva: ACC/SCN; 1998.
40. Belachew T, Nida H, Getaneh T, Woldemariam D, Getinet W. Calcium deficiency and causation of rickets in Ethiopian children. *East Afr Med J* 2005; 82(3): 153-159.
41. Baeten JM, Mostad SB, Hughes MP, Overbaugh J, Bankson DD, Mandaliya K, et al. Selenium deficiency is associated with shedding of HIV-1 infected cells in the female genital tract. *J Acquir Immune Defic Syndr* 2001; 26(4): 360-364.