COMPREHENSIVE NUTRIENT GAP ASSESSMENT (CONGA)

FINDINGS FOR CHILDREN 6–23 MONTHS IN **ETHIOPIA**

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WHY IS CONGA NEEDED?

After a child's first six months, nutrient requirements exceed what breastmilk alone can provide. To meet growing nutrient needs and ensure proper growth and development, along with breastfeeding, infants should be introduced to nutrient-dense solid, semi-solid, or soft foods at six months of age (1,2). Despite this, only 14% of infants and young children aged 6–23 months in Ethiopia consume a diet meeting the minimum recommended number of food groups (3), increasing their risk of micronutrient deficiencies and growth faltering.

Identification of nutrient and dietary gaps during the complementary feeding period is essential to inform policies and programs designed to improve child health and nutrition. However, nationally-representative data specific to young children are usually only available for select nutrients and infrequently collected. Lower quality evidence can help fill data gaps, particularly when multiple sources point to the same nutrients of concern or dietary issues. Yet decision makers have little guidance on how to locate and interpret the evidence to identify the magnitude and significance of nutrient gaps in child diets, given the wide range of indicators used, diversity of data sources and population characteristics, and differences in severity of associated health outcomes. A Comprehensive Nutrient Gap Assessment (CONGA) meets this need by collating the evidence and rating the burden of nutrient gaps[1] and certainty of evidence. This brief summarizes the main food and micronutrient gaps identified from a CONGA conducted in Ethiopia and key policy and programmatic actions required. There are several other nutrients that may be limited in the diets of young children, including omega-3 fats (e.g., DHA) and specific essential amino acids (i.e., the quality of protein). The CONGA method can be extended in the future to these and others as more data becomes available.

KEY MESSAGES

- Based on available evidence, **iron**, **zinc**, **iodine**, **vitamin A**, and **calcium** are micronutrients of concern among young children in Ethiopia.
- **More research** is required on **other nutrients**, like folate and vitamin C, which may also represent important gaps in young children's diets in Ethiopia.
- The best food sources of micronutrients of concern in Ethiopia are **chicken liver** (iron, zinc, vitamin A), **beef liver** (iron, vitamin A), **beef** (iron, zinc), **Ethiopian kale** (iron, vitamin A, calcium), **eggs** (zinc and vitamin A), **lentils** (iron), **milk** (calcium, vitamin A), and **groundnuts** (zinc).
- **More research** is needed to understand the primary barriers to consuming these foods, such as limited **availability**, **accessibility**, **affordability**, or **desirability**.
- Ethiopia needs to improve coverage of **adequately iodized salt**.
- **Biofortification**, **fortification**, and **supplementation** can also help fill gaps for micronutrients of concern, particularly where food insecurity, social norms, palatability, and desirability make sufficient consumption from accessible diverse foods infeasible.

1 Micronutrients investigated via CONGA include iron, vitamin A, zinc, calcium, iodine, Vitamin B_1 (thiamine), niacin, vitamin B_{12}, vitamin B_6, folate, and vitamin C.

HOW DOES CONGA WORK?

We reviewed and summarized findings from nationally representative and quality sub-national surveys, grey literature, and journal articles related to infant and young child feeding practices, micronutrient deficiencies, dietary intake, household consumption and expenditure, and the food supply. Experts reviewed this evidence to rate the burden of gap (none, low, moderate, or high) and certainty of available evidence (low, moderate, or high) for 11 micronutrients commonly lacking in young children's diets.[2] We then identified the most nutrient-dense, locally available food sources of micronutrients of concern based on food composition data and local price data.

WHAT DID CONGA FIND IN ETHIOPIA?

Based on available evidence, micronutrients of concern[3] during the complementary feeding period in Ethiopia are **iron**, **zinc**, **iodine**, **vitamin A**, and **calcium** (Table 1). The annex describes specific evidence considered for all ratings. We summarize consequences of deficiencies in micronutrients of concern and justifications for their ratings below.

Table 1. Nutrient gaps and evidence ratings for children 6–23 months in Ethiopia[4]

	Iron	Zinc	Iodine	Vit A	Ca	Folate	Vit C	Vit B_{12}	Vit B_1	Niacin	Vit B_6
Gap burden	High	High	High	Mod	Mod	Mod	Mod	Low	Low	Low	None
Evidence certainty	High	High	High	High	Mod	Low	Low	Low	Low	Low	Low

Iron

Iron deficiency is a primary cause of anemia and can result in cognitive impairment, decreased work productivity, and death (4). Data reveal low availability of iron in the national food supply and inadequate iron consumption during the complementary feeding period, and recent national surveys indicate high prevalence of iron deficiency and anemia in young children.

Zinc

Zinc deficiency in children is associated with poor health, increased risk of diarrhea, and impaired cognitive and motor development (5,6). Data indicate very low availability of zinc in the national food supply, and both consumption and modeling data suggest high levels of inadequate zinc intake during the complementary feeding period. Recent national surveys indicate high prevalence of zinc deficiency in young children.

Iodine

Iodine deficiency has severe consequences, including growth and cognitive impairment, goiter,[5] and death (7). Biochemical data and estimates of goiter prevalence indicate a large gap in intake. While recent national assessments of household salt iodization suggest coverage is relatively high, quality of iodization needs substantial improvement.

2 Iron, zinc, iodine, vitamin A, calcium, folate, vitamin C, vitamin B_{12}, thiamine, niacin, and vitamin B_6.

3 Micronutrients of concern are those with at least a moderate burden gap *and* moderate certainty of evidence. There may also be other important nutrient gaps, but evidence is limited.

4 Ca, Calcium; Mod, Moderate; Vit, Vitamin.

5 Abnormal enlargement of the thyroid gland, typically caused by iodine deficiency.

Vitamin A

Vitamin A deficiency has severe consequences, even with mild deficiency, including night blindness, increased susceptibility to infections, and death (8). Data reveal very low availability of vitamin A in the national food supply and inadequate consumption of vitamin A-rich foods by infants and young children. Recent national estimates of vitamin A deficiency indicate a problem of moderate public health significance for young children in Ethiopia.

Calcium

Calcium deficiency increases risk of rickets, but the broader health implications of deficiency in young children are poorly understood (9). Data on availability of calcium in the national food supply and intake of calcium and calcium-rich foods in young children suggest calcium needs are widely unmet in children and the broader population. However, no biochemical data was available to indicate the level of deficiency.

Other micronutrients

Burdens of folate, thiamine, niacin, and vitamins C, B_6, and B_{12} gaps were based on low-certainty evidence. More data is needed to generate higher quality evidence on the burden of these nutrient gaps in Ethiopia, particularly for folate and vitamin C.

WHAT CAN BE DONE TO ADDRESS THESE GAPS?

Recommended actions to address each nutrient gap in Ethiopia are summarized in Table 2. The best complementary food sources of micronutrients of concern are **chicken liver** (iron, zinc, vitamin A), **beef liver** (iron, vitamin A), **beef** (iron, zinc), **Ethiopian kale** (iron, vitamin A, calcium), **eggs** (zinc, vitamin A), **lentils** (iron), **milk** (calcium, vitamin A), and **groundnuts** (zinc) (Table 2). More research is needed to understand the primary barriers to consuming these foods, like limited availability, accessibility, affordability, or desirability. **Biofortified** and **fortified** foods (including fortified complementary foods), **point-of-use fortification** products like micronutrient powders and lipid-based nutrient supplements, and supplements can also help fill nutrient gaps. **Continued breastfeeding** rates in Ethiopia are high, yet evidence suggests a possible decline since 2005 (3). Efforts to maintain continued breastfeeding rates should be prioritized to help fill iodine, vitamin A, and calcium gaps. Improving the **quality** of **pregnant** and **lactating women's diets** can also improve their children's nutrition through improved birth outcomes, nutrient transfers at birth, and more nutrient-dense breast milk (10). While coverage of iodized salt is high, **quality** of **salt iodization** needs improvement.

Table 2. Recommended actions to address complementary feeding gaps in Ethiopia

Nutrient gap	Recommended actions to increase dietary intake
Iron	• Assess and ensure availability, accessibility, affordability, and desirability of natural foods rich in iron, including **chicken liver**, **beef liver**, **Ethiopian kale**, **beef**, and **lentils**, as well as **iron-biofortified** and **fortified** foods. • Ensure **adequate coverage** and **quality** of large-scale **iron fortification**. • Consider **micronutrient powders** and/or **supplementation**.[6]
Zinc	• Assess and ensure availability, accessibility, affordability, and desirability of natural foods rich in zinc, including **beef**, **chicken**, **chicken liver**, **groundnuts**, and **eggs**, as well as **zinc-biofortified** and **fortified** foods. • Ensure **adequate coverage** and **quality** of large-scale **zinc fortification**. • Consider **micronutrient powders** and/or **supplementation**.
Iodine	• Maintain high rates of **continued breastfeeding**. • Ensure availability of, access to, and use of **adequately iodized salt**.
Vitamin A	• Maintain high rates of **continued breastfeeding**. • Assess and ensure availability, accessibility, affordability, and desirability of natural foods rich in vitamin A, including **beef liver**, **chicken liver**, **carrots**, **Ethiopian kale**, **pumpkin**, **eggs**, **fresh milk**, and **cottage cheese**, as well as **vitamin A-biofortified** and **fortified** foods. • Ensure **adequate coverage** and **quality** of large-scale **vitamin A fortification**. • Consider **micronutrient powders** and/or continued **supplementation**.[7]
Calcium	• Maintain high rates of **continued breastfeeding**. • Assess and ensure availability, accessibility, affordability, and desirability of natural foods rich in calcium, including **Ethiopian kale** and **milk**, as well as **calcium-fortified** foods. • Consider calcium-containing **micronutrient powders** and/or **supplementation**. • Collect **biochemical** and **dietary data** in young children.

6 Some potential risks have been associated with supplemental iron in children with adequate iron status. Products with low iron doses may be more appropriate in this context.

7 Vitamin A toxicity can occur if excess is consumed over long time periods. Vitamin A supplementation programs should review status and dietary intake regularly.

CONCLUSION

There is clear evidence of significant complementary feeding gaps in iron, zinc, iodine, vitamin A, and calcium in Ethiopia. There may also be other important gaps, but evidence is limited. The best food sources of micronutrients of concern that are relatively available in Ethiopia are chicken liver, beef liver, beef, Ethiopian kale, eggs, lentils, milk, and groundnuts. These foods need to be available, accessible, affordable, and desirable as complementary foods to be consumed in adequate quantities by young children. Other approaches to fill gaps for micronutrients of concern should also be considered, including biofortification, fortification, and supplementation, particularly where food insecurity, social norms, palatability, and desirability make sufficient consumption from accessible diverse foods infeasible. Continued breastfeeding should be encouraged and can help young children consume enough iodine, vitamin A, and calcium.

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ANNEX

Key evidence used to inform ratings[8]

Iron	High burden gap	High certainty evidence

Biochemical data: The 2014/15 NMS found that prevalence of iron deficiency in children 6–59 m was 18% as measured by serum ferritin ≤ 12 μg/L and 30% as measured by soluble transferrin receptor ≥ 4.4 mg/L. The same survey found prevalence of iron deficiency anemia to be 9% and 12% as measured by serum ferritin and soluble transferrin receptor, respectively, and prevalence of anemia 34% (1). The 2016 DHS found prevalence of anemia in children 6–59 m to be 57% (> 70% for children 6–17 m) (2).

Dietary data: According to DHS 22% of children 6–23 m consumed iron-rich foods in the past 24 h nationally in 2016 (up from 13% in 2011) (2,3).

Nutrient intake in children: A small 2010 study in two villages in the Gobalafto district in North Wollo found adequate iron intake for children 12–23 m (4). The 2011 national FCS found that 92% of children 6–35 m had inadequate iron intake (5).

Diet modeling: An Optifood analysis[9] using data from the 2011 national FCS for Tigray, SNNPR, Amhara, and Oromia found iron intake was between 24–52% of RNI for children 6–12 m but adequate in those 12–23 m (6).

Nutrient intake in WRA: Inadequate iron intake in 13% and excessive intake in 64% in the 2011 FCS (5).

Food supply nutrient availability: The amount of iron available in the food supply estimated to be inadequate for 59% of the national population in 2011 (7).

Zinc	High burden gap	High certainty evidence

Biochemical data: Prevalence of zinc deficiency (serum zinc < 70 μg/dL) in children 6–59 m was 35% in the 2014/15 NMS. The same survey also found deficiency of 34% in children aged 5–14 y and 34% in non-pregnant WRA (1).

Dietary data: 8% children 6–23 m consumed meat, fish, or poultry in the past 24 h nationally in the 2016 DHS (2).

Nutrient intake in children: A small 2010 study in two villages in the Gobalafto district in North Wollo found inadequate zinc intake for children 12–23 m (4). The 2011 national FCS found that > 95% of children 6–35 m in Tigray, SNNPR, and Oromia had inadequate zinc intake (no national estimate provided) (5).

Diet modeling: An Optifood analysis using data from the 2011 national FCS for Tigray, SNNPR, Amhara, and Oromia found inadequate zinc intake for all children 6–23 m (ranged between 22 and 60% of RNI) (6).

Nutrient intake in WRA: Inadequate zinc intake in 50% in the 2011 FCS (5).

Food supply nutrient availability: The amount of zinc available in the food supply estimated to be inadequate for 71% of the national population in 2011 (7).

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8 DHS, Demographic and Health Survey; FCS, Food Consumption Survey; h, hours; Mod, Moderate; m, months; NMS, National Micronutrient Survey; RNI, Reference Nutrient Intake; SNNPR, Southern Nations, Nationalities, and Peoples' Region; WRA, women of reproductive age (15–49 years); y, years.

9 Optifood is a linear modeling tool that uses habitual dietary data to analyze the nutrients a population obtains from local diets and develop realistic food-based and non-food-based recommendations to optimize nutrient adequacy. The model also determines 'problem nutrients', for which recommended intakes are difficult to meet based on local food patterns.

Iodine	High burden gap	High certainty evidence

Biochemical data: National prevalence of iodine deficiency (urinary iodine concentration < 100 µg/L) was 48% in children 5–14 y and 52% in WRA in the 2014/15 NMS (1).

Goiter prevalence: Prevalence of goiter was 62% among school children in 2015 in one zone in Northeastern Ethiopia (17) and 37% among school children in one district in Eastern Ethiopia in 2017 (9).

Household iodized salt coverage: 89% of households had iodized salt in 2016 (2). The 2014/15 NMS found that while 89% of households used iodized salt, only 34% used adequately (≥ 15 ppm) iodized salt (via rapid test kit analysis). When using the titration method, only 26% of households had adequately iodized salt (with high variability between regions) (1).

Vitamin A	Moderate burden gap	High certainty evidence

Biochemical data: National vitamin A deficiency (serum retinol < 0.7 µmol/L) in children 6–59 m was 14% in the 2014/15 NMS (1).

Dietary data: According to DHS 38% of children 6–23 m consumed vitamin A-rich foods in the past 24 h nationally in 2016 (up from 26% in 2011) (2,3).

Nutrient intake in children: A small 2010 study in two villages in the Gobalafto district in North Wollo found intake of vitamin A was < 50% of estimated needs in children 12–23 m (4). In the 2011 national FCS, intake in children 6–35 m varied regionally (5).

Diet modeling: An Optifood analysis using data from the 2011 national FCS for Tigray, SNNPR, Amhara, and Oromia did not identify vitamin A to be a problem nutrient for children 6–23 m (6).

Nutrient intake in WRA: Inadequate vitamin A intake in 82% in the 2011 FCS (5).

Food supply nutrient availability: The amount of vitamin A available in the food supply estimated to be inadequate for 90% of the national population in 2011 (7).

Supplementation: National vitamin A supplementation coverage for children 6–59 m was 45% in 2016 (an increase from 53% in 2011) (2,3).

Calcium	Moderate burden gap	Moderate certainty evidence

Dietary data: Animal milk was consumed by 16% of breastfed children 6–23 m[10] and cheese, yogurt, or other milk products by 25% of breastfed children 6–23 m in the past 24 h nationally in the 2016 DHS. Intake of both animal milk and other dairy products was higher in non-breastfed children, but this was based on a small population (2,3,10).

Nutrient intake in children: A small 2010 study in two villages in the Gobalafto district in North Wollo found calcium intake was < 50% of estimated needs in children 12–23 m (4).

Diet modeling: An Optifood analysis using data from the 2011 national FCS for Tigray, SNNPR, Amhara, and Oromia found calcium intake between 80–95% of RNI in most children 6–23 m (6).

Food supply nutrient availability: The amount of calcium available in the food supply estimated to be inadequate for 86% of the national population in 2011 (7).

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10 The estimates for consumption of animal milk are for all children 6–23 months, however, it is recommended that children under 12 months of age do not consume milks (flavoured or plain) (11).

Folate	Moderate burden gap	Low certainty evidence
Biochemical data: Prevalence of folate deficiency among non-pregnant WRA as measured by red blood cell folate < 340 nmol/L was 32% and as measured by serum folate < 6.8 nmol/L was 17% (1). **Diet modeling:** An Optifood analysis using data from the 2011 national FCS for Tigray, SNNPR, Amhara, and Oromia found inadequate folate intake for some children 6–23 m (ranged between 70–88% of RNI) (6). **Food supply nutrient availability:** The amount of folate available in the food supply estimated to be inadequate for 7% of the national population in 2011 (7).		
Vitamin C	**Moderate burden gap**	**Low certainty evidence**
Nutrient intake in children: A small 2010 study in in two villages in the Gobalafto district in North Wollo found median vitamin C intake well below estimated needs in children 12–23 m (4). **Food supply nutrient availability:** The amount of vitamin C available in the food supply estimated to be inadequate for 60% of the national population in 2011 (7).		
Vitamin B_{12}	**Low burden gap**	**Low certainty evidence**
Biochemical data: Vitamin B_{12} deficiency (serum B_{12} < 203 pg/ml) was 15% in WRA in the 2014/15 NMS (1). **Dietary data:** Among breastfed children 6–23 m, 8% ate meat, fish, or poultry, 16% consumed animal milk, 25% consumed other dairy products, and 17% consumed eggs in the past 24 h nationally in the 2016 DHS (2). **Diet modeling:** An Optifood analysis using data from the 2011 FCS for Tigray, SNNPR, Amhara, and Oromia found inadequate vitamin B_{12} intake for nearly all children (6). **Food supply nutrient availability:** The amount of vitamin B_{12} available in the food supply estimated to be inadequate for 40% of the national population in 2011 (7).		
Vitamin B_1 (thiamine)	**Low burden gap**	**Low certainty evidence**
Dietary data: 56% of breastfed children 6–23 m consumed grains (whole grains contain moderate amounts of thiamine) in the past 24 h nationally in the 2016 DHS (down from 66% in 2011 and 70% in 2005) (2,3,10). **Diet modeling:** An Optifood analysis using data from the 2011 national FCS for Tigray, SNNPR, Amhara, and Oromia found inadequate thiamine intake for children in some regions and was never lower than 66% of RNI (6). **Food supply nutrient availability:** The amount of thiamine available in the food supply estimated to be inadequate for 1% of the national population in 2011 (7).		

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Niacin	Low burden gap	Low certainty evidence
Dietary data: 8% children 6–23 m ate meat, fish, or poultry (best niacin sources) in the past 24 h nationally in the 2016 DHS (2). **Diet modeling:** An Optifood analysis using data from the 2011 national FCS for Tigray, SNNPR, Amhara, and Oromia found inadequate niacin intake for most children (ranged between 44 and 90% of RNI) (6). **Food supply nutrient availability:** The amount of niacin available in the food supply estimated to be inadequate for 2% of the national population in 2011 (7).		
Vitamin B_6	No burden	Low certainty evidence
Diet modeling: An Optifood analysis using data from the 2011 national FCS for Tigray, SNNPR, Amhara, and Oromia found adequate vitamin B_6 intake for nearly all children (6). **Food supply nutrient availability:** The amount of vitamin B_6 available in the food supply estimated to be inadequate for 0% of the national population in 2011 (7).		

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