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MINISTRY OF HEALTH-ETHIOPIA
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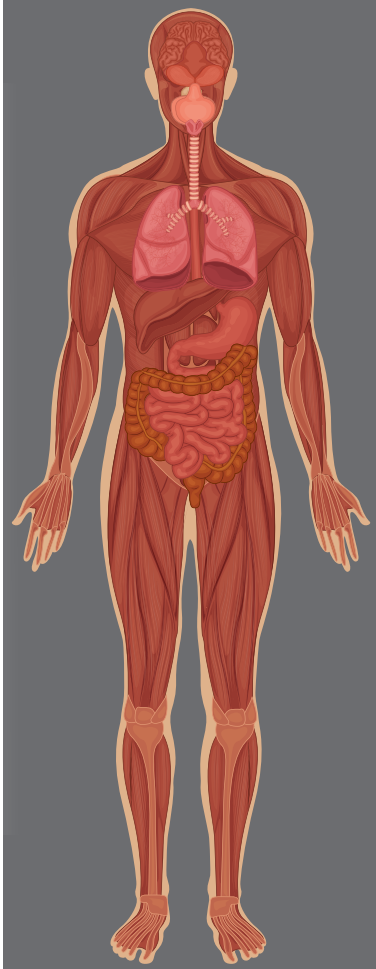
HEALTHIER CITIZENS FOR PROSPEROUS NATION

NATIONAL MICRONUTRIENT DEFICIENCY

Prevention and Control Guideline

VITAMIN A
supplementation



Addis Ababa, Ethiopia
2023

NATIONAL MICRONUTRIENT DEFICIENCY PREVENTION AND CONTROL GUIDELINE

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FOREWORD

The Ethiopian government has demonstrated its commitment to food and nutrition by developing the first Food and Nutrition Policy, its implementation plan (2021—2030), the Seqota Declaration, and Food System Road Maps to end all forms of malnutrition. The ten-year development strategy for the nation (2021-2030) has integrated food and nutrition into a number of sectoral policies and initiatives.

Micronutrient malnutrition is a major public health issue in both high- and low-income nations, though more common in developing countries. Treatments for micronutrient deficiencies are commonly used, easily available, and cheaply priced. The Ethiopian government's recently approval of the mandatory fortification of wheat flour and edible oil in addition to salt is a significant accomplishment in public health nutrition during the previous 15 years.

There is a need for nutrition service providers, universities, regulatory bodies, and researchers to obtain proper direction for implementing the national food and nutrition policy. The 2016 micronutrient deficiency prevention and control guideline has been modified into this guideline. The updated national and international recommendations on micronutrient treatments are incorporated into the revised guideline to support the execution of the national food and nutrition policy.

Five primary strategies are included in these recommendations: dietary diversity, dietary modification, bio-fortification, food fortification, and supplementation. They also include various disease prevention strategies and public health initiatives. This guideline will be reviewed and modified on a regular basis in order to remain current with new developments. This guideline is intended to assist managers and practitioners of health and nutrition programs in food and nutrition sensitive and specific implementing sectors with the design, implementation, and management of micronutrient deficient interventions.

To achieve the objectives of this guideline, commitment, accountability, coordination, linkages, monitoring and evaluation among different stakeholders and actors are crucial. Through collaboration and coordination of all stakeholders, I assure you that we will achieve our goal of ending all forms of malnutrition by 2030. We must prioritize and invest our resources on nutrition to ensure a healthy and productive nation.

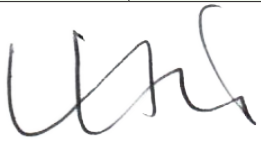
Lia Tadesse, MD, MHA
Minister of Health, Ethiopia

ACKNOWLEDGMENT

The Micronutrient Deficiency Prevention and Control Guideline was revised with the involvement of individuals and organizations from the national and regional food and nutrition implementing sectors, academia, research institutes, the privet sector, and development partners. The Ministry of Health would like to thank Nutrition International and UNICEF for their financial support in the revision of the guideline. Special acknowledgment goes to Nutrition International for hiring a consultant to support the revision process.

Nutrition Coordination office of the Ministry of Health, with assistance from sector ministries implementing the food and nutrition policy and strategy, as well as members of the Micronutrient Technical Working Group produced this guideline after a highly technical intensive consultative process. The Ministry of health appreciates their great work. Finally, I would like to thank all of the experts who contributed to the revision of the guideline.

Sr. No	Name of the participants	Organizations
	Dr. Meseret Zelalem	Ministry of Health
	Hiwot Darsene	Ministry of Health
	Abera Dibabe	Ministry of Health
	Gelila Zewdu	Ministry of Health
	Dr.Belaynesh Yifru	MoH/UNICEF
	Tesfaye Chuko	UNICEF
	Yirgalem Mengistu	Ministry of Health
	Gobane Dea	Ministry of Health
	Kidist W/Senbet	Ministry of Health
	Frehiwot Girma	Ministry of Health
	Dr.Kedir Taji	Haramaya University
	Sofinias Mindesil	Ministry of Industry /FBIRDC/
	Abel Ahmed	Ministry of Industry
	Birara Melese	MOH/Alive & Thrive/
	Nardos Birru	UNICEF
	Girma Mamo	Nutrition linternational
	Dr.Gudina Ejeta	Addis Ababa University
	Zerihun Assefa	Ethiopia Institute of Agricultural Researchs
	Abdurahman Seid	Ministry of Trade and Regional Integration



Hiwot Darsene
Lead Excutive Officer;
Nutrition Coordination Office

TABLE OF CONTENTS

CHAPTER FOUR:

CHAPTER FIVE:

CHAPTER 6:

CHAPTER 7:

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

ANC	Antenatal Care
EDHS	Ethiopia Demographic and Health Survey
FNS	Food and Nutrition Strategy
HIV	Human Immunodeficiency virus
HMIS	Health Management Information System
IDD	Iodine Deficiency Disorder
IFA	Iron Folic Acid
MOH	Ministry of Health
NI	Nutrition International
RBC	Red Blood Cell
RDA	Recommended Dietary Allowances
SAM	Severe Acute Malnutrition
SBCC	Social and Behavioral Change Communication
UNICEF	United Nations Children's Fund
USI	Universal Salt Iodization VAD
VAD	Vitamin A Deficiency
WASH	Water Sanitation and Hygiene
WHO	World Health Organization
WIFAS	Weekly Iron Folic Acid Supplementation
WRA	Women of Reproductive Age

DEFINITION OF TERMS

Bio fortification: is the process by which the nutritional value of food crops is enhanced by various methods including plant breeding, agronomic practices and modern biotechnological techniques.

Dietary modifications: are changes made during food preparation, processing, and consumption in order to increase the bio-availability of micronutrient and reduce micronutrient deficiencies in food at market, individual or household levels.

Enrichment: is the practice of adding micronutrients lost during processing back to a food product .

Food diversification: is the process of increasing the variety of food groups eaten at every meal or each day to ensure that the body is receiving enough nutrients.

Food quality: is a holistic concept that includes all factors that will influence acceptability of any product by consumers and includes positives attributes such as nutritional values, cultural values, color, taste , flavor, texture as well as negative attributes such spoilage, contamination, adulteration, and food safety hazards.

Food safety: refers to a process where food is free from hazardous contaminants and, when eaten, will not cause damage or disease to human beings. Food safety is the protection of consumers from injury or adverse health effects caused by consuming or handling spoilt, adulterated or badly stored foods. Generally, food safety describes the handling, preparation, transportation, and storage of food in ways that prevent food from hazards contaminants.

Foodborne disease: is any disease (acute or chronic) of an infectious or toxic nature caused by the consumption of food (including beverages) (WHO, 2008). Foodborne disease can be caused by microbial, chemical, or radiological hazards.

Fortification: is the practice of deliberately adding essential micronutrients, i.e. vitamins and minerals (including trace elements) into food vehicle so as to improve the nutritional quality of the food supply and provide public health benefits with minimal risk to health.

Legal minimum level (LmL): is the minimum amount of micronutrient that a fortified food must contain according to national laws, regulations and standards. This value is estimated by adding the intrinsic content of a micronutrient in the food to the selected level of fortification (WHO, 2008).

Market-driven fortification: applies to situations where a food manufacturer takes a business-oriented initiative to add specific amounts of one or more micronutrients to food items.

Universal fortification: refers to the addition of micronutrients to foods commonly consumed by the general public, such as cereal flour, edible oils, salt, condiments and milk.

Maximum tolerable level (MTL): is the maximum micronutrient content that a fortified food can present as established in food law, in order to minimize the risk of excess intake. It should coincide with or be lower than the safety limit.

Micronutrient: refers to chemical elements or substances (such as vitamins and minerals) found in the food that are require in minute amounts for growth, health, reproduction and other essential biological functions of a living organism. Most micronutrients except vitamin K and Vitamin D are not synthesized in the body, so they are essential.

Minimum fortification level (MFL): is the level calculated by reducing the Feasible Fortification Level by three standards deviations (or coefficients of variation) of the fortification process, in order that the average coincides with or is lower than the calculated Feasible Fortification Level.

Nutrient requirement: refers to the lowest continuing intake level of a nutrient that will maintain a defined level of nutrients in an individual for a given criterion of nutritional adequacy(WHO) or **The** amount of each nutrient needed in the human **body is called the nutritional requirement.** This is different for each nutrient and also varies between individuals and life stages [2].

Nutritious food: is food that, in the context of the individual who consumes it and where it is consumed , provides beneficial nutrients (e.g., vitamins, major and trace minerals, essential amino acids, essential fatty acids, dietary fiber) and minimizes potentially harmful elements (e.g., anti-nutrients, quantities of saturated fats and sugars). This definition thus encompasses both foods that can contribute to preventing undernutrition and those that can help prevent overweight/obesity and diet-related non communicable diseases (NCDs) (GAIN, 2017).

Standardization: is a set of written instructions used to consistently prepare a known quantity and quality of food for a specific location. A standardized recipe will produce a product that is close to identical in taste and yield every time it is made, no matter who follows the directions. Example: Plumpy'nut.

Supplementation:is the process of providing micronutrients in the form of tablets, capsules, liquid or powder, in order to increase an individual's dietary intake of these micronutrients and improve nutritional status.

Targeted fortification: refers to the fortification of foods designed for specific population subgroups, such as complementary foods for infants.

The estimatedaverage requirement (EAR): **a nutrient intake value that is estimated to meet the requirement of half the healthy individuals in a group**.

Universal salt iodization (USI): refers to the addition of iodine to all salt for both human and animal consumption.

EXECUTIVE SUMMARY

Nutritional deficiencies remain widespread in Ethiopia across the lifespan, with particularly detrimental effects on the health and well-being of women and young children. It is, therefore, critical to design a prevention and control mechanism to address micronutrient deficiency in the country.

This micronutrient deficiency prevention and control guideline is updated in accordance with key recommendations spelled by food and nutrition policy and strategy. The guideline is prepared in a comprehensive manner with the view to facilitating the effective and efficient implementation of not only short term interventions such as supplementation but also long term food based approaches.

Objective: The National Micronutrient Deficiency Prevention and Control Guideline aims to provide a clear guidance to enable effective strategies for addressing micronutrient deficiencies that can be implemented and scaled-up.

Implementation strategies and interventions: Key components of a micronutrient deficiency prevention program include dietary diversification, modifications, staple food fortification (industrial and bio), supplementation, and behavior change communication. The guideline includes both nutrition-specific and sensitive interventions. The guideline covers micronutrient topics including prevention and control of deficiencies of vitamin A, iron & folic acid, iodine, zinc, calcium and vitamin D. It also provides guidance for addressing emerging micronutrient problems such as magnesium, selenium thiamin, niacin and vitamin B12.

Delivery modalities: These interventions could be delivered through the existing service provision in the government system depending on the nutrition sensitive or specifica activities. The health sector provides the service in integration with other health facility or outreach services. Schools, youth centers and farmer training centers can be used as delivery platforms.

CHAPTER ONE:

INTRODUCTION

1.1. Background

Micronutrient deficiency is often referred to as “Hidden Hunger” as adequate food may be present, but the diet contains insufficient amounts of certain vitamins and minerals. Micronutrient deficiencies (MNDs) are now recognized as one component of the triple burden of malnutrition (MrimiID, Palmeirim et al. 2022) contributing to the global burden of disease. In Africa, mineral deficiency risks were highest for calcium (Ca) (54% of the population), followed by zinc(Zn) (40%), selenium(Se) (28%) (Joya, Anderb et al. 2014). In Sub-Saharan Africa (SSA), Deficiencies ofvitamin A, iodine, zinc, calcium and selenium were 53%, 36%, 66%, 75% and 62% respectively. Moreover, iron-deficiency anemia (IDA) affects 26 to 31% of women of reproductive age (Galani , Orfila et al. 2022). Hypertension in pregnancy is one of the causes of morbidity, long term disability and death among mothers and their babies. Worldwide, they account for approximately 14% of all maternal deaths, whereas in Latin America and the Caribbean, they contribute to approximately 22% of all maternal deaths (WHO 2021).

The consequences of MNDs could range from morbidity, disability, mortality and reduced physical growth and cognitive development (Robert , Allen et al. 2008). Pregnant and lactating women and children under 5 are at the highest risk of MNDs including iron, iodine, folate, vitamin A, and zinc (Bailey et al., 2015). All these MNDs are common contributors to poor growth, intellectual impairments, perinatal complications, and increased risk of morbidity and mortality. Moreover, MNDs are also significantly important in special situations such as emergency, military, internally displaced populations (IDPs) and refugee camps (Bailey et al., 2015).

The MNDs of public significance include deficiencies of vitamin A, iron, iodine, folate, zinc, calcium and vitamin D. Deficiencies of micronutrients such as magnesium, selenium thiamin, niacin and vitamin B12 are emerging micronutrient problems that have also public health significance (Bailey et al., 2015).

The global prevalence of vitamin A deficiency (VAD) in the form of night blindness for preschool-age children and pregnant women was 0.9 % and 7.8% respectively while the prevalence of serum retinol <0.70 Ŷmol/l for preschool-age children and pregnant women was 33.3%and 15.3% respectively (WHO 2009). In Ethiopia, evidence showed that the pooled prevalence of sub-clinical VAD among preschool children was 8.3% which is well above the threshold of 20% indicating its public health significance (Sahile, Yilma et al.

2022). Similarly, the prevalence of VAD among women of reproductive age (WRA) was 3.4% based on serum retinol concentration (EPHI 2016).

VAD is a leading contributor to morbidity and mortality among children under-five. Vitamin A deficiency impairs numerous functions and, as a result, can lead to many health consequences, to which infants, young children and pregnant women appear to be at greatest risk. Xerophthalmia is the most specific VAD, and is the leading preventable cause of blindness in children throughout the world. Anemia can result from VAD in children and women, likely due to multiple apparent roles of vitamin A in supporting iron mobilization and transport, and hematopoiesis. Preexisting VAD appears to worsen infections (WHO 2009).

Vitamin A supplementation (VAS) significantly improves survival, health and development of children aged 6-59 months. It is estimated that VAS has saved 167,563 to 376,030 child lives between 2005—2019 in Ethiopia (Laillou, Baye et al. 2021). In June 2022, the national standard council of Ethiopia endorsed mandatory edible oil fortification with vitamin A and vitamin D (CES 2022).

Iron deficiency is one of the most common MNDs worldwide affecting an estimated 2 billion people (Bailey , West Jr et al. 2015;Zimmermann and Hurrell 2007). Although there have been interventions, the prevalence of anemia remains very high among Ethiopian WRA (23%) and in under-five children (56.9%) (EDHS 2016).

IDA is a major cause of maternal and newborn mortality and a leading cause of premature birth and low birth weight. It also impairs cognitive development and has substantial health and economic costs, and contributes to impaired school performance, and decreased productivity (Ford and Stein 2016).

The percentage of women taking iron supplements for 90 days or more was 11%. During the same period, the percentage of women who did not take any iron supplements during pregnancy was 40 %((EDHS 2019).

Iodine deficiency disorders (IDDs) remain high in all regions worldwide and affect populations at all stages of economic development. The global total goiter prevalence (TGP) in the general population was 15.8%. Based on the survey data from 192 WHO member states, 36.5% (285.4 million) of school age children are at risk of iodine deficiency (Andersson, Takkouche et al. 2005). An estimated 31.5% (266 million) of school-age children have insufficient iodine intake (de Benoist, McLean et al. 2008). In Ethiopia, the prevalence of iodine deficiency among school age children, with mean urinary iodine concentration below the cut-off, was 48%. Among women of reproductive age, the prevalence of iodine deficiency was 52% (EPHI 2016). A pooled prevalence of iodine deficiency during pregnancy (68.8%) (Laillou, Baye et al. 2021) was above the threshold (≥ 30%) for severe public health problem (WHO 2007), indicating that children born to those mothers will have some form of mental deficits.

Universal salt iodization (USI) is the most practical strategy to reduce iodine deficiency globally (Bailey, West Jr. et al. 2015). The Ethiopian government also endorsed mandatory salt iodization legislation in 2011. Accordingly , the proportion of adequately iodized salt coverage at market and household levels reached more than 88% in 2018 from 26% in 2015 (EPHI 2018). The percentage of households exposed to excess iodine intake which is above the standard (40 mg /kg of iodine) was 25% (EPHI, 2022).

The prevalence of folate deficiency was >20% in most lower income countries but was typically <5% in higher income countries (Rogers, Cordero et al. 2018). In Ethiopia, the prevalence of severe form of folate deficiency among WRA was reported to be 46.1% (Haidar J, Melaku U et al. 2010). The prevalence of RBC and serum folate deficiency among non-pregnant WRA was 32% and 17.3% respectively (EPHI 2016). The proportion of anemia attributable to folate deficiency was estimated to be 25% and 29% among adult women and men (Andersen, CT, 2022). The incidence rate of NTDs ranged from 107.5 per 10,000 live births in Eastern Ethiopia (Berhane and Belachew 2022) through 126 per 10,000 births in Addis Ababa (Gedefaw, Teklu et al. 2018) to 131 per 10,000 births in Tigray Region (Berihu, Welderufael et al. 2018), which is extremely high above the WHO threshold (6 /10,000 live births).

Inadequate folate status among WRA can lead to adverse health consequences of public health significance, such as megaloblastic anemia (folate deficiency) and an increased risk of neural tube defects (NTDs). Cognizant of this, the government of Ethiopia endorsed mandatory wheat flour fortification with folic acid and other micronutrients (CES 2022).

Zinc is required for normal growth and development from within utero until puberty. The WHO estimates that zinc deficiency affects 31% with prevalence rates ranging from 4-73% in various regions of the world's population. In low-income countries, zinc deficiency is one of the ten significant factors contributing to the burden of disease (WHO 2004). Zinc deficiency increases the risk and severity of various infections, restricts physical growth and affects specific outcome of pregnancy (BrownJuan, Rivera et al. 2004). Zinc supplementation during pregnancy is associated with a significant reduction in preterm births without an effect on infant birth weight (Bailey, West Jr. et al. 2015). In Ethiopia, 37% of children less than five years are stunted (EDHS 2019) that is well above the WHO cut-off of 20% stunting rate which is associated with zinc deficiency (de Benoist, McLean et al. 2008). In Ethiopia, the prevalence of zinc deficiency was 35%, 36% and 34% among the preschool age children, school age children and WRA respectively (EPHI 2016). Systematic review and meta-analysis estimated zinc deficiency to be 59.9% and 38.4% among pregnant women and children in Ethiopia respectively (Berhe, Gebrearegay et al. 2019) . Cognizant of these issues, the government of Ethiopia endorsed mandatory wheat flour fortification with zinc and other micronutrients (CES 2022) .

Deficiencies of calcium and vitamin D are also becoming the emerging MNDs affecting population in low income countries to less extent compared with the deficiencies of the aforementioned major micronutrients. Dietary calcium deficiency is widespread globally, suggesting that approximately half of the world's population has inadequate access to it (Shlisky, Mandlik et al. 2022). Data from across the 74 countries indicate that average national dietary calcium intake ranges from 175 to 1233 mg/day. Many countries in Asia have average dietary calcium intake of less than 500 mg/day. Countries in Africa and South America mostly have low calcium intake between 400 and 700 mg/day. Only Northern European countries have national calcium intake greater than 1000 mg/day (Balk , Adam et al. 2017). The dietary calcium intake of women of childbearing age in Ethiopia is very low (nearly 60—70% - less than the recommended amount). The recommended daily calcium supplementation is 1.5 —2.0g oral elemental calcium starting from 14 weeks of gestation (EPHI 2016). According to the study conducted in south part of Ethiopia, 26.5% among children aged 6-23 months had low dietary calcium intake compared with their age specific recommended nutrient intake (RNI) value (Tezera, Whiting et al. 2017).

Inadequate intakes of calcium have also been linked to other health outcomes, including pregnancy complications, cancers, and cardiovascular disease (Shlisky, Mandlik et al. 2022) The Ethiopian national antenatal guideline recommends the provision of calcium supplements for high risk pregnant mothers before delivery.

Study reports suggest that approximately 1 billion people worldwide are affected with vitamin-D deficiency and around 50% of the global population have vitamin D insufficiency (Siddiqee, Bhattacharjee et al. 2021). In Ethiopia, for instance, the prevalence of vitamin D deficiency was significantly higher among students in urban setting (61.8%) compared with those in rural ones (21.2%) (Wakayo , Belachew et al. 2015).

To curb the consequences of nutritional problems, Ethiopia has developed national Food and Nutrition Policy (FNP) and endorsed it in November 2018 with the overarching multiple policy directions which would serve as an umbrella to develop sector specific strategic actions and key performance indicators to guide the implementing sectors to execute national FNP directions (FDRE 2018). Based on the policy directions, detailed strategic action plan was developed and endorsed in 2021 (FDRE 2021). The strategy has identified key interventions on prevention and control of MNDs.

Accordingly, interventions to prevent and control MNDs include dietary modification (fortifications including bio-fortification, enrichments and standardization), dietary diversification and supplementation, social and behavior-change communication (SBCC) and public health measures such as de-worming, and use of insecticide treated bed net (ITNs).

1.2. Rationale

Even though Ethiopia has been implementing the micronutrient deficiency prevention and control program for decades, the majority of MNDs are above the global threshold for public health significance. MNDs contribute to the triple burden of malnutrition, with direct consequences of poor growth, cognitive development, and learning capacity to poor productivity, all of which have a negative impact on socioeconomic development. The Ethiopian government approved a multi-sectoral Food and Nutrition Policy (2018) and Strategy (2021-2030) with specific objectives, goals, initiatives, and actions.

The 2016 guideline must be revised to be aligned with the new global and national recommendations, as well as to facilitate the effective implementation of both nutrition-specific and nutrition-sensitive strategic actions through multi-sectoral coordination and collaboration.

The aim of this guideline is to improve the implementation of recommended nutrition actions to reach the intended population. It helps to guide health and nutrition service providers, program managers, food and nutrition implementing sectors, academia, and researchers on how to provide high-quality, standardized nutrition services to the community.

1.3. Scope of the guideline

This guideline covers global evidence-based recommendations for micronutrient interventions to general populations aimed at improving maternal, infant, and child health outcomes. It will outline strategies for promoting micronutrients and preventing and eliminating MNDs in all segments of the population, including screening, MND treatment, SBCC, counseling, micronutrient supplementation, dietary modification, and dietary diversification. The document will serve as a guiding principle and prototype for all stakeholders who are implementing nutrition-specific and micronutrient-sensitive interventions.

This guideline targets primary and secondary users.

Primary users: These include program managers**,** nutrition and health care providers, development partners, and organizations implementing nutrition interventions. The use of community-based resource persons, peer counselors, and mother support groups as well as links with agricultural and other extension workers shall be promoted. **Secondary users**: These include teachers, academic institutions, nutrition implementing sectors (Education, Sports and youth; Women and Social Affairs, Trade and Regional Integration, Labor and Skill, Peace and Security, Industry, Agriculture, Local Governments and Water and Environment). However, this guideline is not meant to replace a training manual.

1.4. Purpose of the guideline

The goal of this guideline is to assist health and nutrition program managers and practitioners who work in food and nutrition sensitive and specific implementation sectors in designing, implementing, and managing micronutrient deficiency programs or interventions.

More specifically, the guideline has the following specific objectives.

- Serve as a basic reference material for nutrition and healthcare providers in their day-to-day delivery of nutrition services.
- Direct nutrition-specific and nutrition-sensitive implementation sectors in the reduction of micronutrient deficiencies.
- Assist program managers in planning, organizing, implementing, monitoring, and evaluating service implementation centered on micronutrient deficiency prevention at their respective level.
- Facilitate the standardization and harmonization of program implementation and service delivery on micronutrient deficiency prevention and control at all levels.
- Strengthen operational research to improve micronutrient deficiency prevention and control programs .

1.5. Expected outcomes of the guideline

This guideline is expected to make the following contributions.

Immediate outcomes

- Guiding and orienting health, food and nutrition service providers and program managers
- Serving as a reference for FNS implementing sectors, micronutrient fortifiers, academia, researchers, policy makers, advocates, nutrition champions, development partners, media professionals, and professional associations/societies

Medium- and long-term outcomes

- Increased awareness on utilization of micro nutrient services
- Reduced insuffiucient and excess intake of micro-nutrients among the general population
- Improved micronutrient intake as well as micronutrient and health status of the population.

CHAPTER TWO:

FOOD BASED APPROACHES FOR THE PREVENTION AND CONTROL OF MICRONUTRIENT DEFICIENCIES

2.1. Food-based approach

Food based approach is preventive and comprehensive strategies of uses of foods (i.e whole, refined, processed, fortified and bio fortified.) as an approach to overcome all forms of malnutrition. It is an effective, sustainable and long-term solution to hunger and malnutrition and economic wellbeing (Greiner, 2014). It promotes sustainable 'food-based strategies' to improve nutrition security and enable adequate consumption of micronutrients to reduce the global problem of micronutrient malnutrition. Food-based approach needs multi-sectorial involvement in the design, implementation and management stages, including the monitoring and evaluation of strategies.

Advantage of food-based approach interventions

- It is preventive, cost-effective, sustainable, culturally acceptable and income-generating.
- It promotes self-reliance and community participation.
- It fosters the development of environmentally sound food production systems.
- It is broad-based, aiming to improve the overall diet quality of a population (address multiple nutrient deficiencies simultaneously).
- It helps to build alliances among the government, consumer groups, the food industry and other relevant organizations to achieve the shared goal of preventing micronutrient malnutrition.
- It contributes to the improvement of national economic growth and development, health, cognitive development, education and productivity.

Strategies for food-based approaches

The main food-based strategies that can be adopted to overcome micronutrient deficiencies are dietary diversification, dietary modification, bio fortification, and food fortification.

2.2. Dietary diversification

Dietary diversity relates to the number of food groups consumed over a given period of time. It reflects an individual or household access to a variety of foods and it is a proxy for individual nutrient adequacy, but does not measure the quantity of food consumed.

Promotion of diversified diets: It is essential to promote the availability of food groups such as, cereals, grains, roots and tubers, legumes, nuts and oil seeds, milk and milk products; meat, fish and egg, fruits and vegetables, fats and oils at household level

Ten food groups for women and adults

1. Grains, white roots and tubers, and plantains
2. Pulses (beans, peas, and lentils)
3. Nuts and seeds
4. Dairy
5. Meat, poultry, and fish
6. Eggs
7. Dark green leafy vegetables
8. Other vitamin A-rich fruits and vegetables
9. Other vegetables
10. Other fruits

Eight food groups for children aged 6-24 months

1. Breast milk
2. Grains, roots/tubers and plantains
3. Pulses (beans, peas, lentils, chickpeas, kidney bean), nuts and seeds
4. Dairy products (milk, yogurts, cheese)
5. Flesh foods (meat, fish, poultry, organ meats)
6. Eggs
7. Vitamin-A rich fruits and vegetables
8. Other fruits and vegetables.

N.B: There is no single food (except breast milk for infants below six months) that can provide all the nutrients needed for health, physical and brain growth.

Table 1: List of food groups and items with their pictures

The Ten Food Groups for Minimum Dietary Diversity Score(consider the pictures at the ppt)	
1. Grains, white roots and tubers, and plantains	
2. Pulses (beans, peas, and lentils)	
3. Nuts and seeds	
4. Milk and milk products	
5. Meat, poultry, and fish	
6. Eggs	
7. Dark green leafy vegetables	
8. Other vitamin A-rich fruits and vegetables	
9. Other vegetables	
10. Other fruits	

Recommended action for dietary diversity

- Promote consumption of diversified food, at least five out of the eight food groups with continuation of breastfeeding, for children 6-23 months.
- Promote consumption of five out of ten food groups for general population above 2 years of age.
- Provide nutrition education to strengthen and complement efforts to enhance the availability of micronutrient-rich foods.
- Promote year round organic home gardening to create accessibility and availability of fruits and vegetables.
- Provide a community managed revolving fund for rearing small animal's poultry, goats, sheep, and fish, in order to enable communities to access animal source foods at household level.
- Promote and introduce diversified food (fruit, vegetables and animal source foods) at school feeding, training institutions and refugee camps.
- Promote production of diversified and nutrient dense agricultural products (fruit, vegetables and animal sources foods) in school compounds, training institutions and refugee camps.
- Improve productivity of indigenous cereals, grains, fruit and vegetables.
- Promote and scale up integrated farming (poultry, fish and vegetables).

Table 2: Plant and animal sources of micro-nutrients

Micronutrients	Food Source
Vitamin A	**Plant source**: carrots, dark orange or dark yellow fruits and vegetables (papayas, mangos, pumpkins, carrots), orange flesh sweet potatoes, dark green leafy vegetables (spinach, kale and Swiss chard) and red palm oil **Animal source**: Egg yolk and organ meat (liver), whole milk and milk products, fish, cod liver oil, butter
Iron	**Plant source:** Green peas, kale, spinach, oat bran, lentils, beans, peas, pumpkins, **Animal source**: lean meat, organ meat (liver, heart, kidney, poultry, fish and sea foods and egg
Zinc	**Plant source**: whole grain cereals, nuts, pulses and legume **Animal source**: lean red meat, sea food (fish….)
Calcium	**Plant source**: green leafy vegetables (spinach, kale), seeds (sesame, chia) **Animal source**: milk and milk products (cheese, yogurt, whey protein),
Vitamin B_1 (Thiamin)	**Plant source**: sunflower seed, flax seed, green peas **Animal source**: organ meat, yogurt, fish, whole grains, and legumes

Vitamin B_2	**Plant source**: Green vegetables **Animal source**: Milk and milk products and meat
Vitamin B_3	**Plant source**: Grain and legumes **Animal source**: Liver, lean meat
Vitamin B_9 (folate)	**Plant source**: Dark green leafy vegetables, beans, peanut, sunflower seeds, whole grain, bread, rice, amaranths, etc. **Animal source**: Egg, seafood and liver
Vitamin B_{12}	**Plant source**: soy flour, cereals, fortified cereals **Animal source**: liver, egg yolk, meat, fish, milk, cheese
Vitamin D	**Plant source**: mushroom, **Animal source**: fatty fish, organ meat, milk
Selenium	**Plant source**: mushroom, garlic, green peas, carrot, cereals, soya beans, **Animal source**: Seafood, organ meat, red meat and poultry
Magnesium	**Plant source**: legumes (soya bean, lentils, peanut) and leafy vegetables **Animal source**: milk and milk products, eggs, seafood, red meat

2.3. Dietary Modification

Dietary modifications are changes made during food preparation, processing, and consumption to increase the bioavailability (micro and macro nutrient absorption, digestibility, and utilization) at the market or individual/household level.

It promotes food processing practices such as soaking, sprouting/germination, roasting, milling, and fermentation to reduce anti-nutritional factors (phytate, tannin, oxalate etc.) and increase the energy and nutrient density at commercial and household level. For instance, the practice of optimum cooking and minimizing overcooking of vegetables could help to retain micronutrients and improve the intake and absorption of micronutrients.

Table 3: Type of modified food items and methods of home based modification

Raw material	Modification type at household level	Time	Product (food items)	Benefit of modification
Brown rice	Soaking and sprouting	Overnight	Sprouted brown rice	Increase the vitamin (vitamin C and B-complexes) and mineral content and active compounds
Soybean	Fermentation	Up to 72 hours (hr). at room temperature (RT)	Fermented soymilk	Increase protein and minerals and decrease anti-nutritional factors

Lentils	Soaking	24-72hr. at RT	Dehulled and split lentils	Increase protein and minerals and decrease anti-nutritional factors (Saponins)
Bean, chickpea, pea, millet, soybean, cowpea, mung bean etc.	Soaking/ sprouting	24-74hr. at RT	Sprouted bean, chickpea, pea, millet, cowpea, soybean, and flour for baking	Increase protein concentration and quality and availability of minerals (iron) and vitamins (vitamin C and vitamin B9) and decrease anti-nutritional content
Sorghum, rice, maize	Fermentation	24-72hr. at RT	Fermented sorghum, rice, maize flour	Increase protein and minerals concentration and decrease fat and anti-nutritional content
Vegetables	Steaming	Sliced carrots 6-8 min, Cauliflower 5-6 min, Broccoli 5 min etc.	Steamed vegetable	Keep the vitamin and mineral contents

Source: (Adebo et al. 2022)

2.3.1. Food synergy for improved bioavailability of micronutrients

Food synergy, or the ability of two or more foods to work better together than separately, is an excellent way to extract the maximum amount of nutrients from the foods consumed. It is a consumer centered strategy which requires effective dissemination among the target group, especially the care-givers who are often the change agents of the family with respect to nutrition.

Food synergy for iron and calcium bioavailability: simultaneous consumption of iron-and calcium rich foods with fruits of high ascorbic acid enhances iron absorption.

Food synergy for vitamin D and calcium: similar to zinc, calcium absorption is improved by vitamin D, which is obtained through safe sun exposure and physical exercise.

2.3.2. Food antagonisms interaction and food processing

The existence of food anti-nutritional factors such as phytates, tannins, and oxalates negatively influence the absorption of iron, zinc, and calcium. The common food processing methods include thermal processing, mechanical processing (cutting, milling, dehulling), soaking, fermentation, and germination. Tea and coffee in cereal based meals have inhibitory effects on iron absorption. The consumption of tea and coffee decrease iron and calcium absorption and cause iron deficiency anemia.

Recommended actions for dietary modification

- Promote customary and up-to-date and innovative processing techniques to increase the palatability and bioavailability of food or nutrients. These include germination, fermentation, blanching, and soaking, cooking and minimal processing.
- Discourage tea and coffee consumption with iron and calcium rich foods.
- Drink tea of coffee 60 minits after or before meal.

2.4. Fortification

2.4.1. Bio fortification

Bio fortification is a strategy for increasing micronutrient levels in food groups through the use of modern biotechnology techniques or traditional plant breeding and agronomic practices. It is a one-time investment that provides a cost-effective, long-term, and sustainable strategy for combating hidden hunger.

Bio fortification can be accomplished in three ways:

1. Transgenic using modern biotechnology,
2. Conventional breeding, and
3. Agronomy through fertilizer.

Table 4: List of bio fortified food items released by Ethiopia

Food items	bio fortified by:-	Status
Wheat -folate fortified wheat	Folate (vitamin B9)	in progress
Maize -vitamin A fortified maize	vitamin A	Released
Rice	Zinc, □-carotene (vitamin A)	Released
Pearl millet	Iron and zinc	Released
Lentils	Iron and zinc	in progress
Orange flesh sweet potato	Vitamin A	Released
Irish potato	Iron	in progress
Oats	Zinc	Released
Maize-quality protein mainze	Protein	Released
Iron and zincs beans	Zinc and iron	Released

Recommended action

- Increase the production and distribution of bio fortified foods.
- Promote the production and consumption of bio fortified crops.
- Promote the use of bio fortified crops in complementary food preparation.
- Mainstream key messages for production and consumption of bio fortified crops such as quality protein maize, orange flesh sweet potato, rice with zinc and vitamin A, pearl millet with iron and zinc, oat with zinc, iron and zinc rich beans.
- Strengthen research and development efforts to improve the availability, accessibility, and development of agronomic bio fortification practices and consumption based on the local context.
- Promote and educate the health and nutritional advantages of bio-fortified foods.
- Scale up best bio-fortification technologies.
- Promote innovative and scalable agricultural practices such as improved storage, processing, preservation and handling technologies to ensure year round availability of bio- fortified products.

2.4.2. Food fortification (industrial/ home)

Food fortification is the practice of deliberately increasing the content of an essential micronutrient, i.e. vitamins, minerals and trace elements in a food, so as to improve the nutritional quality of the food supply and provide a public health benefit with minimal risk to health (WHO 2006). Food fortification is a sound public health strategy because it is cost effective, can reach large segments of at-risk populations through existing food delivery systems without requiring major changes in existing consumption patterns. The success of fortification efforts necessitate serious consideration being given to appropriate carrier (variety) and fortificant (premix) selection, bioavailability of nutrients, nutrient interaction, nutrient labeling, appropriate calculation of fortificants doses, packaging maximum retention of fortificants until consumption, etc. According to a global mapping study onfood fortification (2016), there are about five types of fortification. These include:

Mandatory fortification: this is the addition of one or more micronutrients to foods commonly consumed by the general population such as edible oil, cereals, salt, etc. It is usually mandated and regulated by the government sector. Efforts are typically concentrated on the organized food processing sector and large-and medium-size industries.

Voluntary or market-driven fortification: is when a food manufacturer takes a profit-driven initiative to add specific amounts of one or more micronutrients to processed foods, usually voluntarily, but under government regulations or standards such as vegetable ghee, milk powder etc.

Small-scale fortification: refers to efforts to fortify among the informal or unregistered small-scale artisanal or cottage industries.

Targeted fortification: is fortification of foods aimed at specific sub- groups, rather than the population as a whole, to increase their intake of complementary foods for infants and children, emergency feeding and special school meals for children.

Home-level food fortification: also known as point-of-use, is the fortification of micronutrient powders such as sprinkles.

Criteria for selection of mandatory or voluntary fortification (WHO, 2006)

- Severity of the problem and its prevalence within a population group or public health need
- The features of the food industry sector (e.g., capacity, number and geographical distribution)
- When consumer knowledge is poor or demand for voluntarily-fortified product is low
- The political environment/level of government intervention
- Food consumption patterns (i.e. technical suitability of vehicle foods)

Identification of potential food vehicles should be guided at a minimum by the following criteria

- Be consumed by a large number of individuals at risk of micronutrient deficiency
- Be consumed regularly throughout the year
- Be centrally processed as it facilitates large scale and large impact programs

The Ethiopian government implemented mandatory fortification specification of salt with iodine (CES 70, 2011), wheat flour vitamin B's and zinc (CES 309, 2022), and edible oil with vitamin A and D (CES 310, 2022) with a gross period of one year.

Table 5: Micronutrients fortificated on selected food vehicles in Ethiopia

Fortification vehicle	Nutrient	Fortificants compound, min.
Wheat flour	Vitamin B1	Thiamin mono nitrate, activity level , 81%
	Vitamin B2	Riboflavin, activity level, 100 %
	Vitamin B3 (Niacin)	Niacinamide, activity level, 99 %
	Vitamin B6	Pyridoxine, activity level, 82 %
	Vitamin B9 (Folate)	Folic acid, activity level, 90 %
	Vitamin B12	Vitamin B12 (Water soluble form), activity level, 0.1 %)
	Zinc	Zinc oxide, activity level, 80 %
Edible oil	Vitamin A	Vitamin A (Retinyl palmitate)
	Vitamin D	Vitamin D_3
Edible salt	Iodine	Potassium iodate

Source: CES 310:2022, CES 309:2022 and CES 70:2017

Recommended actions

- Promote the use of micronutrient fortified foods.
- Promote appropriate use of adequately iodized salt at household level.
- Increase consumer awareness and create demand for use of fortified foods.
- Encourage and enforce food industries to produce fortified food products.
- Strengthen the regulatory body to regulate the import and sale of non-fortified foods.
- Capacitate regulatory bodies to ensure high-quality fortified foods.
- Improve processing, packaging, handling and storage of fortified foods.
- Encourage centrally processed fortified food vehicles.

2.5. Food based supportive measurement strategies

A. Food safety and quality assurance: Food quality control systems ensure that processed and marketed foods are of high quality and free of chemical residues, adulteration, and other potential contamination sources. Food hygiene and sanitation should be considered when any food-based intervention is being designed. Poor food quality influences the nutritional and economical value of food and food ingredients (FAO assuring food safety and quality guideline for strengthening national food control system 2003).

B. Reducing post-harvest losses of nutrient-rich foods: Post-harvest losses of nutrient-rich foods is one of the major problems in our country. Ensuring post-harvest loss and improved food safety through handling and storage of foods of animal and plant sources enhances accessibility of micronutrients. Food safety and post-harvest technologies and practices during processing and packaging of animal and plant source foods should be implemented.

C. Improving agricultural food market infrastructure: Poor infrastructure, such as roads, transportation, water, and sanitation, a food corridor, storage, and food processing equipment, and lack of knowledge about modern food handling and management practices all contribute to a high proportion of food waste. A public awareness strategy must be developed and implemented across food value chain in order to reduce food loss. Public-private partnerships for investment in post-harvest and value addition to perishable food items are also important.

D. Improving of nutrient levels in soil and plants: Apply an approach using agronomic practices to improve the micronutrient content of foods. This includes correcting soil quality and pH, and increasing mineral content etc., in order to improve the composition of plant foods and enhance micronutrient content and yields. This requires investment in agricultural inputs and agronomic practices. For instance, adding more zinc to fertilizers can increase the soil's zinc content, which raises grain yields and zinc content in the grain.

Recommended actions for the overall food-based approaches

- Capacitate the regulatory body on food quality and safety.
- Capacitatefood value chain actors' knowledge on food safety and quality.
- Strengthen public private partnership to enhance food safety and quality.
- Promote technologies and practices to minimize post- harvest losses.
- Improve market supply chain (accessibility to road, transport, market and storage facility).
- Promote agronomic fortification of soil to improve the micronutrient level in the soil and crop.
- Promote public and private investors to supply fortified fertilizer.

2.6. Food safety and quality

Access to sufficient amounts of safe and nutritious food is key to sustaining life and promoting good health. Unsafe food containing harmful bacteria, viruses, parasites or chemical substances causes more than 200 diseases, ranging from diarrhoea to cancers. It also creates a vicious cycle of disease and malnutrition, particularly affecting infants, young children, elderly and the sick. Good collaboration between governments, producers and consumers is needed to help ensure food safety and stronger food systems.

- Food safety and nutrition are inseparably linked. To achieve optimal human health and wellbeing, people must be both well-nourished and free from foodborne disease. For better health, diets should have to be nutritious and safe. They must enable people to meet nutrient requirements and not expose them to foodborne illness.

- Efficient and effective food-based approach to improve nutrition and reduce foodborne disease requires synergies that seek to improve access to nutrient-dense foods while simultaneously improving their safety.

- Drinking high-sugar soft drinks has been linked to obesity, type 2 diabetes, and weight gain. Sodas can also harm your smile by causing cavities and even visible tooth decay. When you drink soda, the sugars in it react with bacteria in your mouth, resulting in acid and tooth decay (Kenney & Gortmaker, 2017).

- Reduce your intake of carbonated soft drinks, which have a negative impact on your overall nutrient intake. Drinking these beverages may reduce protein, starch, dietary fiber, and vitamin B-2 (riboflavin) consumption,. Those who consume carbonated beverages eat less fruit and drink less fruit juice than those who do not consume sodas (Shoaib & Iqbal, 2019). Soft drink consumption is also linked to lower milk, calcium, and other nutrient intakes, as well as increased risk of several medical problems such as diabetes.**Recommended actions for food safety and quality**

- Maximize risk reduction by applying prevention measures throughout the food chain.

- Consider the farm-to-table continuum; establish emergency procedures for dealing with specific hazards (for example, product recalls); create scientific food control strategies; priorities are established based on risk analysis and risk management; establish and promote holistic, integrated initiatives which target risks and impact on economic well-being.

- Recognize that food control is a widely shared responsibility that requires positive interaction between all stakeholders.

- Avoid high-temperature cooking processes, such as frying, roasting, and baking which might form acrylamide from sugars and amino acid that are naturally present in food.
- Sectoral integration for Food Safety and quality is mandatory
- Food supply chains must ensure nutritious foods are produced in sufficient amounts and with adequate controls on quality and safety, so that both safety and quality are considered throughout the value chain.
- At the farming input stage, soil additives must not contaminate the soil or compromise the nutritional levels of the food product. It is critical to ensure that processes used to improve safety do not reduce the content of beneficial nutrients or increase the content of potentially harmful ones. Food environments refer to storage, preparation, and disposal practices, as well as adequate infrastructure, to keep food safe and minimize food and nutrient loss.
- Advertising and labeling should support the choice and proper handling of safe and nutritious foods by providing information on safe cooking practices and nutrient content.
- Consumers must have access to safe and nutritious foods, as well as the information, purchasing power, decision-making power, and motivation.
- Access to trustworthy information is key as consumers often cannot easily identify whether a food is unsafe via sight or smell
- Technology and information dissemination
- Thorough Information and education, such as disease surveillance data and consumer messaging, empower citizens to recognize and demand safe, nutritious food.
- Strengthen food safety systems, promote good manufacturing practices, and educating food value chain actors on appropriate food handling.
- Promote safe food handling through systematic disease prevention and awareness programmes, through the WHO five keys to safer food message and training materials (Listed below).
- Advocate for food safety as an important component of health security and for integrating food safety into national policies and programmes.
- Monitor regularly the global burden of foodborne and zoonotic diseases at national, regional and global levels, and support countries to estimate the national burden of foodborne diseases.

- Buy fresh foods on the day of consumption when possible, or use before the expiry date (if indicated).
- Buy food from only reputable suppliers and inspect food packaging for leaks or spills that can cause cross-contact.
- Do not buy foods with any of the following danger signs
    - ◊ Bad smell, visible signs of mold, fish with dull eyes, loose scales, soft flesh with pale gills, meat with a bad smell or greyish color.
    - ◊ Mold for dry foods like flour, grains, nuts, legumes etc
    - ◊ Unusual taste, rancidity for oils and fats like vegetable oils, butter, lard, etc.
    - ◊ Any swollen, leaking, badly dented tin and bad smell. Frozen food should be thawed in a refrigerator, should not be put in warm water or left out to thaw.
- Store foods at the right temperature and covered.
- Eat meals as soon as possible after preparation.
- Use clean covered containers for fetching water.
- Use safe water supply, or else boil or use water treatment for all water before use.
- Cook food properly and separate raw and cooked food.
- Wash hands with soap and water before food preparation, before eating meals, and after touching animals, dirty areas, or soil or after visiting the bathroom.
- Wash all utensils thoroughly with water and soap before use.
- Wash all fruit and vegetables before peeling or eating.
- Avoid coughing, spiting, or touch the body during food preparation.
- Use appropriate waste disposal.

- Keep animals away from food preparation areas.
- Store ready-to-eat food above raw food

Promoting safe food handling: The WHO five keys to safer food message are:-

1. Keep clean.
2. Separate raw and cooked.
3. Cook thoroughly.
4. Keep food at safe temperatures.
5. Use safe water and raw materials.

CHAPTER THREE:

PREVENTION AND CONTROL OF COMMON MICRO-NUTRIENTS OF PUBLIC HEALTH IMPORTANCE

3.1. Introduction

It has been shown that vitamin A, folate, iron, iodine, and zinc deficits are of the major public health significance in Ethiopia. Different intervention strategies are used in the country to control and prevent these deficiencies. The approaches are food-based, supplementation-based, and public health-based, as discussed in the following section.

3.2. Prevention and control of vitamin A deficiency

Vitamin A is a fat-soluble vitamin that aids human reproduction, growth and development, cellular communication, and immunological function. It promotes cell growth and differentiation, and it is essential for the normal formation and maintenance of body organs (Blaner WS., 2020 & Ross A., 2014, Blaner WS., 2020 & Ross A., 2014).

Vitamin A insufficiency is regarded as the second-most important risk factor for the global disease burden and a strong quantitative indication of the prevalence of malnutrition (Tian Zhao et la., 2022). It significantly lowers immunity, leaving people–especially children–more susceptible to diseases like malaria, measles, diarrhea, tuberculosis, HIV, and respiratory infections. Iron deficiency anemia, maternal mortality, and unfavorable pregnancy outcomes are all increased as a result of it. Thus, improving vitamin A level reduces the severity of childhood illness. Additionally, research have shown that vitamin A supplementation lowers overall child mortality due to infectious diseases by 24%, diarrhea-specific mortality in children aged 6-59 months by 25%, newborn death by 12%, and diarrhea-specific mortality in children by 24%. (WHO, 2011).

Recommended interventions to prevent vitamin A deficiency

- Diet diversification (consumption of vitamin A rich food)
- Food fortification
- Dietary modification
- Vitamin A supplementation
- Public health interventions (promotion of breastfeeding, complementary feeding, management of measles, diarrhea and other communicable diseases).

3.2.1. Food based approaches for optimal vitamin A status

Recommended Actions

- Promote the consumption of vitamin A-rich animal foods that are readily available in your area, such as fish, cod liver oil, whole milk, and organ meat (liver, heart, and kidney).
- Promote the consumption of vitamin A-rich plant foods like dark orange or dark yellow fruits and vegetables like pumpkins, carrots, and sweet potatoes with yellow or orange flesh, as well as dark green leafy vegetables (spinach, kale and Swiss chard, cabbage and amaranth plant).
- Promote the consumption of foods fortified with vitamin A, such as fortified milk and edible oils.
- Promote the consumption of vitamin A bio-fortified foods like orange-fleshed sweet potatoes.
- Promote the consumption of foods with vitamin A enhancers, such as foods containing fat (e.g., eggs, fish, milk and milk products, chicken, avocado), and foods rich in iron (meat, green leafy vegetables, nuts).
- Cook demonstrations for complementary foods (diversity, frequency, consistency, amount and density).
- Ensure the implementation of mandatory edible oil fortification with vitamin A.

Recommended actions to promote and support optimal infant and young child feeding

- Promote early initiation of breastfeeding within one hour and colostrum feeding.
- Promote avoidance of pre-lacteal feeding/Discourage prelacteal feeding.
- Promote and support exclusive breastfeeding for the first six months.
- Promote the timely introduction of vitamin A-rich complementary feeding and safe, hygienic preparation of complementary foods while continuing breastfeeding.
- Promote continued breastfeeding up to 2 years and beyond.

3.2.2. Vitamin A supplementation

Vitamin A supplementation is a safe, affordable, and effective way to prevent and control vitamin A deficiency, lower childhood morbidity, increase child survival, and enhance the health of children, their families, and communities (WHO 2018). The dosages of vitamin A supplements are shown in the three tables below for various target populations.

Table 6: Schedules of vitamin A supplementation for prevention

Age	Dose	Frequency
Children 6 -11 months	100,000 IU (1 capsule of 100,000 IU)	Once
Children 12-59 months	200,000 IU (2 capsules of 100,000 IU)	Once every 6 months

NB:- The WHO guideline (2011) states that VAS for postpartum women is not recommended as a public health intervention for the reduction of maternal and infant morbidity and mortality (strong recommendation). It is due to the paucity and inconsistent recommendation of the available evidences on VAS during postpartum

Table 7: Vitamin A therapeutic supplementation for children with Severe Acute Malnutrition (SAM)

Age	Dose	Frequency
Children 6-11 months	100,000 IU (1 capsule of 100,000 IU)	One dose at first contact and then as stipulated in the management of severe acute malnutrition guideline*
Children 12-59 months	200,000 IU (2 capsules of 100,000 IU)	One dose at first contact with health unit and then as stipulated in the management of severe acute malnutrition guideline*
**** Do not give VAS if the child has received VAS through HEP within one month and has bilateral pitting edema (SAM).***		

NB: - According to 2019Ethiopian CMAM guideline, a high dose of vitamin A is given on admission only if the therapeutic foods provided are not fortified as recommended in the WHO specifications, and vitamin A is not part of other daily supplements (Table 2.2) (Ethiopia CMAM guideline ; May 2019)

Table 8: Vitamin A therapeutic supplementation for children with xerophthalmia or measles

Doses for the Age Groups			
Schedule	Infants < 6 months of age	Children 6 months-1 year of of age	Children >1 year of age
Immediately on diagnosis	50,000 IU, (a drop from 100,000 IU capsule)*	100,000 IU (1 capsule of 100, 100 IU)	200,000 IU (2 capsules of 100, 000 IU)
Next day	50,000 IU, (a drop from 100,000 IU capsule)	100,000 IU (1 capsule of 100, 100 IU)	200,000 IU (2 capsules of 100, 000 IU)
At15th	50,000 IU, (a drop from 100,000 IU capsule).	100,000 IU (1 capsule of 100, 100 IU)	200,000 IU (2 capsules of 100, 000 IU)

*A drop is equivalent to 50,000IU

NB:- If the patient with SAM has eye signs of vitamin A deficiency or recently had measles (within the past 3 months), a high dose of vitamin A (50,000 IU, 100,000 IU or 200,000 IU depending on age) is given on day 1, 2, and 15, regardless of the therapeutic food they are receiving (Ethiopia CMAM guideline ; May, 2019) (Table 2.3).

Recommended actions

- Provide vitamin A supplementation for children aged 6-59 months every six months.
- Provide vitamin A supplementation with therapeutic feeding programs based on the 2019 CMAM guideline.
- Provide vitamin A supplementation for individuals with clinical eye sign and measles symptoms.
- Promote regular VAS (every six months).

3.2.3. Infection prevention and control

Infections increase the body's excretion of vitamin A and leads to depletion. In a community where vitamin A-rich foods are scarce locally, viral illnesses can exacerbate VAD by increasing use and excretion while reducing intake and absorption. As a result, infection prevention and control strategies must be improved.

Recommended actions

- Increase access to WASH (Water, Sanitation, and Hygiene) facilities.
- Promote food safety and quality.
- Promote infection prevention measures.
- Early detect and treat infectious diseases (such as malaria, TB/HIV, the measles, and diarrhea, etc).
- Ensure access to immunizations services.
- Early detect and treat vitamin A deficiency.

3.3. Prevention and control of iron deficiency anemia

Iron is required for hemoglobin in red blood cells (RBCs), which transport oxygen from the lungs to tissues and carbon dioxide back to the body. It is also essential for physical development, neurological development, cellular functioning, and the synthesis of certain hormones. The increased demand for iron during rapid tissue accretion and growth periods of childhood, adolescence, and pregnancy increases the risk of anemia. Iron deficiency is the leading cause of anemia throughout the world It has a negative impact on cognitive and motor development, and contributes to fatigue and low productivity. Long-term consequences of childhood anemia include impaired physical and cognitive development, as well as lower educational attainment and work productivity.

Iron deficiency anemia during pregnancy causes low birth weight and increases the risk of maternal and perinatal mortality (WHO, 2011). Furthermore, maternal short stature and iron deficiency anemia can increase the risk of maternal death during delivery, which accounts for at least 20% of all maternal deaths (WHO 2010).

Table 9: Hemoglobin levels (g/dL) to diagnose anemia at sea level (WHO, 2011)

Population, Age, Sex	No anemia	Mild anemia	Moderate anemia	Severe anemia
Children, 6—59 months	≥11.0	10.0—10.9	7.0—9.9	<7.0
Children, 5—11 years	≥11.5	11.0—114	8.0—10.9	<8.0
Children, 12—14 years	≥12.0	11.0—11.9	8.0—11.0	<8.0
Non-pregnant women, 15 years and above	≥12.0	11.0—11.9	8.0—11.1	<8.0
Pregnant women	≥11.0	10.0—10.9	7.0—9.9	<7.0
Men, 15 years and above	≥13.0	11.0—12.9	8.0—10.9	<8.0

[a] The hemoglobin level needs to be adjusted for altitude, smoking status and trimester of pregnancy.

***Moreover, WHO recommends correcting the cut-off point of hemoglobin to define anemia in high-altitude (HA) and smoking populations as indicated below.

Table 10: Adjustments to measured hemoglobin concentrations for smokers and altitude

Altitude (Meters above sea level)	Measured hemoglobin adjustment for altitude (g/l(g/dl)	Smoking status	Measured hemoglobin adjustment for smoking (g/l(g/dl)
< 1000	0	Non-smoker	0
1000	-2(-0.2)	Smoker (all)	-3 (-0.3)
1500	-5 (-0.5)	1/2-1packets/ day	-3 (-0.3)
2000	-8 (-0.8)	1-2 packets/day	-5 (-0.5)
2500	-13 (-1.3)	≥2packets/day	-7 (-0.7)
3000	-19 (-1.9)		
3500	-27 (-2.7)		
4000	-35 (-3.5)		
4500	-45 (-4.5)		

NB: Consider altitude and smoking as g/dl adjustments. (To convert from g/L to g/dl, divide the values by 10; to convert from g/dl to g/l, multiply the values by 10).

Table 11: The level of public health significance of anemia`in a population

Prevalence of anemia (%)	Category of public health significance
≥ 40%	Severe
20% -39.9 %	Moderate
5% - 19.9 %	Mild
4.9 % or below	Normal
Source: WHO cut of level for Anemia prevalence (WHO 2011)	

3.3.1. Food based approach

Iron deficiencies can be prevented and controlled through food diversification and fortification. Animal source foods (organ meat, red meat, chicken, fish, and eggs) and plant source foods (dark green vegetables, legumes, and cereals) are the main sources of iron. To reduce the phytate content of plant-based foods, it is important to increase intake of vitamin C source foods like orange, papaya, and grapes, and use dietary modifications like germination and soaking. Similarly, fortification of wheat flour with folic acid and bio-fortification of beans with iron are effective mechanisms for preventing and controlling iron deficiency.

Recommended actions

- Promote the consumption of Iron rich food (food diversification) such as animal source foods (organ meats, red meat, chicken, fish and egg) and plant source foods (dark green vegetables, legumes and cereals like teff)
- Encourage the use of fortified and biofortified foods, such as iron fortified of beans.
- Encourage the consumption of vitamin C-rich foods in order to improve iron absorption.
- Counsel not to consume foods that reduce iron absorption, such as tea, coffee, and milk, between 1 hour before and after consuming iron-containing foods.
- Promote the consumption of calcium and calcium-rich foods after 3 hours of iron consumption.

3.3.2. Supplementation for prevention and control of IDA

3.3.2.1. Iron and folic acid supplementation for pregnant women

During pregnancy, all women should take daily oral IFA supplements for six months immediately after conception or starting from the first ANC contact. IFA supplementation reduces maternal anemia, maternal death, low birth weight and preterm birth.

Table 12: Daily iron and folic acid supplementation in pregnant women

Supplement composition	Iron: 30—60 mg of elemental iron* +Folic Acid: 400Ŷg (0.4 mg)
Frequency	One supplement daily
Duration	Six months during pregnancy, iron and folic acid supplementation should be given for 180 days.
Target group	All pregnant women

* 30mg of elemental iron equals 150 mg of ferrous sulphate heptahydrate, 90 mg of ferrous fumarate or 250 mg of ferrous gluconate.

Recommended actions

- Provide daily oral iron and folic acid supplementation (60 mg elemental iron and 0.4 mg folic acid) to all pregnant women to prevent maternal anemia, puerperal sepsis, low birth weight, and preterm birth (from at least 90 tabs to the maximum 180 tabs; assess compliance and counsel for adherence during each contact).
- Provide iron folic acid supplementation for all pregnant women.
- Counsel on adherence of IFA intake.

- Promote the provision of daily IFA supplementation.
- Enhance nutrition education and counseling (e.g. increasing the intake of micronutrient absorption factors and decreasing coffee and tea for better micronutrient absorption).
- Promote early ANC for IFA supplementation and follow up.
- Counsel on daily intakes of IFA with food at bed time.
- Drink adequate and clean water after IFA intake.
- Counsel on the IFA intake and sides effects (gastrointestinal disturbance, dark stool, nausea, vomiting).
- Counsel pregnant mothers to continue IFA intake after delivery if they have not completed the six-month dose.
- Practice delayed cord clamping.
- Ensure IFA supplies are available at all pharmaceutical retailers.
- Procure and distribute coated IFA tables to reduce heat burn.
- Ensure proper recording and reporting of IFA supplementation.
- Strengthen access to health and nutrition services.

3.3.2.2. Weekly iron folic acid supplementation for Adolescent girls (10-19 yrs)

The World Health Organization (WHO) recommends intermittent (once a week) IFA supplementation as a public health intervention in menstruating women living in areas where anemia prevalence is 20% or higher to improve hemoglobin concentrations and iron status and reduce anemia risk (WHO 2018). Ethiopia meets this criteria, and the oral weekly iron and folic acid supplements (WIFAS) containing 60 mg of elemental iron and 2.8 mg of folic acid are recommended. This is supplemented for both in-school and out-of-school adolescents throughout the school year, with a break from supplements aligned with school vacations. WIFAS also provides an additional opportunity to ensure adequate folate status prior to pregnancy and during the early stages of pregnancy, particularly for those who are pregnant for the first time.

Table 13: Scheme for intermittent iron and folic acid supplementation in adolescent girls (10-19)

Supplement composition	Iron: 60 mg of elemental Iron*+Folic Acid: 2800 Ŷg (2.8 mg)
Frequency	Once a week
Duration and time interval between periods of supplementation	3 months of supplementation followed by 3 months of no supplementation, after which the provision of supplements should restart
Target group	Adolescent girls aged 10-19 yrs.

*60 mg of elemental iron equals 300 mg of ferrous sulphate heptahydrate, 180 mg of ferrous fumarate or 500 mg of ferrous

Recommended action for WIFAS

- Provide weekly 60 mg of elemental iron and 2.8 mg of folic acid to adolescent girls in and out of school.
- Provide nutrition counseling on the benefits and side effects of WIFAS.
- Counsel for regular WIFAS follow-up and improved adherence.
- Address any misconceptions about WIFAS.
- Educate parents, teachers, students, religious leaders, and clan leaders.
- Encourage community participation and engagement.
- Detection of adolescent pregnancy early and link to nearby health facility for ANC services.

Multiple micronutrient supplementation

Micronutrients are essential for normal physiological function, growth, and development in minute amounts. If possible, antenatal multiple micronutrient supplements (13-15 in total) containing iron, folic acid, zinc, and a variety of vitamins and minerals can be given. A pilot study is being carried out in Ethiopia to assess the feasibility of supplementation in accordance with WHO guidelines.

3.3.2.3. Deworming for children aged 12-23 months, 24-59 months; adolescent and pregnant women

Soil-transmitted helminthes (STHs), also known as intestinal worms, are a serious public health problem in tropical climate and wherever there is poor sanitation and hygiene. Soil-transmitted helminthiasis are among the most common infections in Ethiopia, caused by infection with the nematodes Ascaris lumbricoides (roundworm), Trichuris trichiura (whipworm), and Ancylostoma duodenale or Necator americanus (hookworms).

Intestinal anti-helminthic drugs raise hemoglobin levels and reduce the prevalence of anemia in at-risk populations such as women, children, and adolescents. Preventive therapy

(deworming) with biannual single-dose albendazole (400 mg) or mebendazole (500 mg) is recommended as a public health intervention for all young children (12-23 months), preschool children(24-59 months), adolescents (10-19 years), pregnant and lactating women.

Table 14: Recommended deworming tablets for children adolescent and pregnant women

Drug	Tablets must be crushed		Tablets may not be be crushed	Tablets are not crushed	
	12-23	24-35	36-59	Adolescent 10-19	Pregnant
Albedazole 400mg tablet	1/2 tablet	1 tablets	1 tablet	1 tablet	1 tablet
Mebendazole 500mg tablet	1 tablet		1 tablet	1 tablet	1 tablet

Recommended actions

- Promote provisions of deworming tablets.
- Provide albendazole 200 mg tablets (half of the 400 mg tablets) or mebendazole 500mg single dose in crushed form for deworming for children 12-24 months of age.
- Provide albendazole tablets 400 mg for children aged 24 6-59 months.
- Provide albendazole tablets 400 mg or 500 mg mebendazole for adolescent children aged 10-19 years.
- Provide albendazole 400 mg for PLW in the second trimester during ANC.
- Counsel mothers/caretakers, adolescents and PLW on the benefits and side effects of deworming.
- Promote access to clean and safe water for drinking and personal hygiene.
- Promote hygiene and sanitation practices (use of improved latrine).
- Promote WASH practices.

3.3.3. Treatment of anemia

Iron deficiency anemia can be treated with ferrous sulfate, ferrous gluconate, ferrous fumarate, ferric hydroxide, sodium ferric gluconate, iron carbohydrates, and others: the formulation preparation can be tablets, capsules, or liquid.

Table 15: IFA treatment and doses for treating severe anemia in vulnerable groups

Group	Iron*-Folic Acid Dose	Duration
Children < 2 years old	Iron*: 25 mg/day + Folic Acid: 100-400 mcg/day	3 months
Children 2-12 years old	Iron**: 60 mg/day + Folic Acid: 400 mcg/day	3 months
Adolescents and adults — including pregnant women	Iron***: 120 mg/day + Folic Acid: 400 mcg/day	3 months

*25 mg of elemental iron equals 125 mg of ferrous sulphate heptahydrate, 75 mg of ferrous fumarate or 208 mg of ferrous gluconate.

**60 mg of elemental iron equals 300 mg of ferrous sulphate heptahydrate, 180 mg of ferrous fumarate or 500 mg of ferrous gluconate.

***120 mg of elemental iron equals 600 mg of ferrous sulphate heptahydrate, 360 mg of ferrous fumarate or 1300 mg of ferrous gluconate.

If a woman is diagnosed with anemia in a clinical setting, treatment with daily iron (120 mg elemental Iron) and folic acid (400 g or 0.4 mg) supplementation is recommended until her hemoglobin concentration returns to normal. Once the anemia has been treated, the regimen can be switched to an intermittent frequency to prevent recurrence.

Recommended Actions

- Early detect and manage anemia
- Follow up the treatment outcome.
- Provide health education about the benefits and side effects of IFA
- Counsel on adherence to IFA consumption.

3.3.4. Infection prevention

Iron deficiency is associated with impaired innate (natural) and cell-mediated immunity, which increases the risk of infection. Extracellular fluid is depleted of iron during infection and inflammation. Anemia is caused by infections, particularly chronic infections with bacterial infections, helminthiasis, malaria, or other related infections. Several mechanisms contribute to the acute decrease in hemoglobin levels, including decreased red blood cell production induced by the systemic inflammatory response, increased destruction of red cells due to hemolysis and bleeding and increased utilization.

Recommended actions

- Prevent and control infectious diseases (control of helminthiasis (specifically hookworm,) and schistosomiasis)
- Use insecticide treated net properly (ITN) to prevent malaria infection.

- Diagnose and treat helminthiasis and malaria infections early.
- Promote hygiene and sanitation practices (use of improved latrine).
- Provide basic health and nutrition services.

3.4. Prevention and control of folic acid deficiency (FAD)

Folate (vitamin B9) is a water-soluble vitamin that is essential for normal cell and tissue growth, division, and replication. It is also required for DNA replication and serves as a substrate for a variety of enzymatic reactions involved in amino acid synthesis and vitamin metabolism. Because folate is required for fetal growth and development, demand for it rises during pregnancy. Folate deficiency has been linked to abnormalities in mothers such as anemia, peripheral neuropathy, and neural tube defects in the fetus.

Neural tube defects, which include anencephaly, spina-bifida, and encephalocele, are congenital malformations that occur during the structural development of the neural tube taking place within 28 days of conception. Women of childbearing age require adequate folate stores in their bodies before conception. In Ethiopia, the proportion of WRA with insufficient RBC folate levels (i.e., RBC values below the WHO-recommended cutoff of 906 nmol/L) ranged from 60% to 100%, with an average 83% (EPHI, 2016).

Recommended interventions

3.4.1. Folic acid supplementation

Preconception Folic acid supplementation for women of reproductive age. Folic acid supplementation before and during the first weeks of pregnancy helps to lower the chance of neural tube defects.

Recommended actions

- Provide supplementation of daily dose of folic acid (400 Ŷg) from 3 months before the planned pregnancy and continue for the first 3 months of pregnancy (if possible).
- Provide 5 mg folic acid for women who have had a history of poor fetus outcomes (fetus diagnosed with NTDs, abortion, still birth) starting from 3 months before the planned pregnancy (preconception).
- Provide counseling on the benefits and side effects of FAS.
- Promote planned pregnancy in Ethiopia.
- Link WRA for provision of folic acid supplementation at family planning services (on the time of discontinuation of family planning), if they have plan for pregnancy.

- Prepare SBCC materials with messages on the benefits of folic acid supplementation.
- Provide counseling and folic acid supplement for newly married couples.
- Introduce a tracking system for newly married couples.
- Introduce a tracking system for mothers who have previous history of bearing children with NTD.

3.4.2. Food based approach

The most effective FAD prevention mechanism is taking folate rich plant and animal source foods. Consumption of foods that are rich in folic acid like animal source foods (liver (best), chicken giblets, kidney, egg yolk, seafood) and plants source foods (dried beans, lentils, split peas, soya products, spinach, beetroot, Brussels sprouts, broccoli, green leafy vegetables) is highly recommended to prevent folic acid deficiency especially among WRA groups. Furthermore, folic acid fortification of wheat flour in combination with other micronutrients was associated with a decreased occurrence of NTDs.

Recommended Actions

- Promote the consumption of folate rich and diversified food.
- Advocate for implementation of folate fortification.
- Promote consumption of folate fortified foods.

3.5. Prevention and control of iodine deficiency disorders (IDDs)

Iodine is found in trace amounts throughout the body, primarily in the thyroid gland. Its primary function is to synthesize thyroid hormones (T3&T4). Iodine deficiency can lead to a variety of health and developmental consequences known as iodine deficiency disorder (IDD), which include fetal mental retardation during pregnancy and are most noticeable in early childhood. IDD, in its severe form, can result in cretinism, stillbirth, and miscarriage; even mild deficiency can result in a significant loss of learning ability (WHO 2004).

Almost 90% of the world's population consumes iodized salt, despite the fact that recent data indicated only 23 countries had 90% or higher coverage (UNICEF 2021). The proportion of national households with adequate iodized salt has increased from 26% in 2015 to 88% in 2018 (EPHI, 2018). Ethiopia is especially vulnerable to iodine deficiency because it is primarily made up of highland areas (Abuye, Berhane et al. 2008). The iodine content of the soil is decreasing over time as a result of soil leaching caused by floods caused by heavy rainfall, overgrazing, and strong winds in some areas of the country. Furthermore, in some

communities, goiterogenic substances are consumed as staple foods, which may contribute to the development of iodine deficiency.

Recommended interventions

In Ethiopia, public health strategies for the prevention and control of IDD are combined with a food-based approach (universal salt iodization and consumption of iodine-rich foods).

3.5.1. Food based approach

3.5.1.1. Universal salt iodization

To eliminate IDD in Ethiopia, universal salt iodization (USI) requires the sale and use of iodized salt. The iodine content of salt is measured in parts per million (ppm) or milligrams per kilogram of iodine or potassium iodate (KIO3). In Ethiopia, an iodine content of 34-66 ppm as KIO3 is required at the port of entry or the packaging factory, and 20-40 ppm at the household level (FMoH 2010). This iodine concentration may be revised in the future based on daily and national salt reduction strategies based on Ethiopian Food-based dietary guidelines and WHO recommendations.

Dietary recommendations: In addition to the aforementioned strategies, the community should have access to and use iodine-rich foods. Seafood and animal-source foods such as meat and milk are examples of these foods. It is important to reduce the frequency of consuming raw foods that have goiterogenic effects, such as cabbage, cassava, broccoli, and kale.

Recommended actions

- Promote the consumption of iodine rich foods.
- Promote optimal IYCF practices and maternal nutrition.
- Promote healthy feeding practices (dietary diversity).
- Promote proper use of iodized salt.
- Add salt after cooking or at the end of cooking.
- Properly store, handleand utilize iodized salt.
- Reduce consumption of foods containing goiterogenic substance (cabbage, beetroot, cassava; etc.).

3.5.1.2. Iodine oil capsule supplementation

Iodized oil capsules can be taken orally by children aged 6-12 months as a single dose, containing 200-400 mg of iodine and providing adequate coverage . Iodine supplementation is recommended by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) for pregnant and lactating women in countries where less than 20% of households have access to iodized salt, as well as for populations with moderate-to-severe IDD (when the population median iodine urinary concentration is 50 g/L (WHO, 2013) and is usually targeted to women of child-bearing age and pregnant women. Both of the preceding conditions may apply at national and/or sub-national levels in Ethiopia.

Table 16: WHO-recommended annual iodine supplementation

Population Group	Single annual dose of iodized oil supplement (mg/year)
Pregnant women	400
Lactating women	400
Children < 2 years [a,b]	200

[a] For children 0—6 months of age, iodine supplementation should be given through breast milk. This implies that the child is exclusively breastfed and that the lactating mother received iodine supplementation as indicated above.

[b] These figures for iodine supplements are given in situations where complementary food fortified with iodine is is not available, in which case iodine supplementation is required for children 7—24 months of age.

In countries or regions where USI is successful, and the population is considered iodine sufficient, children aged 0 — 24 months do not require iodine supplements.

3.5.2. Public health approach on prevention and control of IDD

- Strengthen the regulatory enforcement of USI.
- Refer for better treatment if individuals have difficulty swallowing and are breathing with exertion
- Protect soil erosion through natural resource conservation system.

3.6. Prevention and control of zinc deficiency

Zinc is a nutritionally fundamental trace element and the second most abundant trace metal in the human body after iron. It is an essential trace mineral required for optimal health, proper growth and development, and the overall functioning of the human body. Zinc is a component of more than 300 enzymes and numerous other proteins (Brown KH, Rivera J, 2004). Zinc requirement is increased during pregnancy and periods of rapid growth, which may precipitate overt zinc deficiency, especially when the zinc intake is marginal. Acute

diarrhea impairs intestinal integrity and reduces absorption, and increases endogenous losses of zinc, particularly in the presence of marginal dietary intakes (S. Gupta et al., 2020). As a consequence, zinc deficiency increases the risk and severity of a variety of infections, restricts physical growth, and affects specific outcomes of pregnancy. According to the 2016 Ethiopian national micronutrient survey report, the national prevalence of zinc deficiency was 35.0% among preschool children, 36% among children in the age group of 5 to 14 years and 34% among non-pregnant women of reproductive age from 15 to 49 years.

Recommended interventions

Food based approach, zinc supplementation for the treatment of diarrhea and public health approach are recommended to reduce zinc deficiency.

3.6.1. Food based approach

Dietary modification strategies like dietary diversifications and fortification are among the food based approaches to prevent and control zinc deficiencies. And also germination, fermentation, soaking or thermal processing are known to enhance zinc absorption and reduce the phytatic acid content of plant based staples by enzymatic hydrolysis induced or non enzymic hydrolysis.

Recommended actions

- Promote dietary diversification and consumption of zinc rich foods (animal sources: red meat, poultry meat and eggs, fish and seafood, dairy and dairy products; plant sources: legumes (peanut, peas and beans).
- Promote food modification techniques like germination, soaking, fermentation to improve zinc absorption.
- Reduce consumption of foods high in anti-nutrient factors (phytate and tannin).
- Promote the consumption of zinc fortified foods.
- Encourage commercial and private farmers to use zinc fortified fertilizers that improve zinc store of the plant.

3.6.2. Treatment of diarrhea Zinc with ORS

Zinc supplementation reduces the duration and severity of diarrhea in children. Ethiopia adopted a joint recommendation of WHO and UNICEF that prioritize zinc and ORS as the first choice of treatment for childhood diarrhea. The most convenient delivery mechanism to ensure co-administration at the community level is bundling the Low osmolarity-ORS (Lo-ORS) with zinc tablets (Table 17).

Table 17: Dosage of Zinc for the Treatment of Diarrhea

Age	Dose	Duration
< 6 months	1/2 tablet of 20mg zinc	10 days
6 months — 5 years	1 tablet of 20 mg zinc	10 days

NB: Zinc comes in a dispersible tablet. It should be dissolved in a small amount of breast milk, ORS or clean water in a cup or spoon. It should be given together with ORS for all types of diarrheal disease.

Recommended actions

- Ensure the availability of zinc and ORS co-pack at health facilities and in community outreach and family based contacts.
- Encourage the wide and early use of zinc and ORS co-pack.
- Promote pharmaceutical retailers, and drug stores to have ORS co-pack over the counter.
- Educate and counsel caregivers on proper preparation and administration of zinc tablets for a full 10 days course of treatment for optimal results.
- Counsel caregivers to increase fluids to rehydrate the child and continue feeding (including breastfeeding) during diarrhea episodes and after diarrhea stops.
- Disseminate appropriate messages on diarrhea prevention, home management of diarrhea with ORS co-pack and appropriate care-seeking using the different media outlets and face-to-face communication.

3.6.3. Infection prevention and control

Nutritional immunity is a process by which the host organism sequesters trace minerals during an infection so it can be of limited availability to pathogens. Zinc is an essential trace element for both host and pathogens. Pathogens require zinc for survival, propagation and disease establishment. This prompts a competitive process between the host and the invading pathogens. Therefore reducing the risk of infection is important to reduce the risk of zinc deficiencies.

Recommended actions

- Promote water sanitation and hygiene.
- Promote the production and consumption of safe foods rich in zinc.
- Early detect and treat diarrhea with ORS co-pack.

CHAPTER FOUR:

PREVENTION AND CONTROL OF EMERGING MICRONUTRIENTS OF PUBLIC HEALTH IMPORTANCE

4.1. Introduction

In Ethiopia, deficits in micronutrients (minerals and vitamins) are of public health concern. In addition to major micronutrient deficiencies (iron, zinc, iodine, folate and vitamin A), the deficiencies of other micronutrients like calcium, selenium, vitamin D, vitamin B's & vitamin C are considered emerging MNDs in Ethiopia. Those micronutrient deficiencies are currently under consideration for public health interventions. Calcium, vitamin D and magnesium have been getting due attention globally for their contributions to a healthy and productive life (Wesselink E. et al,. 2020). Deficiencies in calcium and vitamin D have been linked to various adverse health outcomes, including poor maternal health like loss of bone density osteoporosis and fracture; rickets in children (Fiscaletti M. et al., 2017). Vitamin C deficiency (VCD) results in scurvy, hair loss and spontaneous bleeding. In case of magnesium deficiency, clients could suffer from high blood pressure, heart disease, diabetes mellitus, and osteoporosis.

4.2. Prevention and control of calcium deficiency

Calcium is the most abundant mineral in the body. It is essential for bone and tooth health, normal heart rhythm, muscle contraction and relaxation, nerve, hormone function and blood pressure regulation. The body uses bone tissue as a reservoir for calcium to maintain a constant calcium concentration level in the blood and intracellular fluids. According to the Ethiopian National Food Consumption Survey 2013, the calcium consumption of children and women of child bearing age is 60-70% below the recommended intake.(EPHI 2013).

Recommended intervention

To prevent deficiencies of calcium, dietary diversification, supplementation and public health approach are recommended.

4.2.1. Food based approach

Dietary diversification and food modification techniques improve the bio-availability of calcium. Plant food sources like raw broccoli, coffee, tea and kale can inhibit calcium absorption. Therefore, it is recommended to improve their bio-availability and food modification techniques like germination, soaking and fermentation.

Dairy Products:- plain or low-fat yogurt, milk (skimmed, low-fat, whole), fruit flavored yogurt (low-fat), part-skim mozzarella, cheddar, and cottage cheese.

Plants: Frozen kale, green boiled soybean, dried figs, fresh or cooked broccoli, and oranges. Injera is also a good sources of caclium.

Seafood: Sardines (canned with bones), Salmon (canned with bones), and canned Shrimp.

Recommended actions

- Promote consumption of diversified calcium rich foods.
- Reduce consumption of calcium inhibiting foods like caffeine and broccoli
- Promote food modification techniques to prevent phytate effect by soaking, germination and fermentation.
- Consider foods rich in calcium for those who are taking drugs antagonistic with calcium.

4.2.2. Calcium supplementation for pregnant women

All women need an increased dietary intake of calcium, especially during pregnancy and lactating. In populations where calcium intake is low, an elemental calcium supplementation of 1.5 to 2.0 gm. per day is proposed as one ANC component for the prevention of preeclampsia among pregnant women (WHO 2013).

Table 18: WHO Guideline for Calcium Supplementation in Pregnant Women

Dosage	1.5g to 2.0g elemental calcium/day
Frequency	Daily - divided into 3 doses at mealtimes to increase absorption
Duration	From 14 weeks gestation to end of pregnancy
Target group	All pregnant women, particularly those at high risk of gestational hypertension*.
Setting	Areas with low calcium intake
* High risk of gestational hypertension is pre-existing hypertension, kidney diseases, DM, hypertension with previous pregnancy. N.B: The calcium and iron tablets should not be simultaneously taken; should preferably be administered at least 3 hours apart.	

The guideline should be adapted to the Ethiopian context, in order to integrate the supplementation as one of the ANC components (National ANC Guideline 2022).

4.3. Prevention and control of vitamin D deficiency

Vitamin D —a fat-soluble vitamin and pro-hormone - has multiple functions that are important for growth and development, including bone, immune system and brain development. It also plays an important role in the regulation of calcium and phosphate homeostasis (Curry A., 2013). Vitamin D is obtained by humans through cutaneous synthesis from ultraviolet B (UVB) radiation of the skin and/or from dietary intake. According to studies done in central Ethiopia and Sidama zone, around 42% and 55 % of vitamin D deficiency was reported among school children aged 11-18 years and lactating mothers respectively (Wakayo et.al, 2015, Girma M et al, 2016).

Vitamin D deficiency in infants has been associated with rickets — a bone malformation - seizures and difficulty of breathing (Wintermeyer E et al., 2016). Vitamin D deficiency during pregnancy is associated with an increased risk of preeclampsia, gestational diabetes mellitus, preterm birth, small-for-gestational age infants, impaired fetal skeletal formation (leading to infant rickets) and reduced bone mass, as well as other tissue-specific conditions (Özdemir AA et al, . 2018).

Interventions

Food based approach and public health approach are main strategies to avert vitamin D deficiency.

4.3.1. Food based approach

Consumption of vitamin D rich foods such as cod liver oil, salmon fish, tuna fish, orange juice fortified with vitamin D, dairy and plant milks fortified with vitamin D, sardines, beef liver, mushrooms, butter, oily fish, egg yolk and fortified dairy products and cereal foods are recommended.

Recommended Actions

- Promote consumption of vitamin D rich foods.
- Promote food fortification with Vitamin D.

4.3.2. Public health approach

- Promote exposure to direct morning sunlight with bare skin body for 15-30 minutes either in the morning or evening starting from two weeks of birth without applying ointment.
- Vitamin D comes primarily (80%) from exposure to sunlight.

4.4. Prevention and control of vitamin B12 deficiency

Vitamin B12 is needed for synthesis of DNA, and hence, cell division, and normal function of nervous tissue. Its deficiency affects rapidly dividing cells, such as those forming red blood cells. Vitamin B12 deficiency is particularly common among vegetarians because animal-based food is the natural source of vitamin B12. It can cause neurological, hematological, and psychiatric symptoms and affect the formation of red blood cells and the normal functioning of the nervous system (Nakos, 2016). Vitamin B12 deficiency occurs along with other micronutrient deficiencies, such as folate, iron, and zinc, worldwide, particularly in middle- and low-income countries. The food sources of vitamin B12 are animal source foods. Thus, people who are dependent on plant origin foods like those in Ethiopia are at risk of this deficiency (EPHI food based dietary guideline 2022).

Recommended actions

- Promote consumption of animal source foods such as meat, poultry, fish, eggs, milk, and other dairy products.
- Promote dietary diversification.

4.5. Prevention and control of other emerging micro nutrient deficiencies of public health importance

Based on the public health importance of micronutrient deficiency disorders, fortification and supplementation can be introduced as a strategy depending upon occurring evidence. In addition to the aforementioned micro nutrients, selenium, magnesium, potassium and vitamin C are of public health importance.

Table 19: Interventions and recommended actions for Emerging Micro-nutrient deficiencies

Nutrients	Function	Interventions	Recommended action
Selenium	Proper function of the immune system, antioxidant, improve sperm motility and reduce risk of of miscarriage, thyroid hormone metabolism;	Dietary diversification Supplementation Fortifications (Agronomy fortification)	Promote daily consumption of selenium rich foods: nuts, sea foods, organ meat and milk
Magnesium	Muscle and nerve function, regulate blood pressure, support immune system, combat depression;	Dietary diversification	Promote daily consumption of magnesium rich foods: whole grains and dark-green leafy vegetables, dried beans and legumes and nuts, avocado

Vitamin C	Antioxidant, wound healing, cardiovascular health, lower high cholesterol, age-related muscular degeneration	Dietary diversification	Promote daily consumption of of vitamin C rich foods: citrus fruits (oranges, kiwi, lemon, grapefruit), bell peppers, strawberries, tomatoes, broccoli, Brussels sprouts, cabbage, cauliflower
Vitamin B1	Act as co-enzyme for energy production, digestion, improve brain function, heart health, reduce Alzheimer's risk	Dietary diversification Fortification of staple cereal with Vitamin B1	# Promote daily consumption of of vitamin B1 rich foods: whole-grain cereals, wheat germ and wheat bran, peanut and other legumes, potatoes, fish, meat and pork (richest), egg yolk, yeast, and soy milk. #Avoid highly refined foods and polished rice that have virtually no thiamin # Counsel to reduce consumption of sugar and alcohol # Counsel to reduce foods containing polyhydroxyphenols like coffee, tea.

CHAPTER FIVE:

SOCIAL AND BEHAVIOR CHANGE FOR THE PREVENTION AND CONTROL OF MICRONUTRIENT DEFICIENCIES

5.1. Introduction

Social and Behavior Change (SBC) is a set of approaches and strategies that promote positive and measurable changes towards the improvement, wellbeing and quality of life of the population. The approach involves with communities, partners, and authorities to understand and influence the cognitive, social and structural drivers of behavior change. The current Food and Nutrition Policy of the country emphasizes the need for promoting nutrition literacy which further indicates the potential demand for appropriate SBC modalities (Food and Nutrition Policy, 2018). In addition, UNICEF's causal framework for malnutrition clearly indicates feeding and caring behaviors as critical determinants of nutritional status; consequently, emphasis should be given to SBC as main strategy to achieve the goal on reduction of micronutrient deficiency. Evidence-based Social and Behavior Change (SBC) strategy and intervention implementations enable to reach communities, increase their knowledge, change their attitude, improve their skills and motivation and practice, and contribute to social change which will result in reduction in micronutrient deficiency in the general population The interventions should target every segment of community, primarily pregnant & lactating women, adolescents and parents/caregivers of children less than five years of age. People who have direct influence on the primary targets including mother-in lows, religious leaders, community health workers etc can also be secondary targets.

The core purpose of this chapter is to provide practical guidance to designing, implementing, and evaluating a strategic SBC intervention. Furthermore, the approach will address the knowledge gap on micronutrients, encourage social and behavior change, generate public demand for and utilization of micronutrient supplementation, fortification and dietary diversification, and address policy gaps, if any.

The development of quality SBC programs often requires a range of strategic activities relating to technical areas from policy and financing to improved systems, products, and services to demand and use. In Ethiopia, most SBC interventions provide no detailed programmatic descriptions, lack clear intervention and are not evaluated appropriately. Moreover, SBC materials used in Ethiopia are not standardized across the country and the target segments of the population were mainly infants and young children (Alive&Thrive, 2020; Southey, 2017). In general, nutrition SBC information on adults, women and the elderly are very limited or non-existent (EPHI, 2020).

5.2. SBC strategies and approaches to promoting micronutrients

This social and behavior change strategy on micronutrient promotion uses the Socio-Ecological Model (SEM), a theory-based framework for understanding the multifaceted and interactive effects of personal and environmental factors that influence an individual's behaviors and a community's collective decision to adopt recommended practices and positive social norms. The framework recognizes the dynamic and complex sphere of influence at each level of society.

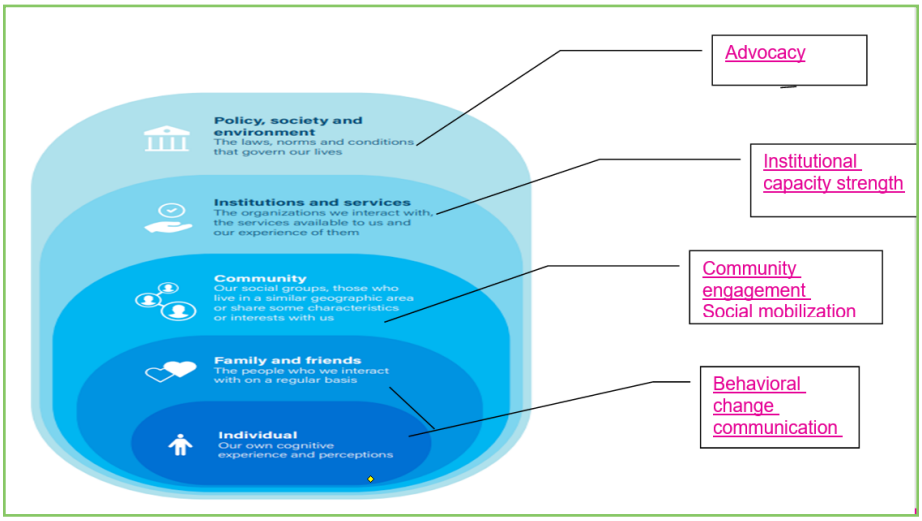


Figure 1: Socio Ecologic Model (SEM) framework for micronutrient SBC (Source: UNICEF, 2020)

SBC approaches and tools employ a mix of key strategies that go beyond and effectively complement individual level behavior change programming. The following are the key SBC approaches and strategies across the levels in socio-ecologic model (SEM):

5.2.1. Enabling environment: Supportive public policies

The public policies, strategies, and programs available and being implemented at national, sectoral, and regional levels need to facilitate and ensure an enabling environment for positive and preventive behavior change on micronutrient deficiency reduction. These have a pivotal role in ensuring conducive environment for micronutrient deficiency prevention and control among PLW and under 5 children.

Public policies can be thought of as guidelines made by the government or other decision makers that derive public action. We consider public policies supportive when they create an enabling environment for SBC objectives. These may include laws that support breastfeeding in the workplace, the new baby food directives, and so on.

5.2.1.1. Advocacy

Advocacy is one of the SBC strategies which help to gain political commitment and stakeholder support, and secure resources for micronutrient supplement and utilization to practice healthy behavior among all age groups of population segments.

Component 1: Enhancing public policy to improve micronutrient use

- Advocate for political commitment, resource allocation, laws, regulations and re-enforcement of mandatory micronutrient fortification.
- Advocate for the development of strategies that entertain community voices in government decision-making related to micronutrient.
- Directly engage policymakers to change laws, systems, and policies on micronutrient supplementation and food fortification.
- Facilitate citizen and community participation to ensure that the needs and concerns of community members influence development, change implementation of micronutrient related policies, strategies and guidelines.
- Provide local government with resources to generate local data and advocate for micronutrient as local priorities. These help changes in guidelines, policies, strategies, resource reallocation , and increase public awareness.
- Build the capacity of change agents, media and intermediary sensitizers and use media and influencers of decision making for advocating the importance of micronutrients.

Component 2: Supporting system financing

- Increase the contribution of public and private domestic resources such as those from food processing industries towards humanitarian and development goals.
- Catalyze and incentivize investment in sectors through public-private partnerships on food fortification and micronutrient supplement supply.
- Promote equity-based financing instead of using a blanket approach (e.g., focusing on districts or provinces with poor child survival indicators).

Advocacy core activities for micronutrient deficiency prevention and control

- Advocate for appropriate budget allocation to tackle micronutrient deficiencies.
- Advocate for political and social commitment for social or policy change.
- Advocate for creating an enabling environment at all levels.
- Promote effective preconception nutrition.

- Encourage dialogue on maternity leave at higher level.
- Encourage dialogue on food fortification policy and practice at higher level.

5.2.1.2. Institution and service delivery

Service delivery facilities and institutions are the main source of information, and community trust in them affects the service utilization. Furthermore institutions with direct and indirect role in community health and wellbeing should be capacitated on SBC so that they can influence positive change regarding micronutrient deficiency prevention and control. The following are institution level SBC approaches and tactics for micronutrient deficiency prevention and control.

a) Service improvement

The current health education and services are not client friendly; they involve long waiting time, and poor counseling. These types of service create barriers work against the behaviors we seek to promote. Service improvement is about designing services that are accessible, usable, and valuable. The service that we design should be easy to access, done in consultation with communities and target to reach the most vulnerable .

b) System strengthening

This relates to strengthening sectoral system to achieve SBC objectives. It includes building the capacity of human resource, both at health facility and community levels, on designing and implementating SBC strategies, ensuring high quality service and placing people ats the center of service delivery.

The following are the SBC components and key interventions for service improvement and system strengthening in micronutrient deficiency prevention and control:

- Update recruitment practices, such as job TORs, to include core SBC skills.
- Develop training plans, manuals and tools to build SBC capacity in HR.
- Mobilize resources for the implementation and distribution of SBC materials.

Component 2: Ensure quality, people centered service delivery

- Create SBC feedback and social accountability mechanisms for sub-regional, district, community, and village services.
- Increase community participation in decision making through SBC activities.
- Use the existing coordination platform across and between sectors.
- Standardize and harmonize SBC tools.

Component 3: Strengthen supportive institutions, governance and leadership

- Hire SBC specialists joining central-level teams.
- Implement 'Leadership for SBC' into regular training for policymakers and program managers.
- Develop budget lines for SBC programs and activities.
- Create behavioral insights units to support and guide the government.

Component 4: Strengthen community structures

- Implement processes that ensure meaningful participation and representation of community diversity in design, implementation and tracking of progress.
- Involve nutrition service providers and frontline workers in the Integrated Refresher Training (IRT).
- Provide training or orientation for salt producers, wholesalers and retailers on quality assurance and the proper handling of iodized salt and other fortified foods.
- Train the Health Development Army (HDA) and Women Development Army (WDA) platforms to educate the community on the proper handling and utilization of salt.
- Map and engage local partner organizations, traditional leaders and influencers during planning and preparation of interventions.

5.2.1.3. Community level: Community engagement

It is critical to partner with the community so they lead the change process. Engaging the community empowers community members to explore, plan and act together on their priority issues. The engagement can be considered at four different community levels:

- **Inform and mobilize** the community to participate in addressing immediate short-term concerns;
- **Consult and involve** the community to improve the delivery of services;
- **Collaborate** with the community to enable priority settings and decisions from the community; and
- **Empower the community** to develop systems for self-governance, establish and set priorities, implement interventions, and develop sustainable mechanisms with partners for development as part of a support.

Key interventions to improve community participation and ownership on micronutrient deficiency prevention and service utilization may include:

- Ensuring participation ofmarginalized groups such as people living with disability, women in emergency situations in the community
- Including key messages on micronutrient deficiency prevention in the existing training manuals and job aids for village health leaders (VHL) and had leaders and help communities know and demand for services
- Developing the capacity of platforms for underserved communities to influence public policy design on micronutrient deficiency preventive actions
- Improving the skills of frontline workers on recommended behavioral practice in micronutrient deficiency prevention and control to ensure improved supplies of services and increase the demand for them
- Empowering individuals, families and communities to engage with micronutrient service design and delivery mechanisms.
- Ensuring that feedback loops benefit communities through training 952 hotline workers on key micronutrient focused messages and tracking community feedback.

5.2.1.4. Individual level: Social Behavior Change Communication (SBCC)

This approach targets change in knowledge, attitudes and practices among targeted audience. It focuses on designing a holistic and data driven communication plan to enable change and applies different tactics like social marketing, community mobilization, mass media and social media messaging, entertainment, interpersonal communication, and SBC material development and utilizarion. The following are common steps for developing communication messages and materials.

1. Understand the program and where communication can add value.
2. Define your communication objectives.
3. Identify your audience.
4. Develop and test your key messages.
5. Identify your communication tactics and materials.
6. Finalize your communication plan.,
7. Measure your result.

SBC is a good approach to reach public needs through creating awareness on micronutrient deficiencies and their impact on health and promoting nutrition services that are in place to tackle these problems.

Table 20: Summary of barriers and recommended behavioral practices on micronutrient deficiency prevention and control

Micro-nutrients	Barriers	Target	SBC Approach	Expected / Recommended Behavior
Iron	Low adherence and compliance of anti-helminthic and iron -folate via pregnant and adolescent girls Poor exclusive breast-feeding practices Misconception of iron supplementation by the community Inadequate intake of animal source foods Early /child marriage Inadequate knowledge on diversified foods	Pregnant and lactating women Adolescents Under five children Community figures	-SBC Community engagement	Increase intake of deworming and iron folate. Increase uptake of diversified food and community participation. Properly counsel on the importance of iron /folate uptake. Increase intake of iron-rich foods. Promote back yard gardening for production of iron-rich foods/fruits.
	Improper supplementation of WIFS Poor school community understanding of of micronutrients Low compliance to food fortification standards among the food processing industry	Institutions Health facilities Schoosl Private sector	SBC Advocacy	Provide anti-helminthic for pregnant women/ adolescents in in and out of school regularly Utilize facility back yard and school gardening for production of iron-rich foods/fruits. Provide nutritional counseling in health facilities. Promote food diversification in school feeding programs. Integrate nutrition in school co-curriculum. Strengthen enforcement of regulation at industry and market levels.
	sub-optimal exclusive breast-feeding practices Lack of multisectoral collaboration Inadequate execution of nutrition-sensitive agriculture policies Poor marketing Inadequate resources Lack of political commitment Lack of food fortification policy	Policy Makers (National and Regional)	Advocacy	Promote effective preconception nutrition Create dialogue on maternity leave entitlements at higher level. Integrat nutrition in school co-curriculum. Enforce breastmilk substitutes (BMS) law.

Iodine	Low consumption of iodized salt at HH level Low awareness on food preparation with iodized salt Weak enforcement of mandatory salt regulation (FMHACA NO189/2010) and monitoring at retailer level Lack of awareness on health benefits of iodine/iodized salt and its preservation at household level.	Community and households	SBC, community regulatory institutions	Increase the uptake of iodine salt. Promote safe food preparation with iodized salt and its storage. Enforce industrialized salt processing and iodization.
Zinc	Misuse of zinc i.e failure to follow instructions Low awareness on the role of zinc Poor supply chain management Inadequate intake of foods rich in zinc	Under five children	SBC, counseling	Strengthen logistic process to ensure delivery of zinc. Counsel parents /caregivers on zinc usage. Improve the intake of zinc rich foods.
Vit A	Low uptake of vitamin A source foods Low compliance to Vit A supplementation for children aged 6-59 months Low awareness and improper handling of vitaminA at facilities	Under five children, women and providers and supply institutions	Counseling, interpersonal communication (IPC), social mobilization	Provde vit A for children aged 6-59 months Increase the intake vit A rich foods. Promote back yard -gardening for production of iron-rich foods/fruits. Improve the supply chain management system.

5.3. Building an SBC strategy/plan

In order to have effective and human-centered SBC plan, one may need to follow the following phases and steps.

1) Build a team that include community members.

2) Diagnose your situation-using models.

3) Determine funding mechanisms and look for opportunities.

4) Outline the needs of affected people.

5) Select SBC approach.

6) Develop a Theory of Change.

7) Define result and select interventions.

8) Determine the budget, timeline, risk and roles,.

9) Implement the planned activity.

10) Monitor and evaluate.

The SBC plan should consider both social mobilization and social and behavioral change.

Social Mobilization:

- Promote iron and folic acid supplementation for adolescent and women of reproductive age.
- Promote access to micronutrient services, including iodized salt and fortified food consumption
- Create awareness on preventing harmful traditional practices.
- Provide comprehensive and routine nutrition counseling and support services.

Behavior Change:

- Promote and support early initiation of breastfeeding within one hour of delivery.
- Promote exclusive breastfeeding for the first six months.
- Promote continued breastfeeding beyond one year.
- Promote timely initiation of solid, semisolid or liquid food at six months of age.
- Promote optimal complimentary feeding among children aged 6-24 months.
- Promote the use of diversified foods.
- Promote the use of and create access to micronutrient-rich complimentary foods.
- Promote use of fortified foods or locally fortified food items.
- Promote prevention and control of micronutrient deficiencies, including the treatment of anemia, vitamin A supplementation for children 6-59 months of age, iodized salt utilization, and the use of zinc and ORS for diarrhea treatment.
- Promote the early treatment and referral of malnutrition cases.

- Promote access and utilization of improved WASH practices — use of clean water, HH water treatment, safe and hygienic preparation and handling of food, and handwashing with appropriate detergents.
- Promote utilization of deworming and vitamin A supplementation every six months.
- Promote the use of multiple micronutrient supplementations to children 6-59 months of age to enrich general ration with micronutrients.
- Promote optimal feeding practices during pregnancy and lactation.
- Ensure the use of iodized salt and deworming during second and third trimesters of pregnancy.

3.1. Program communications

In order to ensure an effective and sustainable program on MND prevention and control, there must be a dedicated collaborative partnership between the government, private sector and NGOs, including all key sectors - health, agriculture, education, water, trade, industry and others.

This can be achieved through effective behavioral communication interventions, such as social marketing approaches using different communication channels (print and electronic media).

- Health workers, both at the private and public health facilities, need to be provided with training on the proper administration of zinc and Lo-ORS as an integral part of diarrhea management. Communications strategies need to focus on adherence issues with regard to individuals taking the full 10 days course of treatment.Include zinc on the family health card to increase awareness, as it is a good tool for interpersonal communications at the community level.
- Food and nutrition professionals and development partners can help enhance zinc fortification with commonly cultural acceptable foods groups.
- Promote behavioral change on zinc rich food consumption and dietary diversification through integrated routine community communication platform.
- Promote (zinc fertilizer), advise and consult for biofortification of zinc nutrient to enrich soil and cereal food collaborated with agriculture and natural resource research centers.

- Check adherence of individual women and provide tailored counseling on actions/ strategies to address barrier to adherence. Women need to be informed why and how to take IFA/MMS supplements. They should be informed of the common side-effects and be counseled on how to manage them. In addition, they need to be encouraged to receive adequate nutrition, which is best achieved through consumption of a healthy, diversified diet.
- Coordinate the supplementation of IFA in collaboration with the MoE and MoH, as a package of the National School Health and Nutrition Strategy.
- Reach out of school adolescent girls through targeted social mobilization in the existing community structures.
- Put strategies in place to reach more women, particularly in hard-to- reach settings.
- Address critical bottlenecks on both the supply and demand side and explore approaches in order to significantly improve service uptake and utilization

CHAPTER 6:

PROGRAM MANAGEMENT AND IMPLEMENTATION MODALITY

6.1. Program management

Program management is an important component in the effective implementation of micronutrient deficiency prevention and control. For the successful implementation of micronutrient supplementation and food-based approach interventions, active involvement of multisectoral collaboration, and involvement of the private sector (e.g., food industries) and other stakeholders is crucial.

It is critical to consider the following components for successful implementation. (Table 22).

- Planning
- Capacity building
- Supply chain management
- Accountable and responsible sectors

Table 21: Program management on micronutrient deficiency prevention and control implementation

Intervention or activities	Planning	Capacity building	Supply chain management	Accountable and responsible sectors
Micro- nutrient supplementation (IFA, VAS, Zn)	Use target population conversion factors. Set baseline and target coverage. Integrate IFA with ANC plan. Integrate WIFAS with school programs. Integrate VAS and EPI plan (routine and campaign). Integrate Zn with child health plan. Plan SBCC for promoting of micro-nutrient supplementation.	Provide orientation for national micronutrient technical working group. Provide in-service training for healthcare providers. Provide integrated refresher training for health extension workers. Conduct supportive supervision. Conduct catchment based mentoring. Conduct program review meeting. Conduct WIFAS training for teachers and healthcare providers Orientation for students	Carry out annual forecasting of for nutrition commodities. Monitor cold chain system. Ensure sustainable Supply.	MoH, EPSA, RHB, ZHB and WoHO, FDA, and TLMt

Food fortification Wheat flour (VB complex, & Zn) Edible oil (VA& VD) Salt (iodine)	Plan on ways to promote consumption of fortified food items with micron nutrients. By target house holds. to Plan to enable new and existing industries to produce fortified foods. Plan to design/utilize quality assurance mechanisms for fortified foods Plan annual premix for each fortificant Plan SBCC activities for promoting fortified foods.	Conduct consultative workshop with private food producers. Exchange visits to countries successfully implementing fortification program. Ensure equipment installation, use and maintenance,. Traing regulatory bodies, institutions and producerson internal QA/QC and production. Train private and public laboratories on standardized laboratory methods and key stakeholders. Develop training manuals and guidelines.	Adjust separate transportation for fortified foods and put in place ware houses or storage from industry to house hold level. Provide transportation access to all areas for fortified food distribution. Keep fortified foods safe during transportation and storage.	MOI, FBPIDI, MOH, MOT, ESA, Private fortified food industries, FDA, TLM
Dietary diversification and modification	Plan annually nutrition education sessions at health facility, community, and school settings. Plan annual SBCC key message to be conveyed through different communication and media platforms. Establish cooking demonstration centers (at least one per village). Establish demonstration sites for nutrition sensitive agriculture practices(one per village) Plan to provide improved verities of seedlings and seeds to small holder farmers. Plan to promote home gardening activities.	Provide training on diet diversification and modification for health and agricultural workers on NSA and IYCF.	Support availability and accessibility of diversified foods at market and house hold levels through market value chain. Procure and distribute seedlings, seeds. Procure and distribute cooking materials demonstration kits, and food items	Health, education and agriculture sectors, community

6.2. Implementation modality

Micronutrient interventions are implemented through multi-sectorial engagement of health, agriculture, education, water, social protection sectors and using different platforms at various entry points. The table below provides a list of MN interventions and delivery modalities.

Table 22: Implementation modality and integration of nutrition interventions

MND	Intervention	Delivery modality	Contact point
VADs	Promote and support optimal breastfeeding	Counseling at ANC follow up Pregnant mothers conference Delivery waiting rooms At Delivery rooms At breast feeding corner At post Natal care At family planning service center At Immunization rooms At Growth monitoring and promotion rooms During House-to-house visit	OPD, ART and TB clinics, ANC, PNC, FP, EPI in hospital, HC and HP levels
	Promote and support optimal complementary feeding	Pregnant mothers conference At growth monitoring and promotion rooms During House-to-house visit Cooking demonstration at farmer training centers, HPs, HC, Community, school)	
	Provide Vitamin A supplementation	Routine at HFs (fixed site for Nutrition service only) Routine At HFs (fixed site with integration with EPI, <5 Yrs. OPD), House to house Integrated campaign (EPI) Through Community Health Day Health and nutrition mobile team	
	Food-based approaches for prevention and control of VADs (Promotion of diet diversity, food fortification, bio fortification, diet modification)	At FTC for production and consumption of diversified and nutrient dense foods Farmers development agents for production and consumption of bio fortified crops Home and school gardening At HP level cooking demonstration At health facilities through counseling At Community level through cooking demonstrations Promotion food-based approaches for VADs prevention and control through mass media Food processing associations for food fortification and promotion for consumption At agriculture research institutions for production and distribution of bio fortified crops At food processing industries for production and distribution of modified foods	
	Prevention and control for VAD (infectious diseases such diarrhea, measles, TB/HIV, Malaria, eye infections),	Promotion of WASH practices at community level Early detection and management of Infectious diseases at Health facilities Statistics and campaign-based measles vaccinations Media engagement for the prevention of TB/HIV infections ITN distribution and education at Household levels	

Iron deficiency anaemia	Promote early ANC for IFA supplementation and follow up	ANC contacts Pregnant women conference, Home to home visit, Community conversation, Mother to Mother support group and local media	
	Provide weekly iron folic acid supplementation for Adolescent girls	schools, health facility and community (Religious institution, youth centers, outreach areas	
	Provide deworming for children		
Folic acid	Preconception folic acid supplementation	Health facilities for provision for folic acid supplementation School, health facility for WIFAS Community for promotion of consumption of food-based interventions and WIFAS Food manufacturing industries for food fortifications Private pharmacies for providing folic acid tablets	
	Weekly iron folic acid supplementation		
	Consumption of folate fortified foods		
	Dietary diversification for folate		
Iodine deficiency disorders	Universal salt iodization		
	Iodine oil Supplementation		
	Public health approach on prevention and control of IDD	Promotion of iodized salt consumption using mass media Promotion of proper storage, handling and utilization using mass media Ensuring regulatory enforcement through continuous assessment.	
Zinc	Public health approach	Provision of zinc with ORS in sick baby clinic according to ICCM/IMNCI Promotion of the utilization of zinc with ORS using different media outlets Promotion of consumption of foods rich in zinc including during ANC, PNC, GMP, EPI, FP, and at sick baby clinic Promotion of dietary modification (fermentation, germination and soaking) during cooking demonstration sessions	
	Dietary modification	Counseling at ANC sessions	
	Food fortification		

	Zinc supplementation for treatment of diarrhea	Provision of zinc with ORS in sick baby clinic according to ICCM/IMNCI Promotion of the utilization of zinc with ORS using different media outlets Promotion of consumption of foods rich in zinc including during ANC, PNC, GMP, EPI, FP services, and at sick baby clinic Promotion of dietary modification (fermentation, germination and soaking) during cooking demonstration sessions	
Calcium deficiency	Calcium Supplementation for pregnant women	Promotion of consumption of calcium rich foods at ANC, PNC, EPI, FP services Cooking demonstration Community conversation (pregnant mothers' conferences, community social networks) Elderly population including those in nursing homes.	
Vitamin D deficiency	Promotion of exposure to direct morning sunlight	Promotion of sunlight exposure during ANC, PNC and EPI services Promotion of the importance of sunlight exposure using mass media, (local, print, and digital media) promote the consumption of food rich in vitamin D Advocate production and consumption of vitamin D fortified foods	
Food-based approach		Promotion of diet diversification, food fortification and dietary modification at all contact points	

CHAPTER 7:

MONITORING AND EVALUATION

7.1. Introduction

This chapter provides guidance on planning, monitoring, evaluation and learning in the performance of the micronutrient interventions across implementing sectors at all levels. The overall objective of the MEAL is to improve service provision by measuring the progress of output, outcome and impact indicators and to facilitate learnings through the process. The indicators included in this guideline are affiliated with the national HSTP II targets and the national food and nutrition strategic plan (FNS, 2020-2030) which is aligned with the global sustainable development goals (SDGs) towards reaching the set targets by 2030.

7.2. Planning

It is expected that nutrition implementing sectors align their nutrition program performance planning with the FNS objectives and indicators. These implementing sectors have their specific annual workplan at all levels. The multisectoral nutrition coordination body from national to kebele levels (NNCB, RNCB, etc.) will collect nutrition specific and sensitive workplan from each sector. Implementing sectors might use different opportunities and platforms to include MN interventions in their performance planning exercises. For instance, the health sector uses annual woreda based costed planning exercise as one of the golden opportunities to include micronutrient interventions targeting at all levels.

7.3. Monitoring, learning and accountability

In the existing system, nutrition implementation sectors conduct sector specific regular progress review meetings to review performance indicators of MN interventions. Monitoring of the micronutrient intervention activities and results will be done through routine collection, analysis, interpretation, and dissemination of data using standardized tools and procedures in each sector. The multisectoral food and nutrition technical committee meets every quarter at national, regional and woreda levels and monthly at kebele level. The food and nutrition council conducts its biannual meeting, which provides an opportunity to review sector specific performance, identify implementation gaps and enhance cross learning between sectors. Sectors can also share innovations and experiences through learning platforms. The sector and multisector food and nutrition coordination offices (vertically and horizontally) could organize learning sessions like community of practice (CoP) to share their best practices and experiences. Learning could be involved in assessing what works well or what does not work well, and which aspects have more influence on the achievement of results, which

strategies can be replicated, etc.. There is a national multisector scorecard tool to evaluate sector specific commitment and accountability from federal to kebele levels. The multisector scorecard tool utilized quarterly ensures nutrition governance among sectors and enforces multisectoral intervention activities across implementing sectors. Furthermore, implementing sectors conduct multisectoral joint supportive supervision quarterly at different levels to assess the implementation and operational challenges of MN interventions.

7.4. Reporting and feedback mechanisms

Implementing sectors regularly share reports through Unified Nutrition Information System for Ethiopia (UNISE) for nutrition governance, nutrition sensitive and nutrition specific indicators. The nutrition specific indicators could be tracked and reported through the DHIS2/ HMIS platform. Implementing sectors are expected to exercise routine data collection and reporting of MN intervention indicators. Data quality standards could be ensured through LQS, RDQA, DQA, and others. Quality data sharing between MN implementing sectors needs to be strengthened to inform decision making. A system of compiling and aggregating routine reports into one platform is also key for nutrition governance, research and comprehensiveness of available data and data use. The multisectoral technical committee receives reports from program teams in accordance with sector specific MN workplan. In addition, periodic reports have to be compiled and analyzed at all levels for feedback, follow-up and fine-tuning of program implementation. After review meetings, monthly reporting and joint supervision, the technical committee will provide feedback to each sector according to their data status and data gaps.

7.5. Evaluation

This guideline recommends that packages of MN interventions be implemented across sectors. The interventions recommended through this guideline could be evaluated within lenses of relevance, effectiveness, efficiency, and impact of MN program interventions. Evaluating the micronutrient interventions that is recommended in this guideline and tracking nutrition and health outcomes require credible information for decision-making to identify ways of achieving the desired results. The outcome and impact indicators of micronutrient interventions and nutritional status in different population segments should be included and evaluated using multiple data sources including EDHS, food and nutrition surveys, DHIS/ HMIS, NDMC, EMNS and other sector specific evaluations and data sources. Sector specific assessments could be conducted in areas where data is lacking.

Knowledge gaps and recommended research areas:

- Bioavailability and absorption of MN supplementations
- MN inhibitors (antagonistic) and enhancers (synergy), MN interaction

- Agronomic fortification and bio fortification
- Feasibility studies on MN products in the Ethiopia context
- MN safety and storage, cold chain related with absorption and nutritional status

7.6. National MN Guideline Logic model

Monitoring and evaluation for the Micronutrient Deficiency (MND) Prevention and Control Program is based on the logic model for micronutrient interventions in public health (WHO 2011), which sketches the logical linkages between the input/supply, delivery and utilization (coverage and compliance) of interventions.

Goal: Reducing morbidity, mortality and long-term economic problems associated with micronutrient deficiencies through implementing public health approaches, supplementation, and food-based approaches and strengthening nutrition education and SBCC activities.

Process, Outcome and Impact Indicators

Expected results	Indicators	Baselin	Target	Data source & MOV	Frequency	Responsible body
Impact						
Reduction of child and maternal mortality	Under 5 mortality rate			EDHS/ Survey		CSA/EPHI
	Infant mortality rate			EDHS/ Survey		CSA
	Maternal mortality ratio			EDHS/ Survey		CSA
Reduction of morbidity related to MNDs	Reduction of stunting prevalence (height-for-age Z-score below -2 SD)			EDHS/ Survey		CSA
	Reduction of under-weight prevalence (weight-for- age Z-score below -2 SD)			EDHS/ Survey		CSA
	Reduction of wasting prevalence (weight-for- height Z-score below -2 SD)			EDHS/ Survey		CSA
	Reduction of low birth weight (birth weight < 2500 g)			EDHS/ Survey		CSA
Improved cognitive development and educational attainment	Proportion of students passing to next level within a given year			Program report		MoE

Outcome/Output indicators						
Strategic objective 1: prevention and control of MNDs						
1.1 Prevention and control of vitamin A deficiency						
Outcome						
	Prevalence of night blindness among pregnant women (XN).			FNS, DHS		EPHI, CSA
	Prevalence of Bitot's Spot among under-5 children (XN).			EMNS, DHS		EPHI, CSA
	Serum retinol level among under-5 children.			EMNS, DHS		EPHI, CSA
	Serum retinol level among pregnant women.			EMNS, DHS		EPHI, CSA
						FMOH
	Percentage of children aged 6-59 months that receive vitamin A supplementation twice a year.			DHIS2/ HMIS report		FMOH
Output	Number of vitamin A capsules procured			Program report		FMOH & partners
1.2 Prevention and control of iron deficiency						
Outcome	Prevalence of iron deficiency anemia among different target groups (children, adolescents, WRA, PW)			FNS		EPHI, CSA
	Percentage of women who received/ reported minimum of 90 IFA tablets during pregnancy and/or postnatal period.			HMIS, DHS		FMOH, CSA
Output	Number of health workers trained in anemia prevention.			Program report		FMOH
1.3 Prevention and control of iodine deficiency						
Outcome	Percentage of 6 -12 year old children (in the community or at school) with goiter.			EMNS		EPHI
	Percentage of HHs using adequately iodized salt (20 ppm of iodine).			EMNS		EPHI

	Percentage of children aged 6 years and above whose median UIE is <100 Ŷg/l (100—199 is adequate).			EMNS		EPHI
	Percentage of UIE < 100 Ŷg/l in general population except PLW and U5 (100—199 is adequate).			EMNS		EPHI
	Percentage of pregnant women with median UIE of <150 Ŷg/l (150—249 is adequate).			EMNS		EPHI
	Percentage of salt produced for human consumption that meets national standards. i.e. 1. Iodized common salt 20-40 PPM (Point of production) 2. Iodized table salt 30-40 PPM (Point of production); 20-40PPM (Retail level))			DHS EMNS Routine program monitoring		CSA, EPHI, EFDA
Output	Metric tons of KIO3 procured			Program report		EFDA
	Number of CIF staff trained			Program report		FBIRDC
	Number of CIFs that conduct regular iodization level test			Program report		FBIRDC
	Number of HHs who have access to adequately iodized salt			Program report		FBIRDC
	Number of wholesaler/ retailer shops distributing adequately iodized salt			Post-market survey		EFDA

1.4 Prevention and control of folate deficiency						
Outcome						
	Proportion of neural tube defect (NTD): Spina bifida &/or anencephaly per year per 10,000 live births			EMNS		EPHI
	Proportion of WRA consuming folic acid for 3 months before pregnancy			Survey		FMOH & partners
	Prevalence of folate deficiency anemia			Survey		
	Proportion of WRA who consumed folic acid supplements for 3 months (with iron folic acid)			HMIS		FMOH
Output	Metric tons of food/ wheat flour fortified with folic acid					
1.5 Prevention and control of zinc deficiency						
Outcome	Percentage of children aged 0 - 59 months receiving zinc with ORS for diarrhea treatment during a recent episode			HMIS, DHS		FMOH, EPHI, CSA
	Percentage of caregivers who administered zinc tablets for the treatment of diarrhea for 10 days			Survey		EPHI, Partners
Output	The proportion of HFs that have no Zn & ORS stock out			Program report		FMOH
	Number of 10 tab blisters of Zn supplements procured (6-23 supplementation)			Program report		EPSS
	Number of caregivers exposed to diarrhea treatment message			Program report		FMOH

Strategic objective 2: Prevention and control of emerging MNDs						
2.1 Prevention and control of Calcium deficiency						
Outcome	Prevalence of calcium deficiency among children aged 12 months, adolescent girls and pregnant women			Survey		TBD
	Proportion of children aged 12 months and older with calcium intake of >500 mg/day (WHO, 2019).			Survey		TBD
	Proportion of pregnant women supplemented with calcium			Survey		TBD
2.2 Prevention and control of Vitamin D deficiency						
Outcome	Percentage of the general population having serum 25 (OH) D <30 nmol/L (<12 ng/mL) (WHO, 2019)			Survey		TBD
	Percentage of children with nutritional rickets in the population			Survey		TBD
Strategic objective 3 : Promote food-based approaches for prevention and control of MND						
	Proportion of households (HHs) that have access to industrially fortified foods			Survey		EPHI
Outcome	Proportion of HHs consuming bio fortified foods			Survey		EIAR
	Proportion of children with minimum acceptable diet			DHS		CSA
	Diet diversity score for target group (children aged 6 -59 months, HHs, WRA, adolescents)			Survey, DHS		EPHI, CSA

	Number of companies and small and medium scale enterprises producing complementary/ therapeutic / supplementary foods locally			program report		FBIRDC
	Proportion of schools feeding programs (schools) that serve fortified foods			Program Report		FMoE
	Proportion of HHs consuming animal source foods			Survey		EPHI, partner
	Proportion of households consuming fruits and vegetables			Survey		EPHI, partner
	Percentage of households accessing potable drinking water			Survey		EPHI, partner
Output	Number of industries certified or licensed to produce and/or import fortified foods			Program report		EFDA
Strategic objective 4: Strengthen public health approaches for prevention and control of MNDs						
Outcome	Proportion of women who received deworming drugs during recent pregnancy.			HMIS		FMoH
	Proportion of infants aged 0-6 months being exclusively breastfed			Survey, DHS		EPIH, CSA, partner
	Percentage of pregnant women and children living in malaria endemic woredas who are utilizing LLINs					
	Proportion of households with toilet facility			Survey, DHS		EPIH, CSA, partner
	Proportion of households practicing handwashing before feeding			Survey, DHS		EPIH, CSA, partner

	Proportion of households practicing household water treatment			Survey, DHS		EPIH, CSA, partner
	Proportion of children aged 0 to 59 months receiving zinc for diarrhea treatment			Survey, DHS		EPIH, CSA, partner
Strategic objective 5: Strengthen SBCC and advocacy approaches for prevention and control of MNDs						
	Percentage of target groups aware of at least one benefit of IFA intake			Survey		EPHI, FMOH
Outcome	Proportion of people addressed through communication on iron deficiency and programs in place			Survey		EPHI, FMOH
	Proportion of people addressed through communication on food fortification and programs in place.			Survey		EPHI, FMOH
	Percentage of households aware of the benefits of exposing children to sunlight			Survey		EPHI, FMOH
Output	Number of SBC materials distributed			Program report		FMOH, partners
	Number of SBC advocacy campaigns conducted, focusing on MN			Program report		FMOH, partners
	Number of service -providers trained in SBC			Program report		FMOH, partners
	Number of organizations supported in SBCC			Program report		FMOH, partners
Planning, Monitoring, Evaluation and Learning						
Output	Number of multisectorl workplan developed on MNs					
	Number multisector joint supportive supervisions					
	Number of periodic multisector performance review meetings					

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