NATIONAL GUIDELINES

For the Prevention And Control of Micronutrient Deficiencies in Nigeria

FEDERAL MINISTRY OF HEALTH
DEPARTMENT OF FAMILY HEALTH
NUTRITION DIVISION
ABUJA, NIGERIA

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LIST OF ACRONYMS / ABBREVIATIONS

ADP	Agricultural Development Project
AIDS	Acquired Immune Deficiency Syndrome
ANC	Ante Natal Care
ARI	Acute Respiratory Infection
CFS	Complementary Food Supplements
CMAM	Community Management of Acute Malnutrition
CS-SUNN	Civil Society Scaling Up Nutrition in Nigeria
DNA	Deoxyribonucleic Acid
EAR	Estimated Average Requirement
EDTA	Ethylenediaminetetraacetic acid
F-100	Formular 100
F-75	Formular 75
FACT	Fortification Assessment and Coverage Toolkit
FAO	Food and Agriculture Organization
FCCPC	Federal Competition and Consumer Protection Commission
FMARD	Federal Ministry of Agriculture and Rural Development
FMFBNP	Federal Ministry of Finance, Budget and National Planning
FMIC	Federal Ministry of Information and CultureFMOH Federal Ministry of Health
FMSTI	Federal Ministry of Science, Technology and Innovation
GAIN	Global Alliance for Improved Nutrition
GAVA	Global Alliance for Vitamin A
HB	Haemoglobin
HDDS	Household Dietary Diversity Score
HIV	Human Immune Virus
HKI	Helen Keller International
HMIS	Health Management Information System

ICN	International Conference on Nutrition
IDA	Iron Deficiency Anaemia
IDD	Iodine Deficiency Disorders
IFAS	Iron Folic Acid Supplementation
iLiNS	International Lipid-based Nutrient Supplements Project
IPTp-SP	Intermittent Preventive Treatment of malaria in pregnancy using Sulfadoxine-Pyrimethamine
IU	International Unit
IYCF	Infant & Young Child Feeding
IYCN	Infant & Young Child Nutrition
LGA	Local Government Area
LLITBN	Long lasting Insecticide Treated Bed Net
M&E	Monitoring and Evaluation
MDAs	Ministries, Departments and Agencies
MICS	Multiple Indicator Cluster Survey
MIYCN	Maternal Infant and Young Child Nutrition
MMS	Multiple Micronutrient Supplements
MNCHW	Maternal Newborn Child Health Week
MND	Micronutrient Deficiency
MNDC	Micronutrient Deficiency Control
MNP	Micronutrient Powders
NAFDAC	National Agency for Food and Drugs Administration and Control
NDHS	Nigeria Demographic and Health Survey
NFA	National Fortification Alliance
NFCNS	National Food Consumption Nutrition Survey
NFCMS	National Food Consumption and Micronutrient Survey
NGO	Non-Governmental Organization
NHMIS	National Health Management Information System
NI	Nutrition International

NID	National Immunization Day
NIH	National Institute of Health
NIS	Nigerian Industrial Standard
NNHS	National Nutrition and Health Survey
NPHCDA	National Primary Health Care Development Agency
NPNL	Non- Pregnant Non- Lactating
RBC	Red Blood Cell
RBM	Roll Back Malaria
RDA	Recommended Dietary Allowance
RNI	Recommended Nutrient Intake
RUSF	Ready to Use Supplementary Feeding
RUTF	Ready to Use Therapeutic Feeding
SAM	Severe Acute Malnutrition
SDGs	Sustainable Development Goals
SCFN	State Food and Nutrition Committee
SMOH	State Ministry of Health
SON	Standards Organization of Nigeria
SQ-LNS	Small-Quantity Lipid-Based Nutrient Supplements
TGR	Total Goitre Rate
UNICEF	United Nations Children's Fund
UNIMMAP	United Nations International Multiple Micronutrient Antenatal Preparation
USAID	United States Agency for International Development
USI	Universal Salt Iodisation
VAD	Vitamin A Deficiency
VAS	Vitamin A Supplementation
WCBA	Women of Child-bearing Age
WFP	World Food Programme
WHO	World Health Organization

WIFAS	Weekly Iron Folic Acid Supplements
WSC	World Summit for Children

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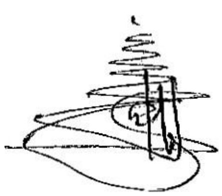

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FOREWORD

The importance of adequate nutrition cannot be over-emphasized as it is vital to sustainable development in Nigeria. Malnutrition negatively impacts individual well-being, community development and ultimately national productivity. Like the saying goes, “a healthy nation is a wealthy nation.”

According to the NDHS 2018, 45.3% of children 6-59 months old consume vitamin A supplements. Also, 68% of under-five Nigerian children are anaemic, while 58% of pregnant women suffer from anaemia. The 2018 WHO report shows that not only children are affected, as an estimated 40% of pregnant women worldwide are anaemic. At least half of this anaemia burden is assumed to be due to iron deficiency with the pre-knowledge that both iron and folic acid deficiencies during pregnancy potentially impact negatively on the health of the mother, her pregnancy, and fetal development. Unfortunately, these deficiencies are pervasive in Nigeria, though not visible to the naked eye (NI, 2018).

Given the importance of micronutrients, especially vitamin A, iron, iodine and recently zinc, their persistent deficiencies remain a significant public health concern in Nigeria, thereby making every strategy for health, education and prosperity an uphill task.

The implementation and coordination of effective programmes to eliminate or reduce the prevalence of vitamin and mineral deficiencies in populations requires a wide array of interventions directed towards ensuring high coverage. To achieve this, the Federal Ministry of Health (FMOH in 2005 developed and approved the National Guidelines for Micronutrients Deficiencies Control to guide the smooth and uniform operation of programme implementation in the country by various stakeholders. The guidelines have since been used to diversify in key strategic areas of supplementation, fortification and dietary diversification as well as public health related measures with different degrees of success.

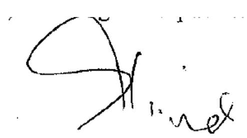
Despite the remarkable progress made, significant risks to the micronutrient deficiencies control programme in Nigeria persist. The challenges posed by the inability of the programme to reach the target groups can severely reduce the effectiveness of the programme. FMOH is committed to ensuring adequate nutrition and health for all, and is open to dynamic innovations, aimed at improving diet quality of nutritionally vulnerable groups, such as infants, young children, adolescent, women of child-bearing age (WCBA), pregnant women, lactating women and the elderly at affordable prices.

The current global drive towards promoting strategies for addressing micronutrient deficiencies at the household level prompted the revision of these guidelines in 2013 to include home fortification with multiple supplements and biofortification.

The 2021 Ministerial Order, approved with immediate effect during the course of this review (20/01/2021), permitted the use of multiple micronutrient supplements (MMS) during pregnancy. This is based on the 2020 WHO recommendation on antenatal care for a positive pregnancy experience. The United Nations International Multiple Micronutrient Antenatal Preparation group has further evidence that suggests the cost effectiveness and programme efficiency of the use of MMS. The MMS that contains 13 to 15 components have been found efficacious and thus approved for use in Nigeria.

Further to the mandatory fortification of flour and its by-products, there is also voluntary fortification of other products considered worthy for inclusion such as bouillon cubes and rice fortification. As desirable as they may be, these guidelines recommend that the ongoing discussions and operations research on the two food vehicles should be encouraged.

It is my sincere hope that these guidelines will be useful for all stakeholders including the health community, development agencies, regulatory agencies, industries, research and academia, NGOs, and the general public.



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EXECUTIVE SUMMARY

The National Guidelines for the Prevention and Control of Micronutrient Deficiency Diseases in Nigeria are composed of seven chapters that provide the background, goals and objectives, strategies, interventions, coordination arrangements, monitoring and evaluation as well as research needs for Micronutrient Deficiency Control (MNDC) in Nigeria.

Specifically, Chapter 1 of the Guidelines provides a short background on micronutrient nutrition from a global perspective, as well as the consequences of micronutrient deficiency especially those that are of public health importance in Nigeria. The chapter outlines the goal to be achieved which is to provide guidance for the prevention and control of micronutrient deficiency disorders in Nigeria. The objectives of the guidelines are captured in five clear statements. These include providing a common framework for the coordination of the implementation of interventions for the control and prevention of MNDC in Nigeria by the key sectors of health, agriculture, industry, education among the critical sectors involved with micronutrient nutrition.

Chapter 2 of the Guidelines reviews the situation of micronutrient deficiencies in Nigeria at the time of articulation of the guidelines. The analysis was specifically focused on the status of iodine deficiency disorders (IDD), vitamin A deficiency (VAD), iron deficiency, folate deficiency and zinc deficiency.

Chapter 3 discusses the strategies that are used for the control and prevention of micronutrient deficiencies in Nigeria. Five different strategies were reviewed and discussed including dietary diversity approaches, biofortification, large- and small-scale fortification including mandatory, voluntary and home fortification strategies, supplementation intervention strategies, as well as other health interventions such as malaria control measures and deworming programmes. The chapter also discusses the importance of behaviour change communication as well as micronutrient deficiency control in emergencies.

Chapter 4 discusses the different interventions and provides guidelines for the public health approaches to be adopted in the control of the different presentations along the life cycle if presented with specific deficiencies. Ranging from prevention of VAD in infants and children 6-59 months, as well as treatment recommendations including discussions on possible adverse events following vitamin A supplementation (VAS). Different food-based approaches to control VAD are also discussed. Control of iron deficiency is covered including in infants, children 6-59 months, the use of micronutrient powders, control of iron deficiency anaemia among adolescent girls, non-pregnant and non-lactating women and women of childbearing age including supplements recommendations and dosage. The chapter also details the use of MMS by pregnant mothers in Nigeria and the approval of the distribution at ALL ANC and PNC clinics in Nigeria in place of iron folic acid tablets earlier in use. The use of small liquid lipid nutrient supplement for young children 6-23 months are introduced and guidance provided. Detailed guidance on mandatory food fortification is provided while the consideration for other potential food vehicles for large scale food fortification are introduced such as rice and bouillon cubes. Prevention and control of zinc deficiency is provided especially for management of diarrhoea while information was provided on dietary sources as well the potential of overdose if abused in supplementary intervention. The chapter concludes with iodine deficiency control measure which by salt iodisation.

Chapter 5 is devoted to the issues around the coordination of micronutrient deficiencies in Nigeria given the multiple stakeholders and sectors involved. The different coordination platforms currently involved and how they can be made to work more efficiently towards a common result framework including the six steps implementation framework.

Chapter 6 discusses the monitoring and evaluation framework for the guidelines, including the indicators for the monitoring and evaluation of progress made towards the micronutrient programme intervention in Nigeria.

Chapter 7 is the concluding chapter of the guideline and recommends some 14 critical research issues as an urgent agenda that must be undertaken while not foreclosing other operational research issues that may evolve in the life span of the guidelines.

A note was also included that defined some of the terms used in the guidelines for ease of understanding and avoiding ambiguity.

CHAPTER 1

INTRODUCTION, GOAL AND OBJECTIVES OF THE GUIDELINES

1.1. Introduction

Micronutrients are vitamins and minerals needed by the body in very small amounts. However, their impact on a body's health is critical, and deficiency in any of them can cause severe and even life-threatening conditions. They perform a range of functions, including enabling the body to produce enzymes, hormones and other substances needed for normal growth and development. Deficiencies in iron, vitamin A and iodine are the most common around the world, particularly in children and pregnant women (WHO, 2021). While iron, iodine, vitamin A and zinc deficiencies have long been identified as endemic and of public health importance on a global scale, vitamin D, vitamin B12 and riboflavin deficiencies are also of concern. Globally, the WHO estimates that almost two billion people are at risk of micronutrient deficiencies (vitamins and minerals/trace elements) (Bailey RL et al., 2015). This figure included approximately 125 million preschool aged children with VAD, with subpopulations at risk of deficiencies of folate, thiamin, vitamin B12, niacin, other B vitamins, and vitamin D (Darnton-Hill, 2017).

Micronutrient deficiency has a tremendous effect on humans particularly vulnerable persons (children, adolescents, women of reproductive age, the elderly, internally displaced persons, persons with disability), as well as on the economic development of communities and nations. These deficiencies culminate in serious health issues, including reduced resistance to infectious diseases, blindness, lethargy, reduced learning capacity, mental retardation and, in some cases, lead to death. Among the debilitating consequences of these dietary deficiencies is loss of human capital and productivity (FAO, 2010). The full genetic potential of the child for physical growth and mental development may be compromised due to sub-clinical deficiencies of micronutrients, which are commonly referred to as "hidden hunger". Children with sub-clinical deficiencies of micronutrients are more vulnerable to develop frequent and more severe common day-to-day infections thus triggering a vicious cycle of under nutrition and recurrent infections (Singh, 2004). Globally, VAD is reported to affect more than 19 million pregnant women and more than 190 million preschool aged children. VAD exists if serum retinol level falls below 20 ug/dl resulting from prolonged low intake of vitamin A rich foods and/or inadequate intake of fats and oils that are required for its absorption. This results in depletion of liver stores and a consequent fall in serum levels from normal (above 20ug/L). While 17.3% of the population is at risk of zinc deficiency due to dietary inadequacy, up to 30% of people are at risk in some regions of the world (CDC, 2020).

The 2013[1] Lancet series on maternal and child nutrition reported that globally, 28.5% of the world's population, or 1.9 billion individuals are iodine deficient. The 2021[2] Lancet series on status and progress reported that micronutrient deficiencies remain largely unabated in children and women globally. While the 2013 figure largely represents those with mild deficiencies (defined as urinary iodine concentration of 50–99 ug/L), about 50 million people have some degree of mental impairment caused by iodine deficiency (WHO 2011c). In 2012, nearly 34 million newborns were unprotected from the lifelong consequences of brain damage associated with iodine deficiency (UNICEF Global database on iodised salt, 2019). For the last 30 years, universal salt iodisation has been the most widely used strategy to control and eliminate IDDs. The international target for universal salt iodisation aims for more than 90 per cent of households worldwide to consume adequately iodised salt (WHO et al. 2007). However, UNICEF estimates that globally only 88% of all households consumed adequately iodised salt in 2019 (UNICEF Global database on iodized salt, 2019).

An evaluation of the mandatory food fortification programme in Nigeria in 2018 based on assessment and coverage of two sentinel sites, found out that the consumption of fortifiable maize flour ranged from 2.9% to 11.0% and fortifiable vegetable oil ranged from 22.7% to 35.9%. The same study revealed that household consumption of mandatorily fortified foods in Kano was 22.7% for wheat flour, 6.9% for semolina, 1.7% for maize flour, 21.1% for sugar and 7.6% for vegetable oil. Almost a similar pattern was observed in Lagos household consumption of mandatorily fortified foods with 5.4% households for wheat flour, 69% for semolina, 0.2% for maize flour, 35.6% for sugar and 7.2% for vegetable oil. The low consumption of mandatorily fortified foods is linked to the dependence of households on locally produced, non-industrial food products.

Since 1995, SON records of inspection at port of entry and at salt companies consistently indicate 90-100% of consignments with iodine levels above 50 ppm. National Food Consumption Nutrition Survey (NFCNS) found 97% of food grade salt met the 50ppm standard. According to NDHS 2018, the proportion of households without salt was highest in the North Central zone (7%), and 9% of the households in that zone where salt was tested did not have iodised salt. Among households with tested salt, Zamfara had the lowest percentage with iodised salt (63%), followed by Niger (67%).

1.2. Goal

The overall goal is to provide guidance for the prevention and control of micronutrient deficiency disorders in Nigeria.

[1] Maternal and Child Nutrition- The Lancet Series 2013 https://www.thelancet.com/series/maternal-and-child-nutrition.

[2] Maternal and Child Undernutrition Progress- The Lancet Series 2021 https://www.thelancet.com/series/maternal-and-child-nutrition.

1.3. Objectives

- To provide a common framework for the coordination of the implementation of the national micronutrient deficiency prevention and control programmes in Nigeria.
- To provide directions on effective interventions for MNDC to stakeholders at all levels.
- To promote effective implementation and delivery of evidence-based and effective micronutrient interventions.
- To improve knowledge and awareness of micronutrient deficiency control interventions.
- To strengthen research, monitoring and evaluation of MNDC programmes.

CHAPTER 2

SITUATION ANALYSIS IN NIGERIA

2.1 Micronutrient Deficiencies in Nigeria

The Nigerian Government launched its first National Policy on Food and Nutrition on November 5, 2002, underscoring its determination to improve the nutritional well-being of its populace. The policy has since been updated and published in 2016. The revised policy on food and nutrition sets new targets to be attained by year 2025, as it relates to micronutrient malnutrition. Some of the highlights include increasing the Exclusive Breastfeeding rate from the 29% level (NDHS 2018) to 65% by the year 2025; reducing childhood wasting including all forms of Severe Acute Malnutrition (SAM) from the 7% level in 2018 to less than 5% by 2025; increasing the coverage of VAS from 45% in 2018 to 65% by 2025; increasing zinc supplementation coverage in the management of childhood diarrhoea from the 23% of 2018 to 50% by 2025 for all children requiring treatment for diarrhoea; increase the coverage of children under five years that are dewormed from 13.4% coverage in 2013 to 50% by year 2025 as well as reducing the prevalence of anaemia in pregnancy from 61% in 2018 to less than 40% by 2025. The earlier targets set in the 2002 policy were largely unmet. For example the target to reduce the prevalence of the deficiencies by 50% and increase the coverage of interventions by at least 50% were unmet considering the 2018 NDHS data on micronutrient nutrition status. Thus greater efforts are required to ensure that the new targets set in the updated 2016 policy are met and even surpassed in the time frame.

The comprehensive data on micronutrient status in Nigeria was published in 2003 National Food Consumption and Nutrition Survey (NFCNS) and since then we have relied on pockets of sub-national surveys, programme coverage performance and data especially for vitamin A and anaemia.

2.2 Iodine Deficiency

The World Summit for Children (WSC) resolved in 1990 to virtually eliminate IDDs from the face of the earth by the year 2000. At that Summit, world leaders, including Nigeria, committed themselves to specific goals to ensure that the rights of children to adequate nutrition, among other rights, are protected.

Nigeria has achieved remarkable success in its Universal Salt Iodisation (USI) programme which is the most basic and common vehicle for iodine supplementation. The USI programme took-off effectively in Nigeria in 1993, at a time when only 40% of salt consumed in Nigeria was iodised. By 1998, goitre prevalence decreased to 11% at sentinel sites, and household access to iodised salt increased to 98%. According to NDHS 2018, household access to iodised salt remains high at 97%.

Virtually all Nigerian newborn babies are protected against the mental impairment arising from the absence of iodine in adequate quantity in their diet. Nigeria has been 'put on the map' in the world for achieving USI status and has become the benchmark for other nations aiming to achieve same feat.

The standard for table salt in Nigeria under the USI defines properly iodised salt as containing:

1. >50 mg/kg iodine at port of entry and salt factory level
2. >30 mg/kg iodine at distributor and retail levels
3. >15 mg/kg iodine at household level

Since 1995, SON's records of inspection at port of entry and at salt companies consistently indicate 90-100% of consignments with iodine levels above 50 mg/kg. NFCNS found 97% of food grade salt met 50 mg/kg standard.

In 1993, the national Total Goitre Rate (TGR) was 20%. the 2003 NFCNS reported that a total of 27.5% of children suffered various degrees of iodine deficiency, while 46.5% had more than adequate levels of urinary iodine. The deficiency was severe in 4.2%, moderate in 8.7%, and mild in 14.6%. Only 26% of the children had optimal levels of iodine. However, it is noteworthy that 16.6% of the children had more than adequate levels, while 29.8% had a possible excess intake of iodine and ran the risk of adverse health consequences.

Furthermore, in mothers 30.7% had varying degrees of iodine deficiency, 28.8% had optimal levels, while 40.5% had a more than adequate intake. Deficiency was severe in approximately 4.2%, moderate in 8.8%, and mild in 17.8%. Among the mothers that had more than adequate intake, 18.3% of them had a more than adequate iodine intake and 22.2% had a possible excess and ran the risk of adverse health consequences. Among the subsample of pregnant women, 10.5% had iodine deficiency, 31.5% had a normal or optimal range of iodine intake, and 23.1% had a possible excess. Deficiency of iodine was reported as severe in 3.1%, moderate in 7.4%, mild in 16%, optimal in 31.5%, more than adequate in 18.9% and with possible excess in 23.1%. More than adequate and possible excessive intakes of iodine were reportedly seen in 51% of children under 5 in the medium sector, 42% in the rural sector, and 49% in the urban sector.

It is expected that the 2020/2021 National Food Consumption and Micronutrient Survey (NFCMS) will produce the data on recent prevalence of goitre in Nigeria to ascertain the impact of salt iodisation on goitre eradication and iodine deficiency disorders in Nigeria.

2.3 Vitamin A Deficiency

Vitamin A (retinol) is an essential fat-soluble nutrient needed in small amounts for the normal functioning of the visual system, growth and development, immune function, etc. There are plant and animal sources of vitamin A. These include green leafy vegetables, carrots, yellow fruits, egg yolk, liver, milk, meat, etc. Vitamin A is important for the integrity and regeneration of respiratory and gastrointestinal epithelia and is involved in regulating human immune function.

VAD is a global problem of public health significance in many under-privileged communities of the world. In settings where VAD is a public health problem, the prevalence of night blindness is 1% or higher in children 24–59 months of age or where the prevalence of VAD (serum retinol 0.70 µmol/l or lower) is 20% or higher in infants and children 6–59 months of age. VAD is a severe public health problem if ≥5% of women in a population have a history of night blindness in their most recent pregnancy in the previous 3–5 years that ended in a live birth, or if ≥20% of pregnant women have a serum retinol level <0.70 µmol/L. Determination of VAD as a public health problem involves estimating the prevalence of deficiency in a population by using specific biochemical and clinical indicators of vitamin A status (WHO, 2016). A 2010 population-based, cross-sectional study, using a two-stage stratified cluster sampling method, reported the national prevalence of xerophthalmia as 1.1%, whilst the national prevalence of VAD using serum retinol < 20µg/dl (or 0.7 µmol/l) as cut-off as 28.1%. Both values are above the WHO cut off points of 1% and 20% respectively, indicative of a problem of public health significance. The WHO global database on prevalence of vitamin A published in 2009 reported that the national prevalence for children under-5 was 29.5%, while night blindness among pregnant women was 7.7%. Unfortunately, this review will not benefit from the findings of the ongoing study on the National Micronutrient survey but will provide significant information on the impact of the various efforts at controlling VAD among others.

According to the only available national survey data, NFCNS 2001/2003, 24.8% of children under 5 suffered from low vitamin A status (serum retinol concentration < 20 ug/dl); and 4.7% had extremely low vitamin A status (serum retinol concentration < 10 ug/dl) and 71.5% of children had adequate vitamin A levels. Using the WHO cut off for determining VAD, a total of 29.5% of children under 5 suffered from VAD (NFCNS, 2001-2003).

The levels of low deficiencies were 28.2% in the dry savanna i.e., the northern belt from North West to North East), 21.6% in the moist savanna, mostly within the North Central region; and 22.8% in the humid forest, mainly the three southern geopolitical zones. The extremely low deficient were more in the humid forest (7.1%) than in the dry savanna (3.1%) and moist savanna (2.4%). The distribution of the low deficient was 23.4% for the rural, 25.1% for the medium, and 22.5% for the urban sector. The extremely low deficiencies were 7.5% in the medium sector while the urban (3.4%) and rural (2.2%) sectors were much lower.

Based on the same survey report, mothers with serum retinol concentration < 30 ug/dl, and considered as being at risk of VAD, were 13.1% of the national sample population. More mothers were at risk of VAD in the medium sector (30.7%) than in the rural (11.2%) and urban (10%) sectors. Mothers with serum retinol concentration < 20 ug/dl were considered as being VAD. From those mothers who were at risk of VAD, only 4.1% were VAD.

Pregnant women with serum retinol concentration < 30 ug/dl and considered as being at risk of VAD were 19.2% at the national level. More pregnant women living in urban (25.2%) and rural areas (24.4%) were at risk of VAD than those living in the medium areas (17.3%). Pregnant women with serum retinol concentration < 20 ug/dl were considered as being VAD. From that group, 8.8% were VAD.

In settings where VAD and/or undernutrition is common, women may produce breastmilk with inadequate concentrations of vitamin A. Current evidence suggests, however, that VAS in postpartum women does not reduce the risk of illness or death in mothers or their infants VAS in postpartum women for the prevention of maternal and infant morbidity and mortality is not recommended (WHO 2011). Therefore, postpartum women should be encouraged to receive adequate nutrition which is best achieved through consumption of an adequate healthy diet, especially foods rich in vitamin A.

However, assessment of dietary diversity showed that 61% of women in urban areas and 51% of women in rural areas consumed foods from five or more food groups in the day or night preceding the interview for the NDHS 2018 survey. Women in urban areas are substantially more likely than those in rural areas to consume meat, fish, and poultry (84% versus 59%); eggs (22% versus 11%); sugary foods (19% versus 13%); and sugar-sweetened (32% versus 13%). It is important to note that all sugar in Nigeria is mandatorily fortified with vitamin A whether imported or locally produced. Additionally, the proportion of women who consumed five or more food groups is lower in the northern zones (North Central, North East, and North West) than in the southern zones (South East, South South, and South West). The lowest proportion is in the North Central zone (47%) and the highest is in the South West (65%). Food consumption patterns by the sampled women are also influenced by the wealth quantiles as the lowest wealth quantiles had less varied diets.

A meta-analysis review of studies on the effect of VAS found that it reduces all cause fatality by 24%, 12 % reduction in mortality due to diarrhoea, but there was no significant effect of vitamin A on mortality due to measles, respiratory disease, and meningitis (Imdad A, et al 2017).

The percentage of children aged 6-23 months who consumed foods rich in vitamin A increased marginally from 52% in 2013 to 59% in 2018 (NDHS, 2018). Also, there were increases in the percentage of children aged 6-59 months who received vitamin A supplements (from 41% in 2013 to 45% in 2018).

2.4 Iron Deficiency

The risk of iron deficiency increases during periods of rapid growth, notably in infancy, adolescence, and pregnancy. The consequences of iron deficiency include reduced work capacity, impaired body temperature and regulation, impairments in behaviour and intellectual performance, and decreased resistance to infections. Iron deficiency results when ingestion or absorption of dietary iron is inadequate to meet iron losses or iron requirements imposed by growth or pregnancy. In most individuals, the concentration of serum ferritin, parallels the total amount of storage iron, and serum ferritin is the only iron status index that can reflect a deficient, excessive, and normal iron status. Serum ferritin is a reliable and sensitive parameter for the assessment of iron stores in healthy subjects. Serum ferritin levels below 12 µg/ml are highly specific for iron deficiency and denote complete exhaustion of iron stores in adults.

NFCNS 2001/2003 reported that the iron status profile of children under 5 at the national level showed that 27.5% of them were at different stages of iron deficiency, as 8.1% already had depleted iron stores (serum ferritin value of less than 20 µg/ml), while 19.4% had a serum ferritin value of less than 10 µg/ml, suggestive of iron deficiency. A range of 20 µg/ml to 100 µg/ml had been taken as normal. In the sample, 48.9% had the range of serum ferritin indicating adequate iron nutrition.

Children under 5 with depleted iron store (serum ferritin concentration < 20 µg/ml) were similar in the different sectors: 10.9% in rural areas, 10.5% in urban areas, and 10.2% in the medium sector. The percentages of the children with normal iron status (serum ferritin concentration 20–100 µg/ml) did not differ much in the sectors, being 47.8% in the rural, 49.4% in the medium, and 48.7% in the urban.

Approximately 24.3% of mothers and 35.3% of pregnant women were at different stages of iron deficiency, with 12.7% of mothers and 19.9% of pregnant women already with iron stores (serum ferritin < 12 µg/ml) suggestive of iron deficiency in 2003.

The prevalence of iron deficiency was more common in the urban areas than in the medium and rural areas. For mothers, the prevalence of iron deficiency was more common in the urban areas than in the medium and rural areas. The corresponding percentage distribution of iron deficiency for mothers was highest in urban areas (26.9%), followed by the medium areas (24.7%), and lowest (2.4%) in rural areas. In pregnant women, about four out of every ten pregnant women (43.8%) in the urban areas were iron deficient, compared with about one-third (33.6%) in both rural and medium areas (34.0%). The prevalence of iron overload was higher in the medium sector (2%) than in the rural and urban sectors (1.1%) (NFCN 2001/2003).

Sixty-eight percent of children had anaemia based on haemoglobin concentration in the blood, with 27% having mild anaemia, 38% having moderate anaemia, and 3% having severe anaemia (NDHS, 2018). The prevalence of anaemia is higher among younger (age 6-23 months) than older (age 24-59 months) children, with a peak prevalence of 81% among children age 12-17 months. Children in rural areas (73%) are more likely to be anaemic than those in urban areas (62%).

The prevalence of severe anaemia is highest in the North West and North East (4% each) and lowest in the South West (1%). By state, Zamfara has the highest prevalence (10%), while Lagos has the lowest (less than 1%). There are wide disparities in the prevalence of severe anaemia among states in the North West. For example, the prevalence is 1% in Kaduna, 5% in Sokoto, and, 10% in Zamfara.

The prevalence of severe anaemia (haemoglobin <8.0 g/dl) is highest among children age 6-8 months (10%) and lowest among children age 48-59 months (5%). The percentage of children with severe anaemia is highest among those whose mothers have no education (11%) and lowest among those whose mothers have more than a secondary education (1%). This result presentation should be reviewed in subsequent surveys because rates in children with mild and moderate anaemia were not reported (NDHS 2018).

The percentage of women taking iron supplementation for 90 days or more increased from 15% in 2008 to 21% in 2013 and 31% in 2018. The percentage of women who did not take any iron supplementation decreased from 44% in 2008 to 36% in 2013 and 31% in 2018. Finally, the percentage of women taking deworming medication during pregnancy increased from 10% in 2008 to 14% in 2013 and 17% in 2018. Women in urban areas were more likely than those in rural areas to have taken iron supplements for at least 90 days (39% versus 25%) and to have taken deworming tablets (19% versus 16%).

2.5 Folate Deficiency

Folate-deficiency anaemia is the lack of folic acid which is the chemical form of the vitamin B9 in the blood. Folic acid is a B vitamin that helps the body make red blood cells. If there are not enough red blood cells, it results in anaemia. Red blood cells carry oxygen to all parts of the body. Folate (vitamin B9) is the natural form of the vitamin that plays a central role in the synthesis and methylation of nucleotides that intervene in cell multiplication and tissue growth. Its role in protein synthesis and metabolism is closely interrelated to that of vitamin B12. The combination of severe folate deficiency and vitamin B12 deficiency can result in a form of anaemia known as megaloblastic anaemia. Low intakes of folate are also associated with a higher risk of giving birth to infants with neural tube defects and possibly other birth defects, and with an increased risk of cardiovascular diseases, cancer and impaired cognitive function in adults. It is particularly important to get enough folate during pregnancy. Folate deficiency during pregnancy can lead to neural tube irregularities, such as spina bifida and anencephaly.

2.6 Zinc Deficiency

Zinc is recognised as an essential micronutrient (trace element) critical in human nutrition. The clinical syndrome associated with zinc deficiency includes growth retardation, male hypogonadism, skin changes, mental lethargy, hepatosplenomegaly, iron deficiency anaemia, and geophagia. Apart from low zinc levels occasioned by rapid growth, pregnancy and lactation can also lead to zinc deficiency if these increased needs are not met.

Presently, no cutoff points for serum/plasma zinc levels have been recommended to classify zinc deficiency. However, plasma zinc supplementation is observed. Consequently, in assessing zinc nutrition of subjects in this survey, 80 ng/ml has been used as the cutoff value for determining zinc deficiency.

Zinc requirement increases in the body during periods of rapid growth like pregnancy, infancy, childhood and adolescence. Since the immune system is immature in children, zinc deficiency manifestations are more common in children, hence this necessitates zinc supplements to boost the immune functions. The Estimated Average Requirement (EAR) was finalised by factorial analysis. The Recommended Dietary Allowance (RDA) is 8 mg/day for women and 11 mg/day for men.

Zinc is important for cellular growth, cellular differentiation and metabolism and deficiency limits childhood growth and decreases resistance to infections. Although severe zinc deficiency is rare in humans, mild to moderate deficiency may be common worldwide.

At the national level, 20% of children under 5 are reported to be zinc deficient (NFCNS 2001/2003). Deficiency of zinc was highest in the moist savanna zone (36.5%), intermediate in the dry savanna (26.0%), and lowest in the humid forest (6.3%) among children under 5 in Nigeria. The deficiency was higher (26.0%) in the rural sector than in the other two sectors (17%).

Zinc deficiency was highest in pregnant women (43.8%), while 28.1% of mothers were zinc deficient. The prevalence was 48.3% in the moist savanna, 35.3% in the dry savanna, and 10.5% in the humid forest. The prevalence of zinc deficiency in pregnant women was highest (73.4%) in the moist savanna, and lowest (23%) in the humid forest. The dry savanna zone had a prevalence of 42.6%. The percentage zinc deficiency prevalence was slightly higher (30%) in the rural sector than in medium (28%) and urban (25%) sectors.

Zinc supplementation in diarrhoea management, which helps to reduce the severity, frequency, and duration of diarrhoea episodes was introduced in Nigeria in 2010 (Federal Ministry of Health 2010). One in three children (31%) with diarrhoea were given zinc, and 23% received a combination of ORS and zinc (NDHS, 2018).

CHAPTER 3

NATIONAL STRATEGIES FOR THE PREVENTION AND CONTROL OF MICRONUTRIENT DEFICIENCIES IN NIGERIA

Micronutrient deficiencies often result from inadequate dietary consumption and infectious diseases which decrease the absorption of nutrients while at the same time increasing individual nutritional requirement (WFP, 2012).

Micronutrient deficiency usually occurs when diets lack variety of food groups or following disease and infections. Short-term interventions have a role in providing specific target groups with vitamin and mineral supplements at certain times, however, only food-based approaches (long-term) can prevent micronutrient deficiencies in a sustainable manner for most of the population.

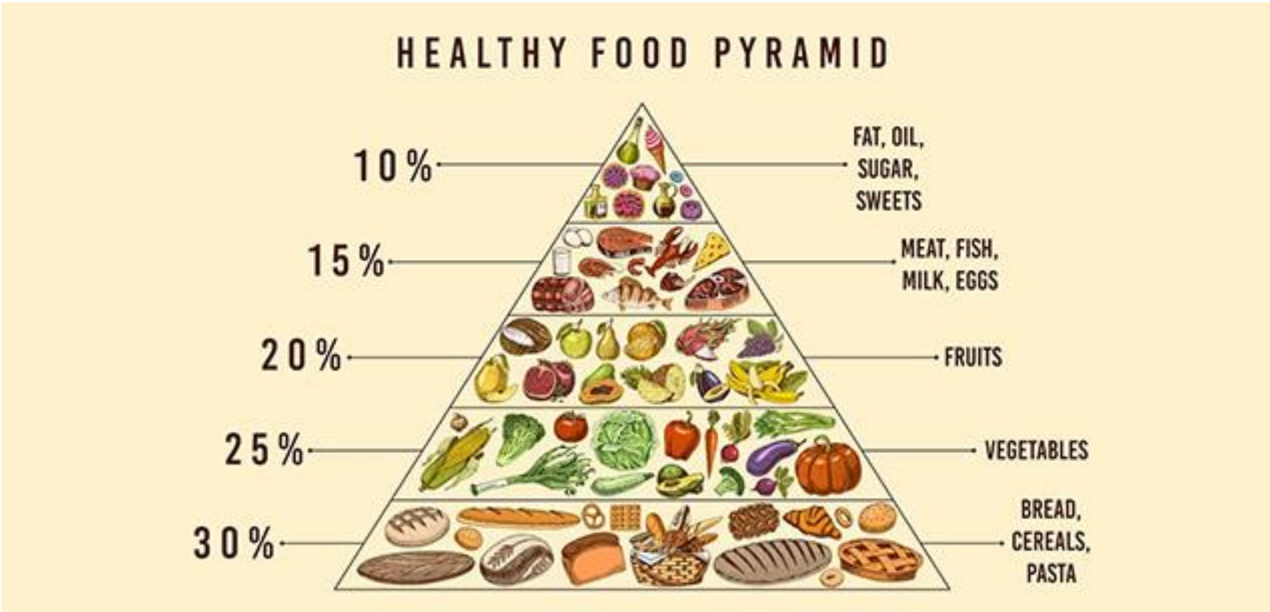
Four main strategies are employed to address micronutrient deficiencies in Nigeria. These are: 1) dietary improvement, including increased production and consumption of micronutrient-rich foods; 2) food fortification; 3) supplementation; and 4) public health and other disease control measures. Food-based approaches, which include food production, dietary diversification, food fortification and biofortification, are adjudged the most sustainable approaches to improving the micronutrient status of populations. The food-based approaches do not only prevent micronutrient deficiency problems but also contribute to general malnutrition prevention.

The December 1992 International Conference on Nutrition (ICN), jointly convened by the Food and Agriculture Organization of the United Nations (FAO) and the WHO with representatives from 159 countries endorsed the World Declaration on Nutrition, with a pledge "to make all efforts to eliminate before the end of the decade... iodine and vitamin A deficiencies" and "to reduce substantially... other important micronutrient deficiencies especially iron."

Linked to this World Declaration on Nutrition is the Plan of Action for Nutrition, which recommends that governments give priority to food-based strategies to control and prevent micronutrient deficiencies.

3.1. Dietary Diversification

Dietary diversification refers to interventions that improve the number and varieties of foods from the various food groups consumed at the household level, such as increasing the consumption of animal-source foods as well as fruits and vegetables. Applying dietary strategies to improve the status of micronutrients such as iron, zinc, vitamin A and iodine in Nigeria requires dietary modification and diversification to achieve a sustainable, economical, equitable, and culturally acceptable strategy that can be used to alleviate several micronutrient deficiencies. The strategies should be community-based and used to enhance awareness of micronutrient deficiencies in the community and help to empower people to be more self-reliant. To implement these dietary strategies effectively, knowledge of local dietary patterns, the availability, cost of foods, food beliefs, preferences, and taboos are required, as well as the ability to change attitudes and practices. To be effective, the dietary strategies must be practical, culturally acceptable, economically feasible, and sustainable to the target group. They must not include substantial changes in the types and quantities of food items commonly consumed. They must also not increase the price of the food item or the preparation and cooking time, which will increase the workload of a caregiver. Furthermore, they should be based on existing food consumption patterns, and be adapted from local food processing procedures and recipes.



Iron is present in both heme and non-heme forms in the diet. Heme iron, the most bioavailable form, is found in the greatest quantities in animal sources such as red meat. Normal individuals absorb between 20% and 30% of dietary heme iron, while iron-deficient subjects absorb between 40 and 50%. Non-heme iron which is absorbed less efficiently than heme iron is the most abundant in other sources of iron, including eggs and all vegetable roots, seeds, leaves, and fruits. Non-heme iron is also present in other heme iron-containing animal tissues. The main sources of dietary folate are leafy green vegetables, fruits, yeast and liver. A low intake of these foods combined with a relatively high intake of refined cereals thus increases the risk for folate deficiency. Malabsorption conditions, infection with giardia lamblia, bacterial overgrowth, genetic disorders (of folic acid metabolism) and chronic alcoholism are also risk factors for folate deficiency.

Vitamin A is found in green and yellow-coloured fruits and vegetables, and as the preformed vitamin in liver and breast milk. Humans need less than 1 mg of vitamin A per day to maintain good health.

Iodine in nature is obtained from the environment such as soil and water, but it has been depleted from the soil and water in many areas of the world. The commonly used source of iodine is in fortified cooking salt.

3.1.1 Dietary Diversification in Maternal, Infant and Young Child Nutrition (MIYCN)

Proper feeding of infants and young children can increase their chances of survival, development and growth. The FMOH recommends that pregnant women should eat one extra small meal or "snack" each day to provide energy and nutrients for their health and that of the growing baby. The consumption of locally available foods rich in vitamin A, iron, zinc and iodine is recommended. These include milk, fresh fruit and vegetables, meat, fish, eggs, grains, peas, and beans. It is recommended that adolescent girls and women of child-bearing age consume adequate foods and nutrients to build their nutritional status before conception and continue to feed adequately during and after delivery.

The continuum of infant feeding from birth till 24 months is referred to as infant and young child feeding practice. The global and national recommendation for optimum infant feeding from birth to 24 months of age is:

i) initiation of breastfeeding within one hour of birth
ii) exclusive breastfeeding up to 6 months
iii) appropriate complementary feeding from 6 months
iv) continued breastfeeding up to 2 years and beyond (WHO and UNICEF 2003)

The breast milk of a healthy mother contains all the micronutrients necessary for an infant. Specifically, iron and vitamin A in breast milk are better absorbed than those from other sources. Additionally, the vitamin C and high lactose levels in breast milk aid in iron absorption. Healthy, full-term babies have enough iron and other micronutrients stores in their bodies.

3.1.2. Biofortification

Biofortification is the enhancement of micronutrient levels of usually consumed staple crops through conventional plant breeding techniques. It is the use of agronomic and plant-breeding approaches in agriculture to increase the concentration of micronutrients in staple food crops. This strategy is far-reaching in addressing micronutrient deficiencies especially in the rural areas and communities which grow their own foods and have limited access to pre-packaged fortified foods, without changing their food consumption patterns. It is also not as restricted as other interventions such as nutritional supplementation and food fortification.

Biofortification has multiple advantages including keeping to the daily intake of a consistent amount of staple foods by all family members. A 2018 review to provide a baseline of the biofortification programme in Nigeria revealed that the policy environment did not overtly promote biofortification in the country.

The study also identified that uptake of biofortified crops in Nigeria is low, arising from very low investment and promotion of the biofortified crops as well as a weak enabling environment.

Currently, however, only maize, cassava, and orange fleshed sweet potato are biofortified with vitamin A, and pearl millet with iron, in the country. Other staple crops for biofortification in the pipeline include zinc rice and iron beans.

A study conducted showed that only 30.2% of farmers planted biofortified crops and, of these, only 30.3% planted were put on sale, while the rest were planted for their own consumption (Phorbee O. et al 2017). The main barrier faced by the disadvantaged group in accessing and benefitting from biofortification include cultural and individual preferences related to product attribution, low education levels among others. Nigeria is currently exploring other avenues to strengthen biofortification.

3.2. Food Fortification

Food fortification is usually regarded as the deliberate addition of one or more micronutrients to particular foods, so as to increase the intake of these micronutrients in order to correct or prevent a demonstrated deficiency and provide a health benefit. Apart from being inexpensive, fortification of foods as an intervention strategy has been proven in other countries to be very effective in correcting and preventing micronutrient deficiencies, as well as improving the nutritional status of a large proportion of the population (WHO 2021). In addition, it does not require changes in dietary patterns nor individual decision for compliance (WHO 2021).

Efforts to curb or eliminate micronutrient deficiency disorders in Nigeria started as a result of recommendations made during the World Summit for Children held in 1990 in New York, USA. Available evidence from the NFCNS (2003) showed that Nigeria had, and still has, one of the highest rates of VAD in children globally, in addition to child and maternal mortality. Food fortification, therefore, represents an economical, high-coverage and sustainable solution to these challenges in Nigeria.

Nigeria is currently implementing two forms of large-scale fortification: mandatory and voluntary.

The fortification process is achieved at industry level by the manufacturer during food processing and involves the addition of small amounts of the specific micronutrients of interest. These are: vitamin A, iron, zinc and folic acid in wheat, maize flours and semolina; vitamin A in vegetable oils and sugar; and iodine in refined salt sold as iodised salt for consumption by the general population. These foods are currently mandatorily fortified in Nigeria as against other food products such as milk and bouillon products that are voluntarily fortified by the manufacturing industries. It is recommended that these initiatives be given adequate support to ultimately achieve the desired impact in the population.

It is recognised that fortified foods suffer significant nutrient losses during final use at the household level. Sufficient coverages of the micronutrients of interest are usually provided for in the premixes in line with the codes of practice for manufacturers. The public health impact of the food fortification strategy therefore depends on several parameters, but predominantly the level of fortification, bioavailability of the fortificants, and the amount of the fortified food consumed.

3.2.1. Mandatory Fortification

Mandatory fortification requires food manufacturers to add specified vitamins or minerals, or both, to specified foods. In the late 1990s, the Government of Nigeria identified three food vehicles – flour, sugar and vegetable oil – to be used for the mandatory fortification programme and established the levels for each of the nutrients, with the implementation commencing in 2002. Similarly, in 1993 Nigeria also established mandatory fortification of salt with iodine. By showing improved compliance over the years, the programme earned Nigeria international recognition with Universal Salt Iodisation Certification and resulted in significant health benefits for the population

(Egbuta 2003, UNICEF 1993). Continuous monitoring is key to retaining these benefits and to ensuring that risks of iodine under consumption and over consumption are minimised.

3.2.2. Voluntary Fortification

Voluntary fortification, on the other hand, allows food manufacturers to add vitamins or minerals, or both, to foods, as long as they abide by food additive regulations, food labelling practices, good manufacturing practices and relevant Nigerian Industrial Standard (NIS). Such product claims and proper labelling must also meet SON and NAFDAC regulations. This guideline recognises the need to continue to encourage industries and food manufacturers to undertake voluntary fortification of their products offered to the general public.

The extent to which a national or regional food supply is fortified varies considerably. The concentration of just one micronutrient might be increased in a single foodstuff (e.g., the iodisation of salt), or, at the other end of the scale, there might be a whole range of food–micronutrient combinations. However, the more widely and regularly a fortified food is consumed, the greater the proportion of the population likely to benefit from food fortification.

After the mandatory fortification of selected food staples, the National Fortification Alliance (NFA) was established in 2007 to coordinate effective fortification programmes in Nigeria. Chapter 5 details the roles and responsibilities of the micronutrient deficiency control coordinating bodies.

3.2.3. Home Fortification

Home fortification is a point-of-use innovation aimed at improving the nutritional, health and developmental outcomes in the vulnerable population. Currently, Nigeria's home fortification programmes are focused on 6-59 months of age with micronutrient powders (MNP) in complementary foods. See chapter 4 for more information on MNP.

3.3. Nutritional Supplementation

Nutritional supplementation is a means of delivering specific nutrients to vulnerable groups in any population, especially where these nutrients are not being consumed in sufficient quantities leading to micronutrient deficiencies. Nutritional supplements are vitamins, minerals, amino acids, fatty acids or other substances and are usually delivered in the forms of pills, tablets, capsules, liquids, powders, etc.

Nutrition supplementation is recommended as a short-term micronutrient intervention that meets the needs of the target population group, across the continuum of care, and helps to strengthen the system as a whole. Studies have shown that supplementation in adequate dosage and duration is efficacious in treating, and preventing deficiencies of iron, vitamin A, and iodine for groups with high prevalence of micronutrient deficiency (MND).

Currently, Nigeria implements nutritional supplementation programmes targeted at young children, school-aged children, adolescents and women of reproductive age with vitamin A, iron and folic acid, and zinc with Lo-ORS in diarrhoea treatment. This strategy has had limited effectiveness in addressing micronutrient deficiency as there are limiting challenges such as the high cost associated with logistics of reach, low coverage and problems of community acceptance.

Nevertheless, though expensive, it is recognised that where such specific short-term interventions are required in the population, supplementation may be a major solution to micronutrient deficiency control in the target group. Through knowledge and awareness building to facilitate increased coverage, as well as dosage and frequency of dosing that assure effectiveness, this process of implementation enables the desired efficacy and impact.

3.4. Other Health Interventions

The current public health measures for controlling micronutrient deficiencies include immunisation, parasitic infections control, provision of water, sanitation and hygiene interventions, control of diarrhoeal diseases and acute respiratory infections (ARI).

These measures are important additions, but should not be considered as replacements for interventions that increase the micronutrient intake of deficient populations. For example, high measles immunisation coverage for children can contribute significantly to VAD control if VAS can be successfully integrated into the measles campaign in Nigeria. Similarly, treatment of hookworm infections and prevention of reinfection have been shown to decrease iron loss, and thus the need to complement iron replenishment strategies. This is why deworming programmes are conducted along with iron and folic acid supplementation. Correction of micronutrient deficiency, in turn, improves response to immunisation and other public health measures, hence simultaneous attention must be paid to improving nutrition status and ensuring effective public health measures to achieve the most cost-effective interventions in deprived populations.

3.4.1 Social and Behaviour Change Communication

Social and Behaviour Change Communication (SBCC) refers to the use of communication strategies to promote the sustained adoption of a desired health behaviour or behaviours that may lead to positive health outcomes. In Nigeria, the most common means of SBCC include interpersonal counselling, print and virtual educational materials, and mass media campaigns. SBCC interventions complement nutrition-specific strategies such as MNDC programmes. SBCC has been shown to enhance programme uptake and increase positive nutrition outcomes. The inclusion of culturally appropriate SBCC, sensitive to local norms, helps to address the tension that can arise between traditional knowledge and science, which is commonly experienced in nutrition interventions.

This approach makes it possible to address multiple nutrient deficiencies simultaneously without risk of antagonistic interactions.

3.4.2 Micronutrient Deficiency Control in Emergencies – Public Heath Emergencies and Humanitarian Crisis Situations

Micronutrient deficiencies can easily develop during an emergency or can be made worse if they already exist. This may be due to disruption in livelihoods, food crops loss, food supplies interruption, disease outbreak resulting in malabsorption and nutrient losses.

Infectious diseases suppress the appetite whilst increasing the need for micronutrients to help fight illness. For these reasons, it is essential to ensure that the micronutrient needs of people affected by a disaster are adequately met. To mitigate this, it is critical and essential that general food-aid rations are adequate to meet nutrient needs, distributed regularly and in sufficient quantities.

One way to meet the recommended daily intake of micronutrients is to provide fortified foods. Fortified foods, such as corn-soya blend, biscuits, vegetable oil enriched with vitamin A, and iodised salt, are usually provided as part of food rations during emergencies. The aim is to totally avert micronutrient deficiencies or prevent them from getting worse among the affected population.

However, foods fortified with micronutrients may not meet fully the needs of certain nutritionally vulnerable subgroups such as pregnant and lactating women, or young children. For this category of people, UNICEF and WHO have developed the daily multiple micronutrient formulas to meet the Recommended Nutrient Intake (RNI) of these vulnerable groups during emergencies.

3.5 Treatment of Xerophthalmia

Xerophthalmia refers to the ocular manifestations arising from VAD. These manifestations are the first signs of VAD that are recognisable clinically without employing biochemical or histochemical analysis. Consequently, the term xerophthalmia is used synonymously with VAD. Xerophthalmia can occur in any age group, but it is most commonly found in preschool-age children, adolescents, and pregnant women. Children are at higher risk of VAD and xerophthalmia owing to their greater need for vitamin A to support growth and development. Because vitamin A acts critically in the maintenance of the immune response, children experiencing VAD are also at higher risk of intestinal infestations and infections. These can impair vitamin A absorption and increase loss of the vitamin. It is this impairment to the immune response that contributes most significantly to the morbidity and mortality associated with VAD. It is the progressively worsening stages of xerophthalmia that allow for the clinical recognition and diagnosis of VAD.

All individuals with xerophthalmia (except pregnant women) should be treated with large oral doses of 200,000 IU vitamin A according to the WHO guidelines (Table 4). The age-specific dose should be given on the first and second days and again two weeks later. This applies to all stages of active xerophthalmia, including night blindness, Bitot's spots, and corneal lesions.

3.6 Small-quantity Lipid-based Nutrient Supplements (SQ-LNS) for Point-of-use Fortification of Foods Consumed by Children 6–23 Months of Age

Small-quantity lipid-based nutrient supplements (SQ-LNS) belong to a group of complementary food supplements (CFS) designed to provide multiple micronutrients within a food base that also provides energy, protein and essential fatty acids, and are targeted towards the prevention of malnutrition in low- and middle-income countries. Improved dietary quality via selection of nutrient-rich complementary foods is the first priority, but the cost may be prohibitive for low-income households[3]. Therefore, various types of fortified products, including SQ-LNS have been designed to fill nutrient gaps during the period of complementary feeding. SQ-LNS is a food supplement that is intended to complement the diet of children aged 6 months and older with essential nutrients. It is in the form of a ready–to-use paste, used to help meet nutritional requirements of infants and young children. As such, it contributes to preventing undernutrition, in particular micronutrient deficiencies and stunting. It is to be consumed directly from the package or by mixing with other foods. One package of 20g contains one daily dose. This product is not a breast-milk replacement.

The International Lipid-based Nutrient Supplements (iLiNS) Project developed SQ-LNS for enriching home-prepared foods for women and infants in low-income settings as a potential strategy to increase nutrient intakes during the “first 1000 days.” Studies suggest that in children 6–23 months of age, the consumption of SQ-LNS added to complementary foods improved growth and anaemia status when compared with no intervention and may be more effective than other alternatives such as fortified blended foods and multiple micronutrient powders at improving growth.

While Ready to Use Therapeutic Feeding (RUTF) has revolutionised strategies for treatment of malnutrition, there are limited options with regards to effective strategies for prevention of malnutrition. To address this, SQ-LNS were developed and provide about 100-120 kcal/day. The proportion of the energy needs provided by SQ-LNS is approximately one-half at 6–8 months, one-third at 9–11 month, and one-fifth at 12–23 month, leaving room for other complementary foods in the diet and breastmilk. Its combination of macro- and micro-nutrients has the potential to address multiple nutritional deficiencies simultaneously, thus reducing undernutrition. A recent meta-analysis that pooled data from 140 randomised controlled trials of SQ-LNS found that children who received SQ-LNS had a 12-14% lower prevalence of stunting, wasting and underweight. They were also 16-19% less likely to score in the lowest decile for language, social-emotional, and motor development, had a 16% lower prevalence of anaemia, and 64% lower prevalence of iron-deficiency anaemia when compared to control children who did not receive SQ-LNS [4].

[4]Kathryn G. Dewey, Christine P. Stewart, K. Ryan Wessells, Elizabeth L. Prado, Charles D. Arnold. 2021

CHAPTER 4

4.0 PREVENTION AND CONTROL OF MICRONUTRIENT DEFICIENCIES

4.1 Prevention and Control of Vitamin A Deficiency

4.1.1 Prevention and Control of Vitamin A Deficiency in Infants 0-6 months

In 2011, WHO developed a global guideline for the control and prevention of VAD through supplementation, however, it was reviewed in 2019[5]. The guideline made global recommendations for member countries to adapt to their context.

The national infant & young child feeding (IYCF) policy recommends that all infants 0-6 months should be exclusively breastfed. Exclusive breastfeeding reduces infection and vitamin A loss. Promotion of exclusive breastfeeding is a strategy for preventing VAD among infants 0-6 months of age. Based on studies, evidence and reviews, WHO did not approve VAS as a public health intervention to neonates (babies from birth to 28 days) and infants below 6 months. The current status of breastfeeding in Nigeria is worrisome and efforts should be made to ensure that all infants are exclusively breastfed. This guideline thus recommends that all infants from birth to under 6 months should be exclusively breastfed.

4.1.2. Prevention and Control of VAD in Children 6-59 Months

In line with the WHO recommendations and guidance, large scale or population-based supplementation of infants and young children shall be implemented in the country twice a year, integrated with other child survival strategies such as immunisation, Maternal Newborn Child Health Week (MNCHW), deworming or other periodic programmes that will enable the child to get 2 doses in a year[6]. The prescribed age-related dose and distribution of vitamin A capsules to all children in Nigeria shall be done routinely following the Health Management Information System (HMIS) scheduling.

Table 4.0: Schedules and Dosage of Vitamin A Supplements

Target group (Age group)	Dosage	Frequency
6 -11 months	100,000 IU (30 mg RE) vitamin A	Twice a year (6 monthly interval)
12 – 59 months	200,000 IU (60 mg RE) vitamin A	Twice yearly (6 monthly interval

The vitamin A capsules contain an oil-based solution of retinyl palmitate or acetate in a gelatin shell.

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[5] 5 Guideline on Vitamin A supplementation in infants and children 6-59 months of age 2018

[6] 6 WHO Recommendation for VAS: *High-dose vitamin A supplementation is recommended in infants and children 6–59 months of age in settings where vitamin A deficiency is a public health problem*.

The oil-based preparation of retinyl palmitate or retinyl acetate is to be administered orally. The capsules are packaged using a colour coding to denote the strength / content /dose. The red capsules contain the 200,000 IU and the blue capsule contains the 100,000 IU.

4.1.3. Vitamin A supplementation and Severe Acute Malnutrition Management

Children who are 6–59 months of age with SAM do not require a high dose of vitamin A as a supplement if they are receiving F-75, F-100 or RUTF that complies with WHO specifications. This is because such products contain sufficient vitamin A, or because vitamin A is part of other daily supplements if appropriate treatment guidelines are used. Over supplementation of vitamin A can lead to toxicity.

However, children with SAM that are given therapeutic foods not fortified as recommended in WHO specifications, and who do not have vitamin A as part of other daily supplements, should be given a high dose of vitamin A (100 000 IU or 200 000 IU, depending on age) on admission.

4.1.4. Vitamin A Supplementation IS NOT RECOMMENDED for All Pregnant Women Including HIV Positive Pregnant Women, Neonates and Post-Partum Mothers

It is recognised that vitamin A is very important to the health and development of the child and mother. However, WHO does not recommend the supplementation in pregnant women including HIV positive pregnant women. Rather such women should be encouraged to consume adequate diets rich in vitamin A.

Similarly, based on studies, evidence and reviews, WHO did not approve VAS as a public health intervention to post-partum women. Where there are concerns on the vitamin A status of the aforementioned group of persons, they should be counselled to consume adequate amounts of vitamin A rich foods including liver, carrots, mangoes and dark green leafy vegetables among other rich sources of vitamin A. Particular attention should also be placed on consumption of fortified foods with vitamin A as may be available.

4.1.5. Treatment of Vitamin A Deficiency

In situations where VAD poses serious threats to vision, health and life, the immediate concern is to restore the Vitamin A status. Conditions such as xeropthalmia, severe infections such as measles, dysentery and persistent diarrhoea among others, treatment is often related to the presenting conditions.

See Chapter 3, section 3.5 for more about xerophthalmia.

Table 4.1. Treatment of xerophthalmia

Age (months)	Dose of Vitamin A (IU)
6 – 12	100 000
Over 12	200 000

Three doses: on diagnosis + next day + 2 weeks later.

4.1.6. Adverse Effects Following the Administration of Vitamin A Supplements

Adverse effects among children within 48 hours of receiving high dose vitamin A supplements are very rare, and are usually mild and transient, with no long-term consequences. Adverse effects may include bulging of open fontanelles in younger infants, and nausea and/or vomiting and headache in older children with closed fontanelles.

The administration of vitamin A supplements above the recommended doses for the different age groups can potentially lead to over dosage, toxicity and consequential adverse reactions called hypervitaminosis A. The amount required to cause toxicity varies among individuals and groups while the manifestation of toxicity will depend on age, dose and duration of the dose as well as liver functions. When correct age specific dose is administered there may be slight but transient adverse effect that resolves easily without treatment. The side effects may be any of the following- loose stools, headaches, irritability, fever, nausea and vomiting.

It is noteworthy that hypervitaminosis A has not been found with public health administration of vitamin A capsules but rather with abuses and deliberate over dosage above recommended values. In such cases, symptoms such as blurry vision or other vision changes, swelling of the bones, bone pain, poor appetite, dizziness, nausea and vomiting, sensitivity to sunlight and dry rough skin were observed.

4.1.7. Food – Based Approaches to Prevent and Control Vitamin A Deficiency in Nigeria

The mandatory fortification of some food vehicles started in 2002 when the National Planning Commission and the Ministry of Industry launched the National Policy on Food and Nutrition (Sablah 2013, UNICEF 2006). The food vehicles include wheat flour, semolina flour, maize flour, sugar, margarine and butter and vegetable oil. While the nutrients mandated to be added to these food vehicles were vitamins A, B1 (thiamine), B2 (riboflavin), B3 (niacin), B6, B9 (folic acid) and B12, and minerals (iron and zinc) are added to wheat flour and semolina flour (SON 2015a, SON 2015b). Most monitoring activities have centred on fortified salt, followed by foods fortified with vitamin A (Busari 2013).

The level of vitamin A to be mandatorily added to the following food vehicles are:

Table 4.2 Levels of Mandatorily Fortified Foods with Vitamin A

Vehicle	Level of Fortification
Sugar	25,000 IU/kg

Wheat/maize flour	30,000 IU/kg
Vegetable oil	20,000 IU/kg
Margarine /butter	26,000 – 33,000 IU/kg

Retinyl palmitate is the approved form of vitamin A premix for use in Nigeria's fortification programme.

4.1.8. Biofortification of Food Crops with Vitamin A as Control and Prevention Measure

Nigeria since 2011 has adopted biofortification of some major staples such as maize, cassava, sweet potato and beans.

Evaluation of consumption of biofortified orange-fleshed sweet potatoes and cassava among population groups in Nigeria indicated positive impact. The low awareness and investment are part of the challenges to increasing consumption of biofortified crops (Phorbee et al, 2017). The consumption of vitamin A biofortified crops shall be promoted among households as a way of increasing the intake of vitamin A on a regular basis, hence serving as both control and preventive measures. Creating awareness among the population will improve biofortification knowledge and consumer choices.

Thus, biofortification of crops with vitamin A shall be promoted and enhanced by the different Agricultural Development Project (ADP) and Ministries of Agriculture, and other relevant stakeholders at all levels. Activities and investments are associated with capacity building on orange-fleshed sweet potatoes, provision of vines and agricultural inputs.

4.2 Prevention and Control of Iron Deficiency (Anaemia)

Anaemia is a condition in which the number of red blood cells or the haemoglobin concentration within them is lower than normal (table 4.3). The most common causes of anaemia are: nutritional deficiencies, particularly iron deficiency; deficiencies in folate, vitamins B12 and vitamin A; haemoglobinopathies; and infectious diseases, such as malaria, tuberculosis, HIV and parasitic infections.

Table 4.3 Haemoglobin levels to diagnose and classify anaemia (g/dl)

Age Group	Normal values	Mild anaemia	Moderate anaemia	Severe anaemia

Children 6- 59mths	≥11	10 – 10.9	7- 9.9	< 7
Children 5-11 years	≥11.5	11 -11.4	8 – 10.9	< 8
Children 12 -14 years	≥12	11 – 11.9	8 – 10.9	< 8
Non pregnant women 15 years and above	≥12	11 – 11.9	8 – 10.9	< 8
Pregnant women	≥11	10 – 10.9	7 – 9.9	< 7
Men	≥13	11 – 12.9	8 – 10.9	< 8

Source: Haemoglobin concentration for the diagnosis of anaemia and assessment of severity. WHO (2012).

Iron status can be considered a continuum from iron deficiency (i) with anaemia, (ii) with no anaemia, (iii) normal iron status with varying amounts of stored iron, and finally (iv) iron overload. Iron deficiency is the result of long-term negative iron balance. Iron deficiency anaemia (IDA) should be regarded as a subset of iron deficiency that represents the extreme lower end of the distribution of iron deficiency.

Iron requirements increase during the period of active growth in childhood, especially from 6 months to 3 years. In infancy, iron deficiency often results from non-practice of exclusive breast feeding and inappropriate complementary feeding thus the need to promote the use and consumption of micronutrient powders for children 6 – 59 months of age.

Iron requirements are proportionately greater in premature and underweight babies. Blood loss during menstruation, and increased iron requirements during pregnancy and lactation predispose women to poor iron stores. Traditional and cultural practices that do not prioritize the diets of females in the family even though the same food prepared for the family is consumed by them, make women and girls more prone to develop IDA than other members of the family.

Other micronutrient deficiencies such as vitamin B12 is necessary for the synthesis of red blood cells (RBC) and its deficiency has been associated with megaloblastic anaemia. Diets with little or no animal protein, as is often the case among the vulnerable groups, coupled with malabsorption related to parasitic infections of the small intestine, might result in vitamin B12 deficiency and anaemia.

Folic acid is also essential for the formation and maturation of RBCs and is necessary for cell growth and repair. Deficiency of folic acid reduces the rate of deoxyribonucleic acid (DNA) synthesis with consequent impairment to cell proliferation and intramedullary death, may result to abnormal cells, which shortens the lifespan of circulating RBCs and results in anaemia.

Helminths such as hookworm and flukes cause chronic blood loss, thus increasing the risk in development of anaemia. A hookworm burden of 40–160 worms (depending on the iron status of the host) is associated with IDA.

Plasmodium falciparum is the primary cause of severe malaria which is endemic in Nigeria. Malaria related anaemia can cause severe morbidity and mortality especially in children and pregnant women infected with plasmodium falciparum. Malaria in pregnancy increases the risk of maternal anaemia, stillbirth, spontaneous abortion, LBW and neonatal deaths.

Certain chronic diseases, such as sickle cell anaemia, cancer, HIV/AIDS, rheumatoid arthritis, Crohn’s disease and other chronic inflammatory diseases, can interfere with the production of RBCs, resulting in chronic anaemia. Kidney failure can also cause anaemia.

A varied array of interventions exist that are designed to prevent and correct iron deficiency anaemia. These include dietary improvement, fortification of foods with iron, iron supplementation, and other public health measures, such as helminth control (deworming), use of long-lasting insecticides treated bed net (LLITBN). All of these approaches improve iron status in some contexts.

4.2.1. Supplementation of Iron

The priority target groups for iron and folic acid supplementation (IFAS) are based on the likelihood of both iron deficiency and the public health benefits resulting from its control. Adolescents, pregnant women, postpartum and children 6-23 months of age are the priority target groups for both reasons. However, due to the high prevalence of anaemia in the country, adolescents, especially girls and women of childbearing age are to be targeted with this strategy. Iron supplements are essential for the rapid treatment of severe IDA in all sex and age groups.

4.2.2. Anaemia Control Programme for Children Aged 6 to 59 Months

Given the observed high prevalence of IDA among this group, the current guidance recommends that children 6-59 months shall receive micronutrient powder in line with the national protocol. This should also be complemented with the national health programmes such as MNCHW, malaria and deworming.

4.2.2.1 Micronutrient powders for point-of-use fortification of foods consumed by children 6–59 months of age

WHO estimated that approximately 300 million children globally had anaemia in 2011. Of this number, children in Africa aged 6-59 months have the highest burden of anaemia, estimated at approximately 62%.

Children in Nigeria are not spared from the high incidence and prevalence of deficiencies of multiple micronutrients especially during the period of complementary feeding when breastfeeding alone can no longer sustain their nutritional needs. They are often fed with poor and inadequate complementary foods at this time.

Infants and children are the groups that are most vulnerable to micronutrient deficiency, given the high vitamin and mineral they need to support their rapid growth and adequate development. Vitamin and mineral deficiencies, particularly of vitamin A, iron and zinc contribute significantly to morbidity and mortality in children under 5 years of age.

Micronutrient powders were developed as an alternative way of providing micronutrients to populations where other interventions such as supplementation or mass fortification are difficult to implement. The powders are used to increase the micronutrient content of a child's diet without changing their usual dietary habits. Micronutrient powders have been shown to reduce the risk of iron deficiency and anaemia in infants and young children, 6–59 months of age.

The National Strategy and Policy on Maternal, Infant and Young Child Nutrition (MIYCN) in Nigeria states that MNP shall be used to promote safe and appropriate complementary feeding, and to improve iron status and reduce anaemia for children 6-59 months in health facilities & communities for routine service delivery.

Table 4.4 below provides a scheme for point-of-use fortification of complementary foods with iron containing micronutrient powders in infants and young children aged 6–59 months.

Table 4.4 Recommended scheme for point-of-use fortification of foods with micronutrient powders for infants and young children aged 6–59 months.

Scheme for fortification	**Target group: infants and young children aged 6–59 months**	
Composition per sachet (summary)	Iron: 10 to 12.5 mg of elemental iron[a] Vitamin A: 300 µg retinol Zinc: 5 mg elemental zinc With or without other micronutrients to achieve 100% of the RNI[b,c]	
Regime	Age	Dosage
	6-9 months	90 sachets
	9-12 months	Free
	12-15 months	90 sachets
	15 – 18 months	Free
	18-23 months	90 sachets
	23-26 months	Free
	26-29 months	90 sachets
	29-32 months	Free
	32-35 months	90 sachets
	35- 38 months	Free
	38-41 months	90 sachets
	41-44 months	Free
	44-47 months	90 sachets
	47-50 months	Free
	50- 53 months	90 sachets
	53-56 months	Free
	56-59 months	90 sachets
Settings	Areas where the prevalence of anaemia in children aged 6- 59 months is 20% or more	

MNP are packed in single-use 1-gram sachets (each sachet weighs 1 gram, supplied in a pack of 30 sachets). The sachet contents should be mixed with a small portion of solid or semi-solid food just before serving. Children aged 6-59 months shall be given one dose (i.e., one sachet) each day. The sachet should not be used if torn or damaged.

MNP have a shelf life of 24 months from date of production.

The product should be stored 30°C and below in original packaging, in a cool dry place, protected from moisture to maintain the full shelf-life of the product. Main risk is the degradation of the vitamins.

Table 4.5 Nutritional composition of MNP (Each one-gram sachet contains)

Vitamins		**Minerals**	
Vitamin A	400µg	Iron	10 mg
Vitamin C	30mg	Zinc	4.1mg
Vitamin D	5µg (200IU)	Copper	0.56mg
Vitamin E	5mg TE	Selenium	17µg
Vitamin B1	0.5mg	Iodine	90µg
Vitamin B2	0.5mg		
Vitamin B3	6 mg		
Vitamin B6	0.5mg		
Vitamin B12	0.9 µg		
Folic acid	90µg		

4.2.3. Iron-folic Acid Supplementation Programme for Non-Pregnant Non-Lactating (NPNL) Women and Adolescent Girls.

In population groups where the prevalence of anaemia among women of reproductive age is above 20 per cent, and mass fortification programmes of staple foods with iron and folic acid are not in place, WHO recommends weekly IFAS as a strategy to prevent iron deficiency and improve pre-conception iron reserves and folate status in women (WHO, 2009b). Though Nigeria currently implements wheat and maize flour fortification with iron and folic acid, the scale of consumption of mandatorily fortified flour is low. It is on the score of this that this guideline recommends weekly supplementation of this target group with iron and folic acid through health facility and schools. The use of a single capsule or tablet that contains 60 mg elemental iron and 2800 µg folic acid, for adolescent girls and non-pregnant and non-lactating women in Nigeria is recommended for use daily as detailed in the table below.

Table 4.6. Scheme for intermittent iron and folic acid supplementation in menstruating women in Nigeria (WHO *2018*)[7]

Supplement composition	Iron: 60 mg of elemental iron* Folic acid: 2800 µg (2.8 mg)
Frequency	One supplement per 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 If feasible, intermittent supplements could be given throughout the school or calendar year
Target group	All adolescent girls and adult women
Settings	Populations where the prevalence of anaemia among non-pregnant women of reproductive age is 20% or higher

4.2.4. Anaemia Control Among Pregnant Women

High physiological demand for iron in pregnancy is usually difficult to meet with most usual diets, thus the need for routine supplementation.

Effective communication with pregnant women about diet and healthy eating, including counselling on food sources of vitamins and minerals, and dietary diversity, is an integral part of preventing anaemia. Such communications will include strategies for improving acceptability and adherence to supplementation schemes as well as managing possible side effects.

Stakeholders should consider task shifting, where health care cadre provides iron supplementation in community settings with poor access to primary health care services.

The recommendations for this guideline for pregnant women are as follows:

Daily oral dose of 60 mg elemental iron with 0.4 mg of folic acid as a combined single tablet to be taken during pregnancy.

Table 4.7 Oral dose of iron with folic acid combined taken during pregnancy

Supplement composition	60 mg elemental iron with 0.4 mg of folic acid combined in a single tablet
Frequency	Daily
Duration	Through the duration of pregnancy
Target group	Pregnancy (Pregnant women)

[7] National policy on the health, nutrition and development of adolescents and young people in Nigeria:2020-2030 (in draft)

This should be complemented with parasite control, with administration of anthelminthic treatment once in the 2nd trimester. However, in areas of the country where hookworm is highly prevalent and documented, a repeat treatment in the third trimester once is recommended.

Intermittent preventive treatment (IPTp) for malaria in pregnancy is part of the minimum package for ANC.

4.2.4.1. The Use of Multiple Micronutrient Supplements (MMS)

MMS is a once-a-day pill of critical micronutrients, typically containing 13-15 vitamins and minerals (nutrients) as outlined by the United Nations International Multiple Micronutrient Antenatal Preparation (UNIMMAP) formula, that are required during pregnancy.

MMS is intended to replace daily oral consumption of IFAS by all pregnant women. The current use of IFAS is missing the added benefits of MMS in terms of the birth outcomes (i.e., reduced risk of LBW etc.). MMS has the same effect in terms of maternal anaemia prevention as IFAS.

The 2021 Ministerial Order permitted the use of MMS during pregnancy. This is based on the 2020 WHO recommendation on antenatal care for a positive pregnancy experience. The UNIMMAP group and NI has provided further evidence that suggested the cost effectiveness and programme efficiency of the use of MMS.

The MMS that contains 13 to 15 components has been found efficacious and thus approved for use in Nigeria. The supplement shall be provided through ANC service at health facilities. It is recommended to be taken orally daily through out pregnancy (1 tablet daily).

4.2.5 Small-quantity Lipid-based Nutrient Supplements (SQ-LNS) for point-of-use fortification of foods consumed by children 6–23 months of age

SQ-LNS was developed by the iLiNS project for enriching home-prepared foods for women and infants in low-income settings (8), as a potential strategy to increase nutrient intakes during the "first 1000 days." Studies suggest that in children 6–23 months of age, the consumption of SQ-LNS added to complementary foods improve growth and anaemia status when compared with no intervention and may be more effective than other alternatives such as fortified blended foods and multiple micronutrient powders at improving growth (10).

While RUTF has revolutionised strategies for treatment of malnutrition, there are limited options with regards to effective strategies for prevention of malnutrition. To address this, SQ-LNS were developed and provides about 100-120 kcal/day. The proportions of these energy needs provided

[8] Arimond M, Zeilani M, Jungjohann S, Brown KH, Ashorn P, Allen LH, Dewey KG. Considerations in developing lipid-based nutrient supplements for prevention of undernutrition: experience from the International Lipid-Based Nutrient Supplements (iLiNS) Project. Matern Child Nutr. 2015;11(Suppl 4):31–61

by SQ-LNS are approximately one-half at 6–8 months, one-third at 9–11 month, and one-fifth at 12–23-month requirements, leaving room for other complementary foods in the diet and breastmilk. Its combination of macro- and micro-nutrients has the potential to address multiple nutritional deficiencies simultaneously, thus reducing undernutrition.

The National Strategy and Policy on Maternal, Infant and Young Child Nutrition (MIYCN) in Nigeria states that micronutrient products such as SQLNS should be used to promote safe and appropriate complementary feeding, and to improve iron status and reduce anaemia for children 6-23 months in health facilities & communities for routine service delivery.

Table 4.8 Recommended scheme for fortification of foods with Small-Quantity Lipid-Based Nutrient Supplements for infants and young children aged 6–23 months

Scheme for fortification	**Target group: infants and young children aged 6–23 months**
Composition per sachet (20g)	Energy value: 109-118 kcal/456-494 Kj Proteins: 2.4-3g Lipids: 7.6 -9.6 g
Regime	Recommended usage is; 90 sachets for 90days for 1st round then interval of 3months, 2nd round 90sachets for 90days and interval of 3months thereafter 3rd round 90 sachets for another 90days.
Settings	Areas where the prevalence of anaemia and diarrhoea in children aged 6- 23 months is 20% or more

SQ-LNS are packed in single-use 20gram sachets, (each sachet weighs 20 grams, supplied in a pack of 30 sachets).

Administration: The product is to be eaten directly from the sachet. Do not dilute with water or add to other foods. The primary packaging is portion controlled: each unit of 20g net packaged in strips of 7-14 sachets/pouches and 546 sachets/pouches per carton. The sachet contents should be mixed with a small portion of solid or semi-solid food just before serving. Children aged 6-23 months shall be given one dose (i.e., one sachet) each day.

The sachet should not be used if torn or damaged. It has a minimum shelf life of 18 months from manufacturing date. The product should be stored 30 °C and below in original packaging, in a cool dry place, and protected from moisture to maintain the full shelf-life of the product. The main risk is the degradation of the vitamins.

Table 4.9 Nutrient composition (Each 20-gram sachet contains)

Vitamins		Minerals	
Vitamin A	400µg	Pantothenic acid	1.6–2.8 mg
Vitamin C	30mg	Niacin	4-5.6 mg
Vitamin B1	0.3–0.6 mg	Calcium:	90-130 mg
Vitamin B2	0.4- 0.5 mg	Phosphorous	80–100 mg
Vitamin B6	0.3–0.4 mg	Potassium	140–170 mg
Vitamin B12	0.5–0.6 µg	Magnesium	14–18 mg
Folic acid	80–110 µg	Zinc	3.6–4.4 mg
		Copper	0.18–0.22 mg
		Iron	8.0–10 mg
		Iodine	80-100 µg
		Selenium	9.0–11 µg
		Manganese	0.07–0.09 mg

4.2.6. Food Fortification for the Control and Prevention of Anaemia.

4.2.6.1. Mandatory Fortification

In Nigeria, all wheat and maize flour including their by-products fall under the mandatory fortification with iron and folic acid as well as other vitamins and minerals implicated for red blood cell formation and integrity as reflected in table 4.10 below.

Table 4.10 Mandatory Micronutrients Requirements for Wheat Flour, Composite Flour, Maize Flour, Wheat Semolina and Whole Maize Meal

Vitamin A	Dry vitamin A palmitate250 CWS/SN/CWD	2.0 mg/kg
Vitamin B9	Folic acid Food grade	2.6 mg/kg
Vitamin B12	0.1% CWS/SN/CWD	0.02 mg/kg
Iron	NaFeEDTA (anhydrous in line with FCC)	40.0 mg/kg
Vitamin B2	Riboflavin Fine powder	5.0 mg/kg
Zinc	Zinc oxide	50.0 mg/kg
Vitamin B1	Thiamine Mononitrate	6.0 mg/kg
Vitamin B3	Niacinamide	45.0 mg/kg
Vitamin B6	Pyridoxine Hydrochloride	6.0 mg/kg

Table culled from Nigerian Industrial Standard (NIS 121. 723; 2015)

4.2.6.2. Voluntary Fortification

Voluntary fortification has been identified as an additional opportunity to address the occurrence of inadequate micronutrient intakes in population subgroups in Africa. It refers to the addition of vitamins or minerals to foods at the discretion of the manufacturer for a number of purposes such as restoration, ensuring nutritional equivalence of substitute foods and enhancing the nutritive value of a food as well as competitive edge of such products in the marketplace.

Dietary patterns are changing at a rapid pace across Africa as populations and food systems experience demographic, technological and urbanization shifts. Food choices have evolved in line with these changes making rice fortification a viable and desirable option, where it was not previously. Today, rice represents over 50% of daily energy & protein intake for 3 billion people but is a poor source of micronutrients and less than 1% globally is fortified. Outside of Asia, the highest per-capita consumption of rice occurs in West Africa, where all forms of malnutrition are endemic and where rice fortification represents a huge opportunity.

Rice fortification in 12 high-consuming countries in Africa has the potential to significantly improve the health of at least 130 million people, most of who live in West Africa with two-thirds of them in Nigeria. Studies in Nigeria, alongside two Fortification Assessment and Coverage Toolkit (FACT) surveys in Sokoto and Ebonyi states, assessed the potential of rice as a fortification food vehicle. They found that household coverage of rice in general was 100% in Ebonyi state and 93% in Sokoto state (far outstripping wheat flour consumption at 10% and 59% respectively). The studies also found that household coverage of rice in fortifiable (i.e. industrially processed and amenable to large-scale food fortification) form was 83% in Ebonyi state and 40% in Sokoto state[9]. Among women of reproductive age (a group particularly vulnerable to malnutrition), intake levels of fortifiable rice were 80 g/day in Ebonyi and 97 g/day in Sokoto.

Micronutrient fortification of bouillon cubes is done on a voluntary basis in Nigeria, with manufacturers deciding the types, chemical forms and levels of the vitamins and minerals added to the product. Although Nigeria has developed and adopted a bouillon manufacturing and safety standard, there is presently no specific national guidance on voluntary micronutrient fortification of this product. Whereas there is consensus on the widespread use of bouillon, there are varied views among various stakeholders, including policy makers, programme managers, private sector bouillon manufacturers and consumers, regarding the consumption and micronutrient fortification of bouillon in Nigeria. Many of these stakeholders agree that bouillon fortification holds a great potential to reach most Nigerians, particularly those in rural areas, with essential vitamins and minerals. However, most also hold safety and health concerns regarding bouillon, and recommend for these to be addressed through research prior to its acceptance as a fortification vehicle.

There is a clear opportunity in Nigeria to introduce rice and bouillon fortification programmes to help reverse the rising levels of micronutrient malnutrition in the country. However, before such a programme can be introduced, we must analyse the rice landscape comprehensively, carry out cost-benefit analyses, build political support and develop the guidelines and standards for rice and bouillon fortification.

4.2.7. Biofortification

Biofortification of some staple food crops in Nigeria is currently receiving attention with the biofortification of beans and millet with iron. This will further boost the nutritional status of Nigerians with the current commercialisation drive of these crops**.** Although progress is being made in controlling micronutrient deficiencies through supplementation and food fortification, new approaches are needed in reaching the rural poor. Biofortification is the enrichment of nutrients of staple crops through plant breeding. Scientific evidence shows this is technically feasible without compromising agronomic productivity[10]. Predictive cost-benefit analyses also support biofortification as being important for controlling micronutrient deficiencies, and with the advent of good seed systems, the development of markets and products, and demand creation, this can be achieved.

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[9] Garrett G., Matthias D. et al. 2019. Doubling down on food fortification to fortify the future in The Optimist blog, Gates Foundation available from https://www.gatesfoundation.org/TheOptimist/Articles/food%20fortification%20to%20fortify%20the%20future accessed on 26 January 2020

[10] Penelope Nestel, Howarth E. Bouis, J. V. Meenakshi, Wolfgang Pfeiffer, Biofortification of Staple Food Crops, The Journal of Nutrition, Volume 136, Issue 4, April 2006, Pages 1064–1067, https://doi.org/10.1093/jn/136.4.1064

4.2.8. Other Health Measures for the Control of Iron Deficiency Anaemia

4.2.8.1 Periodic Deworming Programme

Periodic deworming programme of children 12 to 59 months with deworming tablets is recommended twice yearly. In addition, school age children up to 14 years of age shall be included in the deworming programme as recommended by WHO (2017) and adopted by the FMOH.

Preventive chemotherapy (deworming), using bi-annual single-dose albendazole (400 mg) or mebendazole (500 mg) is recommended as a public health intervention for all young children 12–23 months, 24-59 months, 5–12 years of age (in some settings up to 14 years of age) living in areas where the baseline prevalence of any soil-transmission is 20% or more among children, in order to reduce the worm burden of soil-transmitted helminth infection[11].

4.2.8.2. Control of Malaria Parasites Including Malaria Treatment

Malaria surveillance and control are necessary components of programmes to control iron deficiency and may enhance the efficacy of iron supplementation. The risk of anaemia is increased by malaria infections, and preventive measures against malaria decrease anaemia prevalence in susceptible populations without iron supplementation. Some of the strategies recommended by this guideline is for the population at risk to regularly sleep under long-lasting insecticide treated bed nets, presumptive treatment for malaria as well as other control measures including treatment of malaria.

4.3 Prevention and Control of Zinc Deficiency

Next to iron, zinc is present in every cell of the body and occurs in all enzyme classes, hence it is mainly involved in the biological functions of the immune system and response to infection. Studies report that 10% of the human proteome contain zinc binding proteins. Zinc is an integral component of many metalloenzymes in the body involved in the synthesis and stabilisation of proteins, DNA and RNA, gene expression, signal transduction and apoptosis. It is also involved in oxygen transport and protection against free-radical damage.

The biological role of zinc is ubiquitous in the body. High concentration of zinc is present in the brain, muscles, bones, kidney, liver, prostate and parts of the eye.

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[11] Effects and safety of preventive chemotherapy in preschool and school-age children (2017) https://www.ncbi.nlm.nih.gov/books/NBK487918/#:~:text=Preventive%20chemotherapy%20(deworming)%2C%20using,of%20any%20soil%2Dtransmitted%20helminth

The human body does not store zinc, which means getting enough of the mineral from food is important in preventing a deficiency. Dietary deficiency of zinc is especially common in low-income countries because of a low dietary intake of zinc-rich foods (mainly foods of animal origin) or inadequate absorption caused by its binding to dietary fiber and phytates often found in cereals, nuts and legumes.

Symptoms of zinc deficiency tend to be linked to the roles that zinc performs in the body. Some of the most common zinc deficiency symptoms include loss of appetite, slower than expected growth and poor immune system function. Severe zinc deficiency can cause even more concerning symptoms such as delayed sexual maturity, diarrhoea, eye and skin lesions, lethargic feeling, funny-taste sensation, hair loss, poor wound healing and unexplained weight loss. Men and boys can also experience impotence and hypogonadism, which is when a male's body does not produce enough testosterone.

4.3.1. Zinc Supplementation

Multiple community-based intervention trials in low- and middle-income countries with an elevated risk of zinc deficiency have found that preventive zinc supplementation, provided in the form of a single micronutrient solution or dispersible tablet, decreases the incidence of diarrhoea and acute lower respiratory infections in children.

Zinc supplementation has been shown to reduce the duration and severity of diarrhoea, and to prevent subsequent episodes. WHO recommends that mothers, other caregivers and health workers should provide children with diarrhoea with 20 mg per day of zinc supplementation for 10-14 days (10 mg per day for infants under the age of six months). Implementation of this recommendation will contribute to the achievement of the global goal of reducing the number of stunted under five children. However, 31.1% of children in Nigeria have access to zinc supplementation for diarrhoea management (NDHS 2018).

Zinc supplementation shall be given together with LO-ORS to contribute to the reduction of U5 deaths due to diarrhoea. WHO's new recommendations on the Clinical Management of Diarrhoea (12) states that health care workers treating children for diarrhoea should be using the new low osmolarity ORS solution recommended by WHO and UNICEF in 2003. As before, they are encouraged to provide caretakers of children with diarrhoea with two 1-litre packets of the new ORS solution for home use until the diarrhoea stops. Caretakers should also be provided with enough zinc supplements to continue home treatment for 10-14 days. Printed material (including text and illustrations) with advice on preventing and treating diarrhoea at home should accompany the ORS and zinc supplements. Use of home fluids for preventing dehydration is still recommended, and the criteria for the selection of an appropriate home fluid remains unchanged. However, children with diarrhoea treated at home with home-based fluids shall also receive zinc supplements for 10-14 days.

[12] WHO Guidelines for Policy Makers and Programme Managers

4.3.2 Potential Side Effects of Zinc Supplements Overdose

Zinc supplements are chemical preparations with potential risk of hazard if misused or consumed in large amounts. Taking high amounts of zinc is dangerous. High doses above the recommended amounts might cause fever, coughing, stomach pain, fatigue and many other problems. Taking more than 100 mg of supplemental zinc in a day or daily for 10 or more days or taking supplemental zinc for 10 or more years doubles the risk of developing prostate cancer. There is also a concern that taking large amounts of a multivitamin plus a separate zinc supplement increases the chance of dying from prostate cancer. Taking 450 mg or more of zinc daily can cause problems with blood iron. Single doses of 10-30 grams of zinc can be fatal.

4.3.3. Food Fortification Programme for the Prevention and Control of Zinc Deficiency.

Currently all flours and their by-products industrially produced by millers are mandatorily fortified with zinc. Zinc is a component part of the pre-mix approved for that purpose. However, due to limited regulatory capacity, monitoring and compliance of the available zinc in the products are not routinely monitored or/ and reported.

4.3.4. Biofortification

Biofortified rice, wheat, beans, cassava, potato with zinc and other micronutrients are released in Nigeria but the level of success is very limited. Reviews revealed that the number of micronutrients that can be provided by biofortified staple foods is much lower than the amount that can be achieved by supplementation or food fortification. The potential benefit of biofortification depends on the amount of the staple food consumed per day.

4.3.5 Dietary Sources of Zinc

The most significant dietary sources of zinc in Nigeria are meat (either beef, poultry or pork are excellent sources of zinc), shellfish (including periwinkles are healthy, low-calorie sources of zinc), legumes (like chickpeas, lentils and beans all contain substantial amounts of zinc), whole seeds, tiger nuts, bambara nuts, whole grains, dates, dairy products and eggs. Bitter leaf is also regarded as a good source of zinc. Regular consumption or addition to daily diets of these foods will enhance the zinc status.

4.4 Prevention and Control of Iodine Deficiency Disorders

The USI programme is the first mandatory fortification programme in Nigeria, and clearly defines the standard for properly iodised salt as:

- >50 mg/kg iodine at port of entry and salt factory level
- >30 mg/kg iodine at distributor and retail levels
- >15 mg/kg iodine at household level

This guideline recommends the sustenance of the USI programme as well as the enforcement of regulations on packaging of table salt which has greatly limited the sale of salt in open basins as well as sales of industrial salts as table salts in Nigeria.

The self-regulation practice adopted by local salt manufacturers should also be sustained while periodic but regular field monitoring should be sustained to prevent infiltration of inadequately iodised salt through our land borders.

Local rock salt mining is still practiced in some locations in Nigeria. Such areas should be clearly marked out and all the local salt producers in such areas should be incentivised to adopt small mill fortification with the appropriate fortificant to the required standard level of >30 mg/ kg iodine content of the salt. Markets should be incentivised and monitored to ensure compliance.

The USI programme will benefit from the 2020/2021 National Micronutrient Survey to address key observations with the programme.

Salt iodisation is the only programme that did not have multiple approaches to its control and has benefitted from robust coordination mechanisms between the regulatory agencies of SON and NAFDAC on one hand and the salt industries on the other hand.

CHAPTER 5

MICRONUTRIENT DEFICIENCY CONTROL COORDINATION

This guideline recognises the importance of regulatory controls and coordination of the micronutrient deficiency control efforts, some of which are outside the health sector but with huge impact on the public health of Nigerians especially the vulnerable groups. The role of the donor and development partner networks especially in supplementation includes collaboration in the planning and implementation of the programme.

Effective coordination and programme governance are key to a successful micronutrient deficiency control. This requires a coordination framework that ensures synergy and alignment of resources and clear institutional arrangement. The rationale for the framework can be captured under four areas:

- Accountability
- Harmonisation
- Partnership
- Knowledge Management

Mechanisms for MNDC coordination

The key mechanisms for MNDC coordination are multi-sectoral. To provide coordinated strategy there should be:

1. The Advisory Committee for MNDC domiciled in FMOH (multi-stakeholders committee that advises the Honourable Minister of Health on MNDC matters).
2. National Fortification Alliance (NFA) with secretariat in NAFDAC (multi-partnership committee including industries, regulators (SON, NAFDAC, FCCPC), development partners, INGOs, etc.
3. National Biofortification Alliance domiciled in FMARD (Research institutes, INGOs, development partners and specialized MDAs, etc).
4. Universal Salt Iodisation / Iodine Deficiency Diseases Task Force (USI/IDDTF) with the secretariat in SON.
5. Global Alliance for vitamin A partnership in Nigeria (UNICEF, HKI and Nutrition International).

5.1. Implementation Coordination for Micronutrient Supplementation

Micronutrient supplementation programmes including the biannual VAS to children 6 – 59 months, the distribution of micronutrient powders to children 6 – 59 months, weekly and daily iron and folic acid supplementation of non-pregnant and non-lactating women as well as adolescent girls, will be greatly enhanced if appropriately and effectively coordinated. In addition, the distribution of MMS which will replace iron and folic acid supplements distribution to pregnant women attending antenatal care centers and other potential outreach points require a robust coordination from procurement of the commodities till they get to the potential target population groups and individuals. No pregnant woman in Nigeria should be given both IFAS and MMS. MMS will replace IFAS in pregnancy.

5.2 Coordination Planning, Supplies and Logistics of Vitamin A Supplementation

Vitamin A capsules distribution requires efficient and effective planning, forecasting and transportation to ensure effective coverage of the population groups. This should be done at all administrative levels starting from the national, through the state and the LGA levels, and finally culminating at the ward level. This push approach should give way to requisition and demand by the different tiers to make for ownership, accountability and efficiency.

The current partnership of Government and Global Alliance for Vitamin A (GAVA) should be strengthened for effective coordination and financing, such that the requirements for routine and campaign-based distribution of vitamin A capsules are strategically harmonised for effective service delivery across the country. Currently, the capsules are donated by Nutrition International through UNICEF. However, should government at all levels commence procurement, it should be routed through proper channels and quality assured by relevant agencies. Governments at all levels should commence funding entire VAS programme from procurement of the capsules as well as other associated logistics of getting them into the country until the last mile. It is also important to note that vitamin A is on the essential medicine list of the country, thus a sustainable framework to ensure its availability should be pursued. Each tier of government through efficient micro planning exercises should be able to adequately quantify her requirements for the population of 6-59 months children within her boundaries, as well as place orders for procurement of all supplies and other expendable materials required.

Vitamin A capsules are drugs and could easily be misused and abused with consequences for the health system. Situations where different partners source and bring into the country vitamin A capsules that are not captured in the total national quantifications, portend danger and is discouraged.

The national designated coordinating agency within the health sector shall ensure and enforce that all stakeholders submit to one plan, one monitoring framework, and one evaluation of the national VAS programme.

Coordination during public health emergencies: Delivering vitamin A rich relief food items especially to the vulnerable groups during public health emergencies should also be ensured. Incorporating and integrating vitamin A capsule distribution with routine immunization services is part of the steps to ensure full health system accountability for vitamin A capsules. Home fortification using MNP powder in refugee camps, child health emergency programmes, Community Management of Acute Malnutrition (CMAM) treatment centres and school feeding programmes also calls for integration based on this guideline recommendation.

The FMOH through the NPHCDA is responsible for coordinating all supplementation programmes in the country in close collaboration with the states' Ministry of Health and State Primary Health Care Agencies/ Boards.

The supplementation programme as currently implemented is uncoordinated, with different state entities adopting different supplies for deworming and IFAS preparation. The coordination shall include the standardisation of supplements approved for use in the country, the timing of supplementation, sourcing as well as allied logistics of distribution. These arrangements shall allow for proper and uniform monitoring templates and approaches with a common evaluation framework.

It is also important to note that the school system, safe spaces and workplaces may be involved in some of the supplementation programmes such as the Weekly Iron Folic Acid Supplementation (WIFAS) to allow for a common country approach and standard.

Supplementation though largely standalone means is not the only strategy being used in the country for the control and prevention of micronutrient deficiencies of public health concerns. Thus, information and monitoring of progress as well as linkages with other approaches is recommended such as with fortification and biofortification efforts.

5.3. National Fortification Alliance for Micronutrient Fortification

The fortification programme is being coordinated by the National Fortification Alliance, with its secretariat in NAFDAC and membership from MDAs, industries as well as development partners.

It is recognized that NAFDAC, SON and FCCPC play crucial regulatory roles in the fortification programmes. The coordination platform shall be strengthened to enhance its efficiency and effectiveness with the mandatory fortification programmes so that other industry players such as public analysts as well as industry self-regulation can be encouraged, to provide the required information on the progress of the country fortification efforts. The successes achieved with universal salt iodisation can be replicated to achieve over 90% of Nigeria's household access to fortified foods and their by-products. A well-functioning coordination body shall be positioned to address the challenges. Fortification being a food-based approach and implemented simultaneously shall be required to be properly monitored periodically to avoid consequences of overdose.

The mandatory fortification programme is anchored on the efficiency and effective regulatory framework provided by the national regulatory agencies (SON, NAFDAC and FCCPC) in enforcing compliance with the fortification requirements at the key stages of importation, manufacturing and retailing and household. Self-regulation by the relevant industries shall be encouraged as well as active participation of the association of public analyst.

The zonal laboratories of SON and NAFDAC should regularly monitor and evaluate the compliance to products within their geographic areas.

The premix market and trade should be effectively controlled to ensure that the quality of imported premix and those locally produced meet the national approved standards.

5.4. Biofortification Coordination

Biofortification in Nigeria has not witnessed the expected commercialisation that is intended to raise the consumption status of the at-risk population. Due to the fact that for some of the nutrients enhanced by the technology, biofortification is only one strategy being used, there is the need to link all the approaches together to inform changes that may be required when the threshold values of the micronutrients are reached in the populations.

5.5 Implementation Framework

There are six critical elements identified for the successful implementation of the micronutrient deficiency programme in Nigeria as in any country and they are:

- **Political commitment by government at all levels.** Nigeria has a well-defined policy and strategic documentation that indicates her willingness to address the micronutrient deficiencies of public health importance through the instruments of the National Policy on Food and Nutrition (2016) as well as the National Strategic Plan of Action for Nutrition in the Health sector. In addition, the National Strategic Health Action Plan all provide the frameworks for the control of micronutrient deficiency. The signing on to the implementation of SDGs by the government at all levels, as well as the creation of SDG offices at the executive levels also signify commitment to achieve zero hunger including the hidden hunger. This commitment is actualised by government ownership of the MNDC programme in Nigeria including provision of sufficient funds for procurement and distribution of ALL micronutrient prevention and control commodities such as vitamin A capsules, iron and folic acid supplements, zinc tablets, MMS, and MMP for both regular distribution and humanitarian emergencies by all governments (federal, state and local).

- **Community mobilisation and participation.** Governments at all levels shall invest in community mobilisation of the entire citizenry especially the vulnerable groups of women and children to access health facilities, consume mandatorily fortified foods as well as procure biofortified foods. Governments through the relevant agencies shall inform the citizenry of the benefits and consequences of the MNDC programme. Importance of citizen participation shall be emphasized at the ward and community levels including mobilisation of all political and religious leaders.

- **Human resource development** including training, re-training, and supervision of adequate human resources. This is needed not only in health, agriculture and education but also in the regulatory institutions to enforce regulations such as the codes on marketing of breast milk substitutes, good manufacturing practices, enforcement of mandatory fortification standards at all levels including households and retail outlets, and quality of premix. Government, partners and industries shall be encouraged to develop the capacities of the required human resource needed to implement this MNDC guideline.

- **Targeting the guidelines-identified critical vulnerable groups**, including under five-year old children, women of child bearing age, adolescent girls as well as pregnant women. The other population groups are not left out as they benefit from the general education as well as the dietary sources of micronutrients of public health importance. The target groups are particularly important and shall be properly mobilised for the intervention programme.

- **Monitoring, evaluation, and management information systems** are a critical part of this guideline and are also important in the overall management and implementation of the MNDC guidelines as they provide information on the performance, progress and achievement of the interventions as conceived.

- **Replicability and sustainability of the interventions** shall be achieved with appropriate documentation of the processes, inputs, outcomes and outputs as well as management of the knowledge generated at each level of implementation while ensuring the observance of the coordination framework pillars as stated above.

CHAPTER 6

MONITORING AND EVALUATION FRAMEWORK

Monitoring activity is essential to adjust the direction of the programme and shall involve monitoring of the process indicators as well. In addition, evaluation of programme effectiveness shall also measure the impact of the different interventions.

Monitoring and evaluation (M&E) are vital components of any successful programme and not limited to nutrition or micronutrient deficiency control programmes. M&E with appropriate indicators, including equity-oriented indicators, is encouraged at all stages of this guideline implementation (national and sub-national levels). M&E efforts shall reflect and refine programme response to the challenges faced with micronutrient malnutrition in Nigeria. It shall also enable us to evaluate progress against the national and global nutrition targets, as well as progress towards achieving the SDG targets.

The periodic survey reports such as Multiple Indicator Cluster Survey (MICS), National Nutrition and Health Survey (NNHS), as well as the NDHS, provide useful information for programme progress and coverage. However, they are often inadequate to provide up to date and timely information that is required to efficiently respond to data needs for a robust M&E plan. Thus, the National Health Management Information System (NHMIS) and regular programme data collected and analysed appropriately shall be relied upon for reporting on progress of implementation of this guideline and the MNDC program in Nigeria.

The success of micronutrient programme implementation may not be based on any published blue print but relate more on strategic approaches that are context specific and well targeted M&E component. The programme content, organization, coverage and intensity are key considerations in the overall analysis.

A programme may be deemed successful by virtue of its improved nutrition outcomes in the short term, but such effects may not endure, particularly if there are deficiencies in the process through which programme implementations were achieved. Process factors are critical for sustained success and shall be evaluated to capture the totality of change. Process factors include capacity building and relate most importantly to the way in which changes occur in peoples' capabilities and behaviours.

These are likely to result in improved access and uptake of micronutrient programmes. Participation, ownership and empowerment are important aspects of such a process and are critical to long-term sustainability. If real sustainability is to be achieved, then the process through which nutrition can be improved, shall be seen as part of the ultimate goal, not just the means. Consideration shall also be given to sustainability during the planning and implementation stages.

6.1 Dietary Diversity Measurement

Dietary diversity indicators are a qualitative measure of food consumption that reflects household access to a variety of foods and also a proxy for nutrient adequacy of the diet of individuals. Dietary diversity is usually assessed through prepared questionnaire representing a rapid, user-friendly and easily administered low-cost assessment tool.

Scoring and the analysis of the information collected through the questionnaire is straightforward. The dietary diversity scores consist of a simple count of food groups that a household or an individual has consumed over the preceding 24 hours. The data collected can be analysed to provide information on specific food groups of interest.

The household dietary diversity score (HDDS) is meant to reflect, in a snapshot form, the economic ability of a household to access a variety of foods. Increase in dietary diversity score is associated with socio-economic status and household food security (household energy availability). Individual dietary diversity scores aim to reflect nutrient adequacy. Increase in individual dietary diversity score is related to increased nutrient adequacy of the diet. Dietary diversity scores have been validated for several age/sex groups as proxy measures for macro and/ or micronutrient adequacy of the diet. Scores have been positively correlated with adequate micronutrient density of complementary foods for infants and young children, and macronutrient and micronutrient adequacy of the diet for non-breastfed children.

Typical indicators include:

- Percentage of individuals/households consuming vitamin A rich plant foods in (vitamin A rich vegetables and tubers, dark green leafy vegetables, or vitamin A rich fruits).
- Percentage of individuals/households consuming vitamin A rich animal source foods (organ meat, eggs or milk and milk products).
- Percentage of individuals/households consuming either a plant or animal source of vitamin A (vitamin A rich vegetables and tubers or dark green leafy vegetables or vitamin A rich fruits or organ meat, or eggs, or milk and milk products).

The following indicators can be derived for consumption of heme-iron rich food groups:

- Percentage of individuals/households consuming organ meat, flesh meat, or fish.

The indicators above are calculated by summing the number of households or individuals who consumed ANY of the food groups listed in the questionnaire and then dividing by the total sample size of the survey.

6.2 Supplementation Programmes

Supplementation strategy is a method of choice when *therapeutic treatment* is necessary to address *severe micronutrient deficiency*. Supplementation is also an appropriate strategy for preventive programmes, as long as the distribution system can be maintained, and those receiving the supplements continue to consume them. Supplementation has been shown to be highly cost effective in achieving its nutritional goals and health impact. For the different supplementation programmes covered by this guideline, the following indicators are to be measured and reported:

- # and % children 6-11 months of age who received 1st dose of VAS.
- % of children 6-59 months who received vitamin A supplements twice in the last 12 months.
- % of children 12 – 59 months that received vitamin A supplements in the last 6 months.
- % of children 6 – 23 months who received 90 sachets of micronutrient powders for enriching their diets in the last 6 months.
- % of children 24 – 59 months who received 90 sachets of micronutrient powders for enriching their diets in the last 6 months.
- % of sampled adolescent girls 10-14 years (early adolescent) who received weekly iron folic acid supplement in the last 3 months.
- % of sampled adolescent girls 15-19 years (late adolescent) who received weekly iron folic acid supplement in the last 3 months.
- % of women 15-49 years (within reproductive age) who receive weekly iron folic acid supplements in the last 3 months.
- % of pregnant women that received daily dose of iron folic acid supplement for 6 months during pregnancy.
- % of pregnant women that received daily dose of multiple micronutrient supplement for at least 6 months during pregnancy.
- % of children under-five with diarrhoea that received zinc tablets with Lo ORS for management of diarrhoea.
- % households that have access to bundled zinc supplements with low Osmolar ORS in the management of childhood diarrhoea.
- % health facilities that have stock of bundled zinc+ ORS for the management of diarrhoea of under- five children.
- % health facilities that treated children under five with diarrhoea using zinc supplements and ORS.
- % of health care facility that receive vitamin A capsule.

6.3 Food Fortification Programme

Food fortification is the process by which a nutrient is added to a commonly eaten food to improve the quality of a population's diet. It includes the addition of nutrients at levels higher than those found in the original or in comparable foods. The food that carries the nutrient is referred to as the food vehicle, and the nutrient added is the fortificant.

Monitoring food fortification programmes differs from monitoring other micronutrient deficiency control interventions, because it is concerned with the quality and availability of the product of a food-processing company as it moves from factory to consumer. This involves monitoring the interaction between public regulatory agencies, private industry, trade and public health services.

In addition to the monitoring and enforcement of mandatorily fortified foods and products, voluntary fortified foods claimed by both local and imported foods should also be regularly monitored and evaluated for the veracity of claims especially with respect to the micronutrients of public health importance as well overall health of the population by the relevant regulatory agencies including NAFDAC at product registration.

The regulatory agencies are required to conduct regular and periodic monitoring reports on the mandatorily fortified foods with respect to the level of fortificants at the factory, retail and household levels for all wheat flour, maize flour, sugar, salt and vegetable oils and their by-products such as margarine, butter including bread spreads.

The indicators required should also include process indicators, impact indicators as well as sustainability indicators for the fortification programme. Below are the indicators for monitoring mandatorily fortified foods:

- % of mandatorily fortified foods that are imported that failed to meet the legal standard at ports of entry.
- % of mandatorily fortified foods that are imported that complied with the legal standard at ports of entry.
- % of flour (wheat and maize), sugar and vegetable oil sold in Nigeria that is adequately fortified with vitamin A.
- % of mandatorily fortified foods at the factory level that failed to comply with legal standard of fortification.
- % of mandatorily fortified foods at the factory level that complied with legal standard of fortification.
- % of mandatorily fortified foods by local producers that failed to comply with legal standard of fortification.
- % of households consuming vitamin A fortified wheat and maize flour, sugar and vegetable oil including manufactured by-products.
- % of households consuming vitamin A biofortified maize, cassava and orange flesh sweet potato .
- % of households consuming fortified wheat and maize flour, including manufactured by-products that contains iron, zinc and folic acid.
- % of households consuming adequately iodised salt.
- % of individuals with IDD.

In addition, the coordination platforms will undertake regular reviews of fortification levels at factory (quarterly), distribution/retail (bi-annually) and household levels (annually) by appropriate agencies/ institutions. There must be prompt and regular feedback to all stakeholders including industry partners. Monitoring of cross-border trade in the salt and other food vehicles, especially across borders with countries that do not have effective fortification programme is key. The monitoring framework shall also cover local producers of such foods that fall under the mandatory fortification that are part of the trade network with possible support to encourage them to comply with the trade regulations.

Biochemical markers for iodine deficiency disorder shall also be considered, such as the prevalence of IDD as measured by TGR which is to be plotted over time, and urinary iodine as well. This approach will be easier to illustrate how the iodised salt programme has reduced or impacted IDD elimination in Nigeria. Other forms of presentation suggested is the construction of a table listing age groups by urban or rural location and indicate % inadequate, % adequate, % excess as applicable in the listing.

CHAPTER 7

RESEARCH NEEDS

Intimate interaction between programme development and a supporting agenda of applied research has long been recognised, thus the establishment of research and development units in most organisations /industries. Government public health programmes are also not immune against the implementation of research to further understand as well as implement effective and efficient programmes. The need to conduct operations research is very crucial now given the dynamics of emerging issues such as the use of multiple micronutrients that will serve as a bullet to resolve most, if not all, micronutrient challenges. There are also issues of "safety evaluation" and assessment of "effectiveness" and "efficiency" that brings in elements of a larger research agenda that may not be straightforward given the long-held notion that available funds should be devoted to scale up programme implementation rather than pursue research agenda.

A part of the operational research agenda is the availability of regular impact evaluation studies of some of our micronutrient deficiency control intervention programme. The listing of research focus may not be exhaustive at this stage, but urgent attention should be given to undertake the following as identified by the national stakeholders and a few recommended by WHO as context specific:

1. The implementation research (operation research) to establish the impact of switching from IFAS to MMS, including evaluation of acceptability, feasibility, sustainability, equity and cost-effectiveness.
2. Operational studies on the use of micronutrient powder for children 24-59 months in Nigeria.
3. The feasibility of rice fortification with iron and zinc as well as the impact on anaemia and zinc status of the consumers.
4. The feasibility of fortifying bouillon cubes with folic acid and iron as part of measures to control anaemia among the population especially among women and girls.
5. Operations research on the commercial viability of biofortified crops in Nigeria as most biofortified crops are usually consumed locally without further value addition.
6. Implementing a micronutrient surveillance system in Nigeria for monitoring and evaluation of micronutrient deficiency control programmes.
7. Studies on the feasibility and sustainability of self-regulation in mandatory food fortification programmes.
8. Supply chain mapping and sustainable strategy for community access to nutrition supplements – vitamin A capsules, MMS, IFAS, Deworming tablets, MNPs, SQ-LNS, zinc +LO ORS bundle packs as well as premix for mandatory food fortification programme.
9. Feasibility and sustainability studies on double or multiple fortified salt.
10. Operational research on community distribution of nutrition supplements such as Vitamin A capsules, MMS, IFAS, Zinc +LO ORS and deworming tablets to the target beneficiary groups to achieve enhanced coverage, efficiency and cost effectiveness.

11. Studies of impact of multiple delivery channels of some micronutrients such as vitamin A and iron on population groups (supplementation, fortification, biofortification and dietary diversification).
12. Development of national dashboard of micronutrient intervention performance across the country as data exchange platform to share information.
13. Evaluation of the impact of the micronutrient deficiency control on population groups in Nigeria.
14. Institute a plan to conduct National Micronutrient Surveys every five years.

DEFINITION OF TERMS

Diarrhoea- the passing of loose or watery bowel movements 3 or more times in a day (or more frequently than usual).

Anaemia- a condition in which there is a deficiency of red cells or of haemoglobin in the blood, resulting in pallor and weariness.

Vitamin A Deficiency (VAD)- Vitamin A deficiency (VAD) occurs where diets contain insufficient vitamin A for meeting the needs associated with growth and development, physiological functions, and periods of added stress due to illness.

Xerophthalmia- This is a progressive eye disease caused by vitamin A deficiency.

Estimated Average Requirement (EAR)- The estimated average requirement (EAR) is the amount of a nutrient that is estimated to meet the requirement for a specific criterion of adequacy of half of the healthy individuals of a specific age, sex, and life-stage.

Recommended Dietary Allowance (RDA)- Recommended Dietary Allowances (RDAs) are the levels of intake of essential nutrients that, on the basis of scientific knowledge, are judged by the Food and Nutrition Board to be adequate to meet the known nutrient needs of practically all healthy persons.

Fortificants- this is an additive or nutrient which is added to the matrix (food) which serves as the carrier vehicle. Initially the food is fortified with vitamins, minerals, and iodine.

Biofortification- is the enhancement of micronutrient levels of usually staple crops through biological processes such as plant breeding and genetic engineering.

Acute Respiratory Infections (ARI) – This is an infection that may interfere with normal breathing. It can affect just your upper respiratory system, which starts at your sinuses and ends at your vocal cords, or just your lower respiratory system, which starts at your vocal cords and ends at your lungs.

Recommended Nutrient Intake (RNI) - the daily intake, which meets the nutrient requirements of almost all (97.5 percent) apparently healthy individuals in an age and sex-specific population group.

Iodine Deficiency Disorder- A lack of sufficient iodine in the diet, which can lead to inadequate production of thyroid hormone (hypothyroidism) and enlargement of the thyroid gland (goiter).

Universal Salt Iodisation- The process whereby all household and industrialised salt is iodised.

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