



Women's nutrition

A summary of evidence, policy and practice including adolescent and maternal life stages

Technical briefing paper

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Acronyms

ANC	Antenatal care	MMS	Multiple micronutrient supplementation
BEP	Balanced energy and protein	MNCHR	Maternal, newborn, and child health related services
BMI	Body mass index	MQ-LNS	Medium-quantity LNS
CBI	Cash-based intervention	MUAC	Mid-upper arm circumference
CHW	Community health worker	NCD	Non-communicable disease
CI	Confidence interval	NSA	Nutrition-sensitive agriculture
CMAM	Community-based management of acute malnutrition	PLA	Participatory learning and action
DHS	Demographic and health survey	PLW	Pregnant and lactating women
DOHaD	Developmental origins of health and disease	PLW/G	Pregnant and lactating women and adolescent girls
EHFP	Enhanced homestead food production	PMTCT	Prevention of mother-to-child transmission
ENA	Essential Nutrition Actions	PNC	Postnatal care
ENN	Emergency Nutrition Network	PND	Postnatal depression
FAO	Food and Agriculture Organization of the United Nations	PPE	Personal protective equipment
GAP	Global Action Plan	PUFA	Polyunsaturated fatty acids
GNR	Global Nutrition Report	RCT	Randomised control trial
IFA	Iron and folic acid	RR	Risk ratio
IFE	Infant feeding in emergencies	RUSF	Ready-to-use supplementary food
IMCI	Integrated Management of Childhood Illness	SAPs	Social assistance programme
IYCF	Infant and young child feeding	SDG	Sustainable Development Goals
LBW	Low birthweight	SGA	Small-for-gestational-age
LMICs	Low- and middle- income countries	SQ-LNS	Small-quantity LNS
LNS	Lipid-based nutrient supplements	UNHCR	United Nations High Commissioner for Refugees
LQ-LNS	Large-quantity LNS	UNICEF	United Nations Children's Fund
MAMI	Management of small and nutritionally at-risk infants under six months and their mothers	WFP	World Food Programme
MDD-W	Minimum dietary diversity for women	WHA	World Health Assembly
		WHO	World Health Organization
		WRA	Women of reproductive age



Executive summary

“A number of economic, social and cultural factors contribute to gender inequalities that limit access to optimal nutrition for women and girls.”

Executive summary

Malnutrition – including undernutrition, overweight and obesity, and micronutrient deficiencies – disproportionately affects women and girls, with more than 1 billion women globally experiencing at least one form of malnutrition. While women and girls have a biological vulnerability to certain forms of malnutrition, such as anaemia, a number of economic, social and cultural factors contribute to gender inequalities that limit access to optimal nutrition for women and girls.

Global targets and guidelines

Currently, global targets focus on reducing maternal mortality, reducing the prevalence of anaemia in adolescent girls and women of reproductive age (WRA) (15-49 years), and addressing the nutritional needs of pregnant and lactating women and adolescent girls (PLW/G). With a view to achieving these targets, the following are key international guidelines that include the nutrition of women and adolescent girls:

- World Health Organization (WHO) 2016 antenatal care (ANC) guidelines, covering dietary counselling, balanced energy and protein (BEP) supplementation for undernourished populations, and appropriate micronutrient supplementation.
- WHO 2013 postnatal care (PNC) guidelines, focusing on iron and folic acid (IFA) supplementation and nutrition counselling.
- A number of United Nations nutrition guidelines for populations in humanitarian contexts which include women and girls.

However, there are no guidelines that bring together all the nutrition recommendations for adolescent girls and women. In addition, guidelines are not always routinely updated to ensure that they remain relevant and reflect the latest evidence. Guidelines for humanitarian contexts are particularly piecemeal.

Indicators of nutritional status in adolescent girls and women, including short stature, underweight, anaemia prevalence, overweight and obesity, diabetes and raised blood pressure, are routinely included in global and national monitoring and reporting such as the Global Nutrition Report and Demographic and Health Surveys (DHSs). However, there is currently no routine monitoring of minimum dietary diversity, or other micronutrient deficiencies.

Data for adolescent girls are absent, with adolescents 10-19 years often included with 'other' demographics, if at all. Guidance on how to assess certain aspects of nutritional status for women and adolescent girls is lacking, with no universal WHO definition of wasting currently available for PLW/G (including no agreed thresholds on mid-upper arm circumference (MUAC)). There is also a dearth of global data on pre-pregnancy body mass index (BMI) and gestational weight gain. This makes it challenging to understand optimal pre-conception nutritional status and healthy weight gain trajectories during pregnancy, as well as how to intervene when necessary.

Nutritional vulnerability of women and adolescent girls

Increased nutrient requirements for menstruation, pregnancy and lactation make WRA and adolescent girls physiologically vulnerable to undernutrition and micronutrient deficiencies. While the prevalence of underweight in WRA declined from 14.6% in 1975 to 9.7% in 2014, substantial burdens persist across Africa and Asia, reaching 24% in South Asia. In addition, declines in national prevalence mask 'hotspot areas' at the sub-national level in South Asia and parts of Africa. In areas of South and Southeast Asia, maternal short stature (<150cm) affects 40-70% of women. The focus in humanitarian and developing contexts has traditionally been on undernutrition but it is now critical to consider overweight and obesity due to their rising prevalence worldwide. The burden of overweight and obesity is particularly high in the Pacific Islands, Latin America and the Caribbean, and the Middle East, but very large increases have also occurred in regions such as South Asia, where underweight prevalence also remains high, resulting in a considerable double burden of malnutrition.

“More than 1 billion women globally are experiencing at least one form of malnutrition.”

Limited data on the global prevalence of micronutrient deficiencies suggest that the highest burden is placed on women and children in lower middle-income countries (LMICs). Approximately one-third of WRA across LMICs are anaemic, 63.2% on average are vitamin D-deficient, 41.4% are zinc-deficient, 22.7% are folate-deficient and 15.9% are vitamin A-deficient. Substantial variations in the prevalence of micronutrient deficiencies are evident between countries. While micronutrient supplementation during pregnancy has documented benefits for micronutrient status and birth outcomes, complete repletion of nutrient status may not be achieved due to chronically deficient diets and increased nutrient requirements in pregnancy. In addition, while the supply and intake of micronutrients has increased globally, this does not necessarily equate to higher intakes in women, particularly in countries where gender inequalities influence intrahousehold food distribution.

Many factors, such as climate change and the COVID-19 pandemic, have exacerbated the vulnerability to, and increased the burden of, malnutrition for women and girls, and will continue to do so. For adolescent girls, early marriage and pregnancy have serious adverse consequences for maternal and infant nutrition and health outcomes. Finally, within humanitarian contexts, women are among the most nutritionally at risk. Their existing vulnerabilities may reduce resilience to shocks and can often be further exacerbated by contextual factors that drive or result from humanitarian crises.

Nutrition interventions for women and adolescent girls

Nutrition-related interventions for women and adolescent girls include direct nutrition interventions, such as macronutrient and micronutrient supplementation, and food fortification; and indirect interventions, such as nutrition education and counselling, social protection programmes, sexual and reproductive health services, treatment/management of communicable and non-communicable diseases (NCDs), mental health services, breastfeeding support, nutrition-sensitive agriculture, and women's empowerment interventions. However, much of the evidence from these interventions focuses on the health benefits for infants and children, with evidence on the nutrition and health outcomes of women often being absent or insufficiently powered to draw conclusions.



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Multi-sectoral programmes and those that are integrated into national health systems are likely to have the greatest impact and widest coverage. However, the coverage of interventions is largely not well-documented.

Macronutrient and micronutrient interventions

The majority of available evidence on maternal nutrition programmes and interventions focuses on macronutrient and micronutrient supplementation to tackle undernutrition and anaemia in PLW/G. Supplementation is a commonly used intervention to tackle undernutrition in adolescent girls and women, especially during humanitarian situations, with interventions often prioritising PLW/G based on the evidence of a positive impact on infant outcomes. For example, in humanitarian contexts targeted supplementary feeding is recommended by the Global Nutrition Cluster for all PLW/G up to six months postpartum who are moderately wasted. In such emergency contexts, blanket feeding programmes will often include supplementary feeding for all those within higher risk groups, such as PLW/G. In undernourished populations, BEP supplementation is recommended for pregnant women.

“Climate change and the COVID-19 pandemic have exacerbated the vulnerability to, and increased the burden of, malnutrition for women and girls, and will continue to do so.”

However, numerous gaps exist in the guidelines for macronutrient supplementation in undernourished adolescent girls and women, including the following:

- There is no updated WHO guideline on the detection and treatment of adolescent and adult moderate and severe wasting, including in girls and women.
- Guidelines on BEP supplementation for PLW/G are relatively new, and lack detail and implementation guidance. They are also confusing in places as to how they align with existing guidelines for lipid-based nutrient supplements (LNS) and other supplementary foods.
- Standardised criteria for the inclusion of PLW/G in blanket feeding programmes are similarly lacking.

Antenatal micronutrient supplementation has established benefits for maternal anaemia and birth outcomes, with some of the latest evidence supporting the replacement of antenatal IFA supplementation with multiple micronutrient supplementation (MMS). However, IFA supplementation continues to be recommended in WHO ANC guidelines, with the exception of humanitarian contexts and 'rigorous research settings'. IFA supplementation is also recommended for other sub-groups, including non-pregnant girls and women in high-burden contexts and postpartum women; however, limited evidence exists for this in practice across LMICs and implementation guidance on micronutrient supplementation in general is lacking, particularly outside of pregnancy.

Health interventions and integration

The nutrition of adolescent girls and women is integrally linked with the provision of health services, which provide important contact points for nutritional assessment, counselling and referral. However, in LMICs health systems often suffer from a host of issues, including inadequate human and financial resources, lack of availability and suboptimal quality of commodities, inequitable resource allocation and a lack of accountability mechanisms – factors which tend to be exacerbated in humanitarian contexts.

While studies have demonstrated a relationship between dimensions of women's mental health and nutrition, as well as between a lack of women's empowerment (e.g., through domestic violence) and adverse nutrition outcomes, evidence on the mechanistic links between maternal mental health and nutrition, and on effective screening tools and intervention programmes, is needed. Overall, while ANC services are well-established within health systems, there is limited focus on the integration of postnatal nutrition services and services for non-pregnant women and girls, and a lack of tailored services for pregnant adolescent girls.

Other indirect nutrition interventions

There are insufficient indirect nutrition interventions for women and adolescent girls in LMICs, and there is also a lack of consideration of broader contextual factors (e.g., cultural norms and gender inequalities) within the development of interventions. Gender equality and the empowerment of women and girls is a fundamental human right, which mutually enforces the right to adequate food. Empowering women is one of the most effective ways to improve nutrition outcomes, both for women themselves and for other members of the household, and can help to break intergenerational cycles of malnutrition. However, recognition of the links between gender empowerment and women's nutrition is largely lacking in guidelines and programming efforts. In addition, while numerous interventions link climate change to agriculture, they often fail to consider the specific impacts on women, who are likely to be the most affected by climate-related impacts on food security and nutritional status. More evidence is needed to inform the development of multi-sectoral programmes across health, social protection, education and agriculture which prioritise nutrition for women and girls in their own right, and to mainstream core principles such as gender equality and planetary health.

“Gender equality and the empowerment of women and girls is a fundamental human right, which mutually enforces the right to adequate food.”

Gaps and recommendations

In reviewing the evidence, interventions and guidelines for the nutrition of adolescent girls and women, a number of key gaps and recommendations for progress were identified:

Gap 1: Navigating and finding the latest guidelines on nutrition for adolescent girls and women is challenging.

Recommendation: A repository or website is needed that collates the latest guidance on nutrition for women and adolescent girls. Updated guidelines need to ensure that other relevant United Nations documents are accurately referenced. Ideally, going forward it would be helpful to have a synthesis document that brings together key recommendations for women's nutrition across pre-conception, pregnancy and postnatal stages.

Gap 2: There is a lack of evidence and guidance on pre-conception nutrition, with a particular lack of nutrition programming and policy for adolescents.

Recommendation: Global targets, indicators, policies and programmes need to put greater emphasis on ensuring optimal health and nutrition of non-pregnant girls and women, given the importance of pre-conception nutrition, preventing adolescent pregnancies, and the potential for maximising healthy growth and development during adolescence. In humanitarian settings, the provision of a minimum package of reproductive health services at the initial stages is essential.

“Global targets, indicators, policies and programmes need to put greater emphasis on ensuring optimal health and nutrition of non-pregnant girls and women.”

Gap 3: Global and national indicators are heavily focused on infant and child outcomes, rather than outcomes for the mother herself.

Recommendation: In addition to infant outcomes, clear indicators that are disaggregated for adolescent girls, pregnant women and non-pregnant women are needed as part of global and national targets, in order to measure the effects of interventions on women and to track progress over time. Being able to measure the extent of the problem and its implications also allows for better advocacy, which can lead to much-needed increases in financing and political will for improving the nutrition outcomes of women and adolescent girls.

Gap 4: There is a lack of guidance and clarity on the assessment of nutritional status in adolescent girls and women, including: 1) no optimal, context-specific MUAC cut-off for wasting; 2) no routine collection of dietary adequacy indicators; and 3) a lack of global data on gestational weight gain.

Recommendation: Indicators of women's and adolescent girls' diets and anthropometric status need to be clarified by the respective United Nations agencies, including appropriate measures of dietary adequacy (such as minimum dietary diversity), undernutrition and wasting in adolescent girls and women, and guidance on context-specific (or universal, if appropriate) MUAC cut-offs for wasting. These indicators should be included in national and global surveys, including the Global Nutrition Report, and they should be linked to programme decision-making. Assessment and monitoring of weight gain during pregnancy and other maternal nutritional indicators must be built into health systems, for example through platforms that are already in place to monitor infant growth, with action/referral as necessary.

Gap 5: There are contrasting interpretations of the evidence base for whether IFA or MMS supplementation should be used in pregnancy, making it difficult for policy-makers and implementers to know which strategy to follow. There is also a lack of understanding of the best ways to improve adherence to supplementation, regardless of the formula chosen.

Recommendation: A consultation between organisations/communities of practice holding contrasting views on the use of MMS or IFA in pregnancy should be held to provide policy-makers and practitioners with some clarity and consistent messaging. The debate on the supplementation formula should not detract from a focus on how supplementation regimes can be improved in their coverage and uptake, with a need for context-specific guidance to be made available to policy-makers and practitioners.

Gap 6: There are several gaps in the guidelines for macronutrient supplementation in undernourished women: 1) there is no WHO guideline on identifying and treating adult moderate and severe wasting; 2) the relatively new guidance to provide BEP to PLW/G in populations with high prevalence of undernutrition lacks detail and implementation guidance; 3) there is a lack of guidance on mitigating risks related to the double burden of malnutrition and NCDs.

Recommendation: There needs to be one guideline which covers the different appropriate options for macronutrient supplementation in both humanitarian and development settings, during and outside of pregnancy. This should include: a) appropriate indicators for targeting adolescent girls and women (MUAC and/or BMI); b) details on which products to provide in what context, and details of their optimal nutritional content; c) implementation guidance for delivering these different interventions and measuring their coverage; and d) guidance on mitigating risks related to the double burden of malnutrition and NCDs.

Gap 7: There is a lack of indirect nutrition interventions for adolescent girls and women, including: 1) a lack of gender empowerment in nutrition programmes; 2) a lack of research, screening tool(s) and intervention packages linking maternal mental health and nutrition; and 3) a lack of interventions focusing on the impact of climate change on nutrition.

Recommendation: There is a need for gender empowerment and equity to be mainstreamed into all nutrition programming (both direct nutrition interventions and indirect nutrition interventions, such as those involving agriculture, social protection and climate change programming). Better integration, and inter-disciplinary understanding of the links between maternal mental health and nutrition are needed, with a need for mental health to be more prominently featured in adolescent girls' and women's nutrition guidelines, such as the upcoming revision to the WHO PNC guidelines. Programmes targeting infant growth failure provide an opportunity to also identify at-risk mothers and to target care, benefiting both mother and infant. Climate change and climate resilience interventions need to include a specific focus on the nutrition outcomes of women and adolescent girls and tackling gender inequity as part of their programmes.

Gap 8: There is a lack of integration of nutrition services within health systems.

Recommendation: Nutrition services need to be fully integrated into health systems, not only during ANC but also postnatally and for non-pregnant women and girls. These services should recognise women's risks of NCDs, with better integration of NCD prevention and management services needed for adolescent girls and women in general. Robust assessment of the impact of integrated health and nutrition programmes on the nutrition outcomes of women and adolescent girls would support learning and advocacy, as appropriate.



1 Introduction

“The importance of maternal nutritional status for the health and well-being of future offspring is well-recognised; however, implications for women’s own health and wellbeing have received less attention in global research, policy and programming.”

1 Introduction

1.1 Rationale and overview of paper

In 2013, the Emergency Nutrition Network (ENN) published a technical background paper summarising evidence on maternal nutrition and identifying knowledge gaps in regard to addressing maternal undernutrition in emergencies (1). Given that substantial gaps remain in our understanding of the current state of maternal nutrition globally, and the implications of poor nutritional status for adolescent girls and women, as well as their infants, this technical paper aims to update and expand this evidence base, summarise current international guidance and explore what strategies and interventions are being implemented in both development and humanitarian settings.

Existing gaps in knowledge and practice are highlighted, along with recommendations on the next steps that should be taken to strengthen nutrition programming for adolescent girls and women. **Box 1** provides some explanation of terminology commonly used in the relevant literature and clarification on how this technical paper considers adolescent girls as an integral part of the target population.

In this technical briefing paper, **Section 1** covers the importance of nutrition for adolescent girls and women, global goals and targets, current international guidelines, and the assessment and reporting of nutritional status for this population. **Section 2** explores the nutritional vulnerabilities of adolescent girls and women, giving an overview by type of malnutrition and also by the different factors underlying nutritional vulnerability. It summarises the importance of a life course perspective, before drawing out specific points relevant to humanitarian contexts. **Section 3** provides an overview of the primary interventions targeting nutrition in adolescent girls and women nutrition, covering supplementation, health-related interventions, social protection programmes, education and counselling, nutrition-sensitive agriculture, and empowerment of women and adolescent girls. **Section 4** reflects on limitations of this paper. **Sections 5** and **6** then draw together the key gaps and corresponding recommendations for policy makers, implementors and researchers, to guide the further learning and action that is so urgently required. **Box 2** indicates how and where humanitarian contexts are addressed in this paper.

Box 1: How policies, guidelines and research refer to the target population in resources on nutrition for adolescent girls and women

Much of the literature drawn on in this technical paper uses the following terms: 'pregnant women', 'postpartum women', and 'women of reproductive age'. However, these descriptions are limited since they risk overlooking adolescent girls. In line with the UN Convention of the Rights of the Child, childhood is defined in most countries across the world as the period until a child reaches 18 years of age. This also applies when a girl under the age of 18 has become pregnant or given birth; she is still a child. Therefore, policies and guidance should be saying, for example, 'adolescent girls and women of reproductive age', 'postpartum adolescent girls and women', or 'pregnant and lactating women and adolescent girls'. We use the World Health Organization (WHO) definition of adolescence as being from the onset of puberty until adulthood, approximately corresponding to the 10-19 years age bracket. We have altered the language throughout this paper where possible, but when describing the content of current guidelines we use the terminology originally found in the source document. Readers should therefore be aware that source documents writing about women aged 15-49 years, for example, risk erroneously excluding adolescent girls and/or misclassifying them as women.

Box 2: How and where humanitarian contexts are addressed in this paper

Much of the content of this paper is relevant for both development and humanitarian settings; however, information specifically related to humanitarian contexts is separated out. For readers interested in humanitarian settings **specifically, relevant sections include section 1.5.3** on guidelines in humanitarian contexts; **section 2.4** on the heightened vulnerabilities in humanitarian contexts due to increased nutritional requirements, increased risks and disruption of services; **section 3.1** on supplementation, where the section on macronutrient supplementation (**3.1.1**) is especially relevant for humanitarian settings; **section 3.2.1** on maternal mental health in humanitarian settings; and **section 3.2.2** on infant feeding in emergencies.

1.2 Methods

This technical briefing paper was informed through a review of the relevant literature, including guidelines, policy documents and scientific papers, using a narrative approach which was comprehensive but not fully systematic. Relevant search terms were used in the PubMed and Google Scholar databases. The collation of existing policies focussed on international guidelines. The literature searches for the narrative review sections took place between March and September 2021, with the paper write-up occurring between June and December 2021.

1.3 The importance of nutrition for adolescent girls and women

Key messages

- Malnutrition disproportionately affects women and girls, with more than one billion women globally experiencing at least one form of malnutrition.
- The importance of maternal nutrition for infant health and nutrition outcomes is well-recognised; however, little attention has been given to the implications for women's own health and wellbeing.
- Evidence, policy and programming focuses on nutrition in pregnancy, with a lack of evidence and guidance on optimising pre-conception and postpartum nutritional status.
- Global goals and targets are heavily focused on infant and child outcomes; this is reflected in a lack of global and national-level indicators for assessing nutrition outcomes for adolescent girls and women, both during and outside of pregnancy.

The importance of maternal nutritional status for the health and well-being of future offspring is well-recognised; however, implications for women's own health and wellbeing have received less attention in global research, policy and programming.

Malnutrition disproportionately affects women and girls, with more than 1 billion women experiencing at least one form of malnutrition globally (2). While women and girls may have a biological vulnerability to certain forms of malnutrition, for example

anaemia, a number of economic, social and cultural factors contribute to gender inequalities that limit women's access to good nutrition. These include barriers to education, work opportunities and equal pay, as well as social and political participation. More focus on improving the nutritional status of women and girls is urgently needed to improve their own health and wellbeing, to allow them to fulfil their potential, alongside providing benefits to the next generation, should they become mothers.

Maternal nutritional status at the time of conception, during pregnancy and through lactation is an established determinant of child survival, growth and development, with implications for nutrition and health status throughout the life course and into the next generation (3). There is also increasing emphasis on the need to prioritise nutrition for women prior to conception to achieve substantial improvements in infant outcomes. This is particularly critical for mothers who experience closely spaced pregnancies since the risk of adverse outcomes may be exacerbated by depleted maternal nutrition reserves with each successive pregnancy (4).

1.4 Global goals and targets

Target 3.1 of the Sustainable Development Goals (SDGs) aims to reduce the global maternal mortality ratio to less than 70 per 100 000 live births by the year 2030. However, the current global maternal mortality ratio is estimated at three times this figure (211 per 100 000 live births) (5). Approximately 86% of all maternal deaths occur in sub-Saharan Africa and southern Asia, with very little progress made towards reducing maternal mortality in sub-Saharan Africa in particular over the last two decades (currently at 542 per 100 000 live births) (5).

Despite the links between maternal nutritional status and maternal mortality during the perinatal period, as well as the implications for maternal mental and physical health and wellbeing in the short and longer term, nutrition for women and adolescent girls is often not adequately emphasised nor targeted early enough to support optimal outcomes. In 2012, the 65th World Health Assembly (WHA) endorsed a Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition that included six global targets (**Box 3**). Subsequently, the SDGs have built upon these targets with a vision towards ending all forms of malnutrition by 2030.

Box 3: Global targets for maternal and child nutrition

World Health Assembly targets (2012-2025)

- 40% reduction in the number of children under five years who are stunted.
- 50% reduction of anaemia in women of reproductive age.
- 30% reduction in prevalence of low birth weight.
- No increase in childhood overweight.
- Increase the rate of exclusive breastfeeding in the first six months up to at least 50%.
- Reduce and maintain childhood wasting to less than 5%.

Sustainable Development Goal 2: Zero Hunger

Target 2.2: By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.

Indicator 2.2.1: Prevalence of stunting (height for age <-2 standard deviation from the median of the WHO Child Growth Standards) among children under five years of age.

Indicator 2.2.2: Prevalence of malnutrition (weight for height $>+2$ or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under five years of age, by type (wasting and overweight).

While one of the WHA targets calls for a 50% reduction in the prevalence of anaemia in women of reproductive age (WRA) and while SDG target 2.2 incorporates addressing the nutritional needs of adolescent girls, pregnant and lactating women (PLW), global and national indicators are heavily focused on infant and child outcomes. Thus, operational research and programming efforts predominantly target women who become pregnant, or their infants after birth, with the effectiveness of interventions usually evaluated according to the nutritional status and health of infants and children (6). Since approximately half of all pregnancies are unplanned (7) and half of the women living in low- and middle-income countries (LMICs) who access antenatal care (ANC) services doing so after the first trimester (8), late and poor-quality care is still very common. There is also an absence of effective counselling on diet and weight gain during antenatal and postnatal visits (6). Thus, there is an urgent need to prioritise the nutrition of adolescent girls and women prior to conception, as well as continuing to support them through pregnancy and the postpartum period, particularly in sparsely populated rural areas, dense urban centres, or in settings marked by environmental or political fragility (9).

1.5 Current international guidelines on maternal nutrition

Key messages

- International guidelines on nutrition for adolescent girls and women exist, but are heavily oriented towards the antenatal period, as opposed to the postnatal period, as well as focusing on micronutrient supplementation, particularly iron and folic acid (IFA).
- Guidelines for humanitarian contexts are especially piecemeal, with advice on supplementary feeding for moderately and severely wasted women being limited or absent, respectively.
- Guidelines are not regularly and consistently updated according to the latest evidence, and navigating and locating the latest guidelines is challenging.
- There is a lack of coordination between guidelines developed by various United Nations agencies and guidelines fail to reference each other, despite containing similar information (though sometimes differing guidance) on the same topic.

While international guidelines on nutrition for adolescent girls and women exist, it can be challenging for nutrition practitioners and policymakers to know where to look for the most up to date recommendations. This is particularly the case for guidelines for humanitarian contexts, which remain piecemeal and generally have not been updated in decades. Often old guidelines are still relevant and appropriate, but more regular confirmation would be helpful to allow for confidence in their use. Below is a summary of the main international guidelines on nutrition for adolescent girls and women that are currently in use. Other relevant guidance documents are collated in **Appendix 1**.

1.5.1 Antenatal care guidelines

WHO set out comprehensive international guidelines in 2016 for ANC among pregnant women and adolescent girls (10). Of the 49 guidelines, 14 of them relate to nutrition (11) (**Table 1**). In undernourished populations, **balanced energy and protein (BEP) dietary supplementation** is recommended for pregnant women, to reduce the risk of stillbirths and small-for-gestational-age (SGA) deliveries (see **Box 4** for a note on terminology). However, implementation guidance, including which products to provide and how to assess eligibility, are lacking (12). Since 2016 there have been three official updates to the ANC guidelines, as follows:

1. An update on **vitamin D supplementation** in 2020 (13), during which the evidence was re-reviewed but no changes were made to the key messages.
2. An update in 2020 on **multiple micronutrient supplementation (MMS)** (14). The recommendations changed from MMS not being recommended in 2016, to now being recommended in 'research contexts'.¹ These contexts include controlled clinical trials that measure several key maternal and infant outcomes, and implementation research into the impact of switching from IFA to MMS.
3. An update on **zinc supplementation** in pregnancy in 2021 (15). Zinc supplementation is generally not recommended but can be used in the context of rigorous research.

Box 4: Definitions of common birth outcomes and foetal growth

Low birthweight (LBW): Birthweight <2.5kg

Small-for-gestational age (SGA): birthweight below the 10th percentile for gestational age of a reference standard. Also used as a proxy for foetal growth restriction or intrauterine growth restriction.

Pre-term birth: Gestational age <37 weeks at birth.

Full-term birth: ≥37 weeks gestational age at birth.

Underlying determinants of LBW can include pre-term birth and SGA (16, 17).

The updated WHO (2019) **Essential Nutrition Actions (ENAs)** have similar messages to the ANC guidelines (18). The ENAs summarise key interventions to mainstream nutrition through the life-course. **Table 1** summarises the latest nutrition-related ANC guidelines from WHO, also indicating which of these messages appear in the 2019 ENAs.

The ENAs also cover guidance for non-pregnant adolescent girls and non-pregnant women, which are not included in the ANC guidelines. These include:

- **intermittent IFA supplementation** for menstruating non-pregnant adolescent girls and non-pregnant women (15-49 years) in settings where the prevalence of anaemia in non-pregnant women is 20% or higher; and
- **daily iron supplementation** for menstruating non-pregnant adolescent girls and non-pregnant women (15-49 years) in settings where the prevalence of anaemia in non-pregnant women is 40% or higher.

The ENAs also state that **iodine supplementation** for non-pregnant adolescent girls and women (15-49 years) and pregnant women should be considered where 20% or fewer households have access to iodised salt and where pregnant women are difficult to reach.

¹ There was a stronger recommendation for MMS from the *Lancet* 2021 Series on Maternal and Child Undernutrition Progress; see **section 3.1.2** for more details.

Table 1: Most recent WHO guidelines for ANC (2016 and updates) and ENAs (2019)

	Recommendation in ANC guidelines	Type of recommendation	Year in guideline	Present in ENAs (2019)
Dietary interventions	A.1.1: Counselling about healthy eating and keeping physically active during pregnancy is recommended for pregnant women to stay healthy and to prevent excessive weight gain during pregnancy ² .	Recommended	2016	Not mentioned
	A.1.2: In undernourished populations, nutrition education on increasing daily energy and protein intake is recommended for pregnant women to reduce the risk of LBW neonates.	Context-specific recommendation	2016	Same as ANC (2016) guidelines
	A.1.3: In undernourished populations, BEP dietary supplementation is recommended for pregnant women to reduce the risk of stillbirths and SGA neonates.	Context-specific recommendation	2016	Same as ANC (2016) guidelines
	A.1.4: In undernourished populations, high-protein supplementation is not recommended for pregnant women to improve maternal and perinatal outcomes.	Not recommended	2016	Same as ANC (2016) guidelines
IFA supplements	A.2.1: Daily oral IFA supplementation with 30mg to 60mg of elemental iron ³ and 400µg (0.4mg) of folic acid ⁴ is recommended for pregnant women to prevent maternal anaemia, puerperal sepsis, LBW and pre-term delivery.	Recommended	2016	Same as ANC (2016) guidelines
	A.2.2: Intermittent oral IFA supplementation with 120mg of elemental iron ⁵ and 2,800µg (2.8mg) of folic acid once weekly is recommended for pregnant women, to improve maternal and neonatal outcomes if daily iron is not acceptable due to side-effects, and in populations with an anaemia prevalence among pregnant women of less than 20%.	Context-specific recommendation	2016	Same as ANC (2016) guidelines
Calcium supplements	A.3: In populations with low dietary calcium intake, daily calcium supplementation (1.5-2.0g oral elemental calcium) is recommended for pregnant women, to reduce the risk of pre-eclampsia.	Context-specific recommendation	2016	Same as ANC (2016) guidelines
Vitamin A supplements	A.4: Vitamin A supplementation is only recommended for pregnant women in areas where vitamin A deficiency is a severe public health problem, ⁶ to prevent night blindness.	Context-specific recommendation	2016	Same as ANC (2016) guidelines
Zinc supplements	A.5: Zinc supplementation for pregnant women is only recommended in the context of rigorous research.	Context-specific recommendation (research)	2021	Same as ANC (2016) guidelines
MMS	A.6: Antenatal MMS that includes IFA is recommended in the context of rigorous research. ⁷	Context-specific recommendation, research	2020	States MMS that contains IFA may be considered for maternal health, in settings with a high prevalence of nutritional deficiencies
Vitamin B6 (pyridoxine) supplements	A.7: Vitamin B6 (pyridoxine) supplementation is not recommended for pregnant women, to improve maternal and perinatal outcomes.	Not recommended	2016	Same as ANC (2016) guidelines
Vitamin E and C supplements	A.8: Vitamin E and C supplementation is not recommended for pregnant women, to improve maternal and perinatal outcomes.	Not recommended	2016	Same as ANC (2016) guidelines
Vitamin D supplements	A.9: Vitamin D supplementation is not recommended for pregnant women, to improve maternal and perinatal outcomes.	Not recommended	2016, maintained in 2020	Same as ANC (2016) guidelines
Restricting caffeine intake	A.10: For pregnant women with high daily caffeine intake (more than 300mg per day), ⁸ lowering daily caffeine intake during pregnancy is recommended to reduce the risk of pregnancy loss and LBW neonates.	Context-specific recommendation	2016	Not mentioned

Sources: 10, 13-15, 18

2 The 2016 ANC guidelines state 'a healthy diet contains adequate energy, protein, vitamins and minerals, obtained through the consumption of a variety of foods, including green and orange vegetables, meat, fish, beans, nuts, whole grains and fruit'. The ENAs (2019) further emphasise reducing intake of free sugars, increasing potassium intake, reducing sodium intake, reducing fat intake (especially saturated and trans-fats).

3 The equivalent of 60mg of elemental iron is 300mg of ferrous sulfate heptahydrate, 180mg of ferrous fumarate or 500mg of ferrous gluconate.

4 Folic acid should be commenced as early as possible (ideally before conception) to prevent neural tube defects.

5 The equivalent of 120mg of elemental iron equals 600mg of ferrous sulfate heptahydrate, 360mg of ferrous fumarate or 1000mg of ferrous gluconate.

6 Vitamin A deficiency 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 vitamin A deficiency.

7 The WHO Guideline Development Group clarified that rigorous research includes implementation research using high-quality methods appropriate to the specific research questions.

8 This includes any product, beverage or food containing caffeine (i.e. brewed coffee, tea, cola-type soft drinks, caffeinated energy drinks, chocolate and caffeine tablets).

1.5.2 Postnatal care guidelines

Current WHO postnatal care (PNC) guidelines (2013) focus on IFA supplementation for at least three months following delivery, as well as promoting nutrition counselling for women and their families (19) (**Box 5**). However, there is little evidence of this in practice across LMICs (6, 11).

Box 5: WHO 2013 PNC guidelines which incorporate nutrition (19)

Recommendation 8: Counselling

Women should be counselled on nutrition

- Emphasise with mothers and their family members the importance of eating a greater amount and variety of healthy foods.
- Review/revise national standards, quality improvement tools and training curricula for providers to ensure adequate counselling skills on nutrition in the context of local practices and taboos, particularly adolescents and very thin women.
- Review/revise community health worker (CHW) training curriculum, CHW job aids and behaviour change communication materials to emphasize key postnatal nutrition messages.

Recommendation 10: IFA supplementation

IFA supplementation should be provided for at least three months after delivery

- Review national standards, quality improvement tools, and training curricula on postnatal IFA supplementation for postnatal mothers.
- Strengthen IFA distribution and compliance among postnatal mothers.
- Review/update national standards to remove vitamin A supplementation for postnatal women and transition to promoting dietary sources of vitamin A for postnatal mothers.

The ENAs (2019) have two guidelines for postpartum women:

- vitamin A supplementation for postpartum women is **not** recommended for the prevention of maternal and infant morbidity and mortality
- oral iron supplementation, either alone or in combination with folic acid supplementation is recommended in settings with a 20% or higher population prevalence of gestational anaemia.

1.5.3 Guidance in humanitarian contexts

1.5.3.1 General guidance

The United Nations High Commissioner for Refugees (UNHCR), the United Nations Children's Fund (UNICEF), the World Food Programme (WFP) and WHO jointly developed a manual in 2004 that contains guidelines on how field staff can address the nutritional needs of populations facing humanitarian crises (20). While this manual was developed a long time ago, it sets out basic principles that remain appropriate for consideration today, including the following:

- At a minimum, a general food basket should ensure an average of 2100 kcal is provided daily per person.⁹
- This food basket should aim to meet the micronutrient requirements of the general population.
- PLW require special attention due to their increased vulnerabilities (see **sections 2.1** and **2.4**), including additional energy requirements of 285 kcal/day and 500 kcal/day, respectively, and particular requirements for adequate intake of iron, folate, vitamin A and iodine.
- To meet these additional needs, fortified food commodities in addition to the food basket¹⁰ and micronutrient supplementation should be considered.
- Adequate drinking water, malaria management, treatment of intestinal parasites and nutrition counselling are other important considerations.

1.5.3.2 Micronutrient supplementation

In 2007 three United Nations agencies (WHO, WFP and UNICEF) released a joint statement on the prevention and control of micronutrient deficiencies in populations affected by humanitarian emergencies (21). They recommended that PLW take a daily MMS to meet their recommended nutrient intakes (nutrient composition provided in **Table 2**) and that this supplement should be taken in addition to any fortified foods or IFA tablets already being received, as well as any vitamin A being taken postpartum.

⁹ With adjustment as appropriate for temperature, the underlying health of the population, the demographic profile of the population and activity levels.

¹⁰ With 10-12% energy coming from protein and 20-25% from fat, and micronutrients included that meet at least two-thirds of daily requirements.

They recommended that the duration of supplementation should continue until the population has access to micronutrient-rich food sources, although the guidelines stressed that regular assessments should take place to check the need for continued MMS and ensure that excess consumption of specific micronutrients is avoided.

Table 2: Recommended nutrient composition for MMS among PLW within humanitarian contexts (21)

Micronutrients	Dose
Vitamin A µg	800.0
Vitamin D µg	5.0
Vitamin E mg	15.0
Vitamin C mg	55.0
Thiamine (vitamin B1) mg	1.4
Riboflavin (vitamin B2) mg	1.4
Niacin (vitamin B3) mg	18.0
Vitamin B6 mg	1.9
Vitamin B12 µg	2.6
Folic acid µg	600.0
Iron mg	27.0
Zinc mg	10.0
Copper mg	1.15
Selenium µg	30.0
Iodine µg	250.0

1.5.3.3 Supplementary feeding guidance

In 2011 UNHCR and WFP released guidelines for selective feeding in humanitarian emergencies (22). While it was acknowledged that screening criteria vary by context, the following general guidance was given for admission criteria to supplementary feeding programmes:

For pregnant women and lactating women with an infant aged < 6 months:

- **Targeted supplementary feeding** should be considered for those with mid-upper arm circumference (MUAC) <230mm, although often MUAC <210mm is used in humanitarian contexts and the chosen cut-off depends on caseload and available resources.
- Discharge is recommended either six months after delivery or when MUAC ≥230mm or 210mm, depending on admission criteria.

For non-pregnant women:

- **Targeted supplementary feeding** should be considered for moderate wasting treatment. Admission is body mass index (BMI) ≥16kg/m² and <17kg/m², or MUAC ≥214mm and <222mm. Discharge is BMI ≥18.5kg/m².
- **Severe wasting treatment** is recommended for women with BMI <16kg/m², or MUAC <214mm.

Details on the type and content of supplementary food for treating moderately wasted women are limited in the 2011 guidelines, and details are not given for the treatment of severe wasting in women. However, both the joint United Nations agency 2004 manual (20) and the 2019 ENAs reiterate that fortified blended foods should be provided to PLW in humanitarian settings (specification in footnote 10). The Moderate Acute Malnutrition (MAM) Taskforce set up under the Global Nutrition Cluster recommended in 2017 that *treatment* of moderate wasting in PLW could consider Super Cereal/oil/sugar as a first option and Super Cereal Plus as a second (23). For the *prevention* of moderate wasting in PLW Super Cereal/oil/sugar could be considered where there are no appropriate food sources, with the alternative option being a medium-quantity lipid nutrient supplement. See **section 3.1.1.2** for more details on these products.

While the above information gives some guidance on the types of products to consider for moderate wasting, treatment protocols for moderate and severe wasting in adults (e.g., detailing dosage, admission and discharge criteria) are sparse. While some individual agencies have their own set of guidelines, there are no easily accessible international guidelines that set out how women with moderate and severe wasting should be treated and monitored.

1.5.3.4 COVID-19 pandemic guidance

In response to the COVID-19 pandemic, an interagency brief¹¹ was produced that provides guidance on protecting maternal diets, nutrition services and diets (24). Recommendations were developed that centre around the following key themes, expanded on in detail in the original brief:

- Continued delivery of essential services for women such as ANC, PNC, MUAC screening, MMS and deworming, as guided by local adaptations of international recommendations. Modification of delivery to consider infection prevention (e.g., personal protective equipment, social distancing, modified workflows and service delivery modalities).
- Ensuring a buffer supply of essential nutrition commodities, such as MMS, IFA, deworming, calcium and food distribution, as appropriate for the context.
- Providing support to food systems to ensure nutritious food is locally available, safe, affordable and sustainable.
- Expanding social protection programmes to ensure the needs of women are met.
- Designing communication strategies that focus on healthy eating and food hygiene among women.
- Including indicators for women within nutrition information management, surveillance and monitoring.¹²

1.5.4 The Lancet series recommendations

The *Lancet* Series on Maternal and Child Nutrition provides authoritative, influential collections of papers where the evidence to date is reviewed and the implications for programming are outlined. There have been three series on maternal and child nutrition to date (**Box 6**).¹³ The most recent *Lancet* 2021 series recommended the following interventions for nutrition for adolescent girls and women:

- IFA supplements for non-pregnant adolescents and women aged 15-49 years.
- Counselling on maternal diet during pregnancy.
- Maternal MMS containing IFA in the antenatal period (this is a stronger recommendation than the WHO guidelines, detailed in **section 1.5.1**).

- Calcium supplementation in populations at risk of low intake.
- BEP supplements (<25% energy as protein, see **Box 11**) for undernourished women.

Box 6: The Lancet Series on Maternal and Child Nutrition

- The **first series** in 2008 highlighted the global burden of undernutrition, the importance of intervening in the first 1000 days of life, the consequences of infant and child nutrition across the lifespan, and the most effective interventions to scale up (25, 26).
- The **second series** in 2013 updated the evidence on 'what works', brought in a focus on nutrition-sensitive interventions, included a focus on maternal overweight and obesity, and suggested what was needed to accelerate political momentum and collective action (27, 28).
- The **third series** launched in 2021 summarised the progress made but also the urgent programmatic and evidence gaps remaining, the challenges of the COVID-19 pandemic, and the need for improved programme delivery and for strengthened financing (29, 30).

There are several other *Lancet* series and papers that are also relevant to the nutrition of adolescent girls and women. Some of the items discussed below focus on adolescent girls and women specifically, whereas others are broader in remit but highlight key messages that are of particular relevance to the nutrition of adolescent girls and women.

- In 2016 the *Lancet Diabetes & Endocrinology* published a separate series on **maternal obesity**, highlighting the global burden of obesity in women, including obesity in pregnancy, and the impacts on the health of women themselves, as well as the intergenerational implications (31).
- In 2019 the Lancet Commission outlined recommendations and actions to address obesity within the context of '**the Global Syndemic**', defined as the three intersecting 'pandemics' of obesity, undernutrition, and climate change (32). The paper summarised the common drivers of the Global Syndemic, the potential of double- or triple-duty actions (interventions that target two or all three components of obesity, undernutrition and climate change simultaneously), strengthening public sector governance, civil society engagement, private sector challenges, strengthening accountability systems and strategies for effective funding and research.

11 Endorsed by WFP, UNICEF, the Global Nutrition Cluster and the Global Technical Assistance Mechanism for Nutrition.

12 This topic was also dealt with in detail in a separate brief by the same authors, see https://www.enonline.net/attachments/3414/Nutrition-Information-COVID19-Brief-1_0_14-April.pdf

13 A brief summary of the *Lancet* 2021 series papers' themes can be found in a recent Field Exchange snapshot article, see <https://www.enonline.net/fex/65/lancetundernutritionseries>

- Also in 2019 the EAT-Lancet Commission on **Healthy Diets from Sustainable Food Systems** published a paper outlining the transformation needed within food systems to improve environmental sustainability and global health (33).
- In 2021 the *Lancet* launched its series on **adolescent nutrition**. It included three papers looking at nutrition in adolescent growth and development (34), factors influencing food choice and diet-related issues in adolescents (35), and a summary of strategies and interventions for healthy adolescent growth, nutrition and development (36).

1.6 Assessment and reporting of nutrition status

Key messages

- Guidance and clarity on how to assess the nutrition status of adolescent girls and women is lacking.
- There is currently no universal WHO definition of wasting in PLW and adolescent girls (PLW/G); guidance is needed on the optimal MUAC cut-offs for different contexts.
- Global data on pre-pregnancy BMI and gestational weight gain is lacking; current and healthy trajectories of gestational weight gain and appropriate interventions are unclear.

Assessment of nutritional status in adolescent girls and women can include anthropometric, biochemical and dietary intake indicators. While there are numerous indicators that can potentially be used, the most common ones are outlined below.

1.6.1 Anthropometric indicators

Short stature

- In adolescent girls (aged 10-19 years), including those of reproductive age, short stature is usually defined as height-for-age less than -2 z-scores of the WHO 2007 child/adolescent reference (37).¹⁴

- In adult women (aged 20 years and above), short stature is often defined as a height <145cm, although this definition varies by country and context, with <150cm and <155cm also in common usage.

Underweight/thinness

- In adolescent girls, underweight is defined as BMI-for-age below -2 z-scores of the WHO 2007 child/adolescent reference (37).
- In adult women underweight is defined as BMI <18.5kg/m², and a normal BMI is defined as 18.5 to <25kg/m².
- The above definitions are *not appropriate* for use in pregnancy. There are no universally-agreed definitions of underweight in pregnancy, although MUAC cut-offs for admission into supplementary feeding programmes generally range between 21 and 23cm (22) (see **section 1.6.3.3**).

Overweight/obesity

- In adolescent girls, overweight is defined as BMI-for-age greater than +1 z-scores of the WHO 2007 child/adolescent reference, and obesity as greater than +2 z-scores of the reference (37).
- In adult women overweight is defined as BMI ≥25kg/m² and obesity as ≥30kg/m².

Pregnancy weight gain

The latest ANC guidelines from WHO (10) quote the Institute of Medicine's recommendations for healthy gestational weight gain (38):

- Women who are underweight at the start of pregnancy: gain 12.5-18kg.
- Women who are normal weight at the start of pregnancy: gain 11.5-16kg.
- Overweight women gain 7-11.5kg.
- Obese women: gain 5-9kg.

1.6.2 Biochemical indicators

These involve taking a fluid or tissue sample for analysis of micronutrient status and to detect the presence of inflammation, which may also affect nutrient status. Most commonly this involves a blood sample, although certain vitamins and minerals may also require samples from urine, breastmilk, hair or nails (39). In clinical and research settings a variety of tests can be done depending on available resources, but in public health settings the costs of these are often prohibitive.

¹⁴ This reference is one that merged the 1977 National Center for Health Statistics growth reference (covering individuals aged one to 24 years) with the WHO 2006 growth standards for children under five years.

Table 3: Cut-offs for classification of anaemia by haemoglobin concentration

Population	No anaemia (g/l)	Mild anaemia (g/l)	Moderate anaemia (g/l)	Severe anaemia (g/l)
Non-pregnant adolescent girls and women (15 years of age and above)	≥120	110-119	80-109	<80
Pregnant adolescent girls and women	≥110	100-109	70-99	<70

Source: 41

The most common biochemical indicator collected is haemoglobin concentration in capillary blood for the detection of anaemia. In large-scale surveys and screening programmes most often the anaemia assessment is made based on a pin prick in the fingertip, using a few drops of blood to obtain a rapid haemoglobin measurement from a portable HemoCue® machine. The standard cut-offs for anaemia classification vary by age and pregnancy;¹⁵ the relevant maternal ones are shown in **Table 3**.

1.6.3 Dietary assessment

Dietary intake assessments can include **24-hour recalls** with or without portion size estimation, prospective weighed records, or food frequency questionnaires. The 24-hour recalls prompt the respondent to remember everything eaten over the past day, and can either use a fixed ('sentinel'/'closed') list of foods, or can take an open ('free') recall approach. In research settings the 24-hour recall method is usually performed in duplicate (e.g., two non-consecutive days within a week), including detailed estimates of portion size and use of a local food composition table that captures common meals and individual ingredients. The data from these recalls can provide an estimate of energy and micronutrient intake. Although this method is valuable for assessing dietary adequacy, the process is often too involved to be used in large-scale population surveys.

A more common tool at the population health level is the **Minimum Dietary Diversity for Women (MDD-W)**, which uses a 24-hour recall of food items eaten by women aged 15-49, groups the food into 10 categories, and defines a minimum dietary diversity as consuming at least five out of the 10 food groups. FAO has produced an updated manual detailing the methodology, including how to ensure the tool is adapted to the local context (42).

“Maternal nutritional status at the time of conception, during pregnancy and through lactation is an established determinant of child survival, growth and development.”



Photo credit: ©WFP/Deborah Nguyen

¹⁵ Note that there are also calls for haemoglobin cut-offs to be further adjusted for smoking status and altitude, which are yet to be incorporated into international guidance (40).

1.6.4 Reporting of adolescent girls' and women's nutrition status

Regular national surveys such as Demographic and Health Surveys (DHSs) collect a select range of nutrition indicators in order to report on adolescent girls' and women's short stature, underweight, overweight, obesity and anaemia prevalence (**Box 7**), although there is no measure of dietary adequacy (such as MDD-W).¹⁶

The **Global Nutrition Report** tracks the following indicators that relate to women's health and nutrition:¹⁷

- Adolescent and adult underweight, overweight and obesity.
- Adult diabetes.
- Anaemia in women.
- Adult raised blood pressure.
- Mean salt intake per day.

Similar to the DHSs, there is no measurement of dietary intake, even though children's dietary diversity and meal frequency are tracked.¹⁸

Box 7: Nutrition indicators for women collected in DHSs

Anthropometric indicators (15-49 years)

- Percentage of adolescent girls and women shorter than 145cm.
- Percentage of adolescent girls and women with BMI <18.5kg/m², for those with births in the last three years preceding the survey. The BMI excludes pregnant women and those who are less than three months postpartum.
- Mean height, mean body mass index and mean height-for-age z-score (WHO 2007), by selected background characteristics.
- Percent distribution, mean and standard deviation of height, weight and arm circumference for adolescent girls and women who had a birth in the five (three) years preceding the survey by selected anthropometric indicators.

Micronutrient intake among mothers

- Percentage of adolescent girls and women with a birth in the five years preceding the survey who received a vitamin A dose in the first two months after delivery.
- Percentage who suffered from night blindness during pregnancy.
- Percentage who took iron tablets or syrup for a specific numbers of days
- Percentage who live in households using adequately iodised salt, by background characteristics.

Prevalence of anaemia in adolescent girls and women

- Percentage of adolescent girls and women aged 15-49 classified as having anaemia.

Source: DHS indicators (45)

¹⁶ However, this may change soon as the DHS methodology is currently being reviewed and future versions are likely to include MDD-W.

¹⁷ The Global Nutrition Report compiles data from the NCD Risk Factor Collaboration (43) and the UNICEF/WHO/WB Joint Child Malnutrition Estimates (44), which in turn is informed by a variety of data sources, including DHSs amongst other nationally-representative ones.

¹⁸ As with the DHSs, there are discussions about including more relevant nutrition indicators in future editions of the Global Nutrition Report, so this may soon change.



Nutritional vulnerability of women and adolescent girls

“If not addressed, maternal short stature can be part of an intergenerational cycle of malnutrition.”

2 Nutritional vulnerability of women and adolescent girls

2.1 Vulnerability by type of malnutrition

2.1.1 Undernutrition

Adolescent girls and WRA are physiologically vulnerable to undernutrition due to increased nutrient requirements for menstruation, pregnancy and lactation (2). In particular, requirements for energy, protein and some micronutrients increase substantially during pregnancy and lactation (**Table 1**). The 2021 *Lancet* Series on Maternal and Child Undernutrition Progress (**section 1.5.4**) (29) referred to a previous analysis (46) describing how the prevalence of underweight in women aged 18 years and older has declined from 14.6% in 1975 to 9.7% in 2014. Despite this progress, substantial burdens of low maternal BMI persist across Africa and Asia, with the prevalence in South Asia being particularly high at 24% (46). In addition, declines in national prevalence **mask 'hotspot areas' at the sub-national level** in South Asia and parts of Africa where a prevalence >20% would warrant antenatal BEP supplementation according to WHO (3). In areas of South and Southeast Asia, maternal short stature (<150cm) affects 40-70% of women and increases the risk of maternal pregnancy complications, as well as adverse infant outcomes. Maternal height in adulthood is influenced by nutrition and environmental factors throughout life, with the first 1,000 days (the period of pregnancy and the first two years of life) being particularly influential. If not addressed, maternal short stature can be part of an intergenerational cycle of malnutrition. The risk of maternal short stature is highest in low-income quintiles within low-income countries, often exacerbated by humanitarian crises in many of these contexts.

2.1.2 Overweight and obesity

The focus in humanitarian and developing contexts has traditionally been on undernutrition but it is now critical to consider overweight and obesity due to their rising prevalence worldwide.

Low-income countries and lower-middle-income countries contribute approximately half of the global burden of overweight and obesity in pregnant women and this substantially increases the risk of perinatal complications such as gestational diabetes, pregnancy-related hypertension, and caesarean deliveries as well as postpartum weight retention, obesity and non-communicable diseases (NCDs) in later life (47, 48). The burden of overweight and obesity is particularly high in the Pacific Islands, Latin America and the Caribbean, and the Middle East (49), but very large increases have also occurred in regions such as South Asia where underweight prevalence also remains high, resulting in a considerable double burden of malnutrition. For example, India contributes the largest proportion (11.1%) of overweight and obese pregnant women worldwide (47), despite 42% of women being underweight nationally (29). Consistently across LMICs, women are disproportionately affected by overweight and obesity compared to men, possibly due to either hormonal and physiological sex differences, physical activity levels, economic circumstances, sociocultural factors, or a combination of these.

Maternal obesity also has implications for breastfeeding, with several studies demonstrating decreased rates of initiation and reduced breastfeeding durations in obese women compared to those of normal weight (50). Proposed causes of this include a range of biological (delayed lactation), psychological (embarrassment related to body size and difficulty in breastfeeding discreetly), mechanical (larger breasts and nipples, which create difficulties with latching), and medical (caesarean deliveries, diabetes, thyroid dysfunction), with serious implications for infant survival, growth and development, as well as maternal weight retention, mental and physical health and nutritional status in subsequent pregnancies (48).

“Low-income countries and lower-middle-income countries contribute approximately half of the global burden of overweight and obesity in pregnant women.”

2.1.3 Gestational weight gain

The importance of adequate gestational weight gain to support healthy foetal growth and development, and pregnancy outcomes, is evident. However, there is a lack of global data on weight gain during pregnancy as well as an absence of assessment and monitoring of pre-pregnancy BMI and gestational weight gain in LMICs. While excessive weight gain has implications in regard to poor maternal outcomes, there is very little focus on the maternal consequences of inadequate gestational weight gain in the short or longer term (51). Modelling of DHS data from LMICs in 2015 showed inadequacies in gestational weight gain across all regions of the world, with the exception of Latin America and the Caribbean (52). In sub-Saharan Africa, South Asia and North Africa and the Middle East, average weight gain during pregnancy was approximately 6-7kgs, almost half the minimum amount recommended by the Institute of Medicine for normal weight (11.5kg) and underweight (12.5kg) women (3, 52). Evidence suggests that a woman's weight, BMI, body fat percentage, and weight gain during pregnancy do not influence milk production (48); however, the consequences of mobilising fat, protein and micronutrient stores for breastmilk production may potentially have adverse consequences for the mother's own health and well-being, as well as her ability to support a future pregnancy.

2.1.4 Micronutrient deficiencies

The risks of micronutrient deficiencies for infant outcomes are well-established; however, the 2021 *Lancet* Series on Maternal and Child Undernutrition Progress highlighted a dearth of global biochemical data on micronutrient deficiencies in women and the current reliance on individual studies (3). It is estimated that approximately 2 billion people are deficient in key vitamins and minerals globally (especially in iron, folate, iodine, vitamin D, vitamin B12 and zinc), with the highest burden falling on women and children in LMICs (53).

However, some more specific estimates do exist. In a review of antenatal micronutrient supplementation (54), weighted data from LMICs across several regions indicated that, in addition to the approximately one third of WRA who are anaemic, 63.2% on average are vitamin D-deficient, 41.4% are zinc-deficient, 22.7% are folate-deficient and 15.9% are vitamin A-deficient.



Photo credit: ©WFP/Mariama Ali Souley

Substantial variations in the prevalence of micronutrient deficiencies were evident between countries: for example, in Africa, the prevalence of anaemia in WRA ranged between 17.7% in Ethiopia and 54.5% in Congo and in Southeast Asia, the prevalence of vitamin A deficiency ranged between 1.6% in Vietnam and 43.2% in Pakistan. There was a dearth of evidence on the prevalence of micronutrient deficiencies in pregnant women, with the limited data available indicating that approximately 31.6% of pregnant women in LMICs were anaemic, with particularly high prevalence rates in Africa (48.3%) and Southeast Asia (44.8%).

For lactating mothers, fat and water-soluble vitamins and minerals are secreted into breastmilk to meet the needs of the infant, especially in the first six months, after which some micronutrients in particular, such as iron, need to be supplemented through the introduction of food. For micronutrient-deficient mothers, micronutrient levels in the breastmilk are reduced, but studies have shown that levels can be improved with maternal supplementation, with the exception of calcium, phosphorus, and magnesium (48).

While supplementation during pregnancy has documented benefits for micronutrient status and birth outcomes (see **section 3.1.2** for more details), complete repletion of nutrient status may not be achieved due to chronically deficient diets and increased nutrient requirements in pregnancy (**Table 4**). In addition, while the supply and intake of micronutrients has increased globally, this does not necessarily equate to higher intakes by women, particularly in countries where gender inequalities influence intrahousehold food distribution.

Details of the evidence base surrounding micronutrient supplementation and nutrition outcomes are provided in **section 3.1.2**.

Table 4: Nutritional requirements of non-pregnant, pregnant and lactating women >18 years of age

	Non-pregnant	Pregnant	Lactating
Energy (kcal/d)	2403	+300 on average across pregnancy (T1: +0; T2: +340; T3: +452)	+330 (first 6 months) +400 (second 6 months)
Protein (g/d)	46	+14	+25
Carbohydrates (g/d)	130 45-64% total energy (including six to nine servings of whole grains)	+45	+80
Total fat (% total energy)	20-35% total energy		
Vitamin A (µg/d)	700	770	1,300
Vitamin D (µg/d)	5	15	15
Vitamin E (mg/d)	15	15	19
Vitamin K (µg/d)	90	90	90
Folate (µg/d)	400	600	500
Niacin (mg/d)	14	18	17
Riboflavin (mg/d)	1.1	1.4	1.6
Thiamin (mg/d)	1.1	1.4	1.4
Vitamin B6 (mg/d)	1.3	1.9	2
Vitamin B12 (µg/d)	2.4	2.6	2.8
Vitamin C (mg/d)	75	85	120
Calcium (mg/d)	1,000	1,000	1,000
Iron (mg/d)	18	27	9
Phosphorus (mg/d)	700	700	700
Selenium (µg/d)	55	60	70
Zinc (mg/d)	8	11	12

Source: 48, 55

“While supplementation during pregnancy has documented benefits for micronutrient status and birth outcomes, complete repletion of nutrient status may not be achieved due to chronically deficient diets and increased nutrient requirements in pregnancy.”

Anaemia

The prevalence of anaemia has remained stagnant, or has even slightly increased in adolescent girls and WRA (from 31.6% to 32.8%) and in pregnant women (from 41.6% to 40.1%) between 2000 and 2016, with low socio-economic populations in LMICs being disproportionately affected (3, 56). As highlighted by its inclusion in the WHA targets, reducing the prevalence of anaemia in girls and WRA is critical in order to improve maternal and child health. Anaemic women are at an increased risk of maternal mortality and poor maternal mental health, and their infants are at increased risk of perinatal and neonatal mortality, and poor growth and development during infancy and childhood (57, 58).

There are multiple causes of anaemia but the most common (an estimated 50-60% of anaemia cases) are attributable to iron deficiency as a result of increased requirements during pregnancy (approximately double). Other main causes include low iron consumption and/or absorption, parasitic infections and blood loss (48). However, other micronutrient deficiencies can also play a role in anaemia. For example, vitamin B12 and folate are both required in the metabolic pathways that lead to DNA synthesis, meaning that without adequate supplies of these micronutrients there is a risk of disrupted DNA synthesis and megaloblastic anaemia (59). Vitamin A deficiency is also thought to be a potential driver of anaemia, although the biological mechanisms are still being investigated (60, 61).

Other micronutrient deficiencies

- Further to its links to anaemia, **folate** requirements increase during pregnancy to support foetal and placental development, with deficiency being associated with an increased risk of neural tube defects. Due to the difficulties of meeting these increased requirements through diet alone, folic acid supplementation for pre-conception and during pregnancy (400-800µg daily) is recommended and folic acid is commonly used in fortified staples (48).

- **Vitamin A** is essential for eyesight (ocular function), cellular differentiation, the integrity of mucosal linings, bone development, the maintenance of epithelial tissue, and the proper functioning of the immune system; as such it is also essential for foetal development (62). Deficiency in adolescent girls and women can result in xerophthalmia and night blindness in pregnancy, which are associated with increased morbidity and mortality risk (63)
- **Vitamin D** deficiency is also common in pregnancy, especially in high-risk groups such as those with darker skins and those with low sun exposure, often driven by differences in environmental factors (e.g., avoiding being outdoors in hot temperatures) occupation, clothing, and cultural practices (48, 64). Vitamin D is required for calcium absorption, bone mineralisation and growth, with severe deficiency being associated with congenital rickets and fractures (48).
- **Essential fatty acids**, particularly omega-3 long chain polyunsaturated fatty acids (PUFAs) are critical for foetal and infant brain and central nervous system development (see **Appendix 2** for a summary of the types of fatty acids). Requirements are substantially increased during pregnancy and are an important component of breastmilk. However, intakes of omega-3 PUFA are often suboptimal in LMICs where diets contain little or no oily fish and/or intakes of fats with low α -linolenic acid; instead consumption of oils with high linoleic acid content (omega-6 PUFAs), such as sunflower, safflower, corn, peanut and soy oils, is high (48). Ideally the ratio of omega-3 to omega-6 PUFAs should be kept as low as possible, so that formation of eicosanoids (needed for signalling compounds used in growth and immunity) is not impeded; for most populations this requires eating more foods that are rich in omega-3 PUFAs (65) (**Appendix 2**).

“Reducing the prevalence of anaemia in girls and WRA is critical in order to improve maternal and child health.”

2.2 Factors influencing nutritional vulnerability

Key messages

- While women and girls may have a biological vulnerability to certain forms of malnutrition (e.g. anaemia), a number of economic, social and cultural factors contribute to gender inequalities and limit their access to optimal nutrition.
- Studies have demonstrated a relationship between dimensions of women's mental health and nutrition, as well as between women's disempowerment (e.g., through domestic violence) and adverse nutrition outcomes. More evidence on the mechanistic links between nutrition and maternal mental health is needed to inform the development of effective screening tools and interventions.
- Early marriage and adolescent pregnancy have serious adverse consequences for maternal and infant nutrition and health outcomes.
- Factors such as climate change and the COVID-19 pandemic have exacerbated, and will continue to exacerbate, the burden of malnutrition for women and girls, particularly affecting those in LMICs.

2.2.1 Dietary diversity

Data from 62 studies show poor dietary diversity and inadequate micronutrient intakes among PLW/G in LMICs across Africa, Asia and Latin America and the Caribbean (66, 67). While poverty and food insecurity play a substantial role, food intake during pregnancy and lactation in these regions is also influenced by personal preferences and cravings, as well as sociocultural factors. Cultural beliefs or food taboos lead to the avoidance of certain foods, and varying perceptions regarding the appropriateness of foods during the pregnancy or lactation/postpartum periods, with family members (often mothers and mothers-in-law) or friends commonly reinforcing these (67). Many interventions targeting the first 1,000 days have only focused on infant and child health benefits and outcomes, not maternal dietary consumption during pregnancy and lactation (66, 68) (see **section 3** for more details).

2.2.2 COVID-19 and the global pandemic

Since early 2020, the COVID-19 pandemic has exacerbated the existing burden of malnutrition for women and girls. It has been estimated that 2.1 million additional maternal anaemia cases are expected by 2022 under a moderate scenario, as well as an additional 2.1 million infants born to women with low BMI (69). The mitigation strategies implemented to reduce the spread of COVID-19 have devastated livelihoods, reduced the availability of and access to food, and increased food insecurity. There has been a disproportionate effect on women compared to men, particularly for those in fragile contexts, as well as those working in informal agricultural and non-agricultural sectors without access to services such as paid sick and maternity leave and unemployment benefits (70, 71). It has been reported that access to essential maternal health and nutrition services has been interrupted, inequity in access to education for women and girls (including nutrition education programmes) has increased and access to clean water and safe sanitation services has declined, particularly in urban slums (70, 72).

The effects on household food insecurity are expected to have long-term implications for the nutrition and health of women and girls. This will likely exacerbate existing gender and social inequalities in household food distribution and increase rates of maternal undernutrition and anaemia, as well as concurrent burdens of obesity and NCDs (including type 2 diabetes). These, in turn, are risk factors for poorer prognosis for those infected with COVID-19 (70, 73). Furthermore, the COVID-19 pandemic and household food insecurity have been linked with a greater likelihood of domestic violence and poor maternal mental health, due to a number of factors: maternal fear of vertical COVID-19 transmission; limited access to ANC and PNC; a lack of social support due to social distancing and quarantine procedures; and increased demands of childcare. All of these negatively impact caregivers' abilities to provide nurturing care and optimal infant feeding practices to support infant and child growth and development (70, 71).

2.2.3 Mental health

WHO defines mental health as “a state of wellbeing in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community” (74). Studies have demonstrated a relationship between dimensions of women’s mental health and nutrition outcomes and also a relationship between women’s disempowerment (e.g., through domestic violence) and adverse nutritional impacts, many of which are considerable. Several systemic reviews have found strong associations between maternal depression, prenatally and postnatally, on maternal and infant nutrition and physical health outcomes (75-77). The children of mothers with depressive symptoms are more likely to be underweight or stunted. If the infant population were entirely unexposed to maternal depressive symptoms, it has been estimated that 23% to 29% fewer children would be underweight or stunted (78). Postnatal depression prevalence is often reported at 13% worldwide, however this estimate is based on outdated data from high-income countries (79). Factors associated with an increased risk of postnatal depression include poor obstetric history and social support, low economic and educational status, and history of exposure to violence (76).

Mental health affects caregiving practices and breastfeeding practices, including breastmilk quality and quantity. Among breastfeeding mothers, those with depressive symptoms tend to have low breastfeeding self-efficacy, defined as: low confidence in their perceived ability to breastfeed their infant (80), being less sensitive in touching their infant, and being more likely to have poor positioning of the infant during breastfeeding (81-83). Emotional distress in mothers can inhibit the ‘let-down’ reflex leading to disruption of milk flow and reduced milk volume or milk yield, and therefore affecting breastfeeding duration (84-87). In addition, maternal psychological distress has also been associated with elevated maternal cortisol during the postpartum period, which interferes with the regulation of oxytocin and prolactin and therefore may affect breastfeeding frequency and duration (88-90).

Maternal nutrition also impacts maternal mental health. This happens through various pathways such as food insecurity and nutrients that are important for neurotransmission. However, a recent scoping review (91) concluded that the heterogeneity of the evidence base limits understanding of the underlying mechanisms. While inter-disciplinary programmes and studies in this area are gaining ground, better integration and inter-disciplinary understanding of the links between maternal mental health and nutrition are needed.

Maternal mental health is likely to be especially problematic during humanitarian emergencies, which could have significant implications for breastfeeding and caregiving practices, among other nutrition and health outcomes (see **sections 2.4** and **3.2.1** for more details).

2.2.4 Early marriage and adolescent pregnancy

While the estimated global adolescent fertility rate has declined, the actual number of child births to adolescents has not, due to the large – and in some parts of the world, growing – population of girls in the 15-19 age group (92). The largest number of births to adolescent girls occur in eastern Asia and western Africa (93).

Early marriage and adolescent pregnancy have serious adverse consequences for the growth, development and nutritional status of the young mother as well implications for the infants such as increased risk of preterm birth, LBW, and asphyxia (28). Even more serious is the 50% increased risk of stillbirths and neonatal deaths associated with adolescent pregnancies, and the risk of death being twice as high for the mother during labour in those less than 15 years, compared to older females (94). Complications during pregnancy and childbirth are the leading cause of death for 15-19 year old girls globally (95) due to adolescents being prone to complications of labour and delivery (96).

“Mental health affects caregiving practices and breastfeeding practices, including breastmilk quality and quantity.”

Adolescence is a key period of growth and development (34). Experiencing pregnancy during this period halts the linear growth of that individual, resulting in stunting. It also diverts important fats and micronutrients to the developing foetus, rather than the adolescent, which can lead to wasting and micronutrient deficiencies (97). Adolescent pregnancy is therefore a major contributor to the intergenerational cycle of undernutrition, and programmes to prevent adolescent pregnancy are likely to have the most impact on LBW incidence (98). There are also social consequences, such as girls dropping out of school and therefore having fewer future employment opportunities. Girls who marry before the age of 18 are also at greater risk of domestic violence (99). Unintended motherhood can lead to experiences of stigma, poverty, low education, unemployment, low support, and food insecurity; the combination of these stressors, including adverse environmental factors and structural inequality, can result in poor physical and mental health for adolescent girls, and regressive sexual, reproductive and behavioural practices, for example, inadequate parenting to support their offspring (100).

2.2.5 Seasonality

Seasonality (**Box 8**) is a widely documented predictor of infant health outcomes, influencing the risk of LBW, SGA and premature deliveries, as well as later health and development outcomes, including educational attainment, earnings and mortality (101).

Box 8: Seasonality

Seasonality is a term that captures regular fluctuations of a wide variety of environmental exposures over time, including rainfall, crop cycles, food availability, physical activity and infection rates. Because it is a proxy marker for variations in a number of important exposures, many studies have investigated differences in maternal and infant outcomes between seasons, such as the rainy versus dry seasons, or summer versus winter.

Seasonal variations differ by context, with a greater likelihood of adverse outcomes being documented during the winter months in some settings and in the summer months in others.

While previous studies have suggested that extremes in temperature may be a key determinant of adverse outcomes, these are likely influenced by a range of interrelated factors, including maternal nutritional status. However, the implications for maternal health and nutrition status in the short and longer term are often overlooked.

In rural African populations, higher rates of LBW and SGA deliveries have been linked to seasonal fluctuations in hunger that influence maternal weight and micronutrient status (102). Fluctuations in maternal anaemia, eclampsia and pre-term births have also been associated with seasonal increases in agricultural labour and malaria infection in sub-Saharan Africa (103). For pregnant women in Malawi, dietary diversity and nutrient adequacy were found to be significantly higher in the post-harvest than in the pre-harvest season (104). Similarly, in Bangladesh, seasonal changes in income, employment and food shortages have been associated with increased household food insecurity and reduced dietary diversity (105), with women's work in agriculture thought to influence household nutrition due to inadequate time available for care work in peak agricultural seasons, as well as seasonal energy deficits that adversely affect their own health (106).

2.2.6 Climate change

Climate change exacerbates existing threats to food security and nutrition, with a disproportionate effect on vulnerable populations, including women. Research indicates that climate change has a direct impact on the nutrition of adolescent girls and women through a number of pathways (107). These include food insecurity due to unpredictable weather patterns and pests that influence the reliability of food supply chains, increased food prices, migration-related loss of livelihoods and increased rates of disease. Maternal micronutrient status may be particularly affected as crop yields decrease and rising atmospheric carbon dioxide concentrations reduce the concentrations of nutrients (e.g., protein, iron and zinc) in cereal crops (107, 108). Many climate challenges also impact women's allocation of labour which may, in turn, alter their nutritional needs and reduce their availability for household activities such as food preparation and infant and child caregiving (109).

Efforts to address the impacts of climate change on girls' and women's nutrition must consider equity, since those living in LMICs already face the largest nutrient deficits and are likely to be the most affected by climate-related impacts on food security and nutritional status (107). The Intergovernmental Panel on Climate Change (IPCC) predicts that the biggest climate-related threat to health is undernutrition, with data indicating that those with the lowest incomes, who already suffer from undernutrition, are the most vulnerable to climate change (110). This has serious implications for the vulnerability of adolescent girls and women, with exposure to climate-related effects and dependence on climate-sensitive resources increasing as adaptive capacity decreases.

For pregnant adolescent girls and women, air pollution and extreme heat events pose a threat to themselves and their foetuses, increasing the risk of maternal and foetal stress, pre-term birth and LBW deliveries (107). Thus, climate change will likely exacerbate the intergenerational impacts of malnutrition on health and development for future generations.

2.2.7 Postnatal care

Adequate PNC is a major determinant of maternal health and well-being, with the majority of maternal deaths occurring in sub-Saharan Africa and southern Asia during the early postnatal period (111). Approximately three-quarters of maternal deaths are the result of direct obstetric causes, mainly haemorrhage, hypertensive disorders and sepsis, with a quarter being attributable to indirect causes, such as pre-existing disorders such as HIV which are exacerbated by pregnancy (111).

Both direct and indirect causes of maternal mortality may be influenced by maternal nutritional status. Strong linkages exist between maternal anaemia and short stature and increased risk of haemorrhage and obstructed labour at the time of delivery and during the immediate postnatal period (112). However, the relationship between maternal nutritional status, diet and morbidity across the later postnatal period is less well understood and interventions aimed at supporting maternal nutrition during this time are uncommon.

Maternal postpartum anaemia, in particular, is common in LMICs. Anaemia during the preconception and antenatal periods due to inadequate dietary intake, parasitic infection or malaria, increased pregnancy requirements and inadequate supplementation, may be further exacerbated by blood loss at the time of birth (113). Ensuring that maternal nutritional reserves are replenished postnatally is essential for ensuring that the health and well-being of the mother are adequately supported, and to support optimal infant care and feeding practices, as well as adequate nutrition reserves for any subsequent pregnancies.

In many LMICs, dietary practices during pregnancy and the postnatal period may be influenced by a range of sociocultural factors. These include economic constraints, household food availability, food aversions and cultural beliefs related to appropriate quantities and types of food that are suitable for pregnant and lactating mothers (6). A recent meta-synthesis of qualitative research (114) showed that practical, emotional and psychological support from informed, educated and mobilised family members, peer groups and health services are critical to ensuring the health and wellbeing of new mothers, and their infants. This meta-review is being used to inform the scope of WHO's updated PNC guidelines, due to be released imminently, and it is hoped that an emphasis on maternal nutrition will feature prominently.



Photo credit: ©WFP/Laure Chadraoui

2.3 The importance of a life course perspective

The developmental origins of health and disease (DOHaD) hypothesis describes the association between certain environmental exposures experienced very early in life (particularly during the periods of pregnancy and the first two years of life – the first 1,000 days) and increased risk of poor health outcomes later in life. A catchphrase that summarises this is: *'what happens in the womb lasts a lifetime'*. **Box 9** summarises the key findings coming from the early DOHaD literature, drawn from the work of David Barker (115, 116) and studies on the Dutch Hunger Winter (117-120).

Decades' worth of research has now described how adverse exposures, suboptimal nutrition particularly, during critical periods of plasticity in early life (foetal and infant development) are associated with altered growth and development. It has been hypothesised that this may occur via changes to gene expression and permanent restructuring of the body's tissues, which influence metabolic function and which have long-term consequences (e.g., increased risk of chronic disease in later life). **Appendix 3** provides more details about the key literature underpinning these concepts, including some famous animal studies, and describes some of the potential mechanisms that may explain these patterns.

Box 9: Summary of key DOHaD evidence in humans (detailed in Appendix 2)

- Association between small size at birth and chronic disease risk in adulthood and old age.
- Birth weight shows an inverse association with high blood pressure and type 2 diabetes among adults.
- Exposure to famine during different stages of pregnancy is associated with a greater risk of chronic disease decades later.

As these adverse exposures can happen very early in life, consideration of the periconceptual period is crucially important for potential mothers. This covers the three months prior to conception as well as the period of time around conception. **Appendix 3** provides biological definitions and the rationale for this period. Awareness of the importance of the periconceptual period for foetal development and health across the life course has been increasing in recent years.

The nutritional status of potential mothers is an essential consideration in the periconceptual period, alongside other environmental exposures, such as maternal stress, physical activity levels, cigarette smoke and toxin exposure, and the microbiome. Because nutritional status at the time of conception and throughout the pregnancy influences not only immediate birth outcomes, but also health across the individual's lifetime, the impacts are intergenerational. This means that nutrition interventions during the periconceptual period are critical so that the window of opportunity to influence the health outcomes of future generations, as well as the mother herself, are not missed.

2.4 Vulnerabilities in the humanitarian context

Within humanitarian contexts, women are among the most nutritionally at-risk. Their existing vulnerabilities may reduce resilience to shocks and can often be further exacerbated by contextual factors that drive – or result from – humanitarian crises. In 2017, an estimated 265 million adult women were living in proximity of armed conflict and 16 million were displaced from their homes as a result (121). While targeting malnourished women and girls, particularly those who are pregnant or lactating, is a priority in humanitarian crises, there is limited evidence on maternal nutritional status and its determinants in such contexts (122), and little progress has been made since ENN's previous technical background paper was published in 2013. Food insecurity, reduced access to clean water, and disruptions in nutrition and health services within humanitarian contexts are likely to increase the vulnerability of women in a number of ways (described below), impacting their own nutritional status, as well as their abilities to support healthy pregnancies and maintain optimal infant feeding practices and caregiving roles.

“Within humanitarian contexts, women are among the most nutritionally at-risk.”

2.4.1 Increased nutritional requirements and reduced intakes

- As discussed in relation to climate events (see **section 2.2.6**), humanitarian crises may impact women's allocation of labour and/or intensify workloads, increasing daily energy and nutrient requirements and the risk of maternal undernutrition and micronutrient deficiencies. This, in turn, increases the risk of adverse infant outcomes for PLW, as well as disrupting infant and young child feeding practices and childcare.
- Women disproportionately contribute to caregiving activities. These include disease prevention activities and other activities inside the home, as well as health and social care activities within the society at large, with women comprising approximately 70% of the health and social care workforce in many countries. This means that they are more likely to be exposed to communicable diseases during humanitarian crises, while often being less likely to receive timely medical attention compared to other demographic groups (123).
- The risk of diarrhoeal and infectious disease increases during humanitarian crises. This can result from mass migration and overcrowding, economic and environmental degradation, increased poverty, limited access to safe water, poor sanitation and waste management, the absence of shelter, and poor access to health care (123). This may lead to malabsorption or loss of nutrients, increasing requirements of micronutrients and causing or exacerbating micronutrient deficiencies. Adolescent girls and young women may be particularly affected, due to comparatively their higher micronutrient needs (e.g., for iron), with the greatest impact falling on those who are pregnant or lactating. While fortified food rations may be supplied through humanitarian responses, these may fail to adequately meet micronutrient requirements (124, 125).
- Girls and women are often most likely to restrict their food intakes in favour of other family members during times of short supply, either voluntarily or due to social and gender inequalities (123).
- Some traditional food sources may be lost, impacting access to certain nutrients. For example, in settings where fish is a primary source of protein and other nutrients (such as essential fatty acids), lack of access in humanitarian contexts may alter dietary profiles and increase the risk of deficiencies.

2.4.2 Increased risks

- Gender-based violence often increases during humanitarian crises as women's status in society makes them vulnerable to exploitation, violence and abuse (126). Forced transactional sex and early marriage may also be more likely, resulting in more adolescent pregnancies and associated risks for maternal (and infant) nutrition and health (123).
- Some evidence indicates that women may be at greater risk of mental health problems, [such as anxiety and depressive disorders and post-traumatic stress disorders, during crisis situations (127).

2.4.3 Disruption of services and support

- Access to routine health services (e.g., reproductive health services, ANC and obstetric care, and prevention of mother-to-child transmission of HIV (PMTCT) services) is often disrupted. Reduced access may increase the risk of unwanted pregnancies, HIV transmission, reduced access to interventions such as prenatal micronutrient supplementation and pregnancy and delivery complications for mother and baby. This may be particularly problematic in settings where reproductive and maternal health services are already poor, with one study showing that women who did not receive ANC were 1.83 times more likely to be malnourished (MUAC <21cm) compared to those who did receive care in a humanitarian setting in Ethiopia (122).
- Where essential humanitarian services are in place, women may be disproportionately unable to access these due to safety concerns, social- and gender-based discrimination and limited mobility (123).
- Negative impacts on infant and child feeding (e.g., disruption of breastfeeding and responsive caregiving practices) can arise due to physical and emotional stress during crisis situations. A lack of support services and family support can have adverse impacts on the growth, development and health of the infant, as well as further exacerbating maternal mental health challenges and resilience. This may be further complicated by higher incidence rates of preterm and LBW deliveries, which create a greater need for breastfeeding support. See **section 3.2.1** for more details.



Interventions

“Numerous gaps exist in the guidelines for supplementation in undernourished women, including a lack of specific guidance on adult wasting. There are contrasting interpretations of the evidence base for micronutrient supplementation. There is a lack of evidence and guidance on pre-conception nutrition, with a particular lack of nutrition programming and policy for adolescents.”

3 Interventions

3.1 Supplementation

Key messages

- Numerous gaps exist in the guidelines for macronutrient supplementation in undernourished women, including a lack of specific guidance on adult wasting; a lack of an anthropometric definition of wasting in adolescents and adults; and the absence of details on the type and content of supplementary food to provide for wasting treatment.
- Guidelines on BEP supplementation for PLW/G are relatively new and lack both detail and guidance for implementation.
- It is confusing in places as to how current guidance on BEP align with existing guidelines for lipid-based nutrient supplements (LNS) and other supplementary foods.
- Standardised criteria for the inclusion of PLW/G in blanket feeding programmes are lacking.
- IFA supplementation is still recommended in ANC guidelines, with the exception of humanitarian contexts and 'research settings'. Strong evidence, however, also exists for the benefits of MMS in pregnant women.
- IFA supplementation is usually delivered via health system ANC services; little evidence exists for IFA supplementation for other sub-groups across LMICs (e.g., non-pregnant girls and women in high burden contexts, and post-partum women).
- Implementation guidance on micronutrient supplementation is lacking, particularly for non-pregnant women.

3.1.1 Macronutrient supplementation and specialised supplementary foods

Macronutrient supplementation and specialised supplementary foods for adolescent women and girls are most commonly provided in humanitarian settings. Unless indicated otherwise, this section describes evidence and interventions from humanitarian contexts.

3.1.1.1 Macronutrient supplementation

Supplementation is a commonly used intervention to tackle undernutrition in adolescent girls and women, especially during humanitarian situations, with interventions often prioritising PLW/G based on the evidence of a positive impact on infant outcomes. It is recommended that all PLW/G up to six months postpartum who are moderately wasted should be included in a **targeted supplementary feeding programme**, regardless of their age (23). While blanket feeding programmes often include supplementary feeding for those within higher risk groups, such as PLW/G, there are currently no standardised criteria or recommendations for the inclusion of PLW/Gs in blanket feeding, as the literature base for the management of wasting primarily focuses on children.

The Sphere minimum standards (**Box 10**) state that PLW should have additional nutritional support and may be targeted with supplementary food (128). The decision to include PLW/Gs is, however, context-specific and depends on a variety of factors such as prevalence of LBW, national guidelines, availability of other programmes, programme capacity, resources, and child feeding practices. If programme capacity is low in humanitarian emergencies, it is recommended that children be prioritised first, followed by breastfeeding women, although breastfeeding women are of course prioritised for the potential benefits for their infants (23).

“If programme capacity is low in humanitarian emergencies, it is recommended that children be prioritised first, followed by breastfeeding women.”

Box 10: The Sphere minimum standards

Sphere is a global project that started in 1997 with the aim of improving the quality of humanitarian assistance (128). It is based on the Humanitarian Charter, which outlines the ethical and legal principles underpinning the Sphere project. These form its rights-based foundation:

- People have the right to assistance.
- People have the right to a life with dignity.
- People have the right to protection and security.
- People have the right to fully participate in decisions related to their own recovery.

The Sphere standards cover four primary life-saving areas: water supply, sanitation and hygiene promotion; food security and nutrition; shelter, settlement and non-food items; and health action.

The minimum standards for each of these areas are set out in the Sphere Handbook, along with indicators that can be used to track progress against them. The Handbook is regularly updated; an interactive online version can be found at <https://handbook.spherestandards.org/en/>

In undernourished populations, **BEP supplementation (Box 11)** is recommended for pregnant women. This is based on evidence showing that BEP supplements are associated with decreased risk of stillbirth and SGA deliveries (10). However, this recommendation is not widely implemented and knowledge gaps remain regarding the cost-effectiveness of such programmes at scale (129, 130).

Box 11: BEP supplements

- BEP supplements are formulated to provide less than 25% of total energy as protein (e.g., lipid-based spreads and fortified ground nut biscuits) (131).
- BEP supplementation has been associated with a decreased risk of stillbirth and SGA deliveries (10) and a positive impact on birthweight (131-135).
- However, evidence of longer-term impacts in terms of infant growth or neurocognitive development is inconclusive (133, 135).

In contrast, high-protein supplementation (**Box 12**) is not recommended in any context (10).

Box 12: High-energy protein supplements

- High-energy protein supplements are formulated to provide more than 25% of total energy from protein (131).
- There is no evidence that high energy protein supplements are beneficial to the foetus; instead supplementation for pregnant women has been associated with an increased risk of SGA neonates (131, 133).

While **essential fatty acids** are important building blocks for foetal brain and retina development, it is also possible that they have a positive effect on pre-eclampsia, prenatal depression placental weight and the infant's birth outcomes and linear growth (**Box 13**). However, there are currently no specific recommendations currently for their inclusion in supplements for undernourished women (136-138). It may be important though for some maternal and infant outcomes to increase the intake of essential fatty acids in pregnancy through the diet or via supplementation.

Box 13: Cochrane review on omega-3 fatty acids (137, 138)

- Omega-3 fatty acids (through food or supplements, compared to placebo or no omega-3) were associated with a reduced risk of preterm birth (risk ratio (RR) 0.89, 95% confidence interval (CI): 0.81 to 0.97), perinatal deaths (RR 0.75, 95% CI: 0.54 to 1.03), and LBW (RR 0.90, 95% CI: 0.82 to 0.99). They also showed a borderline protective association with pre-eclampsia (RR 0.84, 95% CI: 0.69 to 1.01).
- Some evidence suggested a possible impact on postnatal depression, but this evidence was of low quality and limited to only two studies.
- There was little/no impact on intrauterine growth restriction, children's neurodevelopment and growth outcomes.

Food distribution programmes, where any foods are distributed without a specific focus on BEP, have not demonstrated any significant impacts on maternal mortality (134). However, although the evidence base is weak, food distribution programmes have been associated with reductions in prenatal and neonatal mortality, LBW, and stunting and wasting in children younger than five years of age (134, 139, 140). The *Lancet* (2021) Series on Maternal and Child Undernutrition Progress stated that although food distribution programmes appear to have benefits, BEP supplements are more likely to have greater effects, thus they recommend that “food supplements for women in food insecure households should be tailored to provide a reasonable balanced energy and daily protein balance” (134).

Lipid-based nutrient supplements (LNS) (Box 14), which are commonly used to treat wasting in children, present another option for supplementing undernourished women. LNS provide energy, protein and essential fatty acids, as well as a range of vitamins and minerals, and therefore could promote improved maternal health, foetal growth and birth outcomes. They are generally used as point-of-use fortification or consumed directly as a source of energy during pregnancy (140). The long storage times and ready-to-eat formulas (no need to add water) make LNS an attractive option for many humanitarian contexts, although the cost can be prohibitive where resources are limited (140). Some LNS products qualify as BEP and some do not; however, BEPs are usually not fortified with micronutrients whereas LNS are.

“Although food distribution programmes appear to have benefits, BEP supplements are more likely to have greater effects.”

Box 14: LNS

- LNS describes a large range of products, but all are characterised by the fact that most of their energy is supplied from fat.
- Three primary LNS products are currently used to treat and prevent child undernutrition and occasionally interventions also provide them to PLW, with the aim of improving the foetus/ infant's nutritional status: (see (140), **Table 5** and **Box 15** for examples):
 - **Large-quantity (LQ) LNS** (180-200 g/day) that aim to provide 100% of nutritional needs; for example, ready-to-use therapeutic food (RUTF). These are primarily used to treat severe childhood wasting.
 - **Medium-quantity (MQ) LNS** (45-90 g/day) that provide 50-100% of energy needs: for example, ready-to-use supplementary food (RUSF). These are primarily used to treat moderate childhood wasting
 - **Small-quantity (SQ) LNS** (approx. 20 g/day) that provide less than 50% of energy needs but have high micronutrient concentrations. These are used through home fortification of local foods. The product is used to prevent childhood stunting and sometimes to prevent micronutrient deficiencies, such as anaemia.

Recently a number of randomised control trials (RCTs) have investigated the effect of LNS on maternal and infant outcomes (**Table 5**), with mixed effects reported depending on the context and composition of LNS. A recent Cochrane review (2018) that analysed the impact of LNS irrespective of composition, dose, or duration of supplementation, found that LNS in pregnancy had positive impacts on birth weight, length and risk of SGA neonates when compared to IFA supplementation, but no benefit for maternal or birth outcomes when compared to MMS (140). The review found no literature relating to humanitarian settings (likely due to the difficulties of conducting RCTs in humanitarian settings) and was unable to make any recommendations due to the small number of studies and effect sizes.

Table 5: RCTs investigating the effect of LNS on maternal and infant outcomes				
Author (date)	Country	Target group	Intervention (study type)	Outcomes
Large-quantity LNS				
Callaghan-Gillespie et al. (2017) (141)	Malawi	Moderately malnourished pregnant women	RUSF vs. fortified corn soy blend with daily MMS (RCT)	<ul style="list-style-type: none"> • Women receiving RUSF had greater weight gain, but weight gain was slow overall. • Birth weight and length were similar across intervention groups. • Modest effects on infant linear growth at birth, 6 and 12 weeks.
Medium-quantity LNS				
Huybregts et al. (2009) (142)	Burkina Faso	Pregnant women	Daily prenatal supplementation of LNS (72g) vs. MMS (non-blinded RCT)	<ul style="list-style-type: none"> • Infants in LNS arm had a higher mean birth length and non-significant higher birth weight.
Small-quantity LNS				
Kathryn et al. (2016) (143)	Bangladesh	Pregnant women	SQ-LNS (118 kcal) vs. IFA supplementation (RCT)	<ul style="list-style-type: none"> • No significant impact on maternal weight gain. • Impact on weight gain among multiparous women under 25 years of age. • Reduction in newborn stunting and positive impact on birthweight.
Adu-Afarwuah et al. (2015) (144)	Ghana	Primiparous pregnant women	LNS (118 kcal) vs. IFA vs. MMS (RCT)	<ul style="list-style-type: none"> • Positive impact on birth weight and length.
Ashorn et al. (2017) (145)	Malawi	Pregnant women	LNS (118kcal) vs. IFA vs. MMS (RCT)	<ul style="list-style-type: none"> • No impact on infant weight, length, head circumference or MUAC at birth or at 18 months. • No evidence of an effect on maternal weight gain, reproductive and urinary tract infections after delivery, maternal inflammation, plasma retinol, B12 and folate levels. • No evidence of an impact on maternal fatty acid measurements or cholesterol level. • IFA group had higher markers or iron status compared to LNS group.

3.1.1.2 Distribution and targeting of specialised food

The targeting of PLW/G for specialised food supplementation in humanitarian contexts is normally done using MUAC, due to its relatively strong association with the risk of LBW deliveries (146-149) and because it is not possible to collect accurate BMI data in pregnant women. The Sphere minimum standards recommend a MUAC cut-off point of 21cm (128); however, very limited literature is available on optimal cut-offs. An individual participant data meta-analysis included data from seven studies¹⁹ with the aim of determining a universal MUAC cut-off for undernutrition in pregnant women.²⁰ The study found that identifying the optimal MUAC cut-off is a complex problem involving multiple trade-offs. If a cut-off with a high sensitivity is selected it is at the expense of specificity, thus health care systems must have the ability to handle large numbers of women who are erroneously identified as 'at risk'.

Similarly, a MUAC cut-off that prioritises a high specificity will ultimately lead to considerable numbers of women who are 'at-risk' not being identified as such. In addition, MUAC is also not always effective at distinguishing pregnant women who are at risk of delivering LBW infants. Subsequently, the meta-analysis concluded that countries and programmes should conduct their own cost-benefit analysis to determine the optimal MUAC cut-off for their specific context (149).

There are a variety of mechanisms by which specialised fortified foods are distributed to populations who are at risk of undernutrition. **Box 15** summarises some of these methods, as well as challenges with targeting PLW, using WFP as an example.



Photo credit: ©WFP/Mariama Ali Souley

19 From Bangladesh, the Democratic Republic of the Congo, Ethiopia, Malawi, Nepal, Pakistan and South Africa.

20 MUAC range investigated 19cm to 26.5cm.

Box 15: Distribution of rations and specialised fortified foods: examples from WFP

WFP is responsible for providing or enabling access to appropriate nutrient-rich foods for PLW/G in emergencies (150). The most recent estimates indicate that in 2020 WFP reached 2.6 million PLW/G through prevention interventions, and a further 3 million PLW/G were reached through treatment of moderate wasting (151).

For the prevention of undernutrition WFP adopts several strategies, including social protection programmes, the use of social and behaviour change communication strategies, a focus on infant and young child feeding, and micronutrient supplementation interventions. General food distribution is just one of the mechanisms used by organisations such as WFP to improve household food security, thereby helping prevent undernutrition in humanitarian situations. General food distribution consists of food rations given to selected vulnerable households in humanitarian interventions. However, as it is designed to meet the needs of the general population it can be challenging to provide adequate nutrition for population subgroups such as PLW/G who have increased nutritional demands (152). Where resources allow, a top-up of the general food distribution using Super Cereal (a fortified blended food), and oil helps improve the nutritional adequacy of the ration.

The WFP supplementary feeding programmes (blanket and targeted feeding) for PLW/G are triggered by a range of factors. These include (but are not limited to) food insecurity thresholds, nutrition indicators among women and young children that illustrate changes in the nutritional status of vulnerable groups, rates of LBW, and how the crisis is affecting infant and young child feeding behaviours. Decisions are further influenced by health system capacity and specific considerations based on national nutrition protocols. WFP's response aims to align with available international policy and guidance on supplementation programmes for PLW/G (see **section 1.5** for examples).

Depending on national protocols, WFP use an admission MUAC cut-off of either 21 cm or 23cm to identify nutritionally at risk pregnant women, depending on national protocols/context. For the treatment of moderate wasting, PLW/G are enrolled and subsequently discharged based on their MUAC. In some countries, depending on the national protocol, as a preventive measure the PLW/G may then be retained in the programme until their infant reaches six months of age. When blanket supplementary feeding is initiated all PLW/G are eligible and remain in the intervention until the infant reaches six months of age. Mothers in the first trimester are enrolled for blanket supplementary feeding programmes, but enrolment is a common challenge in both humanitarian and development contexts due to difficulties in detecting early pregnancy at the population level. To overcome this challenge population-level interventions targeted at women of reproductive age (and in particular adolescents) have been suggested (153) to help break the intergenerational cycle of malnutrition.

One of the common supplementary food products used by WFP in supplementary feeding programs for PLW/G is Super Cereal, a type of fortified blended food containing maize, de-hulled soya beans, dried skimmed milk powder, sugar, vegetable oil and a vitamin and mineral premix. A dosage of 200-250g (with 20-25g oil) is used to treat moderate wasting and a dosage of 100-200g (with 10-20g oil) is used to prevent undernutrition in PLW/G. WFP is also currently exploring alternatives to these types of fortified blended foods. For example, it is using locally produced MQ-LNS, formulated specifically for PLW/G (LNS-PLW/G-75g), delivered at scale in Pakistan as a substitute. The cost is only approximately 0.04 cents more per ration than Super Cereal. Furthermore, a pilot project is currently being implemented in Uganda to test the acceptability of the LNS-PLW/G product and to determine its impact on nutrition outcomes, with the possibility of LNS being rolled out across all countries in the future. This decision is primarily based around concerns regarding the sharing of Super Cereal, and it replacing rather than complementing other foods.

Further information on the range of strategies the WFP adopts across the globe, alongside accountability in regard to the numbers and coverage reached, can be found in its annual 'Nutrition in Numbers' report (151).

3.1.2 Micronutrient supplementation

Current international guidelines on micronutrient supplementation for adolescent girls and women are summarised in **section 1.5**.

Daily oral IFA supplementation with 30mg to 60mg of elemental iron and 400 µg of folic acid is recommended for pregnant women. **Intermittent IFA supplementation** is recommended for menstruating non-pregnant adolescent girls and non-pregnant women in settings where the prevalence of anaemia in non-pregnant women is 20% or higher. In settings where the prevalence of anaemia in non-pregnant women is 40% or higher **daily iron supplementation** for menstruating non-pregnant adolescent girls and non-pregnant women is recommended. IFA supplementation has been demonstrated as effective in preventing anaemia in malaria endemic settings, but iron supplementation can increase the risk of malaria infection and severity (154). Hence, if IFA interventions are implemented in malaria endemic areas, they should be accompanied by adequate measures to prevent, diagnose and treat malaria. Despite the existence guidelines recommending IFA supplementation, coverage remains low, with factors affecting coverage including poor compliance, low levels of ANC attendance and inadequate supply chains (129, 155). IFA supplementation is often integrated with health systems (see **section 3.2.3**), and for adolescent girls schools are sometimes used as platforms for delivery (155, 156).

Much attention has been given to the evidence base regarding **MMS** and related recommendations. The evidence collated and examined in the WHO 2020 update of the MMS supplementation guideline concluded that “whilst the evidence suggests that there may be a limited benefit and little harm in replacing IFA supplements with MMS, the evidence on low birthweight and its component parts (preterm birth and SGA) is difficult to interpret” (14). It was also stated that there is uncertainty regarding the implications of reducing iron dosage from 60mg (commonly used in IFA supplementation) to 30mg (typical in MMS formulations, **Box 16**). As such, the guidelines recommend MMS containing IFA only in the context of rigorous research and WHO's ANC guidelines are yet to fully support a universal switch from IFA to MMS. The UNICEF Nutrition Strategy 2020-2030 (157) recommends the use of either IFA or MMS in pregnancy, in line with the WHO ANC guidelines (10).



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However, others looking at the evidence conclude that there are significant benefits of MMS for mother and infant outcomes, and interpret the WHO guidelines as overly cautious. For example, there is strong evidence that MMS used during pregnancy has a positive impact on LBW, SGA deliveries and stillbirths (134, 158). On the basis of such evidence the latest *Lancet* (2021) Series on Maternal and Child Undernutrition Progress made a strong recommendation for the replacement of IFA in pregnancy with MMS (134) (**Box 16**). Furthermore, WHO's Model List of Essential Medicines added MMS in 2021 (159), which although under current ANC guidelines would pave the way for robust country research, could also help those countries wanting to include MMS in national health systems. While several countries have already implemented policies allowing for MMS supplementation, it is likely that many others will not make the change until MMS is clearly recommended in WHO guidelines. To date, the conflicting guidance on MMS remains a barrier for widespread scale-up.

In humanitarian contexts, due to the increased risk of multiple micronutrient deficiencies, WHO recommends MMS for all PLW (see **section 1.5.3**) (21). Multiple micronutrient powders are not included in this recommendation, due to the limited evidence generated to date on possible benefits or harms (160).

There is limited evidence on the impact of MMS during lactation on maternal and infant outcomes, with a recent Cochrane review only finding two relevant studies (161) (**Box 17**).

Box 16: MMS vs. IFA

MMS is formulated to contain the Recommended Daily Allowance of 15 micronutrients. The formula most commonly used is the United Nations International Multiple Micronutrient Antenatal Preparation (UNIMMAP). It contains the following doses of micronutrients:

Iron 30mg, Zinc 15mg, Copper 2mg, Selenium 65µg, Iodine 150µg, Vitamin A 800µg retinol equivalent (RE), Vitamin B1 1.4mg, Vitamin B2 1.4mg, Vitamin B3 (niacin) 18mg, Vitamin B6 1.9mg, Vitamin B9 (folic acid) 400µg, Vitamin B12 2.6µg, Vitamin C 70mg, Vitamin D 200IU, Vitamin E 10mg

- When compared to IFA, MMS reduces:
 - LBW by 15%
 - stillbirth by 9%
 - pre-term birth by 4%
 - SGA babies by 7% (134)
- MMS compared to iron with or without folic acid has similar benefits for reducing maternal anaemia (158).
- Sub-analysis has shown additional benefits of MMS for anaemic or underweight women (162).

Further information

- The **Healthy Mothers Healthy Babies Consortium** has useful resources²¹ that explain the drive to advocate for MMS, summarising the key research underpinning the switch and information on the cost-effectiveness of the approach.
- **Sight and Life magazine** has a special report²² on MMS in pregnancy, which provides further useful research summaries.
- **Nutrition International** has provided a tool²³ to help governments assess the cost-effectiveness of switching from IFA to MMS.
- There are interim guidelines²⁴ for country decision makers on the switch to MMS, and there are further articles available outlining potential steps to undertake in the preparatory and scale-up stages using existing case studies (163).

Box 17: MMS in breastfeeding women

- In Brazil MMS vs. placebo among adolescent mothers from low socioeconomic backgrounds had a positive impact on maternal anaemia (164).
- In the US, daily supplementation (vs no supplementation) for mothers from low socio-economic backgrounds increased concentrations of vitamin B12 and folate in breastmilk. However, the study reported no significant differences in blood (serum) concentrations (165).

In countries where less than 20% of households have access to iodised salt, either through purchase from markets or iodised salt in general food distributions, WHO recommends **iodine supplementation** for PLW/G (166). A Cochrane review (2017) found that in regions with mild to moderate iodine deficiency, iodine supplementation was associated with increased digestive intolerance in pregnancy but a reduction in postpartum hyperthyroidism and congenital anomalies, although the impact on child development outcomes was less clear (167). In severely deficient regions iodine has been associated with a positive impact on birthweight (mean difference: 200g; 95%CI: 183 to 217g; but this was low-quality evidence) (168), and with a reduced risk of cretinism (169).

Daily **calcium supplementation** is recommended by WHO for pregnant women in populations with low dietary intake, for the prevention of pre-eclampsia (10, 170). Calcium has also been associated with decreased risk of LBW (171). WHO recommends 1.5-2.0g/day, three times a day, which poses adherence challenges as adherence to supplementation regimes decreases with the number of tablets people are expected to take each day (172). Furthermore, there is often confusing messaging about whether or not calcium supplements should be taken at a separate time to iron-containing supplements, due to a reported effect on iron absorption caused by the interaction. There are recommendations to adjust messaging to allow supplements to be consumed at the same time to simplify dosage regimes and improve adherence (172).

21 See <https://hmhbconsortium.org/>

22 See https://sightandlife.org/wp-content/uploads/2020/04/SightandLife_SpecialReport_MMS_2020.pdf

23 See <https://www.nutritionintl.org/learning-resources-home/mms-cost-benefit-tool/>

24 See <https://www.nyas.org/media/23298/012721-mms-guidance-v11.pdf>

While there are limited data on calcium supplementation programmes, available data suggest programmes are not operating at scale (129). Recent analyses, reported in the *Lancet* (2021) Series on Maternal and Child Undernutrition Progress, found that a lower dose is efficacious at preventing pre-eclampsia, although more evidence is needed as the available data are currently too limited (129).

In contexts where vitamin A is a public health concern,²⁵ **vitamin A supplementation** is recommended for pregnant women, to prevent night blindness (10). Vitamin A has also been associated with a reduction in anaemia during pregnancy and a reduction in the risk of LBW deliveries in HIV-positive populations (173). Vitamin A supplementation is not recommended for postpartum women, as the available evidence does not support a reduction in either maternal or infant morbidity or mortality (174). Care must be taken with supplementation in non-deficient populations as excessive doses of vitamin A (>10 000IU/day) have been associated with an increased risk of cranio-facial and cardiac birth defects. However, these risks have largely been found in studies in high-income settings (62).

Zinc supplementation is only recommended for pregnant women in the context of rigorous research (10). Some evidence suggests that zinc supplementation may reduce the severity of maternal infections (175).

There is a growing body of evidence in favour of **vitamin D supplementation** during pregnancy, and on its impact on maternal and infant outcomes. There is evidence that vitamin D supplementation is associated with a decreased risk of pre-eclampsia (13), with some systematic reviews also reporting a positive impact on birthweight, with effects lasting up to one year (176-179). WHO reviewed its ANC guideline relating to vitamin D in 2020, but retained the 'not recommended' advice due to the low quality of available evidence, the confinement of data on pre-eclampsia to high-risk women in few geographical locations, and an inability to judge any undesirable effects and the cost-effectiveness of vitamin D supplementation due to the limited data on these outcomes (13).

3.1.2.1 Food fortification

One of the fastest and cheapest strategies to improve the intake of essential nutrients at scale is through food fortification. Food fortification is the deliberate addition of one or more micronutrients to particular foods with the aim of increasing the intake of these micronutrient(s) to correct or prevent a demonstrated deficiency and to provide a health benefit. FAO and WHO have identified food fortification as one of four main strategies for addressing micronutrient malnutrition. Generally, it is widely-consumed staple foods – such as salt, wheat, rice, and cooking oil – that are fortified, so while they are intended to reach the whole population, they are not specifically targeted at women and girls. However, some of the micronutrients included in fortified foods are especially important for women, girls and mothers. Hence large-scale food fortification has the potential to significantly improve the micronutrient quality of women's diets.

WHO's 2006 guidelines on 'Food fortification with micronutrients' highlights iron and vitamin A as key micronutrients for maternal health and survival, and ones that are safe and effective to include in fortified foods (180). They also highlight fortification of maternal foods as a means of increasing the micronutrient consumptions of infants via breastmilk. The micronutrients that are most likely to be depleted in the breastmilk of undernourished mothers include vitamin A, all B vitamins except folate, iodine and selenium (181).

Vitamin A fortification of margarine and sugar has been shown to be efficacious, with vegetable oils and cereal flours also considered to be useful fortification vehicles. An early evaluation of vitamin A fortification of sugar in Guatemala showed that it is an effective strategy for improving vitamin A status and for increasing the amount of the vitamin in the breast milk of lactating mothers (182).

Iron fortification is already widely practised in many parts of the world. For example, more than 20 countries in Latin America have implemented mass iron fortification programmes, most of which involve the fortification of wheat or maize flours (183). Elsewhere, other frequently used food vehicles include cereal-based complementary foods, fish sauce, soy sauce and milk.

25 Vitamin A deficiency 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.

Universal salt iodisation – that is, the iodisation of all salt for both human and animal consumption – is recommended in both humanitarian and development contexts. This is due to its limited availability in the diet and the negative effects iodine deficiencies have on women's and girls' health (goitre) as well as on brain development in foetuses, infants and young children (184).

A 2004 review concluded that **fortification of flour with IFA** is the best way to provide daily doses of these essential micronutrients to women before they get pregnant and in the early months of pregnancy when brain development and neural tube developments take place (185). It is also the most effective approach in societies where women do not plan their pregnancies (185). However, there is some reluctance to include folic acid in fortified foods in some countries. While the consumption of folic acid in amounts normally found in fortified foods has not been associated with adverse health effects, there has been some concern that high folic acid intakes could mask or exacerbate neurological problems, such as pernicious anaemia, in people with low intakes of vitamin B12 (186).

It is important to note that the extent to which a national or regional food supply is fortified varies considerably. This is highly influenced by national legislation on fortification. The concentration of just one micronutrient might be increased in a single food item (e.g., the iodisation of salt), or, at the other end of the scale, there might be a whole range of food-micronutrient combinations. The public health impact of food fortification depends on a number of parameters, but predominantly it will be influenced by the level of fortification, the bioavailability of these fortificants, and the amount of fortified food consumed (180).

“The nutrition of adolescent girls and women is integrally linked with the provision of health services.”

3.2 Health-related interventions

Key messages

- The nutrition of adolescent girls and women is integrally linked with the provision of health services: health services provide important contact points for nutritional assessment, counselling, referral and delivery of nutrition interventions.
- In LMICs, health systems can suffer from inadequate human and financial resources, lack of availability and suboptimal quality of commodities, inequitable resource allocation, and lack of accountability mechanisms. These factors tend to be exacerbated in humanitarian contexts.
- Evidence is mixed regarding the impact of maternal mental health interventions (e.g., relaxation therapy, cognitive behavioural therapy, social support) on maternal and infant nutrition outcomes and behaviours such as breastfeeding. More research on effective screening tool(s) and interventions is needed, including in humanitarian contexts where women are likely to be at greater risk.
- Integration of maternal nutrition within health services is currently lacking; ANC services are well established within health systems, but more focus on nutrition is needed both postnatally and for non-pregnant women and girls.

The nutrition of adolescent girls and women is integrally linked with the provision of health services. Studies have shown associations between receiving ANC and wasting in PLW/G, as well as risk of LBW deliveries (187). Health services provide an important contact point for nutritional assessment, counselling and referral when necessary, and for delivery of the majority of nutritional interventions (see **section 3.2.3** for more information on the integration of nutrition services into health systems). However, health systems in LMICs can suffer from inadequate human and financial resources, a lack of availability and suboptimal quality of commodities, inequitable resource allocation, and a lack of accountability mechanisms (188). In humanitarian contexts, these problems are often exacerbated (189-195).

WHO outlines a range of **communicable disease interventions** for women, especially in the antenatal period (10). In humanitarian contexts, communicable disease prevention and treatment are largely limited to ANC services only, although vaccinations and malaria treatment programmes for women and children are also sometimes available (196).²⁶

Regarding **NCDs**, there are several guidance documents in circulation for their prevention and control: all are based on WHO's Global Action Plan (GAP) for the Prevention and Control of NCDs (2013-2020) (197-199). These guidelines mention the importance of healthy diets: particularly the need to reduce salt and fat intakes, to consume more fruit and vegetables, and to eat more plant-based foods. However, the evidence base that informs these guidelines is largely from high-income settings (200, 201). More research is becoming available on the delivery of NCD interventions for women and children globally, including in humanitarian contexts; however, the studies to date are mostly observational (202, 203).

3.2.1 Maternal mental health and psychosocial support

Several reviews have focused on interventions for improving infant nutritional status via maternal mental health interventions (28, 204, 205). Five studies have indicated that **relaxation therapies** while breastfeeding appear to improve breastfeeding outcomes and milk yields (205). One further study found that when mothers were provided with a relaxation therapy audio-recording to listen to while breastfeeding this resulted in significantly reduced stress scores and cortisol levels, and their infants had greater milk intake, greater weight gain and longer sleep durations (206). Likewise, there is promising evidence that **cognitive-behaviour therapy-based interventions** provided by community health workers (CHWs) to pregnant women can effectively reduce depression at three months postpartum and at one-year follow-up. However, there was little evidence for impact on infant weight gain or linear growth (28).

A 2019 Cochrane review assessed the effects of programmes offering additional **social support** (emotional, instrumental/tangible, and informational) compared with routine care for pregnant women believed to be at high risk of giving birth to babies that are either preterm (less than 37 weeks' gestation), or weigh less than 2500g, or both, at birth. Key points include the following:

- They found just 25 studies.
- They concluded that women who received additional social support during pregnancy may be slightly less likely to have a baby with LBW (16 studies), or give birth too early (14 studies).
- The number of babies who died around the time of birth was similar for both groups of women (15 studies).
- Women who received the additional social support were, however, probably less likely to be admitted to hospital during their pregnancy (four studies), or to have a caesarean birth (15 studies).
- Women with additional social support may be less likely to be depressed (one study).
- The review concluded that, while programmes that offer additional social support during pregnancy are unlikely to have a large impact on the proportion of LBW or pre-term infants, they may be helpful in reducing the likelihood of caesarean birth and antenatal hospital admission (207).

Humanitarian and crisis situations

People living in countries affected by conflict or fragility are known to be at risk of increased psychological distress and mental health disorders. A 2019 review considered effectiveness and delivery of mental health interventions in conflict settings (208) and found that most of the literature is on mental health interventions targeted at children: very few studies have documented interventions targeted at women (26/157 studies identified). Psychosocial support was the most frequently reported intervention delivered to all study populations, followed by training interventions and then by screening (for referral/with intention to treat). The delivery of counselling, creative arts therapy and psycho-educational interventions were also reported relatively frequently.

²⁶ The United Nations Population Fund have produced a Minimum Initial Service Package for Sexual and Reproductive Health, which outline lifesaving activities to implement in humanitarian contexts, available at <https://www.unfpa.org/resources/minimum-initial-service-package-misp-srh-crisis-situations>

Several types of therapy, including eye movement desensitisation and reprocessing (EMDR), mind-body techniques and group interpersonal psychotherapy, were reported with similarly low frequency. Very few studies reported effectiveness outcomes for interventions targeting women; however, there was evidence of some success in regard to depression, anxiety and sadness scores following psychosocial support interventions (209, 210). Some reported barriers to delivering mental health interventions in humanitarian emergencies have been described, including, access to and security of target populations, language and culture, and inadequate infrastructure. Combining mental health interventions with other sectors could potentially improve their reach: for example, in 2006, WHO recommended integrating psychosocial stimulation for children into humanitarian feeding programmes, yet few studies have evaluated the impact of such combined interventions in humanitarian settings (211).

Despite the lack of high-quality evidence, some guidance for mental health support in humanitarian settings is in place. Psychosocial support for mothers tends to be combined with psychosocial stimulation for children or breastfeeding counselling interventions. The Inter-Agency Standing Committee (IASC) 2007 guidelines recommend that care for caregivers in humanitarian contexts involve the provision of safe spaces for caregivers to meet, support each other and discuss strategies for optimal childcare and other concerns. In addition, the guidelines recommend that referral options for additional support for carers with signs of depression or severe mental health problems should be provided (212).

3.2.2 Breastfeeding care and support

Not only does breastfeeding have benefits for infants, but it also benefits the health of the mother, as well as the mother-infant bond. Increased breastfeeding has been shown to protect against breast cancer, improve birth spacing and have probable positive effects on the risk of ovarian cancer and type 2 diabetes (213). While the importance of breastfeeding is well-recognised, exclusive breastfeeding rates are suboptimal across the globe, both in high-income countries as well as LMICs.

There are numerous activities that can support breastfeeding practices, including breastfeeding promotion, counselling, education, and peer support groups, with research showing mixed effectiveness of these interventions on breastfeeding practices. The impact of any of these interventions is highly dependent on how the intervention is designed and implemented, with factors such as having well-structured modules, increased frequency of intervention and having fathers as peer supporters being important determinants of success (214). Relaxation therapy is a new but increasingly promising method to support breastfeeding practices, as it has been shown to reduce maternal stress and anxiety, increase milk yield and fat levels, and possibly increase infant growth (205, 206) (see **section 3.2.1** above).

In humanitarian contexts the associated practical and psychological factors make appropriate breastfeeding particularly challenging, and the alternatives (formula or early introduction of complementary foods), particularly risky. Thus, the Infant Feeding in Emergencies (IFE) Core group was established in 1999 to address gaps in policy, guidelines and resources (**Box 18**). It has developed Infant Feeding in Emergencies Operational Guidance (150) (updated in 2017) to provide concise practical guidance for humanitarian settings. Key guidance includes the following:

- a. Appropriate assessment of breastfeeding challenges.²⁷
- b. Provision of a package of breastfeeding support services.
- c. Support for safe and appropriate alternative feeding (e.g., formula feeding) where required for non-breast-fed infants and children.
- d. Promotion of the International Code of Marketing of Breastmilk Substitutes, subsequent relevant WHA resolutions and national law on the marketing of breastmilk substitutes, where it exists.

²⁷ Including breastfeeding spaces if required, counselling services integrated into ANC and PNC, family planning and maternity services, and mother-to-mother breastfeeding support.

Box 18: IFE Core Group

- The IFE Core Group is co-ordinated by ENN and comprises both individuals and agencies, including organisations such as WFP, the United States Agency for International Development (USAID), Save the Children, Global Nutrition Cluster, UNICEF, WHO, World Vision, Concern and Médecins sans frontières.
- The IFE Core Group does not directly implement programmes but rather builds capacity for effective infant and young child feeding in humanitarian contexts through the development of guidance, resource materials and shared experience. More information is available at <https://www.ennonline.net/ife>

3.2.3 Integration of nutrition services within the health system

In LMICs, nutrition interventions targeting women and girls, such as micronutrient/food supplementation programmes, nutrition education and counselling, and food fortification (215), have the potential to substantially improve adolescent girls' and women's nutrition outcomes if delivered at scale. However, current evidence suggests suboptimal coverage across LMICs (216, 217). Effective integration and scale-up of nutrition services within existing health systems would improve their efficiency and uptake, with resulting improvements in the health outcomes of adolescent girls, women and children. Evidence indicates that broad, whole-systems approaches (218) that carefully consider context-specific factors (219) are integral to the success and sustainability of such integration. In the past, many efforts to scale up and integrate nutrition services into public health systems have been observed. Key examples of this include integration of prevention of mother-to-child transmission (PMTCT), HIV and reproductive health services, and community-based management of acute malnutrition (CMAM) services (**Box 19**). It can be useful to consider WHO's six building blocks of a health system (220) (**Box 20**) when assessing the success of current integration efforts and areas to focus on in the future.

Box 19: Examples of successfully integrated health interventions

- Community-based management of acute malnutrition (CMAM) (Akwany et al. 2021) (221):
- Globally, many successful examples of the integration of CMAM into health systems exist, with Pakistan, Ethiopia and Kenya being just some of the countries demonstrating the effective employment of CHWs.
- This intervention has been integrated into many health systems, with national bodies having set aside budgets to increase support and training for CHWs, thus boosting the nutrition workforce that is delivering CMAM at scale.

Prevention of mother-to-child transmission of HIV (Kiragu et al. 2017) (222):

- Integrating this intervention with maternal, newborn, and child health-related services across 21 global high-priority countries has resulted in improved coverage, quality and accessibility of services.
- Evidence from several countries indicates that integration of PMTCT reduced stigma and discrimination around HIV, while the success of programmes also prompted a number of governments to develop policies and guidance for national scale-up.



Photo credit: ©WFP/Lina Al Qassab

Box 20: WHO health systems framework (WHO, 2007) (220)

1. **Service delivery** – delivering safe, effective, quality personal and non-personal interventions to those who need them, where and when they are needed and with minimal waste of resources.
2. **Health workforce** – working in responsive, efficient and fair ways to achieve the best possible health outcomes with the given available resources and circumstances.
3. **Health information** – ensuring production, analysis, dissemination and usage of timely and reliable information on the determinants of health, health systems performance and health status.
4. **Medical products, vaccines and technologies** – ensuring access to essential vaccines, medical products and technologies that are of assured quality, safety, cost-effectiveness and efficacy, and that are scientifically sound.
5. **Health financing** – raising adequate funding for health, using methods that ensure people can use needed services, and are protected from impoverishment or financial catastrophe associated with having to pay for them.
6. **Leadership and governance** – ensuring that strategic policy frameworks exist and are paired with effective coalition-building, oversight, provision of regulations and incentives, attention to system-design and accountability.

To date, many efforts to integrate and scale-up nutrition services within public health systems have been observed. For example, in the Asia and the Pacific region, BEP supplementation programmes targeting women and girls (15-49 years) are being delivered through government integrated child development services, and in some instances through primary healthcare systems (223, 224). In Southeast Asia and the western Pacific region, many countries have reported incorporating targets related to maternal nutrition into national health policy (223). Similarly, iron, folic acid and vitamin A food fortification programmes are tied to state policies, which govern their supply through targeted public distribution systems (225, 226). **Box 21** describes the MAMI Care Pathway Package, which provides further resources for integrating nutrition services within existing health systems.

Box 21: The MAMI Care Pathway

The MAMI Care Pathway Package (227) provides practitioners with a resource to screen, assess and manage small and nutritionally at-risk infants under six months and their mothers (MAMI). It is managed by the MAMI Global Network and accompanied by an active learning agenda to capture implementation experiences and build evidence of impact. Its aim is to help put the latest WHO technical guidance into practice, fill implementation guidance gaps and strengthen continuity of care across infant and maternal health and nutrition services. It is modelled on the WHO Integrated Management of Childhood Illness (IMCI) guidelines and is designed to embed within this established child health approach. It contains resources and support materials for adaptation to different contexts, systems and services, to support training, and to guide high-quality context-specific service provision. Mother MUAC less than 230mm is included as independent criteria for moderate risk classification of the mother-infant dyad.

Indeed, research suggests that integration across various health platforms, including ANC, reproductive and sexual health, and adolescent health services (228), increases the accessibility of nutrition services, particularly when combined with community outreach initiatives (222). Adolescent health services play a vital role in reaching girls and young women (36), with a particular focus on anaemia prevention via IFA supplementation (155). For example, the Government of India has implemented routine supplementation through the School Anaemia Control programme and through adolescent-friendly health clinics (224). Although research regarding nutrition service integration into reproductive health services is limited there is some evidence of successful integration of IFA supplementation into these services, sometimes delivered by CHWs (229, 230). ANC services have been essential for the effective delivery of nutrition programmes, with nutrition counselling/education and micronutrient supplementation integrated into most ANC services and delivered via government health facilities, state hospitals or health clinics (231-233).

Beyond the facility-level, CHWs can also play an important role in delivering multi-sectoral interventions, including nutrition. If adequately enabled and supported, they can be in a position to close the gap between nutrition services (e.g., supplementation and nutrition counselling/ education programmes) and the communities who need them (234, 235).

However, many barriers to integration have also been documented, including: a lack of training and shortage of healthcare staff; poor mechanisms for large-scale supervision and support of CHWs; and a lack of coordination among various directorates or departments within ministries of health (219, 236). The literature also highlights a lack of nutrition-specific policies surrounding women and girls, and the need to expand policies and strengthen existing national guidelines in order to facilitate more comprehensive and effective integration.

3.3 Social protection programmes

Key messages

- In general, there are insufficient indirect nutrition interventions for women and girls.
- More evidence is needed to inform the development of multi-sectoral programmes across health, social protection, education and agriculture that prioritise nutrition for women and girls in their own right.
- While the supply and intake of micronutrients has increased globally, this has not necessarily equated to higher intakes by women, particularly in countries where gender inequalities influence intrahousehold food distribution.
- The links between gender empowerment and women's nutrition are, for the most part, missing, within both guidelines and programming efforts.
- While numerous interventions linking climate change to agriculture exist, they often fail to consider specific impacts on women who are likely to be most affected by climate-related impacts on food security and nutritional status.

Social protection programmes have become instrumental in regard to influencing public health in a number of regions, with their adoption primarily driven by governments' willingness to make direct payments to vulnerable populations (237). The expansion of social protection programmes, such as vouchers and cash transfers, into humanitarian contexts is a newer phenomenon, but they are increasingly being used, with 17.5% of international assistance comprising cash and vouchers as at June 2020; this is double the amounts provided in 2016 (238).

Social protection covers a wide range of policies and programmes that enhance the capacity of poor and vulnerable people to escape poverty and better manage risks and shocks (239). These include social insurance, social assistance programmes (SAPs) and minimum labour standards (239). Due to the large scope of social protection programmes, we focus here primarily on the impact of SAPs. SAPs come in the form of direct, regular and non-contributory social transfers, and include cash, voucher or in-kind transfers (key definitions are provided in **Box 22**). Cash and vouchers are referred to as cash-based interventions (CBIs) from here onwards (237).

“Social protection covers a wide range of policies and programmes that enhance the capacity of poor and vulnerable people to escape poverty.”

Box 22: Definitions of SAPs: in-kind, vouchers and cash transfers

- **In-kind assistance** refers to support outside of monetary contributions. This includes the provision of goods (both food and non-food items) and services.
- **Vouchers** can be exchanged for fixed quantities of specific items (food, non-food items or a service) or for cash value (exchangeable for a choice of specified food or non-food items with the equivalent value of the voucher) (240).
- **Cash** is a direct payment of money to those within a programme's target population. Cash transfers can be **unconditional** or **conditional**.
 - For conditional cash transfers beneficiaries must meet pre-defined criteria, such as attending health services to receive the transfer.
- **Cash for work** is when cash (or sometimes vouchers) is given to recipients in exchange for temporary unskilled employment (241).
- **Cash+** is when cash transfers are combined with other agricultural, health or social activities to help maximise the benefits of the transfer (241).

For more information on the debate surrounding whether in-kind, vouchers or cash transfers (unconditional vs. conditional) are most effective at achieving nutritional outcome in women and adolescent girls, see **Appendices 4 and 5**.

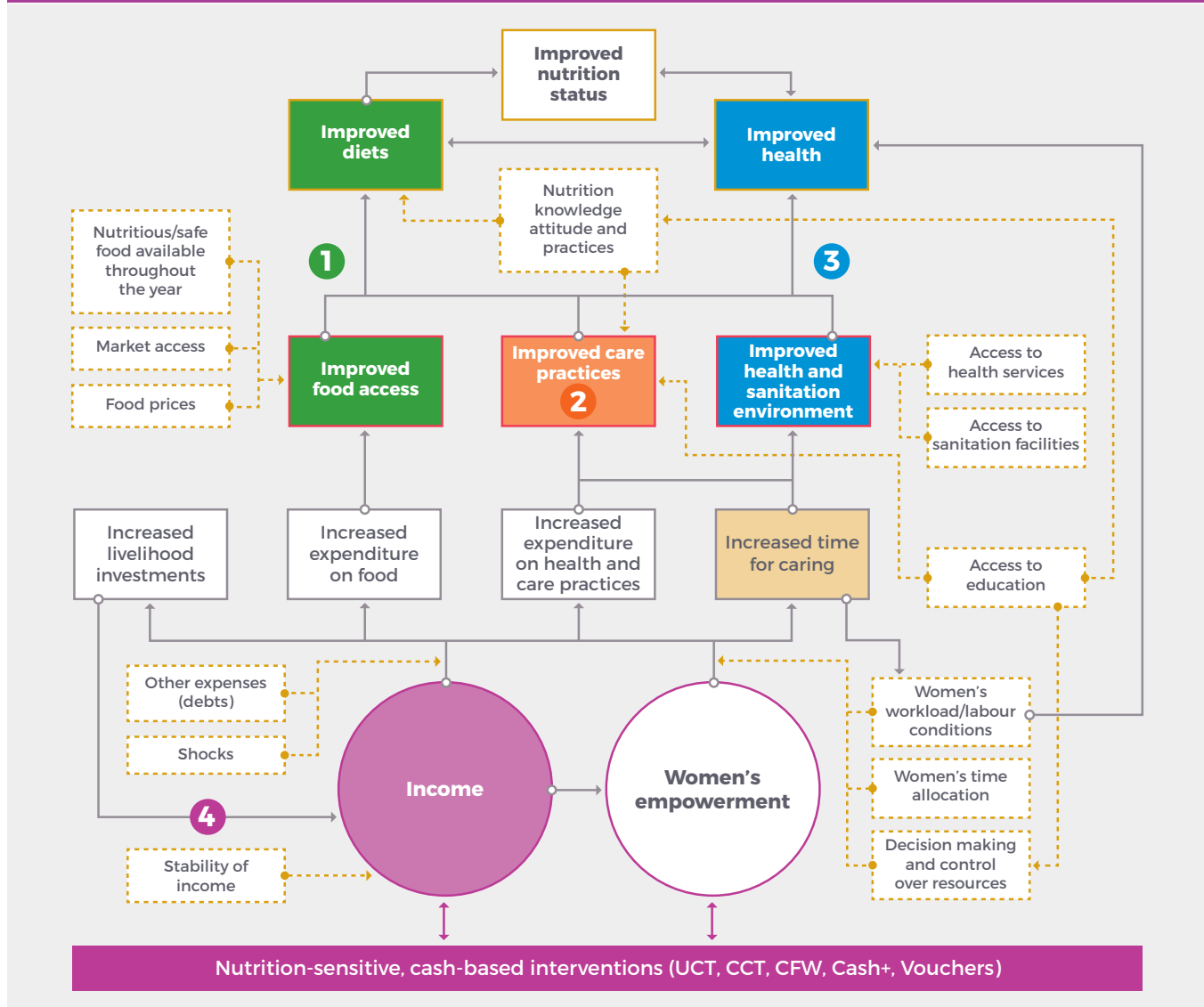
The pathways between SAPs and nutrition outcomes are complex and context-specific, reinforcing the need for tailor-made programmes that carefully consider each of the potential pathways leading to the desired outcomes. However, there is a dearth of evidence on the impact of SAPs on nutrition of women and adolescent girls, with the available studies showing mixed effects on anthropometric outcomes (242-247). Classified as a nutrition-sensitive interventions, the main objective of SAPs is to address the underlying determinants of foetal and child malnutrition, and therefore most studies are generally not sufficiently powered to detect meaningful changes in nutrition outcomes of women and adolescent girls. There is more available evidence supporting a positive impact on women's dietary diversity (242, 243, 245-251) and other pathways within the causal framework outlined in Figure 1. However, drawing meaningful conclusions from existing literature is complicated by the wide range of programme designs, objectives and indicators used (237, 240, 252-254).

Below we summarise the evidence regarding how SAPs may affect some of the key pathways to nutrition outcomes in **Figure 1**. However, it should be noted that a positive impact along the causal pathway (e.g., improved access to diets) does not in itself guarantee improvements in the nutritional status of women and adolescent girls.



Photo credit: ©WFP/Boris Heger

Figure 1: Potential impact pathways from cash-based interventions to nutrition



Source: FAO (2020). Nutrition and cash-based interventions – Technical guidance to improve nutrition through cash-based interventions. FAO, Rome (241).

Improved food access: Arguably, the strongest evidence for a link between SAPs and maternal nutritional status is through improved access to food. The majority of studies to date suggest CBIs can increase household food expenditure and meal frequency for PLW/G (193, 237, 240, 247, 254, 255), although this evidence is weaker in humanitarian contexts (244, 253). There is also consistent evidence that CBIs can increase purchasing power, with some studies suggesting associated reductions in income inequity (237, 255, 256). In-kind transfers work through similar pathways by increasing calorie consumption (253, 257, 258) while also relieving household budgetary constraints.

However, where increased demand for food is not met with sufficient supplies, cash transfers have been reported to increase local food prices (259). Furthermore, studies from Latin America, where there is already a high prevalence of overweight and obesity, have found that SAPs can have a negative impact on maternal BMI due to increased consumption of energy dense products, raising important questions about the types of food provided through in-kind transfers and the communication strategies surrounding CBIs (248, 260-262).

Improved care practices: There is some evidence showing cash transfers can increase maternal health knowledge when transfers are complemented with education (260, 263, 264). However, there is minimal evidence on whether these knowledge gains translate into improved nutrition-related practices. Evidence suggests that cash transfers can also reduce burdens on women's time by reducing the need to engage in income-generating activities or traditional food procurement, which may improve caring practices (254, 255, 265). In contrast, other studies suggest an increase in time burdens for women, who often have to procure the transfer (265).

Improved health and sanitation environment: Some studies suggest that CBIs can increase the utilisation of health services, including maternal health services, as the transfers help overcome direct and indirect costs (e.g., transport) associated with accessing services (251, 254, 255, 263, 265, 266). The evidence is mixed, however. For example, a Cochrane review (2017) found that the impact of unconditional cash transfers may not have a meaningful effect on the likelihood of using any health services. However, the review did find a positive impact of unconditional cash transfers on household health expenditure (267).

The impact of CBIs on final health outcomes (e.g., incidence of illness), is more limited. There is some emerging but inconsistent evidence that cash transfers may reduce adult depression (265, 267). There is also limited evidence from Mexico's *Oportunidades* programme (which utilised conditional cash transfers) that CBIs may reduce maternal mortality (268). A review by UNHCR found that CBIs were most successful when integrated into a comprehensive programme that addressed all barriers to health access, with health service quality and availability being pre-determining factors for success (252).

Increased livelihood investments: Literature describes that CBIs can lead to increased investments in agricultural inputs such as livestock (255, 269, 270). Increased productive assets, in turn, can increase income and household resilience to shocks. Women's empowerment (**section 3.6**) is an essential component in ensuring generated income leads to the improved health and nutrition of women and of their children.

CBIs are often targeted at women, with the hypothesis that they are more likely than men to invest transfers directly in their children's health and nutrition. Again, whether this translated into improved nutritional outcomes is yet to be fully established (240, 255).

Robust evidence from Latin America shows that cash transfers can increase women's participation in household decision-making (237, 260, 271-273). Barber and Gertler (2010) hypothesised that improvements in prenatal care and subsequently birth weight could be due to the fact that Mexico's *Oportunidades* programme empowered women to demand better health care (251, 274). Evidence for Latin America also shows the potential of SAPs to reduce domestic violence (237, 255, 258, 275-277). However, increasing women's control of resources does not necessarily guarantee positive outcomes, as cash transfers have been shown in some contexts to increase conflicts over household resources (237, 255, 272, 276).

It has also been suggested that targeting women with CBIs can reinforce negative stereotypes that women are solely responsible for the social reproduction of the household, especially if the CBIs are conditional on aspects such as a child's school attendance or immunisation status, and if the programme does not address intra-household relationships (237). Beyond cash transfers, policies aimed at supporting women's economic participation through initiatives such as quotas have experienced similar shortfalls, with studies finding they often focus on low-paid and unskilled jobs, rather than upskilling women for higher paid positions (237).

Overall, data are lacking on the impact of SAPs on nutritional outcomes of adolescent girls and women. Despite commitments made under the Grand Bargain²⁸ to realign programme reporting, a lack of robust and consistent monitoring and evaluation mechanisms for SAPs persists.

²⁸ The Grand Bargain is an agreement between several donors, member states, United Nations agencies, non-governmental organisations, Red Cross movements and inter-governmental organisations, committing to improving the effectiveness and efficiency of humanitarian action so that aid reaches those who most need it.

3.4 Education and counselling

Nutrition education is commonly used in development and humanitarian contexts, often targeting PLW/G. WHO recommends nutrition counselling as part of both ANC and PNC, with participatory learning and action (PLA) in women's groups specifically recommended by WHO's ANC guidelines (10, 278) (**Box 23**). PLA in women's groups has the potential to reduce maternal mortality and improve maternal anthropometry, dietary diversity and health knowledge (279-281), as well as reduce neonatal mortality (279, 281). However, there is a lack of consistency in the impacts across the studies, and some find no impact of PLA on important intermediary outcomes, such as ANC attendance and early initiation and exclusive breastfeeding (282).

Box 23: Participatory Learning and Action

This is a form of behaviour communication change that involves active participation of community group members, typically in four phases:

Phase 1: Identification and prioritisation of the problems facing the group members.

Phase 2: Planning solutions that are feasible and sustainable, addressing the priority problems.

Phase 3: Implementing solutions.

Phase 4: Assessing how the activities have gone and translating the lessons learnt into future planning.

WHO's ANC guidelines recommend counselling on the need for increased daily energy and protein intakes in undernourished populations, to reduce the risk of LBW deliveries (10) (**section 1.5**) – a recommendation backed up by evidence (131, 283). Community-based health education has also been shown to improve ANC attendance and breastfeeding initiation, and to reduce the risk of perinatal and neonatal mortality, with interventions being more effective when including other family members (284). Furthermore, attending women's groups has been shown to reduce neonatal mortality (284, 285), with interventions being effective for women across all socio-economic strata (285).



Photo credit: ©WFP/Martin Karimi

Peer support groups and home visits/counselling (separately or combined) have not yet shown a consistent impact on child wasting (no data for home visit/counselling), stunting or underweight (286). However, involvement in peer support groups may potentially improve minimum dietary diversity and minimum meal frequency for children (286), and combined home visits/counselling interventions may also positively impact breastfeeding outcomes (286).

Alternative approaches to traditional methods of education, such as use of mobile technologies (e.g., mHealth), have gained traction with the rising availability of mobile phones. mHealth has been shown to encourage the use of micronutrient supplements in pregnancy (287) and may improve health practices when compared to situations where no messaging is received (288). However, impacts on other maternal and neonatal nutrition and health outcomes are not clear (287-289). Other alternative approaches, such as nutrition education for adolescents through social media platforms, are currently being explored and show potential (290), although more research on the user-friendliness and utility of such education platforms compared to others is needed.

3.5 Nutrition-sensitive agriculture

Nutrition-sensitive agriculture (NSA) describes agriculture programmes that incorporate specific nutrition goals within their design and monitoring. NSA has gained global attention due to its ability to impact the basic, underlying and immediate causes of malnutrition. Kadiyala *et al.* (2014) have developed a conceptual framework detailing six pathways between agriculture and nutrition, outlined in **Box 24** (291). These pathways comprise direct pathways, which include increased consumption of produce and increased income from produce sales, allowing for procurement of other goods and services. They also include indirect pathways, which explore the impact of agricultural interventions on supply and demand, and women's empowerment, time and working conditions. Many (but not all) of the pathways have been hypothesised to benefit nutritional status. For example, working in agriculture may also have harmful impacts on nutritional status due to exposure to hazardous working conditions and high levels of energy expenditure.

Box 24: Potential pathways between agriculture and nutrition. Adapted from Kadiyala *et al.* (2014) (291)

1. Agriculture as a source of food (food production for own consumption).
2. Agriculture as a source of income for food and non-food expenditures (agricultural income).
3. Agricultural policy and food prices (affecting the affordability of food).
4. Women in agriculture and intrahousehold decision-making and resource allocation (aspects of women's empowerment).
5. Maternal employment in agriculture and childcare and feeding (engagement in agriculture may affect ability to manage childcare).
6. Women in agriculture and maternal nutrition and health status (considering the hazardous aspects of agricultural labour).

NSA programmes incorporate a variety of activities: for example, enhanced homestead food production biofortification programmes, such as the introduction of orange flesh sweet potato in Uganda to improve vitamin A consumption (292), irrigation programmes, nutrition-sensitive value chains and livestock rearing.

To date there have been two particularly influential reviews of the impacts of NSA on the nutritional status of women and children. The first was published in 2013 (293) and was subsequently updated in 2018 due to the escalating amount of evidence on the topic (294). The 2018 review highlighted the potential of NSA interventions to improve household dietary diversity and micronutrient intakes, and to increase consumption of animal-source food, fruits and vegetables. However, much of the evidence came from observational studies and the limited data from interventions often overlooked maternal nutrition outcomes. Of the studies that did explore maternal nutritional status, two documented an improvement in regard to maternal anaemia and underweight (295, 296).

The 2018 review called for greater inclusion of maternal nutrition outcomes in future research, as well as better measurement of food security, women's nutrition knowledge and practices, and dimensions of women's empowerment (e.g., decision-making power, social status, time in agriculture, control over assets), to better understand pathways to impact. The need for adequate assessments of the cost-effectiveness and scalability of NSA interventions was also acknowledged (294). Since the 2018 review a small number of NSA intervention studies have been conducted, although, again, their focus has been largely on children's outcomes. **Box 25** provides examples of recent NSA programmes showing positive impacts on maternal nutrition outcomes.

Box 25: Examples of two recent NSA intervention studies that have shown an impact on women's nutritional status

- In Cambodia a longitudinal, three-arm cluster-RCT looked at the impact of either enhanced homestead food production (EHFP), EHFP plus aquaculture, or a control, over 22 months of implementation (297). The agricultural interventions included agricultural inputs (e.g., seeds, seedlings, family tools) and training. The EHFP plus aquaculture arm received training to build fishponds and fish-raising inputs. There was also a nutrition-specific element that considered behaviour change communication on nutrition and hygiene focusing on optimal nutrition for women and infant and young child feeding. In women the following nutrition-related outcomes were considered: haemoglobin concentration, BMI, vitamin A status (serum retinol binding protein (RBP)), iron status (serum ferritin and soluble transferrin receptor), and inflammation (using two acute phase proteins). There was an increase in vitamin A status in the EHFP plus aquaculture arm (RBP difference-in-difference 0.34; $p=0.02$). There were no other impacts on anaemia, nutritional biomarkers, or anthropometry.

In a separate study looking at the same programme and data but focusing on dietary intakes (298), it was found that women in the EHFP and EHFP plus aquaculture arms had higher zinc and Vitamin A intakes compared to the control arm. Furthermore, women in the EHFP plus aquaculture arm also had significantly higher iron and riboflavin intakes. There was no detected impact on energy (kcal/d), protein, fat, calcium, or thiamine intake.

- In India the Upscaling Participatory Action and Videos for Agriculture and Nutrition (UPAVAN) Trial clusters of villages were randomised to one of four arms for over 32 months of implementation (299):
 1. women's groups meetings and household visits, occurring each fortnight using NSA videos (AGRI group).
 2. as above, but combining NSA and nutrition-specific videos (AGRI-NUT group).
 3. fortnightly women's groups meetings using NSA videos and a nutrition-specific PLA cycle meetings and videos (AGRI-NUT+PLA group).
 4. control group (no intervention).

Compared with the control group there was an increase in the proportion of mothers consuming at least five of 10 food groups in the AGRI (adjusted relative risk 1.21; 95% CI: 1.01 to 1.45) and AGRI-NUT+PLA (adjusted relative risk 1.30, 95% CI: 1.10 to 1.53) groups compared with the control group, but not in AGRI-NUT. There were no effects on mean maternal BMI. The authors concluded that women's groups using combinations of NSA videos, nutrition-specific videos, and PLA cycle meetings improved maternal diet quality in rural Odisha state of India. Future efforts could therefore consider integrating similar interventions within larger scale, multisectoral programmes.

“Working in agriculture may have harmful impacts on nutritional status due to exposure to hazardous working conditions and high levels of energy expenditure.”

3.6 Women's and adolescent girls' empowerment

Gender equality and the empowerment of women and girls are a fundamental human right, and mutually enforce the right to adequate food. Empowering women is one of the most effective ways to improve nutrition outcomes, both for women themselves and for other members of the household, helping to break intergenerational cycles of malnutrition. Critical importance has been placed on the empowerment of women and girls, emphasised as being essential to achieving all 17 SDGs. Within the 2021 United Nations Food Systems Summit gender equality and women's empowerment was one of the four 'Levers of Change',²⁹ with a specific focus on seven priority topics.³⁰ However, discriminatory barriers and limiting societal and cultural gender norms and expectations, together with continuing gender inequalities and exposure to violence, continues to prolong unequal access to food, resulting in a higher prevalence of food and nutrition insecurity among women and girls (300). At the global level, the gender gap in accessing food increased from 2018 to 2019 (301), and this is expected to widen further due to the negative and disproportionate gender impacts of the COVID-19 pandemic on household food security and nutrition (302). In addition, the pandemic has increased the work burden of women, now needing to care for sick household members along with children at home due to school closures.

Empowering women links the strengthening of food systems with combatting hunger and malnutrition. Women have active roles throughout food system value chains as farmers, producers, processors, traders, wageworkers and entrepreneurs. With the same access as men to agricultural resources, it has been estimated that women in developing countries could increase total agricultural output by 2.5% to 4%, potentially reducing the number of undernourished people globally by 12% to 17% (303). This becomes even more urgent given recent estimates that over 50% more food will be needed to feed a growing population, which is estimated to reach almost 10 billion in 2050 (304).

Despite the increasing number of interventions incorporating (differing) domains of women's empowerment, the relationship between women's empowerment and women's nutrition (including adolescent girls) is understudied (305). However, there are more studies available examining the relationships between women's empowerment and child nutrition. Here the evidence is mixed, with limitations in study designs meaning it is difficult to draw firm conclusions regarding underlying relationships (306).

It is clear that capturing the relationship between women's empowerment and nutrition is not easy. Women's empowerment is a complex, multidimensional and context-specific concept, with definitions and measures that are often inadequately communicated and interpreted (307). This has led to a wide range of interventions and programmes, with often contradictory outcomes.

29 A Lever of Change is understood as "an area of work that has the potential to deliver wide-ranging positive change beyond its immediate focus". See <https://www.un.org/en/food-systems-summit/levers-of-change>

30 Seven areas of (in)equality cut across the priority areas of the United Nations Food Systems Summit: equal rights to land, economic empowerment of women in food systems, unpaid care and agricultural labour burden, women's leadership in food systems, access to technologies, changing norms and addressing institutional barriers, and gender-responsive agricultural and food systems policies.



Conclusions

“Navigating and finding the latest guidelines on nutrition for adolescent girls and women is challenging. There are no guidelines that bring together all of the nutrition recommendations for adolescent girls and women.”

4 Conclusions

Malnutrition disproportionately affects women and girls, with more than 1 billion women experiencing at least one form of malnutrition. While women and girls may have a biological vulnerability to certain forms of malnutrition – for example, anaemia – there are also a number of economic, social and cultural factors which contribute to gender inequalities and result in limited access to good nutrition for women. Currently, there are global targets aimed at reducing maternal mortality, reducing prevalence of anaemia in WRA, and addressing the nutritional needs of PLW/G. With a view to achieving these targets, key guidelines that include the nutrition of adolescent girls and women are: the WHO 2016 ANC guidelines, covering dietary advice, BEP supplementation for undernourished populations, and appropriate micronutrient supplementation; the WHO 2013 PNC guidelines, focusing on IFA supplementation and nutrition counselling; and a number of United Nations nutrition guidelines for populations in humanitarian contexts which include women and girls. However, there are no guidelines that bring together all of the nutrition recommendations for adolescent girls and women. In addition, guidelines are not routinely updated to ensure that they remain relevant and reflect the latest evidence. Guidelines for humanitarian contexts are particularly piecemeal.

While the coverage of nutrition interventions for adolescent girls and women is largely not well-documented, a number of interventions exist. These include direct nutrition interventions, such as macronutrient and micronutrient supplementation,



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and food fortification; and indirect interventions, such as nutrition education and counselling, social protection programmes, sexual and reproductive health services, treatment/management of communicable and non-communicable diseases, mental health services, breastfeeding support, NSA, and women's empowerment interventions. However, much of the evidence on these interventions focuses on the health benefits for infants and children, with evidence on the nutrition and health outcomes of women often being absent or insufficiently powered to draw conclusions. Multi-sectoral programmes and those that are integrated into national health systems are likely to have the greatest impact and the widest coverage.

While this paper has summarised a large amount of evidence and guidance for improving maternal nutrition, we have also highlighted a number of existing gaps, and we make recommendations for how progress in this area can be improved in the following section.

Limitations of paper

Due to the broad scope of this technical brief, it was not feasible to adopt a systematic review methodology for the narrative. While literature searches were as comprehensive as possible within the time constraints, there may be individual papers that were missed. Furthermore, there are topics that were not able to be fully considered in this paper, but that would merit inclusion in an expanded paper. For example, these include the role of education, expanded sections on nutrition counselling, a more detailed investigation of gender parity, and capturing further dimensions of mental health and wellbeing. Many countries have their own national guidelines to inform nutrition programming for women and adolescent girls, and it was beyond the scope of this paper to review these; instead, we focused on international guidelines. Regarding the latter, WHO guidelines were prioritised, and there may be other United Nations-authored international guidelines that have been overlooked. Furthermore, while some key grey literature was included in the main narrative, and some was further compiled in Appendix 1, it was not possible to comprehensively capture the wealth of grey literature that exists on the topics covered.



Key gaps and recommendations

“In humanitarian settings, provision of a minimum package of reproductive health services at the initial stages is essential.”

5 Key gaps and recommendations

The following gaps and recommendations are presented in the order of the themes discussed in the paper. The recommendations are aimed at researchers, donors and policymakers who can influence the evidence-base and the current guidelines.

1 Navigating and finding the latest guidelines on nutrition for adolescent girls and women is challenging

Gap: The guidelines pertaining to maternal nutrition are piecemeal and spread across several United Nations agencies and topics, such as ANC and PNC, and humanitarian contexts. There is no single location where the various guidelines linked to maternal nutrition can be found, and where the latest versions are highlighted. In addition, not all guidelines reference each other, despite containing similar information (though sometimes differing guidance), on the same topic.

Recommendation: A repository or website is needed that collates the latest guidance for maternal nutrition. Updated guidelines need to ensure that other relevant United Nations documents are accurately referenced. Ideally, going forward, it would be helpful to have a synthesis of key recommendations for women's nutrition across pre-conception, pregnancy and post-natal stages.

2 There is a lack of evidence and guidance on pre-conception nutrition

Gap: We know that the nutrition of women and girls should be optimised before conception to effectively influence intergenerational change. However, the vast majority of policy and programming focuses on nutrition in pregnancy. Only by improving the nutritional status of all girls and women of reproductive age can we ensure that the critical periconceptional period will be covered.

There is a particular lack of nutrition programming and policy for adolescents. Adolescence is a key period of growth and development and access to effective sexual health education and contraception for young girls is essential. Adolescence is an important pre-conception window for influencing the health and life course of future offspring. Preventing early marriage and adolescent pregnancy has significant positive effects on girls' health, as well as having a major impact on LBW incidence.

For those adolescent girls who do become pregnant, lack of access to ANC, physically and socially, leads to even greater risk of maternal mortality and morbidity, and adverse birth outcomes.

Recommendation: Global targets, indicators, policies and programmes need to put greater emphasis on ensuring optimal health and nutrition of non-pregnant girls and women, given the importance of pre-conception nutrition, preventing adolescent pregnancies, and the potential for maximising growth and development during adolescence. The current widespread application of universal health coverage provides an opportunity to offer nutritional counselling, reproductive health advice, parenting support and psychosocial support interventions within primary health care settings. Services for adolescents need to be tailored to their specific needs and made accessible; this can be achieved through greater consultation with adolescent girls themselves. There would be particular benefit to adolescent girls from the development of policies enhancing health equity, gender equity, human rights and poverty reduction.

In humanitarian settings, provision of a minimum package of reproductive health services at the initial stages is essential. This should include nutritional support for pregnant women and girls, access to contraception, and measures to prevent and clinically manage sexual violence. Adolescents should be targeted specifically.

3 Global and national indicators are heavily focused on infant and child outcomes, rather than outcomes for the mother herself

Gap: The lack of indicators for improved nutritional outcomes in women is likely related to the lack of clarity on how to assess some areas of women's nutritional status, female gender disempowerment, and a disproportionate global focus on child health programming.

Recommendation: In addition to infant outcomes, clear indicators, disaggregated for adolescent girls, and pregnant and non-pregnant women are needed as part of global and national targets, in order to measure the effects of interventions on women and to track progress over time. Being able to measure the extent of the problem and its implications also allows for better advocacy which can lead to much-needed increases in financing and political will for improving nutrition outcomes of women and adolescent girls.

4 There is a lack of guidance and clarity on assessing nutritional status of women and adolescent girls

Gap: International guidance, while often mentioning the importance of collecting maternal anthropometry, lacks specifics on how assessments should be carried out. There is also no clear guidance linking the assessment of maternal nutrition to appropriate response packages. Surveys often focus on children aged six to 59 months, resulting in a limited global picture. For example, limited maternal nutrition data are currently included in the Global Nutrition Report, including a lack of routine collection of dietary adequacy indicators (such as minimum dietary diversity). In addition, there is currently no WHO definition of wasting for PLW/G, and different MUAC cut-offs are used in different contexts. There is also a lack of global assessment and monitoring of gestational weight gain, making it more difficult to understand what is normal and what is healthy, as well as when and how to intervene.

Recommendation: Indicators of women's and adolescent girls' diets and anthropometric status need to be clarified by the respective United Nations agencies, including appropriate measures of dietary adequacy, undernutrition and wasting in adolescent girls and women, and guidance on context specific (or universal, if appropriate) MUAC cut-offs for wasting. These indicators should be included in national and global surveys, including the Global Nutrition Report, and linked to programme decision-making. Assessment and monitoring of weight gain during pregnancy and other maternal nutritional indicators must be built into health systems; for example, through platforms that are already in place to monitor infant growth, with action/referral as necessary.

5 Micronutrient supplementation guidelines for women and girls are currently suboptimal and lack implementation guidance

Gap: IFA supplementation is usually delivered to pregnant women via health system ANC visits. It is also recommended for three months postpartum and for all girls and women aged 15-49 years in contexts with high prevalence of anaemia. However, in practice there is limited evidence of IFA supplementation for non-pregnant or recent postpartum women across LMICs. There is also a lack of guidance on how to target and deliver IFA in these instances, and how to ensure that uptake of the tablets is maximised in different contexts.

Recommendation: Implementation guidance on micronutrient supplementation for women and adolescent girls, especially outside of pregnancy, needs to be developed and widely disseminated.

Gap: In ANC guidelines, WHO recommends that MMS, in place of IFA, is distributed for pregnant women in humanitarian contexts, or otherwise in the context of rigorous research. The narrow confines of this recommendation are deemed by others as too cautious, and in other influential documents, such as the *Lancet* (2021) Series on Maternal and Child Undernutrition Progress, a *universal* switch to MMS is recommended. This is causing some confusion for practitioners and policy-makers about which strategy to follow. Additionally, in humanitarian contexts, the recommendation of using MMS can also be difficult to implement if it contradicts national recommendations.

Recommendation: A consultation between organisations/communities of practice holding contrasting views on the use of MMS or IFA in pregnancy should be held to provide policy-makers and practitioners with some clarity and consistent messaging. In the context of humanitarian emergencies, additional guidance should be prepared to help governments and implementing agencies update national protocols to reflect this change in recommendation from IFA supplementation to MMS supplementation.

6 There is a lack of guidance on the targeting, coverage and nutritional content of macronutrient supplements for undernourished women

Gap: There are a number of gaps in the guidelines for macronutrient supplementation for undernourished women. There is no WHO guideline on treating adult moderate and severe wasting (including no anthropometric definition of wasting in adolescents and adults, and no details on the type and content of supplementary food to provide for treating wasted women and adolescent girls). The relatively new guidance to provide BEP to PLW/G in populations with high prevalence of undernutrition lacks detail, lacks implementation guidance, and contradicts or confuses other guidance on the provision of LNS or supplementary foods for wasted PLW/G. There is also a lack of guidance on mitigating risks related to the double burden of malnutrition and non-communicable diseases.

Recommendation: There needs to be one guideline which covers the different appropriate options for macronutrient supplementation in both humanitarian and development settings, and during, and outside, of pregnancy. This should include: a) appropriate indicators for targeting adolescent girls and women (MUAC and/or BMI); b) details on which products to provide in what context and details of their optimal nutritional content; c) implementation guidance for delivering these different interventions and measuring their coverage; and d) guidance on mitigating risks related to the double burden of malnutrition and non-communicable diseases.

7 There is a lack of indirect nutrition interventions for women and there are not enough multi-sectoral programmes

Gap: Women's nutrition programmes do not generally include gender empowerment. While the supply and intake of micronutrients has increased globally, this does not necessarily equate to higher intakes by women, particularly in countries where gender inequalities influence intrahousehold food distribution. The links between gender empowerment and women's nutrition are lacking from guidelines. While this is not a new idea and this concept is well-evidenced, it is still not being mainstreamed into nutrition programming.

Recommendation: Gender empowerment and equity should be mainstreamed into all nutrition programming (both direct nutrition interventions and indirect nutrition interventions, such as those involving agriculture, social protection and climate change programming).

Gap: There is a lack of research, screening tools and intervention packages linking maternal mental health and nutrition. While the associations are clear, there is urgent need for more evidence unpicking the mechanistic links and designing effective screening and intervention programmes in LMICs.

Recommendation: Better integration and interdisciplinary understanding of the links between maternal mental health and nutrition are needed, including mental health being more prominently featured in women's nutrition guidelines, such as the upcoming revision to the WHO PNC guidelines. Programmes targeting infant growth failure provide an opportunity to also identify at risk mothers and target care, benefiting both mother and infant.

Gap: There is a lack of interventions focusing on the impact of climate change on nutrition of women and adolescent girls. While numerous climate and agriculture interventions are taking place, they do not sufficiently consider the specific impacts on women, which largely result in gender inequity. This is especially pertinent as women living in LMICs already face the largest nutrient deficits and are likely to be the most affected by climate-related impacts on food security and nutritional status.

Recommendation: Climate change and climate resilience interventions need to include a specific focus on nutrition outcomes of women and adolescent girls and tackling gender inequity as part of their programmes.

8 There is a lack of integration of nutrition services within health systems

Gap: As with all nutrition services, better integration into national health services will improve the coverage and longevity of interventions. In order to do this, health systems strengthening must ensure sufficient capacity is built for integrating essential nutrition services for women. While ANC is well-established within health systems, better PNC is needed, with a particular focus on nutrition. There is also a need to provide nutrition services within health systems for non-pregnant women and adolescent girls in order to target the crucial pre-conception period, as well as to improve nutrition outcomes for the girls and women themselves. Maternal-focused NCD services, and accompanying nutrition support, are another neglected area within many health services, despite the high mortality risk from NCDs.

Recommendation: Nutrition services need to be fully integrated into health systems, not only during ANC, but also postnatally, and for non-pregnant women and girls. These services should recognise women's risks in regard to NCDs, with better integration of NCD prevention and management services needed for adolescent girls and women in general. Robust assessment of the impact of integrated health and nutrition programmes on maternal nutrition outcomes would support learning and advocacy, as appropriate.

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Appendices

Appendix 1: Useful guidance for maternal nutrition

ENN hosts following free publications and resource platforms to share evidence, experiences and learning. **Field Exchange** is a technical publication that contains detailed field articles, research, and evaluations on nutrition in emergencies and high burden contexts. It is downloadable from the online FEX library, <https://www.enonline.net/fex>. ENN also provides vital 'real-time' technical advice to programme implementers and researchers through its online platform en-net, <https://www.en-net.org/>, linking people to an extensive network of peers and experts. These resources include relevant themes on maternal and adolescent nutrition.

The WHO hosts the **e-Library of Evidence for Nutrition Actions (eLENA)**, a free online library of the latest nutrition guidelines, recommendations and related information. Information is categorised by the stages of the life course and the library is available in all six official languages of the WHO. <https://www.who.int/elena/en/>

Maternal Nutrition Operational Guidance Program Considerations for Low- and Middle-Income Countries (2019), by USAID, provides practical guidance on designing, implementing and strengthening the delivery of maternal nutrition interventions during pregnancy and lactation within the health system. <https://www.mcsprogram.org/resource/maternal-nutrition-operational-guidance-program-considerations-for-low-and-middle-income-countries/>

Strengthening Integration of Nutrition within Health Sector Programmes (2018), commissioned by the European Commission, provides an overview of the evidence on nutrition interventions delivered through the health sector. <https://europa.eu/capacity4dev/file/75785/download?token=cfb27Koq>

The MAMI Care Pathway Package provides practitioners with a resource to screen, assess and manage small and nutritionally at risk infants under six months and their mothers (MAMI). <https://www.enonline.net/mamicarepathway>

Nutrition Matters: Guidance for Nutrition Programming (2016), by the International Federation of Red Cross And Red Crescent Societies, <https://reliefweb.int/organization/ifrc>, provides evidence-informed practical guidance for nutrition programming, including programming for WRA and adolescents. <https://reliefweb.int/report/world/nutrition-matters-guidance-nutrition-programming>

The USAID Maternal and Child Survival Programme partnered with 32 countries with the aim of increasing maternal and child survival. The programme provides a range of resources (technical reports, guidelines and operational guidance) on a variety of topics, including maternal nutrition. <https://www.mcsprogram.org/resources/>

Balancing the benefits of maternal nutritional interventions: Time to put women first! (2019), by Bhutta Z.A., is an editorial discussing the evidence on the use of pre-conception nutrition-specific interventions to address maternal malnutrition. <https://academic.oup.com/ajcn/article/109/2/249/5307133>

Effective interventions to address maternal and child malnutrition: An update of the evidence (2021), by Keats EC et al., provides a comprehensive synthesis of available evidence for a range of direct and non-direct nutrition interventions to tackle maternal and child malnutrition. <https://pubmed.ncbi.nlm.nih.gov/33691083/>

ANC guides

WHO recommendations on antenatal care for a positive pregnancy experience (2016) provide global evidence-based recommendations on routine ANC. <https://www.who.int/publications/i/item/9789241549912>

Micronutrient supplementation

Nutrition interventions update: Vitamin D supplements during pregnancy (2020), by WHO, provides a review of evidence (since the WHO 2016 ANC guidelines) and guideline update on vitamin D supplementation during pregnancy. <https://www.who.int/publications/i/item/9789240008120>

Nutritional interventions update: Zinc supplements during pregnancy (2021), by WHO, provides a review of evidence (since the WHO 2016 ANC guidelines) and guideline update on zinc supplementation in pregnancy. <https://www.who.int/publications/i/item/9789240030466>

WHO recommendation on calcium supplementation during pregnancy for the prevention of pre-eclampsia and its complications

(2018) provides a global evidence-informed guideline on calcium supplementation during pregnancy. <https://www.who.int/publications/i/item/9789240003118>

Iodine supplementation in pregnant and lactating women, by WHO, provides a summary of guidance on iodine supplementation in PLW. https://www.who.int/elena/titles/guidance_summaries/iodine_pregnancy/en/

Use of multiple micronutrient powders for point-of-use fortification of foods consumed by pregnant women (2016), by WHO, provides guidance on the effects and safety of multiple micronutrient powders for point-of-use fortification of foods consumed by pregnant women. <https://www.who.int/publications/i/item/9789241549516>

MMS

Nutrition interventions update: Multiple micronutrient supplements during pregnancy (2020), by WHO, provides a review of evidence (since the WHO 2016 ANC guidelines) and guideline update on MMS during pregnancy. <https://www.who.int/publications/i/item/9789240007789>

Sight and Life Special Report (2020) compiles the latest evidence on MMS, experiences from the field and resources to support the scale-up of MMS. https://sightandlife.org/wp-content/uploads/2020/04/SightandLife_SpecialReport_MMS_2020.pdf

The Healthy Mothers Healthy Babies Consortium has useful resources that explain the drive to advocate for MMS, summarising the key research underpinning the switch from IFA to MMS, and information on the cost-effectiveness of the approach. <https://hmhbconsortium.org/>

Interim Country-level Decision-making Guidance for Introducing Multiple Micronutrient Supplementation for Pregnant Women (2020), by Multiple Micronutrient Supplementation in Pregnancy, UNICEF, Micronutrient Forum, Nutrition International, Vitamin Angels, and John Hopkins, provides guidance to country-level decision makers who are interested in introducing MMS for pregnant women in ANC programmes. <https://www.nyas.org/media/23298/012721-mms-guidance-v11.pdf>

PNC guidelines

WHO recommendations on postnatal care of the mother and newborn (2014) provide evidence-based guidelines for PNC of mothers and newborns in resource-poor settings in LMICs. <https://apps.who.int/iris/handle/10665/97603>

Guidelines: Vitamin A supplementation in postpartum women (2011), by WHO, provides global, evidence-based recommendations on vitamin A supplementation in postpartum women. http://apps.who.int/iris/bitstream/handle/10665/44623/9789241501774_eng.pdf?sequence=1

IFA supplementation

Guideline: Daily iron supplementation in adult women and adolescent girls (2016), by WHO, provides global evidence-based recommendations on the use of IFA supplements as a public health measure for preventing anaemia among adolescent girls and women. <https://apps.who.int/iris/handle/10665/204761>

Food fortification

Guidelines on food fortification with micronutrients (2006), by WHO and FAO, provide guidelines that aim to assist countries in the design and implementation of appropriate food fortification programmes. <https://www.who.int/publications/i/item/9241594012>

Guideline: Fortification of food-grade salt with iodine for the prevention and control of iodine deficiency disorders (2014), by WHO, provides global, evidence-based recommendations on fortification of food-grade salt with iodine, for the prevention and control of iodine deficiency disorders. <https://www.who.int/publications/i/item/9789241507929>

WHO guideline: Fortification of maize flour and corn meal with vitamins and minerals (2016) provides global, evidence-informed recommendations on the fortification of maize flour and corn meal with micronutrients. <https://www.who.int/publications/i/item/9789241549936>

NCDs

Good maternal nutrition: The best start in life (2016), by WHO Europe, provides a summary of the results of a systematic review on maternal nutrition, the prevention of obesity and NCDs. It also reviews national recommendations and opportunities for action in European countries. <https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/publications/2016/good-maternal-nutrition-the-best-start-in-life-2016>

Global Action Plan for the Prevention and Control of NCDs 2013–2020 (2013), by WHO, operationalises the commitments made by heads of state and governments in the United Nations Political Declaration on the Prevention and Control of NCDs. <https://www.who.int/publications/item/9789241506236>

Maternal nutrition in emergencies

Breastfeeding support

Operational Guidance on Infant Feeding in Emergencies Version 3 (2017), by the IFE Core Group, provides operational guidance on infant feeding in emergencies for emergency relief staff and programme managers. <https://www.enonline.net/operationalguidance-v3-2017>

Undernutrition

Moderate Acute Malnutrition: A Decision-Making Tool for Emergencies (2017), by the Global Nutrition Cluster MAM Taskforce, aims to guide decision-making on the most appropriate and feasible programme strategy to address moderate wasting in a particular emergency setting. <https://reliefweb.int/report/world/moderate-acute-malnutrition-decision-tool-emergencies>

Guide to Maternal, Newborn and Child Health and Nutrition in Emergencies (2012), by World Vision International, provides operational recommendations and key technical actions to protect maternal newborn and child health and nutrition in emergencies. <https://www.wvi.org/health/publication/guide-maternal-newborn-and-child-health-and-nutrition-emergencies>

Preventing Moderate Acute Malnutrition (MAM) through Nutrition-Specific Interventions (2014), by the CMAM Forum, is a technical brief that reviews practice and evidence for the treatment of moderate wasting, as well as providing practical guidance for implementors. <https://www.enonline.net/preventingmoderateacutemalnutritionmamthoroughnutritionsensitiveinterventions>

Guidelines for Selective Feeding: The Management of Malnutrition in Emergencies (2009), by UNHCR and WFP, is a practical guide to the design, implementation and monitoring of selective feeding programmes in emergencies. <https://www.enonline.net/selectivefeedingguidelines>

NCDs

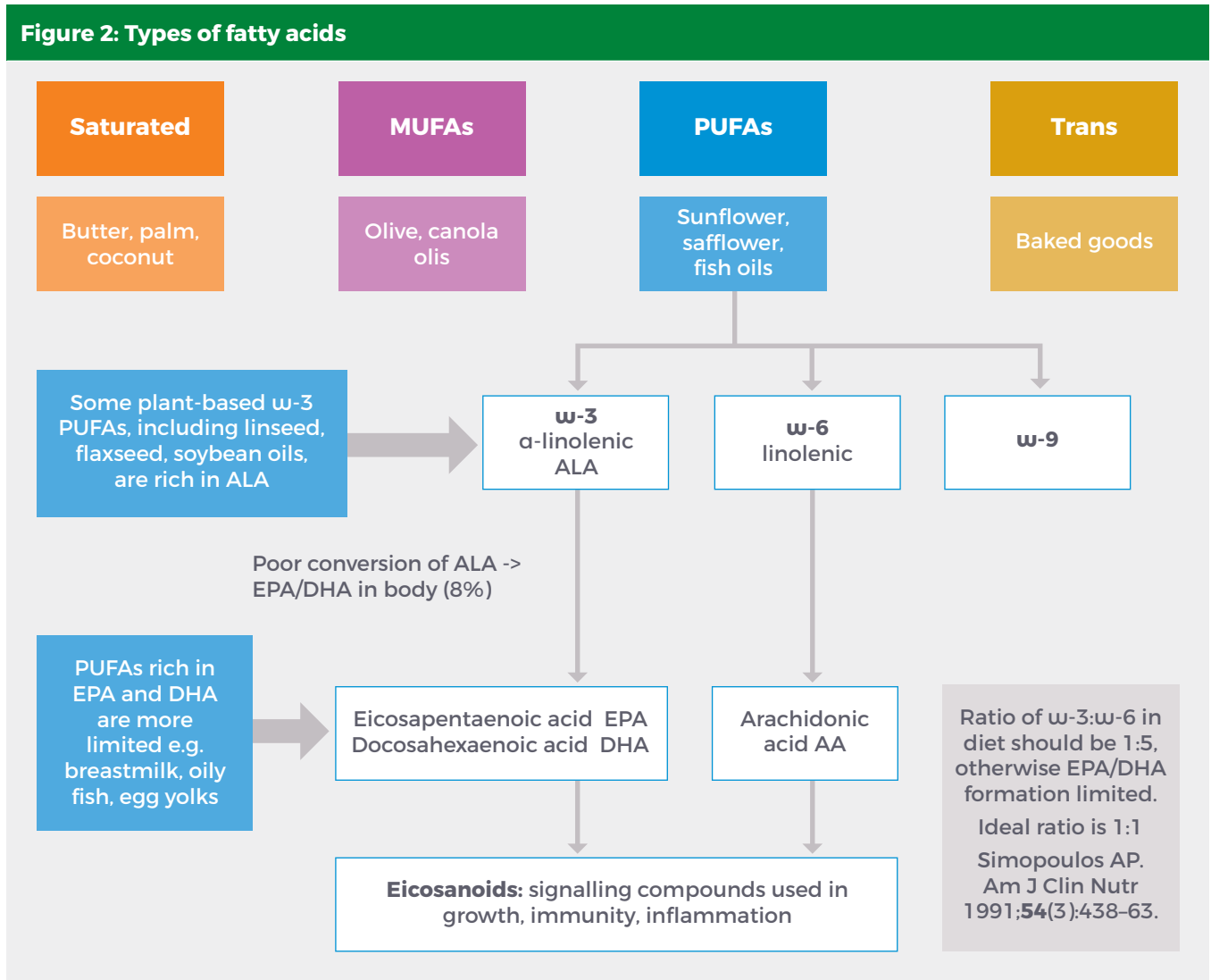
Package of Essential Non-communicable Diseases Interventions for Humanitarian Settings (PEN-H) (2020), by USAID and the International Rescue Committee, is a resource package that provides health workers with guidance to facilitate the delivery of quality NCD care in humanitarian settings. <https://www.rescue.org/report/package-essential-non-communicable-diseases-interventions-humanitarian-settings-pen-h>

Integrating Non-communicable Disease Care in Humanitarian Settings: An Operational Guidance (2020), by UNHCR, the International Resource Committee and the Informal Inter-Agency Group on NCDs in Humanitarian Settings, is an operational guide on integrating care for persons with NCDs into primary health care services for public health staff of humanitarian organisations. <https://reliefweb.int/report/world/integrating-non-communicable-disease-care-humanitarian-settings-operational-guide>

Maternal nutrition in the context of COVID-19

Protecting Maternal Diets and Nutrition Services and Practices in the Context of COVID-19 (2020), by WFP, UNICEF, Global Nutrition Cluster, and the Global Technical Assistance Mechanism for Nutrition, provides interim programmatic guidance on actions to protect the diets and nutrition services and practices of pregnant women and breastfeeding mothers. <https://docs.wfp.org/api/documents/WFP-0000115078/download/>

Appendix 2: Summary of types of fatty acids



Abbreviations: ω = omega, AA = arachidonic acid, ALA = α -linolenic acid, DHA = docosahexaenoic acid, EPA = eicosapentaenoic acid, MUFA = monounsaturated fatty acids, PUFA = polyunsaturated fatty acids, trans = trans-fatty acids.

Appendix 3: More information on the developmental origins of health and disease

Data from several cohorts have driven the DOHaD hypothesis, starting with David Barker's formative research following more than 16,000 people born in Hertfordshire in the UK between 1911 and 1930. He found that lower birthweight was associated with higher blood pressure at age 10, with an even stronger association at age 36 (115). Further observations in this cohort quickly followed, including associations between LBW and adult-onset chronic disease including type-II diabetes, hypertension, and hyperlipidaemia (116). Similar patterns were observed in completely separate cohorts such as the Nurses' Health Study I and II in the USA (308) and another cohort in Helsinki (309).

Birthweight can provide researchers with a useful approximation of the intrauterine environment, but on its own does not tell us what the exact constraints were nor when these constraints were experienced. Subsequent studies have helped to narrow down the timing of the adverse exposure, with famine studies proving particularly useful.

Famine studies

Towards the end of World War II the western Netherlands was under German control. Between November 1944 and May 1945, there was a shortage of food caused by Nazi blockades and a severe winter, resulting in the famine termed the 'Dutch Hunger Winter', which affected 4.5 million people. Calorie intake was drastically reduced (varying by region between a daily intake of only 500-1000 kcal) and an estimated 20,000 people died (310). Researchers discovered an association between women experiencing the famine during pregnancy and a variety of adverse outcomes in their children, ranging from lower birthweight (311) to increased adult blood pressure (117, 118), obesity (119) and risk of schizophrenia (120).

It also appears that the specific timepoint at which women experienced the famine in their pregnancy made a difference. For example, men whose mothers experienced the famine in mid-gestation had twice the prevalence of obesity at age 18-19 years, whereas if their mothers experienced the famine in the third trimester the risk of obesity was decreased (119). Similar observations have been found in China's Great Leap Forward Famine, the most severe period of which was 1959-61. For example, experiencing this famine *in utero* was associated with twice the risk of schizophrenia and increased hyperglycaemia later in life (312, 313).

These famine studies give us convincing evidence that environmental exposures (or 'insults') experienced early in life are associated with later adverse health outcomes. It is likely that these insults are nutrition-related, but these studies cannot provide us with a causal link. Furthermore, the exposure of interest may be related to depleted energy, reduced micronutrient intake, or a combination. Indeed, there may be other related exposures that may explain some of the associations seen – for example, maternal stress.

Nutrition-related studies

Other studies give us more information on the specific nutritional exposures that may play a role in DOHaD mechanisms. The Pune Maternal Nutrition Study in Maharashtra State of west-central India followed 797 women just before and throughout their pregnancies. Mothers who ate more green leafy vegetables, milk and fruit had larger babies than those with lower intakes (314). Taking blood samples at 28 weeks gestation showed an association between increased maternal folate concentrations and increased adiposity and insulin resistance in their children aged 5-6 years. Lower B12 concentrations in the mothers was also associated with insulin resistance in the children, and the strongest associations were found when the mothers had high folate but low B12 concentrations (315).

The Women First Trial was a multi-centre study conducted in India, Pakistan and Democratic Republic of the Congo, testing the effects of a 20g lipid-based (118 kcal) multi-micronutrient supplement. In Arm 1 daily supplementation was provided to women at least three months prior to conception. In Arm 2, supplementation was initiated only at 12–14 weeks gestation, versus no supplementation in Arm 3. Maternal nutrition intervention initiated either prior to conception (Arm 1) or by the end of the first trimester (Arm 2) resulted in greater new-born length and weight, and lower rates of stunting and SGA compared to no nutritional intervention (Arm 3) (316). A follow-up study confirmed that the anthropometric improvements were sustained through the first six months of life (317). Many other studies have confirmed the importance of preconception nutrition on infant outcomes and the implications for health across the lifecourse: for example, from Vietnam in the PRECONCEPT trial (318) and from The Gambia through the work of the Medical Research Council (319, 320).

Potential mechanisms at work

There is now much interest in which mechanisms may help explain the observations found in the DOHaD literature. Much attention has been given to maternal nutrition, especially nutrients involved in one-carbon metabolism. This represents an interlinking set of metabolic pathways that are responsible for folate, methionine and homocysteine metabolism, as well as transsulfuration and transmethylation processes. Nutrients are involved in one-carbon metabolism both as substrates (folate, choline, betaine and methionine), and as cofactors (vitamins B6, B12, B2). Jointly, these metabolic pathways are responsible for DNA synthesis; biosynthesis of phospholipids, proteins, polyamines, and antioxidants; and transmethylation processes that are involved in signalling, epigenetic mechanisms, DNA transcription and translation.

One-carbon metabolism therefore plays essential roles in foetal development. In an influential and accessible review, Steegers-Theunissen et al. (321) describe the different processes relevant to one-carbon metabolism across the key phases of preconception, conception, implantation, placentation and embryo- or organogenesis stages (see **Box A**). Given the centrality of one-carbon metabolism to such key biological processes it becomes easier to understand how maternal nutritional status of nutrients that feed into these metabolic pathways can influence the development of the foetus, with implications for the child's later health and development across the life cycle. See **Box B** for details of a famous animal experiment that demonstrates some of these principles clearly.

Box A: The periconceptual period

- Steegers-Theunissen R et al. (321) define the periconceptual period as a **five- to six- month period** in women: oocyte growth, fertilisation, conceptus formation and development to Week 10 of gestation.
- Women: most active phase of ovarian follicular development starts at around 14 weeks preconception.
- In men, consider around 10 weeks preconception for the spermatogenic cycle.
- **Summary of key phases:** preconception, conception, implantation, placentation and embryo- or organogenesis stages
- The periconceptual period is an extremely active time of gamete maturation, epigenetic reprogramming of the genome, and cellular differentiation. Appropriate maternal nutrition is critical to support these processes as the foetus develops.

A review by Christian and Stewart (322) summarises some of the potential mechanisms involved that might link maternal nutrition status to foetal development, a set of ideas that is sometimes referred to as 'metabolic programming'. The authors suggest that maternal micronutrient deficiencies can lead to hormonal adaptations and/or changes in epigenetic regulation that might in turn influence the number and structure of cells during the time of organ development. For example, deficiencies in iron, zinc, vitamin A or folate could lead to suboptimal development of nephrons in the kidney, leading to impaired renal function in later life. Through similar effects on cardiovascular, pancreatic and pulmonary functions, changes to tissue modelling could lead to increased risk of hypertension, insulin resistance and other cardiometabolic problems in later life.

Tissue remodelling is just one of several potential mechanisms at play. Other mechanisms could involve nutrient-sensing signals, oxidative stress, epigenetic changes and the gut microbiota, for example (322-324). Fleming et al. (325) summarise the notion that different physical attributes (phenotypes) can result from different environmental exposures, including maternal nutrition, at the time of conception, despite the sequence of DNA (genotype) remaining unaffected. The premise is that around the time of conception there is heightened sensitivity to the environment, with the embryo being able to 'sense' the environmental cues. This may indeed give the embryo the chance to optimise its development to maximise chances of survival (e.g., a hypothesis such as famine situations at conception triggering adaptations for the developing child to better store energy). This may be particularly beneficial if the later environment matches the environment at the time of conception. However, if there is a mismatch between the environment at conception and that experienced later – for example, if the child was conceived in a time of nutritional deprivation but later grows up in an environment with more food available – the consequences could be disadvantageous (325, 326).

Box B: The Agouti mouse experiment

Several animal experiments have shown that the maternal diet can influence offspring health and development. For example, in a famous experiment by Waterland and Jirtle (327), pregnant mice (dams) were fed a diet that differed by concentration of vitamin B12, folic acid, betaine and choline. The dams that were fed diets higher in these micronutrients produced pups that had higher levels of DNA methylation (methyl groups bonded to DNA at certain nucleotide sites), near the Agouti gene. This in turn affected the colour of the pup's fur, leading to browner rather than yellow fur colour. This also affected body composition later in the life of the pups – the browner pups were also leaner than the yellow pups (328). All the pups were isogenic (having the same genotype) but had different phenotypes (i.e. fur colour, adiposity) according to the diet their mothers had in pregnancy. This is an example of **epigenetic** mechanisms at work, where gene expression is affected by environmental factors (in this case, maternal nutrition), without changing the underlying sequence of DNA.

Appendix 4: Cash vs. voucher vs. in-kind transfers

Cash- and voucher-based programmes are increasingly being used to complement, or as an alternative to, in-kind assistance, as they are perceived as more efficient and cost-effective than in-kind assistance, while being more supportive of local communities, human agency and beneficiaries' dignity (193, 240, 253). However, there are multiple nuances to such evaluations. Furthermore, differences observed between cash, voucher and in-kind transfers often depend on objectives and indicators used (257): for example, food-based assistance have been shown to be most effective at increasing per capita calorie intake but cash has been shown to be more effective at increasing household dietary diversity (253, 257). Differences appear to be more affected by context specific factors such as capacity and resource availability than the modality itself, thus decisions on what form of social assistance to use should be context-specific and should emerge from a comprehensive response analysis (257). While this evidence is not specific to maternal nutrition, it is these factors which determine the commodities mothers often receive. Programmes need to further consider maternal preferences and factors, while further evidence is needed on what specific conditions are needed for each of these modalities to positively impact maternal nutrition.

Appendix 5: Conditional vs. unconditional cash transfers

There is ongoing debate around the possible additional benefit of conditional cash transfers compared to unconditional transfers for nutrition outcomes. This debate focuses on children's nutritional outcomes but is also relevant to the nutritional outcomes of women. For conditional cash transfers beneficiaries must meet pre-defined criteria (240), such as attending health services to receive the transfer. However, it is important to consider factors such as capacity as conditional transfers need more complex monitoring and distribution systems, alongside well-funded services that can accommodate increased demand (237, 255). Furthermore, placing conditions on transfers may exclude those who are most vulnerable as these populations are least likely to be able to meet these conditions. This is an important ethical consideration, especially for humanitarian contexts. It has been noted that increased knowledge of services is an important component for conditional transfers (237, 255). This could potentially be achieved with unconditional transfers with the right communication strategy. Similarly, while evidence is still sparse, how transfers are labelled might be an important factor for ensuring funds are not redirected from the programmes objectives, as labelling gives an important opportunity to communicate the intended use of the transfer to the beneficiaries (240).

Complementary programmes are an important component of cash transfer programmes, with a general consensus that cash transfers are not likely to be effective in improving nutrition outcomes unless they have nutrition-specific objectives and are complemented with other direct and indirect nutrition actions (240). While this evidence is primarily based on literature relating to children's nutritional outcomes, it is arguably applicable to women's nutritional outcomes. Other important factors for cash-based programmes are the timeliness of intervention, beneficiaries' preferences, scale, duration, the value of transfers and the mechanisms used to transfer and access payments. However, how these factors impact maternal nutrition specifically is still relatively unknown, with current programme models varying between implementing agencies.



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