

MEASURES TO PREVENT MALNUTRITION FROM AGRICULTURE- NUTRITION APPROACH

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Abstract

Nutrition is a fundamental pillar of human life, health, and development across the entire life span. From the earliest stages of fetal development, at birth, through infancy, childhood, adolescence, and on into adulthood and old age, proper food and good nutrition are essential for survival, physical growth, mental development, performance and productivity, health and well-being. It is an essential foundation of human and national development. The fundamental WHO goal of health for all means that people everywhere throughout their lives, have the opportunity to reach and maintain the highest attainable level of health. This is impossible in the presence of hunger, starvation, and malnutrition. "Nutrition is the process of taking in food and converting it into energy and other vital nutrients required for life". The science of foods, nutrients, and other substances they contain; and of their actions within the body including ingestion, digestion, absorption, metabolism, and excretion.

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Introduction

Nutrition:

Nutrition is a fundamental pillar of human life, health, and development across the entire life span. From the earliest stages of fetal development, at birth, through infancy, childhood, adolescence, and on into adulthood and old age, proper food and good nutrition are essential for survival, physical growth, mental development, performance and productivity, health and well-being. It is an essential foundation of human and national development. The fundamental WHO goal of health for all means that people everywhere throughout their lives, have the opportunity to reach and maintain the highest attainable level of health. This is impossible in the presence of hunger, starvation, and malnutrition. "Nutrition is the process of taking in food and converting it into energy and other vital nutrients required for life". The science of foods, nutrients, and other substances they contain; and of their actions within the body including ingestion, digestion, absorption, metabolism, and excretion. Nutrition security is achieved "when all people at all times consume food of sufficient quantity and quality in terms of variety, diversity, nutrient content and safety to meet their dietary needs and food preferences for an active and healthy life, coupled with a sanitary environment, adequate health, education, and care" (FAO, 2012). The lack of ability to access a minimum nutrition requirement, expressed in terms of daily energy intake in calorie terms, has serious implications for human development. Protein and energy deficiencies affect physical and cognitive development in children and lead to higher morbidity and mortality rates among children and low labor productivity in the long run.

In recent years, much attention has been paid to the relationship between agriculture and nutrition in the development sector as a whole. These relationships may seem obvious: We get nutrition from the food we eat, and we eat food produced by agriculture. However, the claim that agricultural interventions (such as home gardens) can improve nutrition has come under scrutiny due to a lack of evidence to support this (Masset et al. 2012; Girard et al. 2012). To understand these relationships and close the evidence gap. Agriculture plays an essential role in development, and although it does not automatically improve nutrition, its potential to do so is undeniable. Recent efforts have provided a critical framework for program design and implementation of agricultural interventions that aim to improve the nutrition of vulnerable populations. These frameworks for "nutrition-sensitive agriculture" interventions help us understand complex problems and identify avenues for solutions.

Nutritional well-being depends upon four main factors: food, care, health, and environment. Food and nutrient security means access by all people of all ages, in all seasons, to the food, diet, and nutrients they need for a healthy life. From WHO's health-focused perspective, this means action to ensure, for example, that:

- Pregnant women have the additional food they need to meet their nutritional requirements during pregnancy;
- The iodine requirements of the growing fetus are met;

- Infants are breastfed exclusively for the first 4–6 months of life, and continue to breastfeed after complementary feeding has begun;
- Infants and young children consume a safe, balanced diet to ensure optimal growth and development;
- Iodine requirements of the entire population are met through iodized salt;
- Households have access to sufficient amounts of safe food throughout the year to meet the nutrient requirements of all members.

Other Important Nutrition Issues Affecting Large Population Groups Include:

- Only 35% of infants ever exclusively breastfed between 0-4 months of age;
- Poor complementary feeding practices are very widespread—a major cause of childhood malnutrition; Scurvy, beriberi, and rickets in badly deprived and refugee populations;
- Folate deficiency in women of childbearing age and adolescent girls, causing three-quarters of the cases of anemia and neural tube defects;
- Zinc deficiency in deprived populations, contributing to growth retardation, diarrhea, immune deficiency, and skin lesions;
- Selenium deficiency, widespread in China and the Russian Federation, causes Keshan disease and Kashin-Beck disease.

Malnutrition

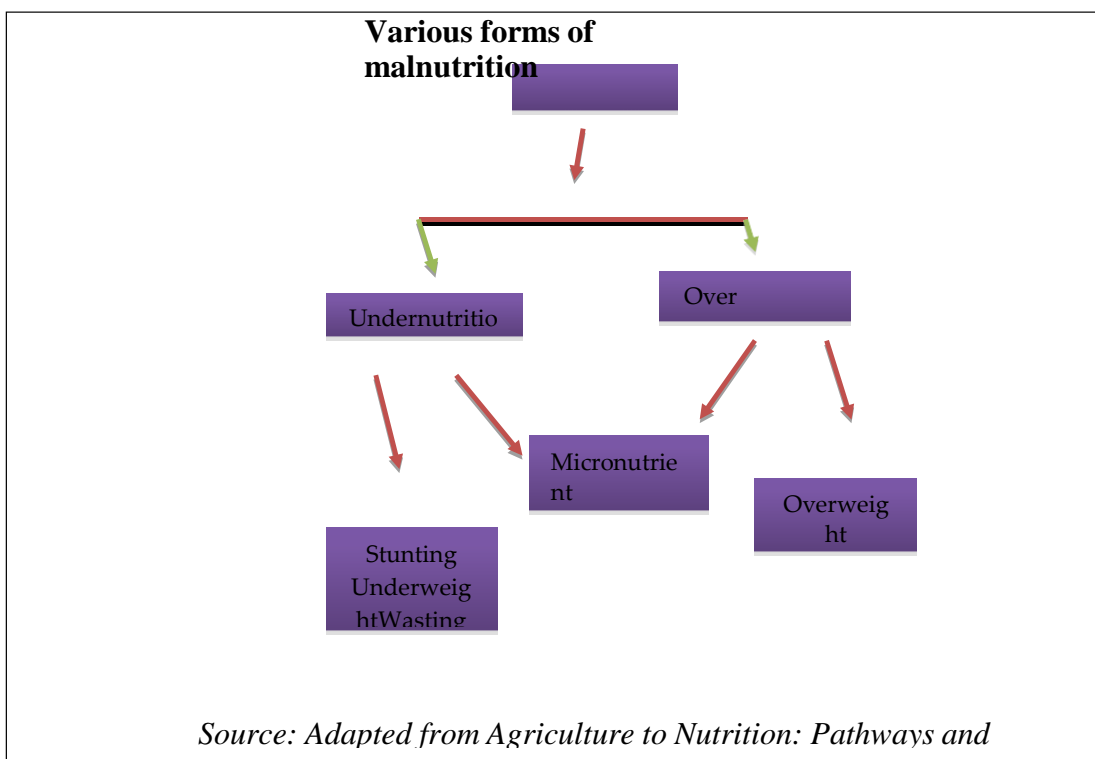
Hunger and malnutrition remain among the most devastating problems facing the majority of the world's poor and needy, and continue to dominate the health of the world's poorest nations. Nearly 30% of humanity—infants, children, adolescents, adults, and older persons in the developing world—are currently suffering from one or more of the multiple forms of malnutrition. This remains a continuing travesty of the recognized fundamental human right to adequate food and nutrition, and freedom from hunger and malnutrition, particularly in a world that has both the resources and knowledge to end this catastrophe. Malnutrition is a term used by nutritionists to describe all kinds of nutritional deficiencies. It arises due to food insecurity caused by deficiency, excess, or imbalance in the intake of micro/macro-nutrients in one's diet. In other words, the triple burden of malnutrition includes under-nutrition, over-nutrition, and micro-nutrient deficiency but the present paper will focus mainly on under-nutrition.

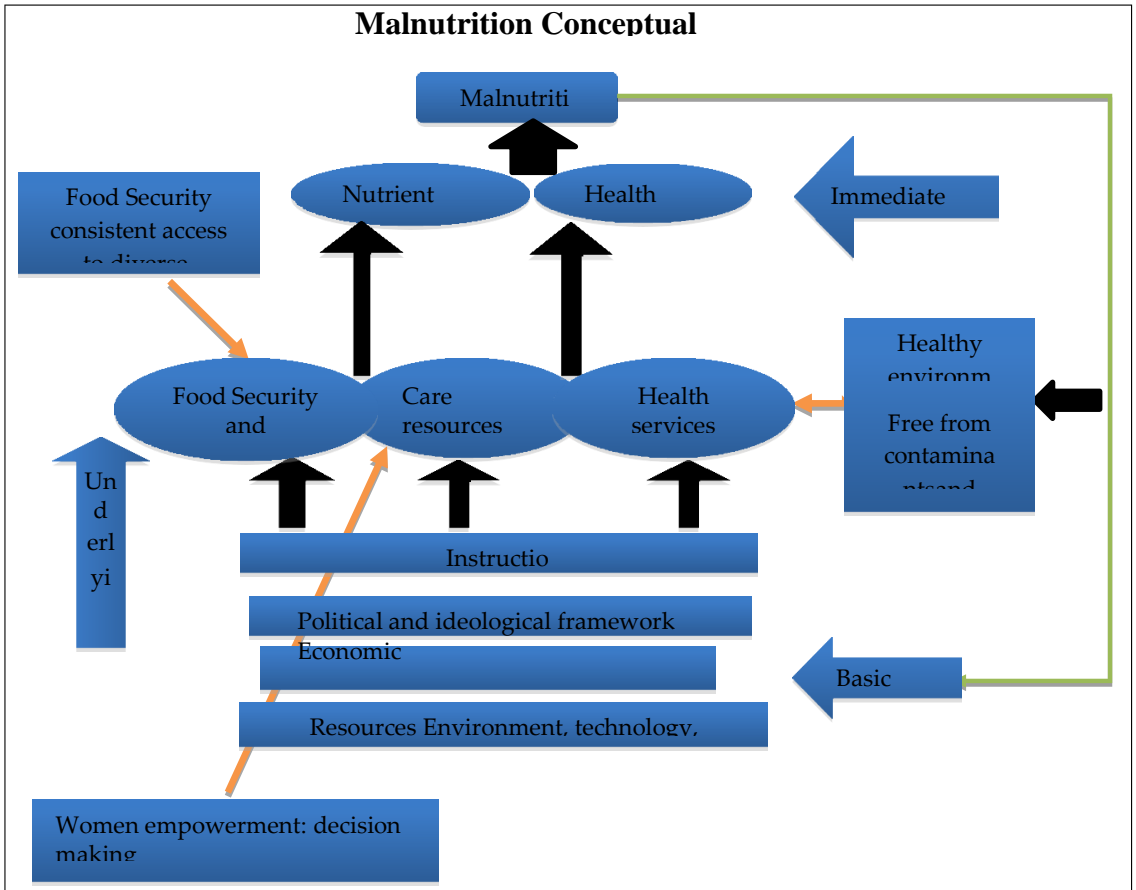
The World Health Organization (WHO) defines malnutrition as: "...deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients." The term malnutrition covers two broad groups of conditions. One is 'undernutrition'--- which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age), and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other is overnutrition, which includes obesity and diet-related non-communicable diseases (such as heart disease, stroke, diabetes, and cancer)".

Even though malnutrition can affect anyone, certain groups are more vulnerable. These include young children, pregnant and lactating women, adolescent girls, the elderly, the immuno-compromised (e.g. people with HIV/AIDS), indigenous people, and people

living in poverty. People also become vulnerable to malnutrition during or after conflicts, disasters, and famines, or when other problems affect their food and nutrition security (Development Initiatives 2018a).

Malnutrition is especially dangerous for women of reproductive age and children in their first thousand days of life (i.e. from conception to two years of age) because malnutrition in these situations can have irreversible consequences. With the high burden of malnutrition in India, The COVID-19 crisis will have an unprecedented effect on food availability and accessibility, health and nutrition, and the livelihoods of people around the world. Although the analysis in the report was done before the COVID-19 crisis, the findings remain valid in light of this pandemic.





Source: Adapted from UNICEF 1990

Nutrition-Specific and Nutrition-Sensitive Approaches to Malnutrition

Approaches to address malnutrition can be described as being nutrition-specific or nutrition-sensitive. *Nutrition-specific* interventions address the immediate causes of malnutrition and some of the underlying causes (UNICEF 2017). The Lancet 2013 Series on Maternal and Child Nutrition reported that stunting (an indicator of chronic undernutrition) can be reduced by 20% if core nutrition-specific interventions are scaled up to reach 90% of the target population (Bhutta *et al.* 2013). Examples of core nutrition-specific interventions include micronutrient supplementation for children and women of reproductive age (e.g. zinc, iron, vitamin A, calcium, and folic acid); promotion of exclusive breastfeeding during the first six months of life and adequate complementary feeding from six months to two years of age; and prevention and treatment of severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) in children (Bhutta *et al.* 2013).

Nutrition-specific interventions are essential, but on their own, they are not enough to reduce chronic malnutrition to more "acceptable" levels, much less to achieve a world

free of hunger. This is why *nutrition-sensitive* interventions are also necessary. Nutrition-sensitive interventions address underlying and basic causes of malnutrition by integrating nutrition goals into interventions from other sectors, such as agriculture, education, health, and WASH (water, sanitation, and hygiene) (UNICEF 2017).

Agriculture to Nutrition Pathways and Principles

The pathways that link agriculture and nutrition (Herforth and Harris, 2014). The pathways are interconnected rather than linear. An understanding of how these interactions function in a particular context would help change agents know how nutrition-sensitive agriculture activities could improve access to food and healthcare, promote adequate caring practices and contribute to an enabling environment. These could eventually improve the nutrition of the entire household, not just mothers and children.

The main pathways from agriculture to nutrition are through

1. Food production
2. Agricultural income
3. Women's empowerment

Value Chains for Nutrition:

An aspect of agriculture to nutrition that farm produce takes from the farm to the consumer is known as a value chain. A value chain is the set of steps, processes, and participants that relate to a specific product (or related products), including production, transformation, transportation, and sale to the consumer. Value chains have great potential to contribute to the nutrition of vulnerable populations. For example:

- Those employed within the value chain earn income that can be used to buy food or to pay for health care, improving nutrition and health.
- A value chain can yield new and/or improved nutritious foods and products for vulnerable populations to access and consume.
- Some processes used in a value chain can reduce waste and nutrient loss, or can increase the availability of nutrients (e.g. fortification).
- Nutrition-sensitive activities can be incorporated into the value chain. For example, the value chain can include nutrition education; facilities that allow and promote breastfeeding; and marketing messages to improve the nutrition knowledge and practices of the consumer.

Agriculture-Nutrition Programming Principles

These are necessary for the current guiding principle consider for effective program design and implementation.

- Incorporate explicit nutrition objectives and indicators into program design. This ensures that improving nutrition is a priority from the beginning.

- Assess the local context. What challenges and resources already exist in the community?
- Target the vulnerable and improve equity. Malnutrition hits some groups harder than others.
- Collaborate and coordinate with other sectors. Malnutrition has many underlying causes.
- Maintain or improve the natural resources base. Safeguard water resources especially.
- Empower women. The women's empowerment pathway explains why this is so important.
- Facilitate production diversification, and increase production of nutrient-dense crops and small-scale livestock. Diversity contributes to resilience and better nutrition.
- Improve processing, storage, and preservation. These can help retain nutrients, reduce crop losses, and decrease the time it takes to prepare nutritious meals.
- Expand markets for nutritious foods and market access for vulnerable groups. This might be done through farmers' associations and/or by creating value-added products.
- Incorporate nutrition promotion and education. Try to build on local knowledge.

Aim and Objectives of NHD:

The overarching aim of WHO's work in nutrition, spearheaded by the Department of Nutrition for Health and Development (NHD), is to prevent, reduce and eliminate malnutrition worldwide, (especially protein-energy malnutrition; iodine, vitamin A, and iron deficiencies; obesity and diet-related diseases; and other specific deficiency diseases), and to promote sustainable health and nutritional well-being of all people, thereby reinforcing and accelerating human and national development.

The four main objectives in support of this aim are:

1. To strengthen and support the capabilities and effectiveness of Member States for assessing and addressing nutrition, malnutrition, and diet-related problems, primarily through the development and implementation of national nutrition policies, programs, and plans of action.
2. To develop, through consultation, research, and collaboration, the scientific knowledge base, methodologies, authoritative standards, norms and criteria, and guidelines and strategies for detecting, preventing and managing all major forms of malnutrition, whether of deficiency or excess, for application by Member States.
3. To promote optimal sustainable health and nutrition benefits of food-assisted development projects targeted to the vulnerable and food-insecure, particularly by ensuring the relevance and effectiveness of WFP food aid policies and programs, in both emergency and development contexts.
4. To maintain global databases for monitoring, evaluating, and reporting on the world's major forms of malnutrition, the effectiveness of nutrition programs, and progress toward achieving targets at national, regional, and global levels.

Nutrition Strategy for Prevent Malnutrition

The National Nutrition Strategy of India by the NITI Aayog (NITI Aayog 2017) entitled "Nourishing India" calls for convergence among four proximate determinants of nutrition, namely, health services, food security, safe water and sanitation, and income and

livelihoods. The strategy envisages an India free of malnutrition (KuposhanMukt Bharat), linked to Clean India (Swachh Bharat) and Healthy India (Swasth Bharat). Nourishing India lays down a road map for effective action and enables states to make strategic choices through decentralized planning and local innovation, with accountability for nutrition outcomes. It also gives prominence to demand and community mobilization as key determinants to bring about behavioral changes toward better nutrition. The strategy specifically addresses malnutrition among urban as well as rural populations. Thus, it is only logical to include nutrition interventions as part of the package of services to be provided in health and wellness centers (HWCs).

The strategy has set goals, targets, and recommended approaches. The goals are as follows:

- (i) To prevent and reduce under nutrition (underweight prevalence) in children (0–3 years) by 3 percentage points per annum from NFHS-4 levels by 2022.
- (ii) To reduce the prevalence of anemia among young children, adolescent girls, and women in the reproductive age group (15–49 years) by a third of NFHS-4 levels by 2022.

National Nutrition Mission

The government has initiated a National Nutrition Mission known as POSHAN Abhiyaan under the Ministry of Women and Child Development (Press Information Bureau 2017). POSHAN Abhiyaan aims to create synergy between different nutrition schemes and across ministries to achieve the common goal of reducing malnutrition. To strengthen the delivery of basic services, convergence between various schemes relating to nutrition, drinking water, sanitation, school education, and urban housing and livelihood needs to be promoted.

POSHAN ABHIYAN'S activities include:

1. Mapping of various schemes contributing toward addressing malnutrition;
2. Introducing a very robust convergence mechanism;
3. Information and communication technology (ICT)-based real-time monitoring system;
4. Incentivizing states and unscheduled tribes to meet the targets;
5. Incentivizing Anganwadi workers to use ICT-based tools;
6. Eliminating registers used by Anganwadi workers;
7. Introducing height measurement of children at the AWCs;
8. Social audits;
9. Setting up nutrition resource centers; and
10. Involving masses through Jan Andolan for their participation in nutrition through various activities, among others.

Health Promotion Campaigns

Nutrition interventions should focus on the first 1,000 days of life (i.e., pregnancy + first 2 years of childhood), which is the critical window for intervention, as that is the period

of life when a child's physical and mental growth and development are determined, and any losses suffered during that period are almost impossible to make up later on in life. While food security and access to health services are important, increased awareness leading to a change in behavior toward nutrition will be the key to success. Such behavior change should include infant and young child feeding practices, eating behaviors during pregnancy, healthcare-seeking behaviors, personal hygiene, and sanitation. This would also entail availing of institutionalized services of nutrition experts, nutrition counselors, and trained ASHAs and Mahilaarogyasamitis integral to NUHM. In addition, inputs and support from two national agencies will be needed: the Food Safety and Standards Authority of India, to set standards and implement same; and the National Institute of Nutrition in the Indian Council of Medical Research, to provide comprehensive technical support including training, monitoring, and research.

Fortified Notorious Food: Fortified foods are those that have nutrients added to them that don't naturally occur in the food. These foods are meant to improve nutrition and add health benefits.

According to FAO, WFP, and UNICEF, 815 million people were suffering from hunger in 2016. Levels of nutrient deficiencies are also alarmingly high: two billion people suffer from micronutrient deficiencies, also known as "hidden hunger". Therefore, micronutrient fortification along with supplementation programs has become a focus of national and international health agencies. Bio-fortification is a relatively new strategy that uses conventional breeding technologies, biotechnologies, and agronomic practices to reduce anti-nutritional factors or to increase the micronutrients (vitamin A, zinc, and iron) in the economic parts of staple food crops. This approach will not only lower the number of severely malnourished people who require treatment by complementary interventions but will also help them to maintain improved nutritional status. Moreover, biofortification provides a feasible means of reaching malnourished rural populations who may have limited access to commercially marketed fortified foods and supplements. Bio-fortified staple foods cannot deliver as high level of minerals and vitamins per day as supplements or industrially fortified foods, but they can help to bring millions over the threshold from malnourishment to micronutrient sufficiency (Bouis and Saltzman, 2017).

Therapeutic Foods: Management of severe malnutrition within the person's home with ready-to-use therapeutic foods are possible much of the time. In those who have severe malnutrition complicated by other health problems, treatment in a hospital setting is recommended. This often involves managing low blood sugar and body temperature, addressing dehydration, and gradual feeding. Routine antibiotics are usually recommended due to the high risk of infection. Longer-term measures include: improving agricultural practices, reducing poverty, improving sanitation, and empowering women.

The major public health problem throughout the developing world, mainly in Asia is severe acute malnutrition (SAM). Ready-to-Use Therapeutic Food (RUTF) is a broad term that includes different types of foods, such as compressed or spreads products, purposely designed for the treatment of SAM. Generally, it consists of a mixture of milk powder, vegetable oil, sugar, peanut butter, and a vitamin-mineral premix. Since bacterial growth in

RUTF is limited and can be stored safely at home without refrigeration, it can be used even in areas where hygienic conditions are not optimal because it does not need water, utensils, etc., before taking it. Thus, both in non-emergency situations and in disaster relief programs, RUTF has steadily turned out to be the most extensively used therapeutic resolution to fight child malnutrition (Lanyero et al., 2017).

Complementary Feeding: Timely, safe, and adequate complementary feeding, with continued breastfeeding, needs to be accorded priority status on the global nutrition agenda. Indeed, the continued high levels of growth faltering in many parts of the world suggest that complementary feeding practices remain inadequate for substantial numbers of children. More needs to be done to improve feeding practices based on locally available and affordable foods, to develop guidelines and indicators of appropriate nutritional outcomes, and to expand the content and availability of objective and consistent informational and educational materials for health workers, mothers, and families. Action-oriented research is also needed to identify causes and remedies for growth faltering.

Kitchen Gardening: The main purpose of kitchen gardening is to provide the family daily with fresh vegetables rich in nutrients and energy. They have the potential to impact Vitamin A, provide support for malnourished and sick children and potentially provide nutritional diversity to support complementary feeding. The World Health Organization advocates that five portions of fruit and vegetables (400 g collectively) need to be consumed daily to maintain a healthy diet with enough essential micronutrients. In 1996 the UNDP proposed that urban agriculture could contribute significantly to combat urban hunger and malnutrition by providing increased and consistent access to fresh, nutritional food at lower than market cost. To achieve Sustainable Development Goals, Nutri-gardens can have a big role to play (Shubha et al., 2020).

To have an impact on micronutrient nutritional status, sufficient Vitamin A-rich foods need to be grown (butternut, orange flesh, sweet potato, carrots, dark green leafy vegetables, and pumpkin). Vegetables are rich sources of nutritional bioactive compounds. They are important sources of protective nutrients like vitamins, minerals, antioxidants, folic acid, and dietary fibers. Therefore, it is cautiously proposed that the existence of a food garden has the potential to provide nutritional benefits in terms of increased micronutrient intake and potentially beneficial income replacement options. The diversified and highly nutritive vegetables are affordable and cost-effective solutions to overcome hidden hunger and malnutrition.

Farming System for Nutrition: Farming System for Nutrition (FSN) is an interventional approach that includes a combination of sustainable agricultural remedies involving advanced crop production practices, biofortification, promotion of backyard/community nutrition gardens of fruits and vegetables, livestock and poultry development, setting up of small-scale fisheries and regularizing veterinary services as a stimulant for rendering higher income and better nutrition output. Food and diets lacking diversity and without nutrition-focused, farming system either boosting income (solely indirect effects) or monotonous diet (solely direct effects) may not be appropriate to improve household nutrition and health

status. A combination of innovative FSN strategies that can diversify diet (directly) and make better use of income for nutritional adequacy (indirectly); concurrently with other interventions to improve education, health, sanitation, and household infrastructure stand a better chance of combating undernutrition and micronutrient deficiency problems.

Improving Access to Food and Nutrition Programs

1. Implement strong regulatory and policy frameworks to support healthier diets for all at the country and community level and across sectors, from production to consumption.
2. Strengthen and increase research spending to address major nutrition questions, identify cost-effective solutions, and stimulate innovation.
3. Roll out nutrition services within health services by developing costed nutrition care plans, which should be scaled up and sustained to cover all forms of malnutrition, including overweight, obesity, and other diet-related non-communicable diseases.
4. Invest in human resources to increase the number of qualified nutrition professionals, and level out access to quality nutrition care.
5. Include nutrition-related health products like therapeutic foods and innovative technological solutions like digital nutrition counseling, where appropriate, especially when working with more remote and harder-to-reach communities, as well as with elderly people.
6. Nutrition care, both preventive and curative, must be fully integrated into national health sector plans and must be supported by a strengthened multisectoral approach
7. The number of qualified nutrition professionals should be increased to enhance the delivery of quality nutrition care. Frontline workers involved in nutrition service delivery should have the required pre-and in-service training, means, and motivation to perform their assigned roles.
8. The food and drink industry should comply with international and national codes of conduct, including health and nutrition benefits to society and environmental protection and improvement.
9. Strengthen food systems to support nutrition security.
10. Leverage any event to renew and expand nutrition commitments and strengthen accountability.

Possible Measures to Improve Food Environments that Support Healthy Diets

Food sub-systems	Measures	Impact on the food environment
Agricultural production	<ul style="list-style-type: none"> • Encourage policies and investments that support diversification and the production of nutrient-rich foods (e.g. fruits and vegetables and legumes). • Promote value chain Development for nutrient-rich food crops • Ensure that agriculture research investments focus not only on staples but also on nutrient-rich crops 	<p>Actions on several of the food sub-systems simultaneously will increase the availability, affordability, and desirability of nutrient-rich foods, while making foods high in fat, sugars, and/or salt less available and affordable</p>
Food storage, transport	<ul style="list-style-type: none"> • Invest in transport and cold-chain infrastructure to reduce food loss. 	
Trade	<ul style="list-style-type: none"> • Encourage domestic trade, rural-urban linkages, and short food supply chains (where feasible) for nutrient-rich foods, especially vegetables, fruits, legumes, and nuts. • Lower tariff and non-tariff trade barriers for fruits and vegetables, especially during off-season periods, or increase import tariffs on foods high in fats, sugars, and/or salt. 	
Food transformation	<ul style="list-style-type: none"> • Encourage food reformulation laws • Take measures to introduce food and nutrition labeling laws • Support the establishment of investment funds for start-up Small and Medium Enterprises that produce nutrient-rich foods • Create incentives for processing techniques that reduce costs and increase the nutritional value of foods 	

<p>Food retail and provisioning</p>	<ul style="list-style-type: none"> • Support policies to improve food safety in informal and wet markets • Offer price incentives to encourage street vendors to use ingredients of better nutritional quality while ensuring food safety standards • Impose taxes to discourage the consumption of foods high in fat, sugar, and/or salt, such as sugar-sweetened beverages • Support the review of food subsidies, to cover foods such as fresh fruits, vegetables, and legumes and make them affordable to consumers • Implement planning regulations and investments to support wholesale markets, wet markets, and informal retailers that provide fresh produce to consumers especially low-income populations • Establish social protection policies and programs to ensure that nutrient-rich foods can be accessed by vulnerable populations – e.g. school food and nutrition programs that provide nutrient-rich foods, or conditional cash transfers to facilitate access to fresh fruits and vegetables • Introduce legislation to ensure institutional procurement from local smallholder farmers • Apply zoning for fast food outlets, especially around schools 	
<p>Other</p>	<ul style="list-style-type: none"> • Control the marketing of foods • Introduce mandatory regulation • Support education reforms to introduce food and nutrition education into school curricula 	

Source: WHO, 2010; FAO, 2016

Conclusion

It may be concluded that these above-mentioned strategies may help in combating malnutrition. Fortified food has been introduced to overcome the nutritional problem and to make the important micronutrient bio-availability in staple food crops and vegetables. The use of therapeutic diets like F100 and RUTF rectifies several health problems like anemia and vitamin deficiency diseases. Whereas, kitchen gardening ensures the availability of nutrient-rich vegetables. Also, complimentary feeding allows better absorption of nutrients in children, while FSN strategies diversify the diet and make better use of income for nutritional adequacy. No single organization can adequately address malnutrition. We need to learn about the connections and interactions within these collaborate with other individuals and organizations that work in complementary areas (e.g. nutrition, health, agribusiness, etc.), and become bridge builders. Only then will we be able to unleash agriculture's potential to improve the nutrition and well-being of the most vulnerable. The measures through which policymakers can influence food systems to promote healthy diets and prevent malnutrition in all its forms, including undernourishment, stunting, wasting, micronutrient deficiencies, overweight, and obesity, as well as diet-related non-communicable diseases (NCDs).

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