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Global Trends in Nutrition and Health through the Life Course

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Foreword

The past few years have seen unprecedented times for health and wellness. Across the globe, the pandemic prompted sudden changes in lifestyle that changed the nutrition and diet patterns of families everywhere. For many people, safeguarding immunity and prioritizing wellbeing became the number one concern.

As we open up after the pandemic, what can we do to ensure the optimum health of children? We need to advocate for support that enables families to adopt positive eating habits and food choices. By redefining our practice, we can do even more for our patients and those we care for.

The 98th Nestlé Nutrition Institute Workshop, held on the 11th, 14th, and 17th October 2022, was delivered in collaboration with the International Academy of Nutrition Educators and NNEdPro Global Institute for Food, Nutrition and Health.

On day 1 of the workshop, speakers from all over the world brought fascinating insights on recent developments in nutrition and metabolic health. Prof. Sumantra Ray discussed the connection between nutrition, diet, and malnutrition, and explored why a multiagency approach is needed to tackle malnutrition in all its forms. Prof. Naglaa Kamal looked at why interventions in infancy are crucial to addressing the increasingly global problem of obesity. Wrapping up day 1, Dr. Federica Amati investigated how the pandemic and economic instability have made it harder to address the global malnutrition challenge.

The second day of the workshop gave expert speakers the chance to shed light on the emerging practice patterns in nutrition and healthcare applications. Prof. Martin Kohlmeier examined the link between nutrition and the development of a resilient immune system. Otilia Perichart-Perera, PhD, then took up a discussion on nutrition and immunity, discussing key nutrients and supplementation in women and children. Closing out day 2, Shane McAuliffe, RD, looked at how nutritional support could keep vulnerable people out of hospital, and help them recover after treatment.

Day 3 of the workshop featured an illuminating panel discussion on preparing for the future of nutrition in healthcare delivery. Prof. Sumantra Ray, Celia Laur, PhD, Prof. Dhanasekhar Kesavelu, Dr. Katherine Martyn, and Lauren Ball, PhD, discussed everything from how to ensure equitable access to nutritious food to how nutrition professionals should approach social media.

As always, I hope you find the proceedings of this workshop thought-provoking and insightful. By bringing together nutrition experts from around the world, we can help refine and develop our field, and bring even more benefit to the patients we care for.

Dr. Josephine Yuson-Sunga
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Double Burden of Malnutrition and Double Duty Actions

Sumantra Ray, Wanja Nyaga

Nutrition is defined as the total of the processes referred to as the taking in and the utilization of food substances for growth, repair, and maintenance. It involves ingestion, digestion, absorption, and assimilation. Nutrition science is the study of nutrients in food, how the body uses nutrients, and the relationship between diet, health, and disease [1].

The words nutrition and nutrients cannot be used interchangeably, but they are closely related. Nutrients are stored by the body in various forms and drawn upon when the food intake is not sufficient. Specifically, nutrients are chemical compounds that are needed for growth and metabolism. They must be supplied in the diets as they cannot be synthesized in the body. Macronutrients and micronutrients are two primary categories to describe the nutrient needs of animals. Macronutrients are the protein, fat, and carbohydrates that the body needs in large amounts to provide energy for us, as well as maintain the body's structure and systems. Micronutrients, including vitamins and minerals, are only needed in milligram or microgram quantities but are essential for the support of metabolism and maintenance of health [1].

Malnutrition is a serious condition that happens when the diet does not contain the right amount of nutrients, including inadequate intake of one or more nutrients, excessive intake of one or more nutrients, or an imbalance in the intake of nutrients. It presents in three forms, including undernutrition, overnutrition (obesity and diet-related noncommunicable diseases such as heart disease and diabetes), and micronutrient deficiencies.

The double nutritional burden is the coexistence of undernutrition alongside overweight or obesity which is a major driver of other diet-related NCDs such as diabetes and stroke. This is prevalent in both developed and developing countries [2]. Undernutrition can often be accompanied by micronutrient deficiencies, and equally, those with obesity may also be micronutrient deficient. The double nutritional burden can occur not only in the same populations but also in individuals through the life course at different stages within the various

countries, cities, and communities who may be experiencing different types of malnutrition. This double burden poses a huge challenge to national policy, health policy, and resource allocation.

While the double burden of malnutrition may pose a significant public health challenge for nutrition [3], related sectors, and actors, they also present an important opportunity for integrated action. Programs and policies that aim to address the malnutrition burden through double-duty evidence-based actions are likely to be both successful and cost-effective [3]. Double-duty actions include interventions, programs, and policies that have the potential to simultaneously reduce the risk of both undernutrition (including wasting, stunting, micronutrient deficiency) and overweight, obesity, or diet-related NCDs, including type 2 diabetes, cardiovascular disease, and some forms of cancer [4].

The type of action, and its effectiveness, will vary between and within countries. Designing for double duty is not an approach of “one size fits all” but a method of crafting nutrition actions that are appropriate to the individual setting. For example, in the global nutrition report [5], India has a higher prevalence of stunting and wasting as compared to Australia; however, Australia has higher incidences of overweight than India. Therefore, the double duty should be designed for different situations to tackle specific nutrition problems.

References

- 1 Academy of Medical Royal Colleges. Relationship between nutrition, diet and malnutrition; 2010.
- 2 Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. *Nutr Rev.* 2012;70(1):3–21.
- 3 Wells JC, Sawaya AL, Wibaek R, Mwangome M, Poullas MS, Yajnik CS, et al. The double burden of malnutrition: aetiological pathways and consequences for health. *Lancet.* 2020;395(10217):75–88.
- 4 Hawkes C, Ruel MT, Salm L, Sinclair B, Branca F. Double-duty actions: seizing programme and policy opportunities to address malnutrition in all its forms. *Lancet.* 2020;395(10218):142–55.
- 5 2020 Global Nutrition Report: action on equity to end malnutrition. Bristol: Development Initiatives. Available from: https://globalnutritionreport.org/documents/566/2020_Global_Nutrition_Report_2hrssKo.pdf

Evolving Trends in Eating Habits of Children

Federica Amati, Sarah Armes

Fetal Programming is a theory that focuses on the importance of the uterine environment during a critical period of the first 1,000 days from conception to the second birthday. Insults or changes in this time can lead to a permanent change in the structure or function of physiology and metabolism in later life [1]. This research gave rise to the developmental origins of health and disease hypothesis, in that environmental stressors, such as suboptimal nutrition, induce metabolic changes in utero and programme a higher risk of later chronic disease. Infant and child nutrition in utero, but also in infancy and childhood, may affect long-term health. Malnutrition is intergenerational in nature; poor nutrition starts in utero among women with poor nutritional status, and extends throughout the life course, affecting future generations. In low- and middle-income countries, low-birth-weight babies are nearly two to five times more likely to be underweight, stunted, or wasted during childhood [1]. This child will grow into a malnourished adolescent, then an adult, and if female, finally a malnourished pregnant woman, perpetuating the intergenerational cycle of malnutrition. As a result, it is critical to act early to ensure the best possible start in life [2]. In infancy, this may include adequate care for low-birth-weight infants, adequate breastfeeding, vitamin A supplementation, adequate immunization, minimized exposure to poverty, minimized vertical transmission of infections, and avoidance of environmental hazards. In early childhood, early nutritional intervention should include adequate complementary feeding, growth monitoring, management of wasting, and supplementation of iron, vitamin A, iodine and zinc. Additionally, other interventions include adequate immunization, minimizing exposure to poverty, avoidance of environmental hazards, and maximizing positive caregiver interactions and social and cognitive stimulation.

During the COVID-19 pandemic, enforced changes in social patterns meant that children spent more time away from structured school settings and isolated from support systems outside the home. As a result, many children may have experienced increased stress, irregular

mealtimes, less access to nutritious foods, increased screen time, and decreased physical activity. A study conducted during this time discovered significant increases in BMI rates, with those already affected by overweight or obesity and younger school-aged children experiencing the greatest increases in BMI [3]. Additionally, families and households who were already predisposed to socio-economic and health inequalities may have experienced additional disruptions to income, food security, and other social determinants of health. In recent years, there has been an increase in multiple forms of food insecurity including physical availability and financial access [4]. According to the most recent Food Foundation [5] survey, one in every four households with children (25.8%) experienced food insecurity, affecting an estimated 4 million children in the United Kingdom. This was the highest level of food insecurity since the start of the pandemic. The pandemic has had a catastrophic impact on the most disadvantaged and vulnerable groups in the United Kingdom, and the issue of household food insecurity is far from resolved. Exacerbating the problem of food insecurity is the increasing global food prices. This has huge implications for food security and health, particularly in developing countries, such as Africa and Asia, where cereals contribute as much as 70% of energy intake. The rising food prices have contributed to food insecurity in many low-income countries, which already had increased food insecurity in response to the pandemic, adverse weather events, and conflict.

There is a need for an intergenerational approach with cross-discipline collaboration to impact the underlying determinants of malnutrition including poverty, maternal health, education, and household food security.

References

- 1 Guyatt H, Muiruri F, Mburu P, Robins A. Prevalence and predictors of underweight and stunting among children under 2 years of age in Eastern Kenya. *Public Health Nutr.* 2020 Jun;23(9):1599–608.
- 2 Actions EN. Mainstreaming nutrition through the life-course. Geneva: World Health Organization, 2019.
- 3 Lange SJ, Kompaniyets L, Freedman DS, Kraus EM, Porter R, Blanck HM, et al. Longitudinal trends in body mass index before and during the COVID-19 pandemic among persons aged 2–19 years – United States, 2018–2020. *MMWR Morb Mortal Wkly Rep.* 2021 Sep 9;70(37):1278.
- 4 Ntenda PA. Association of low birth weight with undernutrition in preschool-aged children in Malawi. *Nutr J.* 2019 Dec;18(1):1–5.
- 5 Food Foundation. New data show 4 million children in households affected by food insecurity; 2023. Available from: <https://foodfoundation.org.uk/publication/new-data-show-4-million-children-households-affected-food-insecurity>

Nutrition and Immunity

Martin Kohlmeier, Ebiambu Ondoh Agwara, Emmanuel Gyasi Baah

Good nutrition is a key precondition for effective immune function. There is now robust evidence for the critical contribution of several specific nutrients to the immune response. Inadequacy of these nutrients is relatively common which explains increased vulnerability to respiratory tract infections in children and adults, not least the common infections of nose and throat during the cold season.

Numerous nutrients are needed for an effective innate and acquired immune response to infection [1]. Some of these, including vitamins A and D, selenium, iron, and polyunsaturated fatty acids, play essential roles in the proliferation and maintenance of epithelial cells and white blood cells which are the body's basic defense mechanisms. These nutrients are found in several good food sources and can be supplemented if need be.

Nutrient deficiencies in vitamin A, vitamin D [2], omega-3 fatty acids, iron, copper, and selenium appear to contribute to the development and severity of respiratory tract infections. The COVID-19 pandemic has further highlighted the importance of nutrition. The increased risk of COVID-19 infection and more severe outcomes have become apparent in populations living at high latitudes, such as North and Central European countries, and Canada. Early in the pandemic, people living in the northern half of the United States had 8–10 times the risk of dying from COVID-19 than those in the southern half of the United States. Self-described African Americans were twice as likely to die than light-skinned Americans [3], also with a strong latitudinal gradient of the risk. These two observations could point to an important role of vitamin D because both are linked to differences in UV-mediated vitamin D production in the skin.

Links between vitamin D deficiency and increased susceptibility to COVID-19 infection were reported from both observational [4] and interventional [5] studies, though results varied and appeared to depend on both adequate dosing and early timing.

In the end, avoidance of deficiencies in critical nutrients as well as having a good overall nutritional status and balanced metabolism is the best starting point for a resilient immune system.

References

- 1 Calder PC. Nutrition, immunity and COVID-19. *BMJ Nutr Prev Health*. 2020 May 20;3(1):74–92.
- 2 Lanham-New SA, Webb AR, Cashman KD, Buttriss JL, Fallowfield JL, Masud T, et al. Vitamin D and SARS-CoV-2 virus/COVID-19 disease. *BMJ Nutr Prev Health*. 2020 May 13;3(1):106–10.
- 3 Kohlmeier M. Avoidance of vitamin D deficiency to slow the COVID-19 pandemic. *BMJ Nutr Prev Health*. 2020 May 20;3(1):67–73.
- 4 Louca P, Murray B, Klaser K, Graham MS, Mazidi M, Leeming ER, et al. Modest effects of dietary supplements during the COVID-19 pandemic: insights from 445 850 users of the COVID-19 Symptom Study app. *BMJ Nutr Prev Health*. 2021 Apr 19;4(1):149–57.
- 5 Alcala-Diaz JF, Limia-Perez L, Gomez-Huelgas R, Martin-Escalante MD, Cortes-Rodriguez B, Zambrana-Garcia JL, et al. Calcifediol treatment and hospital mortality due to COVID-19: a cohort study. *Nutrients*. 2021 May 21;13(6):1760.

Nutrition in Disease Recovery

Shane McAuliffe, Jenneffer Rayane Braga Tibaes

The topic of nutrition in disease recovery is extremely broad as the impact of nutrition is so great on so many disease processes and outcomes. To take a recent example, the COVID-19 pandemic has shone a light on those in society who are most vulnerable, with many of these groups intersecting with those at the highest nutritional risk in our communities. This chapter will focus on some of the science and physiology underlying the effects of disease on nutritional status and the effects of nutritional status on disease course and recovery.

Infection increases the metabolic demand for energy-yielding substrates (e.g., glucose, amino acids, and fatty acids) to facilitate the production of immune system cells and mediators. These processes also require vitamins and minerals, which act as cofactors in several metabolic reactions. Therefore, an adequate nutritional status contributes to an effective immune response. On the other hand, suboptimal nutritional status might result in blunted responses, as seen in different conditions of macronutrient deficiency [1].

From a public health perspective, the prevalence of malnutrition is evident in the community when patients are admitted to secondary care. Loss of appetite, which often develops during hospitalization, might be either a consequence of an underlying health condition (e.g., pneumonia), medical treatments (e.g., pain medication, chemotherapy), or social factors, such as depression, social isolation, or advanced age. Both acute and chronic illnesses are associated with loss of appetite and poor nutritional intake, frequently accompanied by a proinflammatory state and loss of lean and adipose tissues. Often, patients are discharged from the hospital without adequate nutritional care, which contributes to the cycle of worsened nutritional status, recurrent hospital admissions, and functional decline (Fig. 1) [2].

Mortality from COVID-19 has been highest among older people and those with comorbidities, who are also often most at risk of malnutrition in society [3]. Numerous barriers exist to optimizing nutritional status for those suffering from COVID-19 in the community before ever being admitted to the hospital. These challenges exist more widely across multiple patient groups, related to specific illness-associated nutrition impact

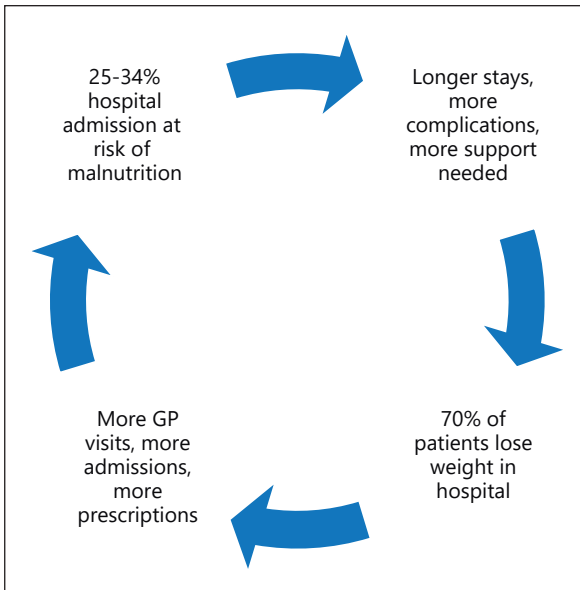


Fig. 1. Adapted from BAPEN Malnutrition Carousel [4]. Adapted from the original with the kind permission of Prof. Marinos Elia, British Association for Parenteral and Enteral Nutrition.

symptoms. Accordingly, a focus on nutrition in the rehabilitation process should be an important priority. To promote optimal recovery from illness and build a more resilient population for future health challenges and pandemics, a focus on nutrition increasingly appears to be of paramount importance [4].

References

- 1 Calder PC. Nutrition, immunity and COVID-19. *BMJ Nutr Prev Health*. 2020 May 20;3(1):74–92.
- 2 BAPEN. Introduction to malnutrition; 2018. Available from: <https://www.bapen.org.uk/malnutrition-undernutrition/introduction-to-malnutrition?start=1>
- 3 Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. *JAMA*. 2020 Apr 7;323(13):1239–42.
- 4 Cawood AL, Walters ER, Smith TR, Sipaul RH, Stratton RJ. A review of nutrition support guidelines for individuals with or recovering from COVID-19 in the community. *Nutrients*. 2020 Oct 22;12(11):3230.

The Future of Nutrition Care in Health Systems

Celia Laur, James Bradfield, Lauren Ball

Leading health systems of the future will embed support for healthy eating as a core component of care. In this chapter, we describe three ways that health systems can act to provide support for healthy eating: (1) being agile in service delivery to adapt to individual's ever-changing support needs, as well as contribute to broader health and food system decision-making; (2) prioritize food as an individual's right to health, and take responsibility for ensuring access to nutritious foods when required; and (3) upholding evidence-informed implementation strategies to underpin evolving healthcare systems. These three interconnected strategies will support the future of nutrition care considering individual and system-level factors.

Agile Healthcare Systems

Within an agile healthcare system, the changing needs of individuals need to be considered within the interconnected aspects of a complex system. Leading health systems of the future need to focus on individual needs while maintaining sustainability and equity across populations. Food and healthcare systems are, and should be, strongly interconnected due to the significant role of food in human health. However, food systems have changed significantly as technology and agriculture have advanced. Not only do these changes impact food quality and access, they also impact the healthcare system. The COVID-19 pandemic clearly illustrated the interdependence between health and food systems. For example, disruptions to food supply chains limited access to certain foods and products, which impacted people's health and put additional strain on individuals and healthcare services [1]. The pandemic also strained business operations in the food industry. The interconnected nature of these systems cannot be ignored and learnings from the COVID-19 pandemic need to be considered in developing more agile, equitable, and sustainable food and healthcare systems that acknowledge their connection and interdependence.

An Individual's Right to Health

The right to health and the right to food are highly connected. While healthcare systems need to be agile to rapidly provide what is needed for the societies that we live in regarding healthy food and quality of care, there are differences in how this looks between countries and populations. Equitable access to health services and high-quality food is a longstanding issue in many countries. In the past, healthcare actions have not genuinely demonstrated the vast impact of these issues, and this cannot be ignored any longer. Change is needed to find equitable and sustainable approaches to provide long-term access to healthy, high-quality food, regardless of why people do not have access, e.g., socioeconomic, geographical, or a natural disaster.

Evidence-Informed Implementation Strategies

To develop agile food and healthcare systems, evidence-informed implementation strategies at the individual, organizational, and systems levels are needed. At the individual level, behavior change theories can be crucial to support sustained change. For example, the COM-B model articulates how individuals need the Capability, Opportunity, and Motivation to change behavior [2]. For example, for an individual to move toward eating a healthier diet, they need the knowledge and skills (Capability) to know what to buy and how to prepare it. Individuals also need the Opportunity, such as an income that allows them to buy healthier food, access to food to purchase, and space to prepare the food. Motivation is also needed to change their eating patterns. All three elements are needed to encourage behavior change. However, individuals live in systems, and each aspect of the COM-B model is impacted by where people live, the availability of food, the political structure, and other complex and systems-level factors.

References

- 1 Hobbs, JE. Food supply chains during the COVID-19 pandemic. *Can J Agr Econ*. 2020;68:171–6.
- 2 Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci*. 2011 Apr 23;6:42.

Globesity and Increasing Noncommunicable Diseases

Naglaa M. Kamal, Sara A. Abosabie, Salma A.S. Abosabie

Globesity, the global obesity epidemic, has become a significant concern affecting individuals across various age groups from infancy to the elderly. Adult obesity is more prevalent worldwide than undernutrition, while pediatric obesity rates have reached approximately 5.9% in children under 5 years. The impact of obesity extends to both communicable and noncommunicable diseases. Notably, during the COVID-19 pandemic, obesity was associated with worse outcomes, including increased disease severity and mortality [1]. Furthermore, the lockdown measures implemented during the pandemic resulted in reduced physical activity, contributing to a significant increase in BMI among children aged 2–19 years as reported by Kompaniyets and colleagues [1].

Obesity is strongly linked to noncommunicable diseases, leading to substantial medical and economic burdens. It affects multiple organ systems, resulting in various comorbidities such as idiopathic intracranial hypertension, systemic hypertension, metabolic-associated liver disease, gall bladder disease, pulmonary function abnormalities, obstructive sleep apnea, increased cancer risk, and endocrine abnormalities, among others.

The etiology of obesity is complex and involves both unmodifiable and modifiable factors. Unmodifiable factors include genetics, ethnicity, and intrauterine factors, while modifiable factors encompass diet, lifestyle, socioeconomic status, physical activity, sleep patterns, and dysbiosis [2].

Efforts should be directed toward preventing and managing the globesity epidemic through a comprehensive, multimodal integrated action plan that addresses different levels of prevention. The primary goal of this action plan is to achieve and maintain an energy balance throughout an individual's lifespan. Early intervention is crucial due to increased plasticity and reduced adverse effects of lifestyle changes, aligning with the life course model of obesity and noncommunicable diseases (Fig. 1) [4].

Intervening early to break the cycle of childhood obesity is fundamental. This can be achieved by reducing obesity in pregnant women,

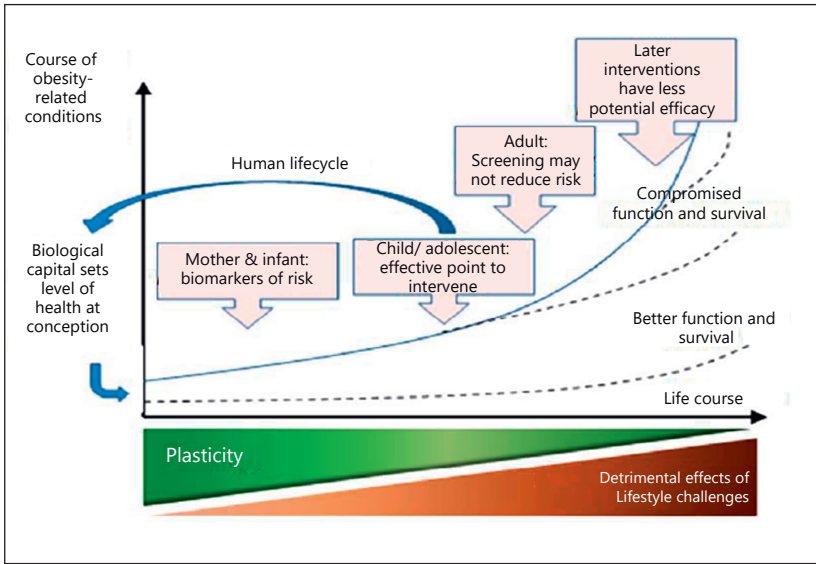


Fig. 1. Life-course model of obesity and other noncommunicable disease risk. Reproduced from Hanson [3].

promoting breastfeeding as the optimal postnatal nutrition, and ensuring proper formula preparation for infants who are not breastfed. It is well-established that high protein content in infant formula during the first year of life can have insulinogenic and adipogenic effects. Therefore, using lower protein infant formula can positively impact BMI trajectories up to 11 years, resulting in similar BMI values at adiposity rebound as observed in breastfed infants [5].

Supplementing infant formula with human milk oligosaccharides is essential to maintain a healthy intestinal microbiota. Preserving microbiota homeostasis and preventing dysbiosis have implications for preventing obesity, metabolic syndrome, and noncommunicable diseases [6].

In addition, healthy weaning practices and promoting a balanced diet for toddlers and children are crucial. This includes limiting the consumption of sugary and fatty foods and beverages and curtailing their promotion on television and digital media. Implementing clear labeling for food products containing high sugar, high fat, trans fat, saturated fat, and artificial sweeteners should be mandatory. Further measures, such as banning the sale of unhealthy foods in schools and increasing taxes on such products, can help reduce their consumption [4].

Promoting physical activity and encouraging children and their parents to engage in regular exercise are important strategies. Additionally, maintaining adequate sleep duration is beneficial in supporting overall health and well-being. It is crucial to monitor healthy nutrition practices throughout the human life cycle, with the active involvement of pediatricians and society as a whole, for the effective prevention and management of obesity [4].

References

- 1 Kompaniyets L, Goodman AB, Belay B, Freedman DS, Sucusky MS, Lange SJ, et al. Body mass index and risk for COVID-19-related hospitalization, intensive care unit admission, invasive mechanical ventilation, and death – United States, March–December 2020. *MMWR Morb Mortal Wkly Rep.* 2021;70(10):355–61.
- 2 Lifshitz F, Lifshitz JZ. Globesity: the root causes of the obesity epidemic in the USA and now worldwide. *Pediatr Endocrinol Rev.* 2014;12(1):17–34.
- 3 Hanson M. Nurturing human capital along the life course: investing in early childhood development. Presented at World Health Organization, Geneva, 10–11 January 2013. Available from: <https://www.who.int/publications/i/item/9789241505901>
- 4 Bhisma M. Childhood stunting, wasting, and obesity, as critical global health issues: forging cross-sectoral solutions. 7th International Conference on Public Health; 2022. Available from: http://theicph.com/en_US/concepts-principles-and-policy-approaches-to-tackling-health-inequity/
- 5 Totzauer M, Escibano J, Closa-Monasterolo R, Luque V, Verduci E, ReDionigi A, et al. Different protein intake in the first year and its effects on adiposity rebound and obesity throughout childhood: 11 years follow-up of a randomized controlled trial. *Pediatr Obes.* 2022;17(12):e12961.
- 6 West CE, Renz H, Jenmalm MC, Kozyrskyj AL, Allen KJ, Vuillermin P, et al. The gut microbiota and inflammatory noncommunicable diseases: associations and potentials for gut microbiota therapies. *J Allergy Clin Immunol.* 2015;135(1):3–13.

Nutrition and Immunity: Key Nutrients and Trends in Nutrient Supplementation in Women and Children

Otilia Perichart-Perera

Micronutrient deficiencies represent a public health problem worldwide. One third of the population suffer from at least one micronutrient deficiency. Pregnant women and children are particularly affected groups, as well as individuals living in low- and middle-income countries (LMICs). Anemia, iron, vitamin A, iodine, and vitamin D deficiencies are prevalent in many countries. Even though micronutrient intakes have improved around the world, there are still inadequate intakes of some nutrients in many countries, including calcium, iron, zinc, vitamin A, and vitamin C [1].

In this context, and considering the COVID-19 pandemic, it is very relevant to improve nutritional status around the world. It is well known that nutrition plays a key role in strengthening the immune system. A healthy dietary pattern provides adequate quantity and quality of protein, which is associated with a reduced risk of infection. Also, a healthy diet includes an adequate amount of total fat and healthy fats, specifically monounsaturated and polyunsaturated fat (PUFA). Omega 6 PUFA may have proinflammatory effects, while omega 3 PUFA (eicosapentaenoic acid-EPA and docosahexaenoic acid-DHA) exerts antiinflammatory effects, among other health benefits. Only some countries in the East Asia region meet the daily intake recommendation of DHA (250 mg per day). Monounsaturated fat may have antioxidant, antimicrobial, and antiviral effects. A healthy diet also provides high-quality carbohydrates (low glycemic index and/or high-fiber foods) (grains, legumes, fruits, vegetables, milk) and limits high glycemic index foods and added sugars, which have been associated with higher concentrations of C-reactive protein and proinflammatory cytokines. A healthy diet provides many nutrients with antiinflammatory and antioxidant properties. Vitamins D, A, E, C, B-complex, selenium, zinc, and iron, among others, elicit immune boosting properties, and the deficiency of any of these micronutrients is detrimental to the immune function (Fig. 1) [2, 3]. In this context, nutrient supplementation may be relevant in some individuals and populations.

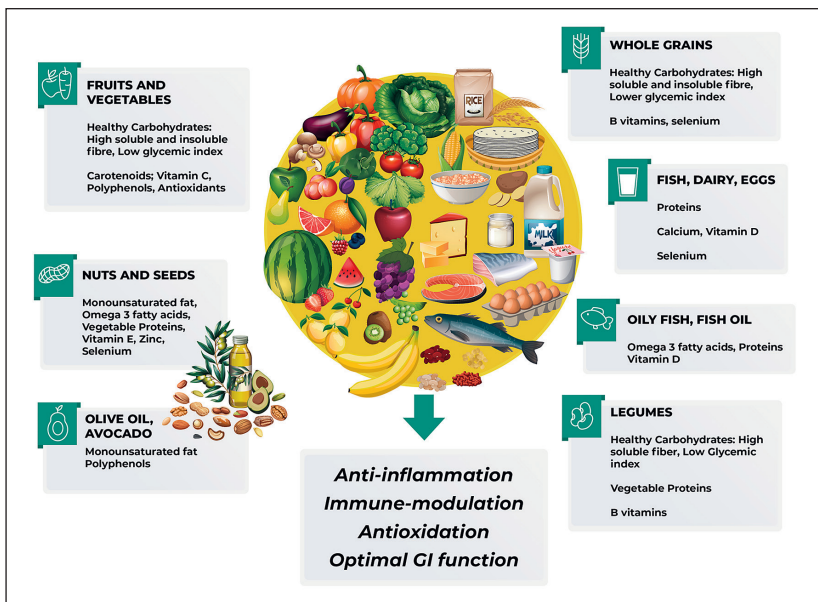


Fig. 1. Healthy dietary pattern food components that play an important role in immunity.

For pregnant women, the World Health Organization recommends iron and folic acid (preconceptionally) supplementation. In women with a high risk of preeclampsia and low calcium intakes, calcium supplementation is necessary to reduce the risk of preeclampsia. In women with nutrition deficiencies, malnutrition, food insecurity, or vulnerable groups, multiple micronutrient supplementation (MMS) is recommended. MMS appears to decrease the risk of low birth weight (LBW) and small for gestational age (SGA) newborns, and probably, the risk of preterm birth. Other nutrients, such as DHA, zinc, and vitamin B12, may be needed, particularly in the presence of deficiencies or with inadequate intake of these nutrients [4]. In the case of vitamin D, controversy exists about doses and benefits of supplementation, but recent evidence has shown possible protection against gestational diabetes, as well as LBW and SGA newborns. In children, vitamin A supplementation is associated with a reduction in all-cause mortality, and mortality associated with diarrhea and zinc supplementation, mainly in Asia, has been shown to decrease the risk of acute respiratory infections [5]. In terms of immunity in adults, vitamin D supplementation appears to reduce the probability of intensive care unit admission in hospitalized patients with COVID-19, and to decrease the

risk of mortality. No clear effect has been observed for primary prevention of COVID-19 [6]. Some studies in adults, mainly in North America, have shown that vitamin D supplementation reduces the risk of respiratory tract infections, while other studies have not [5]. This concern for improving immunity in some individuals has led to an increase in the use of supplements. In general, people using supplements tend to be older, female, have higher education, higher income, and healthier lifestyles, but there is scarce information from LMICs [7]. In the COVID-19 pandemic, studies from different countries reported an increased use of dietary supplements, increasing the over-the-counter use of supplements, probably resulting in excessive intake of some nutrients. Countries should focus on increasing the nutrient density of the food supply, improving access and utilization of nutrient-dense foods, and decreasing the availability of ultraprocessed, energy-dense foods to promote health and optimal immunity. Implementing nutrition interventions such as the promotion of healthy diets, the recommendation of individual nutrient supplementation schemes, and nutrition education should be a priority. Nutrition assessment is critical to adequately recommend micronutrient supplementation for individuals or populations. There is a need for high-quality evidence of micronutrient supplementation studies and its effect on preventing and treating infections and COVID-19.

References

- 1 Han X, Ding S, Lu J, Li Y. Global, regional, and national burdens of common micronutrient deficiencies from 1990 to 2019: a secondary trend analysis based on the Global Burden of Disease 2019 study. *EClinicalMedicine*. 2022 Feb 12;44:101299.
- 2 Calcuttawala F. Nutrition as a key to boost immunity against COVID-19. *Clin Nutr ESPEN*. 2022;49:17–23.
- 3 Iddir M, Brito A, Dingo G, Fernandez Del Campo SS, Samouda H, La Frano MR, et al. Strengthening the immune system and reducing inflammation and oxidative stress through diet and nutrition: considerations during the COVID-19 crisis. *Nutrients*. 2020 May 27;12(6):1562.
- 4 World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. Geneva: WHO Press; 2016.
- 5 Vlieg-Boerstra B, de Jong N, Meyer R, Agostoni C, De Cosmi V, Grimshaw K, et al. Nutrient supplementation for prevention of viral respiratory tract infections in healthy subjects: a systematic review and meta-analysis. *Allergy*. 2022 May;77(5):1373–88.
- 6 Hosseini B, El Abd A, Ducharme FM. Effects of vitamin D supplementation on COVID-19 related outcomes: a systematic review and meta-analysis. *Nutrients*. 2022 May 20;14(10):2134.
- 7 Zhang FF, Barr SI, McNulty H, Li D, Blumberg JB. Health effects of vitamin and mineral supplements. *BMJ*. 2020 Jun 29;369:m2511.

Social Media: The Weapon in the Armory

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In recent years, health communication via social media has increased due to the ever-growing number of technology users globally [1]. Social media use in public health education reduces the barriers that affect access to healthcare resources and support. Despite this great advantage, social media also poses challenges such as misinformation on various health topics and lack of a standard verification system for those sharing health messages [2]. As public health promotion becomes more deeply rooted in Internet-based programming, health educators are tasked to become more competent in social media messaging that factors both online and offline consumer health experiences [1].

Additionally, there are various food and nutrition trends [3] on social media platforms, whereby experts, industries, marketing agencies, and influencers engage their audience in the hot topics. Some of the topics explored in depth in this review include “No Salt, No Sugar, Vitamin D deficiency” among others.

With the increasing demand for healthcare services, social media platforms have become a necessary tool for healthcare providers to share information with the public. This chapter explores a few topics that have come across as hot topics on social media platforms, e.g., complementary feeding among others.

When harnessed properly, social media is a great tool for healthcare providers to disseminate their findings and share health resources with the public. Additionally, healthcare providers need to understand the drawbacks to using social media in the field and come up with strategies for overcoming challenges to using social media in health promotion and the best practices for designing, implementing, and evaluating social media forums in communicating public health information.

References

- 1 Stelfson M, Paige SR, Chaney BH, Chaney JD. Evolving role of social media in health promotion: updated responsibilities for health education specialists. *Int J Environ Res Public Health*. 2020 Feb 12;17(4):1153.

- 2 Moorhead S, Hazlett D, Harrison L, Carroll J, Irwin A, Hoving C. A new dimension of health care: systematic review of the uses, benefits, and limitations of social media for health communication. *J Med Internet Res* 2013;15(4):e85.
- 3 Healthline. Food and nutrition trends. Available from: https://www.healthline.com/nutrition/food-and-nutrition-trends#_noHeaderPrefixedContent.

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