# Advancing Nutrition Science to Meet Evolving Global Health Needs

Eur J Nutr. 2023 Dec;62(Suppl 1):1-16. doi: 10.1007/s00394-023-03276-9. Epub 2023 Nov 28. PMID: 38015211; PMCID: PMC10684707.

Lynnette M. Neufeld[1,2,3] Emily Ho[4], Rima Obeid[5], Charalampos Tzoulis[6], Marina Green[7], Luke G. Huber[8], Michelle Stout[9], James C. Griffiths[10]

**Abstract**

Populations in crisis! A global overview of health challenges and policy efforts within the scope of current nutrition issues, from persistent forms of undernutrition, including micronutrient deficiency, to diet-related chronic diseases. Nutrition science has evolved from therapeutic and prevention emphasis to the implications for the current focus on diets and food systems. Working and consensus definitions are needed, as well as guidance related to healthy diets and the emerging issues that require further research and consensus building. Between nutrient deficiency and chronic disease, nutrition has evolved from focusing exclusively on the extremes of overt nutrient deficiency and chronic disease prevention, to equipping bodies with the ability to cope with physiologic, metabolic, and psychological stress. Just what is 'optimal nutrition' and is that a valid public health goal and what terminology is being provided by the nutrition science community? Adapting nutrition intervention studies to demonstrate health impact are concrete real-world examples of study designs and outcome measures that may be used to demonstrate the impact of interventions on the healthy life expectancy (often termed "healthspan"), resilience and intrinsic capacity. Finally, experts provide views on ongoing

[1] The co-authors are listed in the order of their presentations and sections within this manuscript.
[2] The views expressed in this publication are those of the author(s) and do not necessarily reflect the views of FAO.
[3] Food and Nutrition Division, Food and Agriculture Organization of the United Nations, Rome, Italy.
[4] Linus Pauling Institute and College of Health, Oregon State University, Corvallis, OR USA.
[5] Department of Clinical Chemistry and Laboratory Medicine, University Hospital of the Saarland, Homburg, Germany.
[6] Neuro-SysMed, Department of Neurology, Haukeland University Hospital and Department of Clinical Medicine, and K.G. Jebsen Center for Translational Research in Parkinson's disease, University of Bergen, Bergen, Norway.
[7] Nutrition Research Centre Ireland, South East Technological University, Ireland.
[8] Council for Responsible Nutrition, Washington, DC USA.
[9] Amway / Nutrilite, Buena Park, CA USA.
[10] Council for Responsible Nutrition – International, Washington, DC USA.

challenges of achieving consensus or acceptance of the various definitions and interventions for demonstrating health promoting effects, and how these can inform new government policies aimed at health promotion.

Nutrition topics that receive particular focus in these proceedings include choline, xanthophyll carotenoids, and NAD-replenishment in neurodegenerative diseases. Choline is a crucial nutrient essential for cell metabolism and functions, requiring consumption from foods or supplements due to inadequate endogenous synthesis. Maternal choline intake is vital for fetal and infant development to prevent neural tube defects. Neurodegenerative diseases pose a growing health challenge, lacking effective therapies. Nutrition, including NAD-replenishing nutrients, might aid prevention. Emerging research indicates xanthophyll carotenoids enhance vision and cognition, potentially impacting age-related diseases.

## Introduction

Poor and suboptimal nutrition is a global issue that affects a significant portion of the population, particularly preschool children and women of reproductive age. Despite some progress being made in reducing poor nutrition, the COVID-19 pandemic and rising food prices may have impeded this progress. Micronutrient deficiency, while not generally included in global targets, is a major concern. Healthy diets are essential for preventing disease and promoting optimal health, but there is often contradictory advice, especially in the lay press and on social media platforms, on what constitutes a healthy diet. This report explores the role of nutrition in optimizing human health, including the importance of choline, NAD (nicotinamide adenine dinucleotide) replenishment in neurodegenerative diseases, and the xanthophyll carotenoids.

Precision and personalized nutrition, which consider individual differences in response to food, nutrients, and bioactives, is an emerging area of opportunity. The microbiome, which plays a key role in human health and how we metabolize nutrients and respond to food, has implications for personalized nutrition, as diets tailored to individual microbiomes may optimize health.

Choline is an essential nutrient that plays a vital role in cell metabolism and functions. It is not synthesized by the body in adequate amounts, making it necessary to consume choline-rich foods or supplements. The importance of maternal choline supply in fetal and infant development has been highlighted in the literature, with low dietary choline intake or low circulating levels in the mother being associated with an increased risk for neural tube defects. Choline deficient diets can cause fats to accumulate in the liver, and removing choline from the diet causes fatty liver in preclinical research. As such, public health authorities across the globe should recognize choline as an essential nutrient for early life development.

Neurodegenerative diseases (ND) are a major health challenge in the 21st century, with the number of people affected expected to continue to substantially increase in the coming decades. Currently, there is a lack of neuroprotective or disease-modifying therapies available to prevent or delay disease progression. Primary prevention would be a much more efficient approach than treatment, and population-wide prevention would be an ideal approach against ND. Diet, including nutrients for NAD replenishment, may play a role in the prevention of ND.

The xanthophyll carotenoids (XC), lutein (L), zeaxanthin (Z), and meso-zeaxanthin (MZ), are natural lipid-soluble micronutrients obtained only from the diet. They have become increasingly important for their role in preserving and enhancing human function, such as visual performance and potentially cognitive function, along with their potential diagnostic and therapeutic implications for chronic and age-related diseases. Understanding the underlying mechanisms by which they are absorbed and metabolized is important for developing targeted nutrition as a cornerstone for individualized medicine.

Poor nutrition may appear as undernutrition, micronutrient deficiencies, and as diet-related non-communicable diseases. Each of these situations has the potential to lead to severe disease states as well as social and economic burdens. It is a public health imperative to implement policies that address these modifiable challenges and support access to healthy diets worldwide. In addition, developments in precision and personalized nutrition advance the understanding of responses to food, nutrients, and bioactives, leading to improved health outcomes. This CRN-International Scientific Symposium and resulting conference report are

intended to support the path toward a nutrition policy roadmap that will improve the health of current and future generations.

Over the last decade, the Council for Responsible Nutrition-International (CRN-I) has focused increasingly on a triad of over-arching issues at the annual CRN-I Scientific Symposium and concomitant publications in the European Journal of Nutrition. The symposia have been held at the Codex Alimentarius Committee on Nutrition and Foods for Special Dietary Uses (CCNFSDU). The most recent topics are tangential to each other and have covered optimal nutrition[45, 79, 132], healthy ageing[80, 102], and concepts around health promotion[56]. Further key publications that explore these inter-related topics include: *From Lifespan to Healthspan[154]*; *Opportunities to Improve Nutritional Status and Promote Health[103]*; *Sex Differences Across the Life Course[6]* and *Optimizing Health with Nutrition-Opportunities[63]*.

## CONCLUSION

The annual CRN-International Scientific Symposium reflected upon the health challenges resulting from malnutrition and an aging population, both that come with significant social and economic costs. The 5 recognized experts shared their perspective on the importance of focusing on prevention and optimizing nutrient status prior to the onset of health-related issues. Recognizing that the globally agreed nutrition goals are off-track and healthy diets are not affordable or accessible to all, there is an urgency for the evolution in policy and research to enable progress forward.

Nutrition policy recommendations to prevent nutrient deficiencies remain important, however, efforts should evolve to consider recommendations that support resilience, optimal health and expanded healthspan. Going beyond nutrition, policy shifts are needed across multiple sectors to enable households and individuals to consume a healthy diet and ensure those most vulnerable to malnutrition are provided with access to them. Suggested solutions included; 1) transformation of agriculture and trade policy to prioritize actions to ensure availability and access to nutritious food, 2) protection of policy continuity gains from political interests taking precedence over prioritized programs that ensure nutrition actions in the context of e.g.,

universal health care and effective social protection, and 3) incentives and disincentives to shift food production towards healthier food to address the many nutrition issues linked to the high availability and lower cost of unhealthy foods.

Solutions to address these health challenges and policies must be based on reliable evidence. Evaluation of the impact and cost effectiveness of these actions are necessary, requiring innovation in methodological approaches, moving away from reliance on the medical models (i.e., randomized trials of single nutrient interventions), that are not feasible or appropriate. Advancing research to identify better biomarkers for optimal health and healthspan along with the factors that influence individual response variability are essential to inform future public and personalized recommendations.

The opportunities identified start to build a roadmap for impact, but action is required. The decisions that are made today to progress nutrition science and policy will design the future for the next generation. Therefore, it is critical that all stakeholders (government, academia, private sector) come together to identify and implement solutions that will optimize nutrition status and improve healthspan to enable heathier lives for all at all ages, perhaps going beyond traditional public health measures.