

Personalised, population and planetary nutrition for precision health

Nutrition is a global science that originally was envisaged to biologically analyse and integrate the processes related to food transformation into energy and nutritious components for cell functions and homeostasis.¹ Noteworthy, it is now evident that such physical, chemical and metabolic reactions participate in human development to ensure life expectancy and well-being, with a growing and inseparable relevance for personal, population and planetary health.² Nowadays, nutritional challenges and nutritionist's interests are being focused on health and wellness involving physical, emotional, intellectual, cognitive, spiritual, environmental and occupational facets.³ Moreover, according to the newer emerging health scenarios, food intake should be assessed in relationship with social, satisfaction, satiety, security, safety and sustainable dimensions. In this context, two apparently alternative approaches, one derived from a global public health perspective and another derived from a precision-personalised nutrition paradigm, should be harmonised and deliberated since they are complementary to each other and as such, personalised, participative, preventive and predictive strategies are all needed in order to maintain a healthy status as well as to prevent and manage diseases.⁴

PRECISION PERSONALISED NUTRITION

The evolving notion about precision nutrition concerns personalised nutrition guidelines and tailor-made dietary prescriptions for the prevention and treatment of obesity, diabetes, cardiovascular events and other chronic diseases. The management of metabolic impairments, inflammatory/haematological disturbances or neoplasia/tumorous diseases with nutritional approaches are needed for health maintenance as well as in clinical practice.⁵ In this context, precision nutrition not only

considers an individual's genomic background and nutrient-gene interactions but also a thorough phenotyping evaluation, including family and personal clinical features, perinatal feeding programming and expectantly a wide spectrum of bioinformatic data concerning metabolic pathways. This last aspect involves omics strategies and high-throughput technologies such as metabolomics, proteomics, (epi) genomics or metagenomics related to macronutrients and micronutrients metabolic utilisation.⁶ Indeed, the conceptual framework describing precision nutrition is based on evaluating the interpersonal diversity caused by genetic/epigenetic differences, the environmental and lifestyle exposome heterogeneity, metagenomic variations in microbiota and objective behavioural/psychological features with evident consequences for conjoint personal and population public health-related challenges and applications. Consequently, precision nutrition should contemplate the implementation of an efficient individualised nutritional status and assessment of strategies based on validated indices and metrics for metabolic care in every person, being not only restricted to patients suffering chronic diseases but also to healthy subjects.⁷ Thus, it is a good mandate to recognise individual's differences and to develop new genetic and transcriptomic indicators, inclusive of proteomic, lipidomic and metabolomic approaches and nutrigenomic and metagenomic tools related to nutrient metabolism.⁸

Nevertheless, personalised clinical and phenotypical features including one's own psychological/personality patterns, specific food allergies and intolerances, differential cultural, social and environmental backgrounds, drug side effects, personal dietary preferences as well as singular lifestyle and environmental factors such as cold weather or warm, and very warm climates need to be addressed for a robust precision nutrition and medical approaches. Regulatory issues are needed to be developed and implemented for a smooth

growth of nutrition and personalised endeavours and methodologies, where important achievements, recommendations and challenges are expected for combining public and personal health benefits including ethical issues.⁹

PRECISION POPULATION NUTRITION

A number of policies and public efforts are being currently devoted to generate evidence for health promotion and disease risk reduction supported by food-based dietary guidelines (FBDG) in order to instruct populations about healthy dietary habits.¹⁰ These messages are better interpreted than nutrient intakes only and easier to make recommendations on primary prevention of noncommunicable diseases (NCDs) when they are based on Mediterranean dietary components and other regional foods from Oriental, Latin American and Indian diets with spices rich in bioactive compounds.^{11 12} Of equal importance are the traditional African foods and diets which have not received global dimensions even though these are rich in their diverse nutrient quality such as nutrients provided insect foods.

In any case, nutritional advices in different continents and regions seem to be comprehensively similar across countries such as to consume a variety of foods in balanced proportions including fruits and vegetables, whole grains, cereals, legumes and moderate animal-source products and limit high energy yielding sugary and fatty foods. The adverse impact of ultraprocessed foods and discretionary food consumption involving red and processed meats, added sugars, confectionery and other detrimental food ingredients need to be explicitly disclosed on the packaged food labels and scores following the dietary guidelines.¹³ On the contrary, some myths on fats, oils and nuts need to be dispelled, given the strong available scientific evidence of their cardiovascular benefits and the dangers of overconsumption beyond a level without proper exercise to metabolise them adequately in the body.¹⁴

Information sourced from the FBDG repository of the FAO or articulated by WHO reveals that FBDG are currently available for about 100 countries or regions, where the incorporation of bioactive compounds occurring on foods and the analysis of environmental sustainability information, climate change data and considerations to sociocultural factors and swiftly varying dietary tendencies are fairly documented.¹⁵ It is not the intent of this article to serve as advise to different countries, but to highlight the parameters to be considered in nutrition and health of the population depending on the climate and the nature of agricultural nutritious products that they are growing and which are used within traditional food practices over thousands of years.

Furthermore, epidemiological investigations concerning the impacts of Japanese, Nordic, Latin American and Mediterranean diets or African, Indian and Oriental plant-based nutritional patterns on NCDs have positioned evidences with remarkable benefits in health outcomes and life expectancy compared with westernised food intake habits of high fatty food and meat-rich diets.¹⁶ Furthermore, some well-conducted trials such as PREDIMED or DASH and Diabetes Prevention Programs implemented in USA, Europe, China, India or Japan have confirmed the role of lifestyle and dietary practices on health maintenance or prevention/management of obesity, diabetes and cardiovascular events.¹⁷

Additionally, specific population-oriented public health-nutrition communication should reflect the specific physiological needs across the life cycle, including infancy and pregnancy or lactation status, which require tailored nutritional supplies to balance particular nutrient requirements and to account for cultural and socioeconomic differences among areas, countries and regions. Of course, education, practical training and professional development for sustainable food systems and dietary practices need to consider differential personal and population profiles in the low-income and high-income

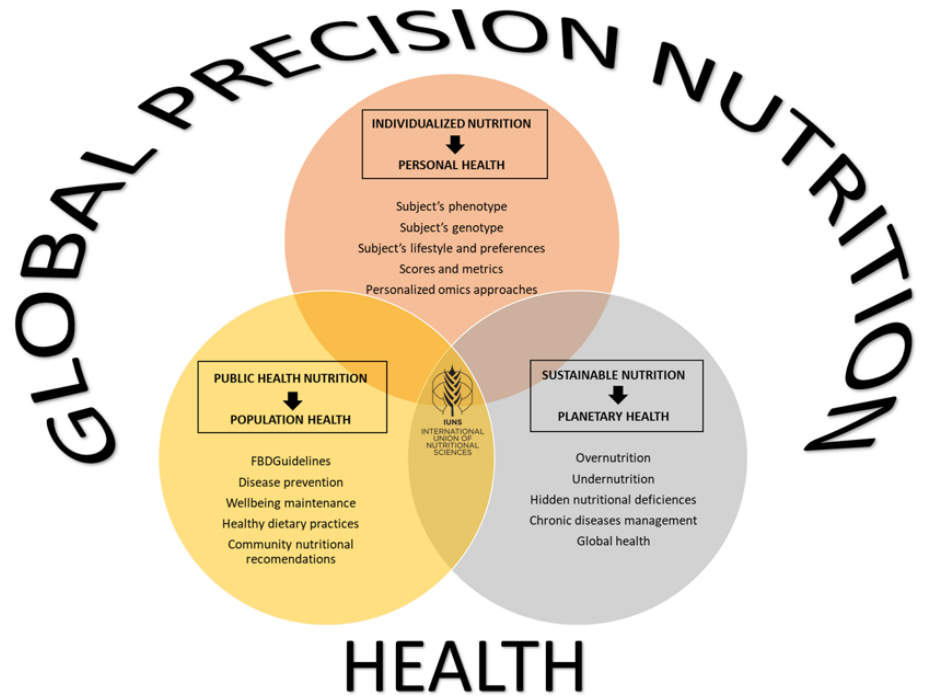


Figure 1 Schematic representation of global precision nutrition and its role in health from the perspective of linkages of nutrition to personal, population and planetary health respectively (based on IUNS task force).

countries and regions.¹⁸ Outstanding research and maintenance of large and long-term high-quality cohorts such as The European Prospective Investigation into Cancer and Nutrition, Framingham, The Supplementation en Vitamines et Mineraux Antioxydants, Nurses and Health Professionals and UK Biobank are important tools to develop/design policies and healthy messages for the people. These interventions need to be replicated with local modifications and food availability for sustainable nutrition agenda. New food frequency questionnaires and the implementation of appropriate biomarkers of food intake and surrogates of metabolic utilisation shall continue to improve our knowledge in a dynamic fashion.¹⁹

PRECISION PLANETARY NUTRITION

As stated in International Union for Nutritional Sciences (IUNS) vision declaration, to live a life without undernutrition is a fundamental human right, while nutrition improvement anywhere in the world is a societal, household and individual concern. Indeed, a major focus of planetary nutrition is to fight

against the aetiological roots and hazardous consequences on health concerning the double burden of malnutrition, which involves not only undernutrition, stunting, underweight and wasting, including hidden deficiencies of micronutrients, but also excessive body weight and obesity, which are associated to a high impactful of NCDs across the globe.²⁰ These endeavours should be based on concepts of sustainability, food security and environmental and climate change monitoring, which are receiving support and resources from important organisations and institutions such a UN agencies, UNICEF, FAO, WHO-OMS, World Bank, FMI and IUNS. Such attempts are also through integrated or independent initiatives such as GAIN, Scaling Up Nutrition, IUNS Task Forces and specifically via the WHO's Sustainable Development Goals. International embracing of a global nutrition agenda should address food and nutrition problems in developing countries as well as training/capacity building for nutritionists. The same is the situation with high-income countries and NCDs and the obesity pandemic.

Current planetary challenges in nutrition include enhanced agricultural production for sustainable human development in order to match the planetary needs for nutrient intake.²¹ Socioeconomic and political issues controlling food distribution, food system transformation, food reformulations or discretionary taxes application to unhealthy dietary products, trade regulations concerning staple foods, the adoption of national/regional FBDG concerning healthy meal consumption such as vegetables, grains, legumes, cereals, seafood protein sources to fill in the nutritional gaps.²² The research of innovative and efficient dietary biomarkers and research metrics for nutritional surveillance are needed urgently and be complemented with sustainability factors on land and water use, climate change management and reduction in human-generated greenhouse gas emissions. It is only then when a friendly environment for mankind well-being with health and sustainability perspectives concerning global food consumption will emerge.²³

In this context, precision, personalised, population and planetary nutrition for public health implementation must concentrate on promoting advancement in nutritional sciences, research and development through international cooperation at the global level (figure 1), where sustainable diets, nutrition in chronic diseases, infections and cancer, precision nutrition, risk and cost-benefit effectiveness of micronutrient interventions can be evaluated. It should also complement and supplement endeavours involving nutrient quality, food safety and attempts with global approaches for prevention and control of malnutrition, via traditional, indigenous and cultural foods and multidimensional indicators of child growth and development.²⁴ Furthermore, novel approaches in nutrition programmes should encourage communication and collaboration among scientists as well as to disseminate information in nutritional sciences through modern communication virtual technologies

aided by capacity building and online learning strategies accompanying a strong public health nutrition workforce.²⁵ IUNS is making such attempts in this direction to reach out such knowledge networking spread globally, where phenotypical traits and the genetic makeup should be considered.²⁶

Precision nutrition conclusions

Indeed, precision nutrition should deem all factors involved in global quality of life and metabolic well-being depending not only on the genotype but also on the dietary intake and associated healthy lifestyles in order to be worldwide developed and implemented in personalised, population and planetary settings for individual's, public and sustainable global health considering genetic and nongenetic-related phenotypes as well as environmental factors.

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