Nutrient- gene interactions: Knowledge to action within an IUNS Task Force

Personalized nutrition and nutritional genomics are globally becoming important areas of interest that should complement the knowledge and applications in order to benefit not only individualized wellbeing issues but also to fulfill public health demands. The accessibility to modern technologies, the availability of recognized and new biomarkers based on genome data and the understanding of genotype information are three relevant tasks have been developed and investigated in personalized nutrition frameworks.

Nutrition and dietary intake are essential elements concerning the interactions between environment and genes for achieving a health status. Furthermore, personalized nutrition would be based on the principle that food or nutrients may be risk or protection factors for preventing and treating various diseases, whose performance depends on their ability to regulate the expression of genes and on the genetic predisposition of the individual Thus, the interplay of personalized nutrition depends either on genetic background information (e.g. heritage and epigenetic markers), and on biological (physical activity, history of diseases, intolerances, and allergies) and cultural variation (e.g. food preferences, religion, and food accessibility) asweel as on own likes and dislikes

In turn, nutritional genomics is the science that involves all “omics” approaches (e.g. transcriptomics, proteomics, metabolomics, foodomics, lipidomics, metagenomics, etc) to explain how food/ nutrients and genes interact and are expressed to reveal individual phenotype differences, including health or disease condition. It also includes research in nutrigenetics, nutrigenomics, nutriepigenetics, and systems biology Furthermore, nutritional genomics can contribute in personalized nutrition, in order to discover reliable biomarkers of dietary response or to achieve individual requirements.

In this context, the occurrence of "single nucleotide polymorphisms" (SNPs), which consist in replacement of a single nitrogenous base in a nucleotide of DNA and occur in at least 1% of population, may affect synthesis and functions of proteins and therefore may alter nutritional needs and nutrient metabolism. SNPs in candidate genes may interact with energy. micronutrient and macronutrient provided by the dietary prescription

Interindividual differences in disease susceptibility depend not only on the DNA sequence (e.g. SNPs) but also on epigenetic factors affecting gene expression such as DNA methylation, covalent histone modifications, chromatin folding and the regulatory actions of miRNA. From a epignetics perspective, the identification of those individuals that at an early age could present changes in the methylation profiles of specific genes could help to predict their susceptibility to later develop obesity and related-comorbities in later life, which may allow to prevent and follow-up its progress, as well as to research and develop newer preventive and therapeutic approaches In addition, the recent description of protocols for tailored dietary treatments based on algorithms are facilitating their possible applications in individuals nutrition

Even so, there are some challenges concerning nutritional genomics and implementation in nutritional prevention and treatment. One of them is that most SNPs prevalence differ in importance depending on ethnic background, so even more studies with large and/or mixed populations, and with different racial subgroups are required. The cost of the genetic analyses and the personalized advice must be lowered in order to extend the use of nutritional genomics to public health and population practices. Furthermore,

nutritionists and other health professionals must be familiar with the genetic information of these tests and be able to translate the genetic results into personalized nutrition. Thus, continuing education at the undergraduate and postgraduate levels for the Nutrition professionals should be encouraged. Finally, concrete implementation of the regulation and provision of better information of the benefits and limitations of using Nutritional Genomics for consumers are still required as well as the clarification and harmonization of emerging ethical issues. Overall, the promotion of scientific events in the Nutritional Genomics area and the coordination of existing consortia /societies concerning this field, such as Nutrigenomics Organisation – NUGO and the International Society for Nutrigenetics and Nutrigenomics – ISNN also must be encouraged to interact with IUNS.

Interestingly, the "Nutrient- gene interactions: Knowledge to action" is an IUNS Task Force that since 2005 has been specifically devoted to these endeavors. Indeed. the number of publications/articles related to nutritional genomics and associated branches such as Nutrigenetics and Nutrigenomics are continuously evolving, (near 1.000 documents with more than 12.000 citations since 2001), which is paving the way to provide asuccessful and efficient personalized nutrition for a healthy life in the community.

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