Handout : Nutrigenomics

Walter Wahli
Klinik Obach - Fortbildung
Suche nach Ursachen und Angriffspunkten bei der Therapie der Fettsucht
Solothurn, 29 Oktober 2009

Throughout the natural history of humankind, interactions between nutrients and the genome have been taking place in the context of a diet that differs greatly from our modern foods in the amount of vitamins, essential minerals and types of fat. The facilitated access to abundant and fast food, the emergence of industrialized edibles, such as solid vegetable fats, as well as the development of food preservation techniques have led to drastic quantitative and qualitative changes in our nutritional supply. In comparison to this rapid nutritional upheaval, our genome has remained quite stable. The alarming worldwide rise in the prevalence of obesity and associated pathologies (type 2 diabetes, cardiovascular diseases, hypertension, stroke) points the finger at a mismatch between our contemporary diet and the “saving genome” we have inherited from our ancestors, which has been optimized to maximize energy storage. Associated with our sedentary life style, this mismatch results in the emergence of a phenotype characterized by excess caloric storage in fat tissues, which is responsible for a wide range of metabolic deregulations such as hyperglycemia, hyperinsulinemia, dyslipidemia and hypertension. The "metabolic syndrome" refers to the clustering of these cardiovascular risk factors related to insulin resistance. It has become one of the major public-health challenges worldwide.

To gain insight into the molecular mechanisms by which nutrients, and micronutrients in particular, affect our metabolism, the latest genomic technologies are applied to nutrition and have led to the concept of “nutritional genomics”. Nutritional genomics is commonly declined in two distinct approaches both aimed at unveiling nutrient-gene interactions: nutrigenetics focuses on the genetic causes of individual responses to nutrients and how they may be related to disease predisposition. Nutrigenomics is the study of the effects of foods and food constituents on the whole genome (stability, expression, epigenetic profile) and on the metabolic alterations that may result, and thus their impact on health. In practical terms, nutrigenomics relies on these new high-performance tools to define and characterize global “diet signatures”. In brief, these “omics” technologies aim at analyzing the effects of food components not only on the integrity of the genome, but also on its expression at the level of messenger RNAs (transcriptomics), proteins (proteomics) and metabolites (metabolomics).

The challenges of nutrigenomics are, first, to prevent disturbances leading to disease development by detecting nutrient impacts on biological markers identifying early stages of disease and develop “ smart” nutrient/micronutrient combinations affecting metabolic genes able to re-establish well-balanced metabolic pathways. The second challenge is therapeutic, once the disease takes hold. Here, nutrigenomics allies itself with pharmacogenomics in seeking maximum benefit from treatments. Similar to pharmacogenomics, which tries to individualize treatments based on the patient unique genetic background (genotype), nutrigenomics leads to the concept of personalized nutrition. In a few years, tailor-made nutritional recommendations will be possible,

taking into account individuals' personal nutritional needs on the basis of their genotype, age, sex, physical and professional activity. Applied at a large scale, nutrigenomics should contribute to the improvement of the population's general state of health.

Personalized, genotype-based nutrition will impact on humans' relationship with nutrition in its economic, social, ethical and medical dimensions. This will mean greater responsibility for individuals in the way their eating habits evolve. Medicine, biology, human sciences, pharmaceutical companies and the food industry will have to join forces in promoting nutrigenomics as a vector for scientific and social innovation in the prevention of, and the fight against, diseases arising from certain foods, eating habits and sedentary lifestyle.