Genes Nutr (2007) 2:3–4
DOI 10.1007/s12263-007-0018-5

OPENING ADDRESS

Personalized nutrition from a health perspective: luxury or necessity?

Ben van Ommen

Published online: 19 September 2007

Keywords Biomarkers · Dietary interventions · Personal diet

Scientific progress has shown the involvement of diet in a large number of diseases and disorders (e.g. colon cancer, cardiovascular disorders, diabetes mellitus type 2, a number of inflammation related health problems, etc.). This triggered the introduction of functional foods, dietary components with "added health value". So far, only a few successful products were launched (cholesterol lowering stannols, probiotics, a number of specific fatty acids), and most of these functional foods had great difficulty to obtain scientific proof of efficacy. Why does nutritional science have such a hard job in providing evidence for health claims related to dietary components? Unlike pharmacological and biomedical research, where bioactive compounds are developed to treat a well-characterized disease, nutrition deals with prevention of disease and optimization of health. Biomarkers that quantify the health status essentially are missing, and much of the nutrition research (the large observational and intervention cohorts) relies on disease endpoints instead of health endpoints. Also in the "golden standard" of nutrition and health research, the crossover dietary intervention studies, the quantification of the effect is a major issue. Usually, the observed effects are minor and great efforts have to be made to unravel treatment related health effect from the confounding parameters. In other words, the confounding parameters have a large impact. The recent "omics"-related observations in human intervention studies confirm that intra-individual variation is much smaller than inter-individual variation. Differences between study subjects may be much larger than differences directly related to dietary treatment.

The keys for personalized nutrition actually are these "confounders" that make the life of nutritional scientists so difficult. Age, gender, life style (e.g. exercise), phenotype (e.g. body mass index), genetic make-up and epi-genomic imprinting all possibly determine our nutritional needs, the way we respond to nutrition, and thus our "personal diet-and-health relationship". Infant nutrition clearly differs from sports-diet. Now, the question is two faceted:

1. To what extent is this personal diet- and health-relationship practically valid;
2. How can nutritional science demonstrate this? My personal opinion is that indeed this relationship exists to a much greater extent than assumed until now, and that nutritional science will need to do a much better job in accurately identifying and quantifying the subtle differences in health status related to dietary treatment. A complete merge of nutrition with a number of fundamental scientific disciplines (molecular biology, biochemistry, bioinformatics, statistics, etc.) will be essential here.

Most disorders related to nutrition are packed with genetic variation, but the effect of nutritional modulation of the phenotypic outcome of these variations is difficult to assess as yet. Nutrition is the worst case scenario for this approach in science: multiple minor genetic differences possibly modulated by multiple food bioactives, usually with low receptor affinity, resulting in multiple minor changes in gene expression and resulting phenotypic expression. Many nutritional crossover intervention studies did not provide

B. van Ommen (✉)
TNO Quality of Life, European Nutrigenomics Organization, Utrecht, The Netherlands
e-mail: ben.vanommen@tno.nl

the expected results; primarily due to the large inter individual differences in results. Again, the "confounders" kill the study. Inclusion of the genetic component causes financial and ethical problems, as (depending on the frequency and complexity of the haplotype) a big effort needs to be made in subject selection. Unexpected complications like ethnic genetic diversity now appear to be a major problem in the famous EU-funded multi-center studies. On top of this, bioinformatics and biostatistics needs to be further developed to meet this new type of approach. In other words, some work to be done.

A second major bottleneck in the nutrition and (personalized) health relationship is the inadequacy to determine effects. We all know (or suppose?) that nutrition is related to diseases and disorders. However, we fail to measure the correct effect. Slowly, we now begin to realize that between the nutritional impact on daily homeostasis and the disease (endpoints), a separate layer of "overarching processes" both controls health and drives disease onset. Think about metabolic stress, inflammatory stress, and oxidative stress. These processes are both complex and interacting. Also, they are controlled by "setpoints" adding an additional complexity related to neurology, endocrinology and epigenomics. It might be worthwhile to revisit these "overarching processes" once we have a better grip on nutritional systems biology, i.e. the ability to study these processes both in molecular detail and in their relationship, embedded in molecular physiology. Nutritional science may and very likely eventually will determine a large number of personalized nutrition and health relationships. However, this is only a small part of the equation. Food consumption nowadays is hardly related to health, but much more to convenience. "Food is pleasure" rightfully is the credo and science will have a hard job in promoting healthy diet if this aspect is compromised. So, a personalized diet needs to be both optimized towards personal health and personal convenience. What a challenge!