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NUTRIGENOMICS- AN INTERACTION OF NUTRITION, HEALTH AND GENOMICS, A STEPPING STONE TO PERSONALIZED NUTRITION

R. Selvam

Assistant Professor, Department of Animal Genetics and Breeding, Veterinary College and Research Institute, Tirunelveli – 627 358, Tamilnadu, India

E-mail: selvam.r@tanuvas.ac.in

Abstract: Nutrigenomics is a science which deals with role of nutrient on gene expression. It analyzes how nutrients affect genes (influence on gene expression and function) and how genes affect diet (how an individual responds to nutrients). The individual genotypic variations can alter nutrient metabolism. Nutrigenomics has various benefits and applications as biomarkers, developing strategies for prevention of diseases, designing functional foods, identification of pathways and candidate genes, improving production and reproduction and make a pathway towards personalized nutrition. Nutrigenomics approaches promise to set new standards for nutritional research and will revolutionize the views of nutrient requirements and interactions.

Keywords: Nutrigenomics, Genotype, Gene expression, Biomarkers, Personalized nutrition.

Introduction

In 1996, Ghai and co-workers filed a patent, which highlighted the potential for development of foods that could alter the expression of genes associated with human diseases [1]. This was the beginning of the study of the relationship of nutrition with genes. Nutrigenomics defined as a science which deals with role of nutrient in gene expression [2]. Nutrigenomics includes effect of nutrients on synthesis of mRNA (Transcriptomics), protein synthesis (Proteomics) and metabolite production (Metabolomics). The new arenas of research showed that the disease prevention may be possible by intake of a proper diet which depends upon an individual's genetic makeup [3]. New techniques like genomic, proteomic, metabolomic, and bioinformatics helps to better understanding of interaction between nutrient and genes [4]. Recently various researches have proved the relationship among nutrition, health, disease and production. A major goal of nutrigenomics is the prevention of the onset and progression of disease. Current research could lead to the development of personalized nutrition and specific sub-populations, which could decrease the risk of diseases.

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Genetic variation within populations

Numerous studies have shown that individual genotypic variations can alter nutrient metabolism, from mild conditions like lactose intolerance to potentially severe phenylketonuria. Obesity and lipid metabolism are currently the most studied examples of genetic influence on the nutrition. The quantity and quality of the diet modulates the expression of genes in various tissues. Each individual will respond to a specific diet in a unique manner that corresponds with their genetic profile. The goal of nutrigenomics is the development of consensus responses to specific nutritional stimuli so that disease can be identified and studied further [5].

Benefits from Nutrigenomics

- New biomarkers can be identified for diagnosis of nutrition-related diseases
- Biomarkers to monitor the efficacy of nutritional intervention through gene expression
- Knowledge about the genes, the molecular pathways and their specific role in the pathogenesis will bring forth novel strategies for prevention of disease.
- Data on the molecular pathogenesis useful for designing and applying novel functional foods.
- Identification of pathways and candidate genes for economically important traits
- Nutrigenomics provide new tools that can be used to understand how nutritional management can be applied to address disease, performance and productivity [6].

Application of Nutrigenomics

- Developing food that can be matched to genotypes of individuals to benefit health and enhance normal physiological processes [7].
- Selection of nutrients for favorable genes expression, for ex., keeping stress response genes switched down with proper nutrition so that the individual is healthier and more productive.
- Nutritional management to improve the performance of individual
- The nutrigenomics approach can be applied to understanding the aging process
- It is possible to use specific gene expression patterns to evaluate the effects of nutrition on metabolic processes relating to reproduction. Modern nutrigenomics will play a key role in developing strategies for addressing the issues in reproductive performance [8].

- Since both diet and genes alter health and susceptibility to disease, identifying genes, regulated by diet and that cause diseases could result in the development of diagnostic tools, individualized intervention and strategies for maintaining health [9].

The challenge for nutrigenomics research is to target the genes involved in the diseases. The bioactive ingredients of food may turn on some genes and simultaneously turn off other genes involved in a disease. The success of this science will require meaningful biomarkers. The application of different molecular biological techniques in transcriptomics, proteomics and metabolic and microarray technology as nutrigenomics research tool will provide gene expression variation and explanations for regulatory interactions between nutrients and genes.

Nutrigenomics - Future Prospects

Nutrigenomics approaches promise to set new standards for nutritional research and will revolutionize the views of nutrient requirements and interactions. The gene expression studies will helps to define the unknown effects of specific nutrients and nutrient interactions [3]. By understanding these new nutrient effects, it will be able to define and test new nutritional concepts. Nutrigenomics assure to provide the tools needed for programmed approach to nutrition in both animals and humans. More importantly, the more precise measures of nutrient effects afforded by biomarkers and molecular profiling techniques will provide new tools for evaluating nutrient requirements and diet formulation strategies that ultimately results towards the personalized nutrition according to the individual's genotype [10].

Conclusion

Nutrigenomics is a rapidly emerging science. The innovations in nutrition research with use of various molecular technologies will definitely update the understanding of nutrient, gene and health interaction. By targeting the specific gene through nutritional manipulation, it may be possible to get the desired performance in terms of health as well as production. The microarray or other advances DNA technology in nutrigenomics research enables screening of large numbers of genes simultaneously, giving a comprehensive picture of the variation of gene expression patterns and provide explanations for complex regulatory interactions, such as those between diet-nutrients and genes. These approaches will enhance researcher's abilities to maintain individual's health, optimize performance and improve production. The ultimate aim of this emerging field-nutrigenomics is prevention rather than cure. This is unerringly analogous to the statement of Hippocrates, the father of medicine who said "Leave your drugs in the chemist's pot if you can heal the patient with food."

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