ACTA SCIENTIFIC NUTRITIONAL HEALTH

Volume 2 Issue 12 December 2018

Mini Review

Review on Nutrigenomics and its Potential in Prevention of Metabolic Syndrome

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Received: November 05; **Published:** November 22, 2018

Abstract

Nutrigenomics provides a genetic understanding for how; common dietary components affect the balance between health and disease by altering the expression and/or structure of an individual's genetic makeup. Nutrigenetics describes how the genetic profile, impacts the response of body to bioactive food components, influencing their absorption, metabolism, and site of action. In this way, considering different aspects of gene-nutrient interaction and designing appropriate diet for every specific genotype, optimizing individual health, diagnosis and diet and nutritional treatment. Hence optimizing individual health, diagnosis and nutritional treatment of each and every individual. This we could, to prevent and control the conversion of healthy phenotype to diseases.

Keywords: Nutrigenomics; Metabolism; Heart Health; Hypertension; Obesity; Coronary Arterial Diseases (CAD); Cardiovasular Disease (CVD); Weight loss, Molecular Nutrition

Abbreviations

CVD: Cardiovascular Disease; CAD: Coronary Arterial Diseases; HT: Hypertension; MetS: Metabolic Syndrome; NCDs: Non-Communicable Diseases.

Introduction

The MetS represents a constellation of metabolic perturbations including:

- Central obesity (excessive fat tissue in and around the abdomen),
- Insulin resistance or glucose intolerance (the body can't properly use insulin or blood sugar),
- Atherogenic dyslipidemia (blood fat disorders - mainly high triglycerides and low HDL cholesterol - that foster plaque build-ups in artery walls).
- Raised blood pressure (130/85 mmHg or higher).
- Prothrombotic state (e.g., high fibrinogen or plasminogen activator inhibitor in the blood).
- Proinflammatory state (e.g., elevated high sensitivity C-reactive protein in the blood).

The MetS and these interrelated risk factors are associated with increased risk of type 2 diabetes (T2DM) and cardiovascular disease, continue to be the major cause of metD [1,2].

Cardiovascular diseases are a cause of morbidity and mortality in developed countries. Our understanding of their homeostasis and pathogenesis is an important factor when considering therapy and preventive strategies. In clinical practice it is not uncommon to find patients with premature CVD without any of the conventional risk factors. This is probably due to genetic risk factors which could lead to the susceptibility of atherosclerosis. Research has shown that the presence of certain genetic variants or SNPs in key enzymes for lipid homeostasis can affect concentrations of LDL, HDL and trigylcerides. As the name suggests Apolipoproteins are a group of proteins that are involved in lipid metabolism-and hence having a great impact on Cardiovascular disease and Alzeimers disease. Variations in this enzyme have been reported to affect the populations consuming diets rich in saturated fat and cholesterol. Other genes effecting the lipid metabolism are MTHFR, PPAR gamma and Lipoprotein Lipase.

Obesity is a multifactorial condition often associated with an excess of body fat. Nowadays obesity has emerged as the second-most important leading cause of death yet, preventable as well as major public health issue. Prevalence of obesity is steadily increasing, leading to morbidity and mortality due to diabetes, and cardiovascular diseases amongst others. Approaches to combat obesity include reducing caloric intake and increasing physical activity. However, other factors such as genetic susceptibility in predisposing an individual to obesity have been studied in the past few years.

Genome wide association studies (GWAS) and studies on twins have demonstrated that genetic factors contribute 40-70% of variability in susceptibility to obesity. It is well established that nutrients alter molecular processes such as DNA structure, gene expression, and metabolism, and these in turn may alter disease initiation, development, or progression. One of the most important genes is the fat mass and obesity associated (FTO) gene, which not only has the largest influence on body mass index but is also widely expressed in many tissues. One of the most important genes is the fat mass and obesity associated (FTO) gene, which not only has the largest influence on body mass index but is also widely expressed in many tissues. Several genes such as MC4R and BDNF genes are directly involved in weight regulation. Genes such as ACE, PPARG are involved in gene diet and gene-exercise interactions and have been reported to affect blood glucose and insulin levels [3,4].

Although research on the genetic basis of obesity has advanced, the mechanisms underlying the condition are still complex due to its heterogeneity even within families.

Molecular nutrition and wellness

Molecular nutrition examines the interactions between nutrients and intracellular and extracellular molecules and is beginning to unravel the way nutrients affect cellular processes. This emerging field has been identified as one of the most exciting new frontiers in biomedical technology with the potential to dramatically improve human health and wellness worldwide [5]. A component of molecular nutrition, nutrigenomics, or nutritional genomics is a multidisciplinary science that combines information from genetics, nutrition, physiology, pathology, and molecular biology. The diet - nutrient interactions which occur in different individuals is complex and scientists are focusing on the polymorphisms which affect these interactions to help alleviate health disparities.

Dietary chemicals have been shown to alter gene expression in a number of ways [6].

For example, they may:

- Act as ligands for transcription factor receptors,
- Be metabolized by primary or secondary metabolic path ways thereby altering concentrations of substrates or in termediates or,
- Alter signal transduction pathways.

In understanding these effects, nutrigenomics attempts to define the relationship between specific nutrients and specific nutrient regimes (diets) on human health. Nutritional genomics, or nutrigenomics, is the study of how foods affect our genes and how individual genetic differences can affect the way we respond to nutrients (and other naturally occurring compounds) in the foods we eat. While somewhat controversial, nutrigenomics has been popularized with the idea of personalized nutrition based on genotype. While there is hope that nutrigenomics will ultimately enable such personalized dietary advice, the science is in its infancy and many more fundamental questions must be answered [7].

Nutrition and disease prevention

In order to address the increasing incidence of these diet-related-diseases, the role of diet and nutrition has been and continues to be extensively studied since the 20th century [7]. To prevent the development of disease nutrition research is investigating how nutrition can optimize and maintain cellular, tissue, organ and whole-body homeostasis. This requires understanding how nutrients act at the gene, protein and metabolic levels. As a result, nutrition research has shifted from epidemiology and physiology to molecular biology and genetics.

With this paradigm shift new data has emerged in support of dietary interventions in preventing, mitigating, or treating chronic disease, and certain cancers. The conceptual basis and scientific evidence to support dietary interventions can be found in the following observations:

- Under certain circumstances and in some individuals, diet can be a serious risk factor for a number of diseases.
- Common dietary chemicals can act on the human genome, either directly or indirectly, to alter gene expression or structure.

- The degree to which diet influences the balance between healthy and disease states may depend on an individual's genetic makeup.
- Some diet-regulated genes (and their normal, common variants) are likely to play a role in the onset, incidence, progression, and/or severity of chronic diseases.
- Dietary intervention based on knowledge of nutritional requirement, nutritional status, and genotype, have been used to prevent, mitigate or cure chronic disease.

The emergence and development of nutrigenomics has been possible due to powerful developments in genetic research. With these developments, biochemical disorders with a high nutritional relevance have been linked to a genetic origin [7,8].

Promise of nutrigenomics

In nutrigenomics, nutrients are seen as signals that communicate with specific cells in the body. It is believed that different diets will elicit different patterns of gene and protein expression and metabolite production. Nutrigenomics seeks to describe the patterns of these effects which have been referred to as dietary signatures [7]. Such dietary signatures can be examined in specific cells, tissues and organisms and in this way the manner by which nutrition influences homeostasis can be better understood. Genes which are affected by differing in levels of nutrients are now being identified and their regulatory pathways are under investigation [5]. Through the identification of these genes and their regulatory pathways, scientists will soon have a better understanding of how nutrition influences metabolic pathways and homeostasis. Such an understanding will be essential in attempts to prevent the development of chronic diet related diseases such as obesity and type 2 diabetes. In this regard, finding markers of the early phase of diet related diseases for the intervention with selected nutrients that could reverse or slow the disease process will expand the application of nutrigenomics. Thus, once a marker has been found and measured, the extent to which an individual is susceptible to disease development may be quantified and personalized dietary recommendations prescribed. Progress in this area will lead keeping people healthy according to their individual needs.

Conclusion

In conclusion Nutrigenomics, is the science of the future based on the concept of precision Nutrition, wherein each and every individuals' genes, genomes, proteomes, biomes are taken into consideration while planning the diets. It is the science of the current day which can make NCDs, genetic disorders to be prevented and managed much easily than before. Advances in interventional nutrition research may not only improve the public and professional perception of nutrition but may also provide more options for the management of modern-day chronic diseases.

Bibliography

1. Moller DE and Kaufman KD. "Metabolic syndrome: A clinical and molecular perspective". *Annual Reviews* 56 (2005): 45-62.
2. Rosamond W., et al. "Heart Association Statistics i Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics-2007 update". *Circulation* 115 (2007): e69el71.
3. Sowmya Bharani. "Harnessing the power of nutrigenomics to combat obesity" *Journal of Obesity and Weight Loss Therapy.*
4. K Rajendra Rao., *et al*. Indian Journal of Medical Research 140.5 (2014): 589-603.
5. Chavez A and Munoz de Chavez M. "Nutrigenomics in public health nutrition: short-term perspectives". *European Journal of Clinical Nutrition* 57 (2003): 97-100.
6. Kaput J and Rodriguez RL. "Nutritional genomics: the next frontier in the postgenomic era". *Physiological Genomics* 16 2004): 166 -177.
7. Miiller M and Kersten S. "Nutrigenomics: Goals and Perspectives". *Nature Reviews Genetics* 4 (2003): 315-322.
8. Schuster GU. "Nutrients and Gene Expression. (In Nutritional Genomics: Discovering the Path to Personalized i Nutrition). Kaput, J and Rodriguz, R (eds). Wiley and Sons, Inc. NY. (2006).

Volume 2 Issue 12 December 2018