Nutrigenomics: Impact of nutrition on gene expression

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Food has an impact on our bodies. For evidently covering up the impact of nutrition on medical conditions nutrigenomics is the new boon in the field of nutrition, medical science, and genetics. This deals with the impact of diet on the genomics and expression of genes related to various medical conditions like obesity, diabetes, and cardiovascular diseases. The present review gives a glimpse of nutrigenomics, genetic databases, and their application in medical sciences.

**Keywords:** Genomics, database, Nutrigenomics, Nutrition

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Introduction

Nutrition plays an important role in growth, development, prevention and treatment of various disease (1). It provides energy to the body so that it can carry out different tasks of daily life. Insufficient intake of food nutrients can ultimately leads to various disease, weakness and disabilities (2). Nutrigenomics is the rapidly emerging area of nutrition that uses molecular tools to search, access and understand the various responses procure through certain diet applied between individuals or population groups (3). In simple words, it tells us how our genes interact with nutrition or the way in which food or food ingredients affect gene expression (4). It is concerned with the impact of dietary components on the genome, the proteome (the sum total of all proteins), and the metabolome (the sum of all metabolites) (5).

The biological effects of nutrients and food bioactives depend on a series of physiological processes, including absorption, transport, biotransformation, uptake, binding, storage and excretion, and cellular mechanisms of action, such as binding to nuclear receptors or regulating transcription factors. Each of these processes can involve several genes, each with common polymorphisms that could alter their function and ultimately the physiological response to a dietary compound. The field of nutrigenomics harnesses multiple disciplines and includes dietary effects on genome stability (DNA damage at the molecular and chromosome level), epigenome alterations (DNA methylation), RNA and micro-RNA expression (transcriptomics), protein expression (proteomics) and metabolite changes (metabolomics), all of which can be studied independently or in an integrated manner to diagnose health status and/or disease trajectory (6).

It should also be said that effect of nutrition on different individual can be different. The main determinant is the background genetic content. With some genetic underlying patterns, such as some polymorphisms, some individuals might be tolerable to nutritional impairment or fluctuation. On the other hand, the other

Individual might be highly prone to get the nutritional problem. Hence, it is no doubt that the study on the complex relationship between gene and nutrition can be useful in medicine and this is the basic concept of introduction of nutrigenomics (7).

Nutrigenomics will promote an increased understanding of how nutrition influences metabolic pathways and homeostatic control, how this regulation is disturbed in the early phases of diet-related disease, and the extent to which individual sensitizing genotypes contribute to such diseases (8).

In nutrigenomics core competencies are genomics (studying, sequencing and analyzing the genome), genetic variation (studying the variation in genome), metabolomics, transcriptomics, epigenomics and Proteomics.

Databases used in nutrigenomics:

Database is the digital information stored in computer in an organized way. To access the information and interpret the results the databases are very important (7). In nutrigenomics, to identify the effect of diet on different types of gene, some databases are developed. For developing an efficient databases following activities are to be done accurately:

01. Data Collection:

Data is collected from different reliable sources. The data can be in any form be it in the form of numbers, signals, words etc.

02. Data verification

The data verification involves checking the correctness of the information collected and validating the sources.

03. Data registration

This involves feeding the data in the computer system. This will enable systematic pattern of data storage.

04. Data storage

The registered data is then stored in the central processing unit of the computer system.

05. Data maintenance

It involves correcting the errors and updating the information to make the Database compatible with the time and research going on in the particular field.
Whenever the operator requires the stored data, he/she has to extract the data and then use it for comparing the observations, results and inferences.

There are various databases in bioinformatics which are being used for research in nutrigenomics. For conducting research on nutrigenomics one must have access to genomic databases. DNA sequencing have undergone many technical and technological advancements. Sequence databases have been classified into primary sequence depositories (raw sequence data obtained from independent experiments conducted by scientists and secondary databases (which are derived from primary databases).

Various databases that are being used for nutrigenomics are as follows:

01. SGMD: The Soybean Genomics and Microarray Database

This database gives a combined view of soy cyst nematode and soybean interaction. It is embedded with EST, genomics and micro array data along with analytical tools. We can dig into microarray data instantly by combining various analysis tools within the data itself. This database contains approximately 50 million rows of micro array data obtained from USDA labs and collaborators (9).

02. Nutritional Phenotype database (dbNP)

This database stores the biologically related data. Also it provides descriptive and phenotype data and blend of this data at different levels (genotype, phenotype, food intake etc.). This biological information is significant for nutrition research which requires standard protocols, modular data basing, networking and integrated bioinformatics (10).

03. GxE

This contains information about interaction between gene and environment. It is embedded with interactions related to blood lipids, nutrition and various cardiovascular diseases. It is significant for medical disorders related to nutrition. This is a good example of database with clear and simple application on nutrition related disorder in medicine (11).

04. v Protein

It is used for identification of amino acid complements obtained from plant based foods (12).

05. Barley Base

It is for visualizing data and analyzing data statistically. It covers the data studied on wheat, maize, soybean and rice. It is beneficial not only for nutrigenomics but also for plant genomics (13).

For doing research on nutrigenomics it is required to select the appropriate database and then analyzing the results. However, there are many more databases that can be useful in nutrigenomics studies apart from the mentioned ones.

**Application of nutrigenomics**

Nutrigenomics approaches to untangle effects of nutrition on health. The potential of this approach is enormous and it can help in health management significantly. Although the stage of this new approach is the beginning stage with time it is getting more attention and importance in nutritional and medical science. The given section is all about the application of nutrigenomics.

Nutrigenomics has its application in the treatment of obesity and cardiovascular diseases. Although obesity is related to energy imbalance several genetic factors can also contribute to obesity and endocrine disorders (14). Various genes and single nucleotide polymorphisms (SNPs) have been related to the phenotype of obesity both in humans and animals (15). FTO gene located in chromosome 16 is associated with obesity. At these points, nutrigenomics will give us an idea about the effect of diet on the expression of these genes and will help in treating obesity. Similarly, other diseases like cardiovascular diseases and diabetes can be treated by studying the effect of nutrition on the genomics related to diseases.

**Conclusions**

Nutrigenomics is an evolving area in the field of nutrition, medicine, and genetics. This can be helpful by learning the interactions of various genetic factors and nutrition or environmental factors and nutrition which will help in the medical sector in treating diseases. This will help...
In improving the dietary intake and people will get to take the nutritional uptake seriously especially during the time when people are more prone to obesity and diabetes due to alteration in the eating habits and lifestyles.

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