Minireview Article

Nutrigenomic aspects over dental health: A Review

ABSTRACT

People living in different cultures have different genetic compositions, which affects the uptake and breakdown of nutrients. Investigators found that certain changes have been seen in the genomes due to nutrient demand. The nutrigenomic method is the best choice for understanding the genomic relation with healthy or diseased conditions in medical and dental settings to create a personalized nutritionplan. The paper emphasizes nutritional requirements for dental conditions.

KEYWORDS: Nutrigenomics, nutrition, diet, gene, periodontal health.

INTRODUCTION

Nutrition is one of the main processes needed for injury recovery and avoidance. Awareness of nutrition is crucial for selecting food and maintaining a good dietary pattern, which is required for dental care.[1] American Dietetic Association considered nutrition as the fundamental element of oral health care. An imbalance in diet and nutrition may influencetooth decalcification and regeneration.[2]Nutrigenomics is powerful in detailing the changes in nutritional absorption and distribution, hence it promotes healthy conditions.[3] Nutrigenomicsis an interdisciplinary field that focusing on how individual genetic variations influence responses to nutrients and dietary patterns [14-16].It describes the scientific approach that integrates nutritional sciences and genomics and includes the application of other highthrough 'omics' technologies such as transcriptomics, proteomics and metabolomics to investigate the effects of nutrition on health [17-20].Transcriptomics is the study of how mRNA is transcribed from a given condition to provide genetic information. Proteomics is used to understand the expression of proteins in a cell, tissue, or organ whereas metabolomics is the study of metabolites that occur during chemical reactions in a biological system.[4]

Definition

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Nutrigenomics is the science, that deals with the expression of genomics with the outcome of food and its essential nutrients, using the techniques like Transcriptomics, Proteomics, Metabolomics, and Epigenomics.[5]

History

In 1997, the first nutrigenomics business was established and was renamed genomics by Nancy Fogg-Johnson & Alex Merolli in the year 1999, and Pelegrin coined the word "nutrigenomics" in the year 2001.[5] Long-term illnesses like heart disease, cancer, chronic respiratory diseases, and diabetes are causing 60% of the death rate in worldwide, which was reported by World Health Organization (WHO) in 2005. Changes in different cultures and food choices have been made in the evolution of chronic diseases, where variability in genes is causing the changes. As a result, food science has led to identifying the disease-causing diet and nutrition for balancing health at the molecular level to the organ level. Awareness of nutrition is important to avoid the progress of disease at the cellular level. The advanced development in the human genome has made the investigators to find out the relation between food, genomic expression, wellness, and illness.Consequently, the association between diet and genomic studies has made progress in the development of nutrigenomics.[6]

Relationship between oral health and nutrition

There is a direct relationship between oral health and nutrition. Oral tissues like teeth, muscles, joints, and bones are important for mastication, ingestion, and digestion. During mastication, food is broken down into smaller components and forms a bolus with saliva, which helps in the digestion of starch. Taste receptors choose by selecting food, which promotes nutrition to the body.

Oral health issues affect nutrition by carious teeth, loss of teeth, which in turn, malfunction of the masticatory system, decreased food consumption, and malnourished with reduced quality of life. Awareness of the relationship between oral health and food is important for maintaining a healthy oral life. Maintaining good oral hygiene along with nutritious food can reduce the occurrence of dental caries, periodontal problems, etc. Low fat and sugar content can reduce the development of oral disease-related problems. Nutrient elements like calcium, fluoride,

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magnesium, and phosphorus are important for the stability, growth, and development of oral structures.

Gingivitis is the most commonly seen inflammatory condition, which is affected due to a change in the proper dietary pattern. Liu et al conducted a study to assess periodontal disease and food intake, Healthy Eating Index in harmony with the Dietary Guidelines for Americans recommendations, found that higher Healthy Eating Index participants showed less chances of periodontitis.

Wen et al highlighted that there is a relationship between magnesium and the occurrence of periodontal disease. Various studies carried out by the National Health and Nutrition Examination Survey found that high dietary magnesium intake causes reduced periodontal disease, where they are negatively related. [7]

Nishida et al found that intake of vitamin C is directly related to the periodontal condition of smokers. There is a higher prevalence of periodontal problems seen in smokers with less consumption of diet containing vitamin C. Even compromised conditions of periodontium with increased bone resorption and hypocalcemia are seen in patients with less intake of calcium-rich food. According to the studies of DiSilvestro in 2009 showed that mouthwash consisting of hydro-alcoholic extract of pomegranate have lessened the dental plaque forming microorganisms by about 84%. Antioxidants present in pomegranate locally act to prevent the organisms from causing dental plaque.[8]

Mechanism of nutritional interaction in periodontal health and disease.

Diet is important in the development and spread of periodontal disease and has become popular in nutritional science. It affects the periodontal condition by changing infective reaction, redox imbalance, and the state of integrity of tissues.

- Change in infective reaction: Anti-inflammatory eicosanoids are produced by omega-3 fatty acids to reduce infective reactions. Products of metabolism act to lessenneutrophil-mediated tissue damage. Vitamin D also helps prevent the reactive response in periodontal tissues.
- Mechanism of antioxidants:Oxidative damage occurs when there is a disruption between free radicals and the immune system of the body. The antioxidants such as vitamins C

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and E, carotenoids, and selenium, counteract the free radicals and help to prevent the damage in the tissues.

- Metabolism of bone: Calcium, vitamin D, magnesium, phosphorus, and vitamin K are important for the metabolism of bone. It maintains the integrity of bone.
- State of integrity of tissues: Collagen is mainly synthesized by vitamin C. It is the integral component of gingiva, periodontal ligaments, and alveolar bone. Its inadequacy causes disruption in structure and function.
- Change in the immune system: Zinc, and vitamin D help to regulate the immune activity of macrophages and T cells, which protects the periodontium.
- Microbial imbalance: Nutrition affects the microorganisms in oral tissues. Vegetables and fiber-rich food help in the development of favorable organisms, which reduces the pathogenesis of periodontal inflammation.[9]

Some of the vitamin and mineral deficiencies affecting teeth and oral mucosa are shown in Table :1 [10]

Uses of Nutrigenomics in Dentistry

Dentists can able to specify the treatment and cure for the patients by considering the relation of nutrition with genes and periodontal conditions. The ways in which nutrigenomics can be useful in periodontics such as:

- Gene-Diet relation: A good diet can control the gene to manage the inflammatory conditions of periodontium. The awareness of the relationship between genes and diet among practitioners can improve the periodontium.
- Risk assessment: Change in the particular gene may cause periodontal disease in susceptible persons.Nutritional genomics can help the individuals to assess the condition at threat, and provide timely interventionor specific prophylactic methods.
- Specific nutritional advice: Intake of more omega-3 fatty acids can help to reduce the inflammatory process in certain conditions because of the genetic constitution. Thus dentists can prefer a diet that can maintain periodontal health by recognizing the changes in the genes that affect nutrient absorption.

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- Drug-Nutrient-Gene relation: Certain medications are required for periodontal conditions that can influence nutrient gene relation. Nutrigenomics can assess these relations at the genetic level to provide the therapy in a productive way by reducing the harmful effects.
- Microbiome-Genomic relation: The oral microflora plays an important role in periodontal health. Nutrigenomics can relate to the diet that affects genetic constitution, thereby leading oral conditions into a healthy one.[9]

DISCUSSION

The chemical constituent needed for encoding a message as to an action or internal processes in a cell or organ where nutrients play a vital role. The essential value required for the genomic expression is the degree of uniqueness. According to Allan Walker in 2004, carbohydrates, amino acids, fat, vitamins, and minerals can control the genes individually. However, to explore such precise measurements it is necessary to develop to evaluate the transcription, protein metabolism...etc, which is valued for the genetic production.[11]

CONCLUSION

Definite analysis of diet intake is important for the study of nutrition related to the particular genome.Deterioration of RNA is difficult to find in in vivo. That also has to be developed for its measurements, unless the result of genetic expression can only be reported. Rules and regulations are further required to promote such 'omics' techniques, such that the relation between samples, testing, and results can be correlated. Thus, individual dietary patterns can be guided.[11]

Clinical significance

Dental practitioners have very little awareness regarding the genomic-nutrition relation, which can affect various dental conditions.[12]Genes are the basic unit of heredity, whereas nutrition can change the genomic component. To study the relationship between genes and nutrition, nutrigenomics has been raised to explain with mechanism of transcriptomics, metabolomics, epigenomics, and proteomics.

Considering periodontal disease and diet is important to prevent and treat the diseased condition, thereby reducing the loss of teeth. European Workshop on Periodontology in 2011 proposed that

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practitioners should emphasize the consumption of fruits, vegetables, fish oils, and fibers, reduced sugars can reduce periodontal diseases to an extent.[13]

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TABLE

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Deficiency	Effects on oral structures
Vitamin A	Decreased *oral*epithelial development, impaired tooth formation, enamel hypoplasia, periodontitis.
Vitamin B1	Cracked lips, angular cheilitis
Vitamin B2, B3	Angular cheilitis, glossitis
Vitamin B6	Cheilitis, Burning sensation related to glossitis and stomatitis
Vitamin B9	Recurrent foot-and-mouth disease (RA)
Vitamin B12	Angular cheilitis, glossodynia (tongue pain)
Vitamin C	Reduced salivary secretion, iron deficiency, scurvy(bleeding gums)
Vitamin D	Salivary gland dysfunction, Periodontitis
vitamin E isomer-αtocopherol	Pulpal inflammation
Zinc	Gingival inflammation
Increase in serum copper	Periodontitis
Calcium, magnesium, phosphorus, Vitamin K	Affects development of teeth, periodontal disease

Table :1 showing some of the vitamin and minerals deficiency affecting teeth and oral mucosa.[10]

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