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Mini Review

Gut Microbiome Modification, Metabolomics and Brain Disorders

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Abstract

Growing evidence has shown that gut microbiota dysbiosis is closely related to autoimmune and neurodegenerative diseases. Several factors, such as lifestyle, diet, food ingredients, antibiotics and pesticides, influence the balance of the intestinal microbiota. Gut microbiome modification via dietary intervention strategies or fecal microbiota transplantation could be used in near future as a therapeutic approach for brain disorders. We are entering an era where health can be modified through personalized nutrition in conjunction with parallel clinical evaluation and periodic examinations of the unique gut microbiome and metabolomic profile of patients.

Keywords: *Brain Disorders; Foodomics; Gut Microbiome; Gut Microbiota; Metabolomics*

Approximately 100 trillion micro-organisms (most of them bacteria, but also fungi, protozoa and viruses) exist in the human gut, comprising a virtual but essential organ of the body, the Gut Microbiome. Gut microbiota provide essential benefits for the host through several functions, including the protection of the host from harmful bacteria, the training of host immune system to recognize foreign materials and the conversion of otherwise indigestible food into energy and absorbable nutrients.

The human genome consists of about 23.000 genes, whereas the microbiome encodes over three million genes producing thousands of metabolites, which replace many of the functions of the host, and consequently influence the host's fitness, phenotype, and health. Numerous possible mechanisms could explain the obvious interconnection between the brain and the intestine, including communication via the vagus nerve (a major nerve which links the gut and brain), the immune system and hormonal changes, as well as the production of neuroactive chemicals by gut microbes [1,2].

Metabolomics is a newly emerging field of research, regarding the comprehensive study of the metabolome, the repertoire of biochemicals present in cells, tissues, and body fluids. There is the concept that a person's metabolic state could provide a close representation of his overall health status. This metabolic state reflects what has been encoded by the genome, and modified by diet, environmental factors and the gut microbiome as well. Metabolomics could enable detection of disease states and their progression, could monitor response to given therapies, and also help to stratify patients based on their biochemical profiles [3].

Growing evidence has shown that the compositional and functional changes of gut microbiome are closely related to autoimmune diseases, probably through dysbiosis and the resulting metabolites, which may cause aberrant immune responses via epigenetic modifications. Recent studies have suggested that alterations in the gut microbiota (dysbiosis), are associated with Multiple sclerosis (MS), while

gut microbiota differs in patients with multiple sclerosis from the healthy population. This is supported by a recent study in which, fecal microbiota transplantation was associated with 10 years of stability in a patient with secondary progressive multiple sclerosis (SPMS). Dysfunction in the brain-gut microbiota axis was investigated in irritable bowel syndrome, inflammatory bowel disease, depression, and anxiety, as well as neurodevelopmental disorders such as autism, Parkinson's disease (PD), and Alzheimer's disease (AD) [4-14].

It is a common knowledge that medicines, food ingredients, antibiotics, and pesticides could all have adverse effects on the gut microbiota, while specific foods and dietary patterns can all influence the abundance of different types of bacteria in the gut, which in turn can affect health. Diet seems to be involved in either exacerbation or improvement of symptoms in patients with multiple sclerosis with a direct effect on gut microbiota. Also studies have shown that, food ingredients found in herbs or Mediterranean diet could intervene with the inflammation of the intestinal mucosa, gut microbiota and their metabolome by-products, genetic and epigenetic factors and finally autoimmunity with potential, therapeutic effects [15-19].

Conclusion

We conclude that, the interpretation of the crosstalk between gut dysbiosis and epigenetic modifications and their influences on autoimmune diseases could enhance our understanding and offer a new therapeutic approach for optimal host health. Also, more sensitive and more specific biomarkers could be unmasked as well as potential therapeutic targets.

Clinical trials in near future will unravel the potential role of the gut microbiome in the pathogenesis of MS, AD and other brain disorders and will lead to proposals for microbiome modification as a therapeutic strategy. Also, fecal microbiota transplantation must be evaluated for its effectiveness, safety profile, and mechanism of action. We are entering an era where health can be modified, through personalised nutrition and optimal diet in conjunction with parallel measurement of their effects through periodic examinations of gut microbiome and metabolomic profile of patients. New dietary intervention strategies could arise by applying metabolic profiling to food science (Foodomics) for the development of functional foods, in order to improve well-being and health not only as a complementary therapy, but preventive too [20-22].

Conflict of Interest

There is not any financial interest or any conflict of interest.

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