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Gut Microbiome and its Role in Type 2 Diabetes

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DESCRIPTION

Type 2 diabetes (T2D) is a complex metabolic disorder characterized by insulin resistance and impaired glucose regulation. While genetic predisposition and lifestyle factors such as diet and physical activity are well-established contributors, recent research has illuminated the significant role of the gut microbiome in the pathogenesis and management of T2D. The gut microbiome, comprising trillions of microorganisms residing in the human gastrointestinal tract, plays a crucial role in metabolic health, immune function, and inflammation. Understanding its impact on T2D opens new avenues for potential therapeutic strategies. The human gut microbiome consists of bacteria, viruses, fungi, and other microorganisms that live symbiotically within the digestive tract. These microorganisms aid in digestion, synthesize essential vitamins, and protect against pathogens. The composition of the gut microbiome is influenced by various factors, including genetics, diet, age, and antibiotic use. The gut microbiome influences metabolic health through several mechanisms Certain gut bacteria can extract more calories from food, contributing to increased energy intake and potentially leading to obesity, a major risk factor for T2D. Fermentation of dietary fibres by gut bacteria produces SCFAs, such as butyrate, propionate, and acetate, which have anti-inflammatory properties and improve insulin sensitivity. Symbiosis, an imbalance in the gut microbiome, can lead to increased intestinal permeability, allowing endotoxins like lipopolysaccharides (LPS) to enter the bloodstream. This triggers systemic inflammation and insulin resistance. Gut bacteria modify bile acids, which play a role in lipid metabolism and glucose homeostasis. Altered bile acid profiles can impact insulin sensitivity and glucose metabolism. Several studies have shown that individuals with T2D have distinct gut microbiome profiles compared to healthy individuals. Key findings include T2D patients often exhibit decreased gut microbiome diversity, which is associated with metabolic dysfunction. Increased levels of certain bacterial strains, such as Bactericides and Clostridium, and decreased levels of others, like Faecal bacterium prausnitzii, have been observed in T2D patients. Faecal bacterium prausnitzii is known for its anti-inflammatory properties and its reduction may contribute to inflammation and insulin resistance. Alterations in microbial metabolites, such as reduced SCFA production, are commonly seen in T2D, suggesting a link between these metabolites and glucose regulation. The connection between the gut microbiome and T2D has prompted interest in microbiome-targeted therapies, including Supplementing with beneficial bacteria strains may help restore gut microbiome balance, improve gut barrier function, and enhance insulin sensitivity. Certain probiotics have shown promise in reducing blood glucose levels and inflammation in T2D patients. These non-digestible food ingredients stimulate the growth of beneficial bacteria in the gut. Prebiotics, such as inulin and fructooligosaccharides, can increase SCFA production and improve metabolic health. Diet significantly impacts the gut microbiome. High-finer diets, rich in fruits, vegetables, and whole grains, promote a healthy microbiome and SCFA production, potentially improving insulin sensitivity and glycaemic control. Although still in experimental stages, FMT involves transferring focal bacteria from a healthy donor to a recipient. Initial studies suggest that FMT can improve insulin sensitivity in T2D patients, but more research is needed to establish its efficacy and safety. The gut microbiome plays a pivotal role in the development and progression of type 2 diabetes through its influence on metabolism, inflammation, and insulin sensitivity. While traditional risk factors for T2D, such as diet and genetics, remain crucial, the gut microbiome offers a novel and promising avenue for therapeutic interventions. Future research focused on understanding the intricate interactions between the gut microbiome and host metabolism will be essential in developing effective strategies for the prevention and management of type 2 diabetes.

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CONFLICT OF INTEREST

The author's declared that they have no conflict of interest.

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