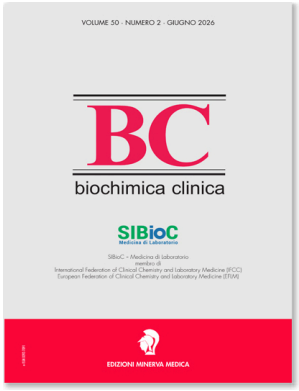

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The gut microbiota-diabetes axis: mechanisms, modulation, and therapeutic perspectives

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The gut microbiota (GM) is recognized as a major regulator of the host's metabolic processes, immune responses, and metabolic equilibrium. Recent studies have shown that changes in the composition of GM are closely related to diabetes mellitus, encompassing both type 1 (T1DM) and type 2 diabetes (T2DM). Dysbiosis, generally marked by decreased microbial diversity, shifts in the *Firmicutes/Bacteroidetes* ratio, and loss of key short-chain fatty acid (SCFA)-producing bacteria, has been shown to contribute to impaired glucose metabolism, heightened insulin resistance, and persistent low-level inflammation. Recent research has identified several microbial metabolites and components, including SCFAs, lipopolysaccharides (LPS), and trimethylamine N-oxide (TMAO), as potential early indicators for predicting disease and improving risk assessment. These compounds affect metabolic health through complex mechanisms, including modulation of gut barrier integrity and immune signaling. Some interventions aimed at restoring gut microbial balance have gained attention and are becoming a complementary method for managing diabetes. Approaches include supplementation with probiotics and prebiotics, dietary modifications that support beneficial taxa, fecal microbiota transplantation (FMT), and emerging microbiome engineering techniques. Recent studies, both from experimental and clinical research, suggest that microbiota-based therapies may improve and enhance diagnostic accuracy, leading to the development of tailored treatments for diabetes. This narrative review aims to summarize the recent evidences of the literature in the topic.

KEY WORDS: Gastrointestinal microbiome; Diabetes mellitus; Dysbiosis; Fecal microbiota transplantation