

METABOLIC SYNDROME, INSULIN RESISTANCE AND ALTERATIONS IN THE GUT MICROBIOTA AS RISK FACTORS FOR THE DEVELOPMENT OF CARDIOVASCULAR DISEASES: A LITERATURE REVIEW.

Ana Flávia Pontes Sodré

Ana Flávia Pontes Sodré - Student of the Medicine course at the University of Marília (UNIMAR); Marília; São Paulo; Sandra Maria Barbalho - Post-graduate Program in Structural and Functional Interactions in Rehabilitation; University of Marília (UNIMAR); Marília; São Paulo; Brazil

RESUMO

INTRODUCTION: The intestinal microbiota maintains a symbiotic relationship with humans and plays an essential role in metabolic homeostasis. The gut microbiome is responsible for fermenting non-digestible substrates, such as dietary fiber, leading to the production of short-chain fatty acids (SCFAs), mainly butyrate, acetate, and propionate. These metabolites regulate energy expenditure, glucose metabolism, appetite, and immune responses, directly influencing metabolic health and contributing to the regulation of Metabolic Syndrome (MetS). SCFAs also provide energy to colonocytes and exert systemic effects through the portal circulation. Additionally, they stimulate the secretion of GLP-1 and peptide YY (PYY), contributing to satiety, intestinal homeostasis, and anti-inflammatory activity, helping protect against Metabolic Syndrome (MetS) and related metabolic disorders such as obesity. **OBJECTIVE:** This review aims to elucidate the relationship between metabolic syndrome (MetS), insulin resistance (IR), alterations in the gut microbiota as risk factor to the development and progression of cardiovascular diseases (CVD). **METHODOLOGY:** This narrative literature review was conducted through a systematic search of the scientific databases PubMed and SciELO aiming to identify studies addressing the relationship between metabolic syndrome (MetS), insulin resistance (IR), alterations in the gut microbiota, and the development of cardiovascular diseases (CVD). The search included articles published between January 2018 and May 2026, a period selected to ensure the inclusion of the most recent and relevant evidence on the topic. The descriptors used, combined with Boolean operators ("AND" and "OR"), were: "Metabolic Syndrome", "Insulin Resistance", "Gut Microbiota", "Short-Chain Fatty Acids", and "Cardiovascular Diseases". The inclusion criteria comprised original articles, systematic reviews, and meta-analyses available in full text that investigated the relationship between metabolic syndrome, insulin resistance, gut microbiota alterations, and cardiovascular diseases. Editorials, case reports, duplicate studies, conference abstracts, and unrelated articles were excluded. **RESULTS:** Studies have shown that reduced levels of short-chain fatty acid (SCFA)-producing bacteria are associated with the progression of MetS. SCFAs interact with G-protein coupled receptors, such as GPR43, stimulating GLP-1 secretion and improving IR, glucose metabolism, and energy balance. These mechanisms directly counteract IR, one of the main determinants of MetS. Low fiber intake, commonly observed in Western dietary patterns, decreases SCFA production and contributes to ectopic fat accumulation, abdominal obesity, and metabolic dysfunction. Reduced activation of GPR43 also impairs lipid and glucose regulation in adipose tissue and skeletal muscle, favoring the development of obesity and other cardiovascular risk factors associated with MetS. The intestinal microbiota has therefore been investigated as a therapeutic target for MetS. Probiotic supplementation, such as *Bifidobacterium lactis*, has been associated with reduced hepatic gluconeogenesis, improved GLUT4 translocation, and decreased insulin resistance. Likewise, increased dietary fiber intake promotes the proliferation of SCFA-producing bacteria, contributing to metabolic balance and reduced adiposity. **CONCLUSION:** In summary, evidence suggests that factors promoting increased GLP-1 release, particularly the elevated production of SCFAs by the intestinal microbiota through adequate fiber intake, are strongly associated with attenuation of MetS. These mechanisms contribute to improved metabolic

homeostasis, reduced insulin resistance, and a lower risk of future cardiovascular and metabolic diseases.

Palavras-chave: Metabolic Syndrome/MetS Insulin Resistance Gut Microbiota Short-Chain Fatty Acids Cardiovascular Diseases.