

Microbiota-Driven Modulation of Hypertension: Exploring Microbial Metabolites as Therapeutic Targets

Amir Hossein Moradian^{1,2} Majid Eslami^{2,3} (Ph.D.)

1 Student Research Committee, Semnan university of Medical Sciences, Semnan, Iran

2 Department of Bacteriology and Virology, Faculty of Medicine, Semnan University of Medical Sciences, Semnan, Iran

3 Clinical Research Development Unit, Kowsar Educational, Research and Therapeutic Hospital, Semnan University of Medical Sciences, Semnan, Iran

Abstract

Background and Aim: Hypertension is the most prominent risk factor in the world for cardiovascular morbidity and mortality. This condition is caused by a complex interworking of genetics, diet, and environment. One of the gut microbiota, a complicated community of commensal, symbiotic, and pathogenic microorganisms, is also emerging as a contributor and it is attracting attention for its role in the regulation of blood pressure and cardiovascular health. Hypertension and other cardiovascular diseases (CVDs) are associated with dysbiosis which is described as the alteration of microbiota composition, indicating that it might be a treatment target.

Methods: Using PubMed, Scopus, and Google Scholar databases, a deep literature review was done. The searches comprised of studies from the past two years and used studies like 'microbiota', 'hypertension' and 'therapeutic targets' to find the preclinical, clinical, and mechanistic studies of interest.

Results: Among the metabolites produced by gut microbiota, Short-chain fatty acids (SCFAs), Trimethylamine N-oxide (TMAO), bile acids, and polyphenols are key regulators of cardiovascular function. SCFAs have antihypertensive properties derived from their ability to modulate vascular tone and immune responses. On the other hand, increased TMAO levels are associated with adverse cardiovascular outcomes. Dysbiosis has been linked with hypertension, atherosclerosis, heart failure, and myocardial infarction. Addressing microbial imbalance and improving cardiac function has shown promise with strategies such as dietary changes, pre/probiotics, fecal microbiota transplantation (FMT), TMAO reduction, and exercise. The mechanisms that contribute to these benefits need to be understood further.

Conclusion: The gut microbiota and metabolites present new prospective therapies for hypertension and cardiovascular disease management. It is critical in this era of modern medicine to delve deeper into the complex microbial – host interactions as well as their influence on the medication and treatment responses.

Keywords: Microbiota; Hypertension; Therapeutic targets