Short Communication
Volume 14:01, 2024

Journal of Bioengineering & Biomedical Science

ISSN: 2155-9538

Open Access

An Emerging Role of Micro and Nanoplastics in Vascular Diseases

Rocha Svetoslav*

Department of Bioengineering, School of Engineering, The University of Tokyo, Tokyo, Japan

Introduction

Microplastics and nanoplastics, ubiquitous in the environment due to their extensive use and poor degradation, have recently gained attention for their potential impact on human health. While much research has focused on their effects on marine life and ecosystems, there's a growing body of evidence suggesting a link between micro- and nanoplastics exposure and vascular diseases in humans. This article provides an overview of the current understanding of how micro- and nanoplastics may contribute to vascular diseases, including atherosclerosis, thrombosis, and hypertension. Additionally, it explores the mechanisms through which these plastic particles exert their detrimental effects on the cardiovascular system and highlights the need for further research and regulatory measures to mitigate their potential health risks [1].

Description

Microplastics (MPs) and Nanoplastics (NPs) are small plastic particles that have become pervasive in the environment, posing a significant threat to ecosystems and potentially human health. While their impact on marine life and the environment has been extensively studied, their effects on human health, particularly on cardiovascular health, have only recently begun to emerge as a concern. Vascular diseases, including atherosclerosis, thrombosis, and hypertension, are leading causes of morbidity and mortality worldwide. This article aims to explore the emerging evidence linking micro- and nanoplastics to vascular diseases, elucidate potential mechanisms of action, and discuss the implications for public health and regulatory policies [2].

Microplastics are defined as plastic particles with a size range between 1 µm and 5 mm, while nanoplastics are even smaller, typically less than 100 nm in diameter. These particles originate from various sources, including the breakdown of larger plastic debris, industrial processes, and the fragmentation of microfibers from textiles. Once released into the environment, micro- and nanoplastics can be transported over long distances through air and water currents, eventually accumulating in terrestrial and aquatic ecosystems. Human exposure to micro- and nanoplastics can occur through ingestion, inhalation, and dermal contact, with food and water being major routes of intake. Several recent studies have suggested a potential association between micro- and nanoplastics exposure and vascular diseases in humans. Epidemiological data have revealed higher levels of plastic particles in tissues and organs of individuals with cardiovascular diseases compared to healthy controls. Animal studies have provided further evidence, demonstrating that exposure to micro- and nanoplastics can induce endothelial dysfunction, oxidative stress, inflammation, and vascular remodeling, all of which are key pathological processes underlying vascular diseases. Moreover, experimental studies have shown that plastic particles can translocate across the endothelial barrier, accumulate in vascular tissues, and trigger a cascade of cellular and molecular events leading to vascular dysfunction and injury [3].

The mechanisms through which micro- and nanoplastics exert their detrimental effects on the cardiovascular system are multifaceted and complex. One proposed mechanism involves the generation of reactive oxygen species (ROS) upon interaction with cellular membranes, leading to oxidative stress and endothelial dysfunction. Plastic particles can also activate inflammatory pathways, including the production of pro-inflammatory cytokines and chemokines, thereby promoting vascular inflammation and atherosclerosis. Additionally, micro- and nanoplastics have been shown to disrupt intracellular signaling pathways, impair nitric oxide bioavailability, and alter vascular tone, contributing to hypertension and thrombosis. Furthermore, the adsorption of toxic chemicals onto plastic surfaces and their subsequent release into the bloodstream may exacerbate vascular damage and increase the risk of cardiovascular events [4,5].

The emerging evidence linking micro- and nanoplastics to vascular diseases underscores the need for further research to elucidate the mechanistic pathways involved and assess the magnitude of the health risks posed by plastic pollution. Longitudinal epidemiological studies are warranted to establish causal relationships between plastics exposure and cardiovascular outcomes, while experimental research should focus on investigating the effects of different types, sizes, and concentrations of plastic particles on vascular function and pathology. Moreover, regulatory measures aimed at reducing plastic production, improving waste management practices, and developing eco-friendly alternatives are essential for mitigating the environmental and health impacts of plastic pollution. Public awareness campaigns and educational initiatives can also play a crucial role in promoting sustainable behaviors and minimizing plastic contamination of the environment and human exposure. Ultimately, addressing the threat of micro- and nanoplastics to vascular health requires concerted efforts from policymakers, researchers, industries, and the general public to safeguard both the environment and human well-being [6].

Conclusion

Micro- and nanoplastics represent a novel and emerging environmental pollutant with potential implications for vascular health. The evidence linking plastic particles to vascular diseases is still evolving; accumulating data from epidemiological experimental and mechanistic studies suggest a plausible association. Given the widespread presence of micro- and nanoplastics in the environment and their ability to accumulate in tissues and organs, it is imperative to prioritize research efforts aimed at understanding their health effects and implementing effective strategies to mitigate their adverse impacts. By addressing the issue of plastic pollution comprehensively, we can safeguard vascular health and promote a sustainable future for generations to come.

Acknowledgement

None.

***Address for Correspondence:** Rocha Svetoslav, Department of Bioengineering, School of Engineering, The University of Tokyo, Tokyo, Japan, E-mail: rocha@svetoslavl.jp*

Received: 27 January, 2024, Manuscript No. jbbs-24-133300; **Editor Assigned:** 29 January, 2024, PreQC No. P-133300; **Reviewed:** 14 February, 2024, QC No. Q-133300; **Revised:** 19 February, 2024, Manuscript No. R-133300; **Published:** 26 February, 2024, DOI: 10.37421/2155-9538.2024.14.402

Conflict of Interest

None.

References

1. Lyle, Alicia N. and W. Robert Taylor. "The pathophysiological basis of vascular disease." *Lab Investig* 99 (2019): 284-289.
2. Tesfamariam, Belay and Albert F. DeFelice. "Endothelial injury in the initiation and progression of vascular disorders." *Vascul Pharmacol* 46 (2007): 229-237.
3. Abdellatif, Mahmoud, Heiko Bugger, Guido Kroemer and Simon Sedej. "NAD+ and vascular dysfunction: From mechanisms to therapeutic opportunities." *J Lipid Atheroscler* 11 (2022): 111.
4. Jeong, Se-Jin and Goo Taeg Oh. "Unbalanced redox with autophagy in cardiovascular disease." *J Lipid Atheroscler* 12 (2023): 132.
5. Woo, Sang-Ho, Dae-Yong Kim and Jae-Hoon Choi. "Roles of vascular smooth muscle cells in atherosclerotic calcification." *J Lipid Atheroscler* 12 (2023): 106.
6. Serra, Raffaele, Andrea Abramo, Nicola Ielapi and Salvatore Procopio, et al. "Environmental pollution and peripheral artery disease." *Risk Manag Healthc Policy* (2021): 2181-2190.

How to cite this article: Svetoslav, Rocha. “An Emerging Role of Micro and Nanoplastics in Vascular Diseases.” *J Bioengineer & Biomedical Sci* 14 (2024): 402.