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Physical Activity to Modulate Gut Joint Axis in Microgravity to Prevent Skeletal Health: A Literature Review

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ABSTRACT

Osteoporosis is characterised by decreased absorption of calcium-containing minerals in bones. Metabolic studies suggests that in astronauts, space night is the cause of decreased calcium levels in the body. The gradual reduction in bone mineral density and gut metabolism is associated with the increasing affluence of gut microbiota, suggesting a potential interplay between the gut microbiome and skeletal health and influencing bone metabolism through the immune system and calcium absorption. During spaceflight, the electromagnetic environment changes due to the absence of gravity which plays a role in space induced osteoporosis.The composition, functioning, diversity, and Short Chain Fatty Acids (SCFAs) production of the gut microbiota are all significantly affected by physical activity. Exercise and gut microbiota have a complex relationship, impacting metabolic and muscular performance. Exercise regulates bile acid pools, supporting the host gut microbiota's health and supporting the gut-joint axis.The study aims to address thespace-induced osteoporosis/osteopenia caused by gut bacterial overgrowth. A comprehensive literature search was performed on PubMed, Scopus and Cochrane Library databases between 2015 and 2024 using the keywords (microbiota OR microbiome) AND (microgravity OR physical activity) in this narrative review . The study concluded that in post spaceflight,the abundance of Firmicutes gradually elevated, while the Bacteroides abundance gradually decreased and the spaceflight-induced osteoporosis may be addressed by targeting the gut microbiota. It is analysed that these changes disrupt bone metabolism and influence host metabolic processes, modulating the regulatory metabolites like SCFAs within the gut-bone axis. Hence, provides the evidence of connection between the intestinal microbiome, diet, and physical activity.

Keywords: Astronauts, Bacteroides, Gastrointestinal microbes, Short chain fatty acids.