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POSSIBLE FACTORS IN THE CASCADE OF EVENTS WHERE THE CREB1 GENE MAY MODULATE THE ADVERSE EFFECTS OF MICROGRAVITY ON ASTRONAUT HEALTH

Abstract

The CREB1 gene plays a crucial role in cAMP signaling pathways, acting as a second messenger and facilitating cell growth, differentiation, and function in response to extracellular signals. Upon cellular stimulation, transcription of CREB1 increases, which activates specific proteins that induce biochemical changes in DNA-binding proteins, enabling the transcription of genes that respond to CREB1. These genes share an 8-base enhancer known as the cAMP response element (CRE). According to the Kyoto Encyclopedia of Genes and Genomes (KEGG), CREB1 participates in numerous cellular pathways and networks, including those related to cortisol. Cortisol, a steroid hormone synthesized in the adrenal cortex, performs metabolic, immune-regulating functions, and is regulated by corticotropin. Interleukin-6 (IL6) also plays a role in the pathogenesis of inflammatory situations, while oxidative stress, resulting from the imbalance between free radicals and antioxidants, can cause chronic inflammation. Stress, exacerbated in extreme conditions such as microgravity, requires a multifactorial approach. It is time to consider the Microbiome as an area of opportunity to maintain in balance the physiological state of a cell once it is also affected by the phenomenon of stress, and for this reason, the trace element selenium is considered as a nutritional aspect that favors constant well-being, before, trans- and after exposure to extreme conditions. Data from Tardigrade are also included as support in its processes of microgravity, oxidative stress, cortisol, CREB, inflammation and selenium. In this article, the importance of the CREB1 gene in the maintenance of well-being during extreme conditions such as spaceflight is presented theoretically through an extensive literature review using journal articles from platforms such as Embase, PubMed, GenLab and the Digital Library of the Autonomous University of the State of Hidalgo, including proposals for support for microbiome care and selenium supplementation. Concluding that there is sufficient scientific evidence to consider the proposed mechanisms as part of the pathway between CREB1 and the performance of the individual in extreme conditions, genetic confirmation is suggested in addition to a proposal for experimentation of selenium as an adjuvant to improve the microbiome. The findings are supported by similar processes in the Tardigrade.