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## Endocannabinoids, exercise, pain, and a path to health with aging.

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### Abstract

Physical activity is an important lifestyle factor for growth, development, and sustained health throughout life. In recent years, the benefits of physical activity have drawn more attention to its physiological effects on the body, including well-being. The endocannabinoid system (ECS) has emerged as a focal point to ascertain the mechanisms for how exercise benefits the body and how it reduces or controls pain. The ECS, its ligands [the endocannabinoids (eCB)], receptors (CB1 and CB2), enzymes for the synthesis and degradation of eCB, and the polyunsaturated fatty acids (PUFA) that serve as substrates, comprise a powerful biological organization of multiple controls that affects mood, inflammation, pain, and other neurological aspects of the central nervous system and peripheral nervous system. Recently, investigators have reported increases in circulating levels of eCB after exercise, with some eCB exerting analgesic effects from exercise. The focus of this review is to discuss evidence for the role of eCB and the complexities of the ECS in exercise and pain. Some aspects presented herein are production of eCB and activation of the cannabinoid receptors in the brain following exercise; eCB, pain, and physical activity; oxylipins; and joint pain. Future research on the ECS must include mechanistic approaches to endocannabinoid signaling and explain the role of dietary PUFA in altering signaling of the receptors that affects pain. Additionally, how other types of exercise, such as Tai Chi, which is reported to improve well-being, should be investigated to ascertain if changes in eCB mediate the mind and body benefits of Tai Chi. As we age, exercise in the form of play has evolved with the exploration of our body from walking to running, recreational, and competitive sports, to midlife physical activity focusing on maintaining fitness and a healthy body weight. Furthermore, exercise has been a target of investigation to explore various hypotheses to explain the mechanisms for cognitive benefits in the young and in older adults. The science of exercise has matured to a level of importance in the life cycle to reduce pain with aging and include new investigations on the ECS to explain its role in well-being and improved quality of life in later years.

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