Nano-Nutraceuticals Dietary Supplements for Athletes: An Eminent Approach for Managing Traumatic Brain Injuries

Neurological disorders among athletes and sportsmen due to injury, trauma, or pathological conditions trigger inflammation and neurodegeneration to mediate both short-term and long-term disabilities, including life-threatening conditions [1]. Usually, such instances initially progress slowly and thus often remain undiagnosed or are ignored for a long period [2]. Such brain injuries are accompanied by the activation of different inflammatory mediators, degeneration of structural and physiological functions of neurons, neurochemical disbalances, deposition of protein aggregates inside neurons, and damage of the integrity of the blood-brain barrier [3]. In addition, the activation of microglia and astrocytes further mediate pivotal signalling pathways, which lead to clinical conditions of hematoma, cognitive impairments, epilepsy, axonopathy, physically challenged states, and even early deaths [4].

Mishra et al. (2021) discussed the role of different anti-inflammatory phytoconstituents in the protection of such pathological states [5], whereas Dhote et al. (2021) reported how different types of injuries behave differently in terms of their pathological states, signalling mechanisms as well as inflammatory cascades [6]. Furthermore, despite highly crossed-linked and complicated neuro-signalling networks in such a disordered state of brains after injuries or inflammation, current therapeutic interventions are still based on the conventional belief of one drug one target hypothesis [7]. Hence, the inability of these drugs to restore the altered multiple signalling pathways into a normal one leads to limited efficacy or high chances of drug resistance [8]. Of late, different treatment approaches, more specifically nutraceuticals and nanocarriers, were extensively explored due to the multifactorial mode of actions [9]. Iqubal et al. (2021) reported the therapeutic significance and mechanism of different nutraceuticals in traumatic brain injuries [10]. Khatoon et al. (2021) disclosed how different nanocarriers of many secondary plant metabolites of polyphenols class favoured them in terms of their excellent free-radical scavenging attributes, anti-inflammatory properties, anti-cancer roles, and immunomodulatory impacts [11]. Subsequently, clinical cases of age-related Alzheimer’s disorders are one of the most common features associated with such injuries, which adversely impacts cognitive functions [12]. Hence, Iqubal et al. (2021) further reported how nanotechnology processed nutraceuticals may overcome pharmaco-technical limitations of finished dosage forms of anti-Alzheimer’s nutraceuticals, which preferably enabled a reduction in the size of particles, increased shelf-life, solubility enhancement, blood-brain barriers invasion, as well as improved pharmacokinetic properties, leading to the desired oral bioavailability profiles [13], whereas Kale et al. (2021) described how integrating different physiotherapy tools and regular exercises, in addition to nutraceuticals, may manage hyper-glycaemia-induced neuropathy cases [14].

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