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Commentary

# Diet: Its Importance in Neuroinflammatory and Neurodegenerative Diseases

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## Abstract

Millions of people worldwide are affected by neurodegenerative diseases and, with the increase in life expectation, their global socioeconomic impact is increasing considerably.

While some of the physical or mental symptoms associated with neurodegenerative diseases can be relieved by some treatments, currently there isn't way to slow the progression and there is no cure. An association between dietary habits and individual lifestyle and neurodegeneration has been highlighted, emphasizing the role of nutrition as a potential prophylactic intervention for neuroinflammation and neurodegeneration.

More research is needed to better understand the potential interactions of diet and supplementation with the processes leading to neurodegeneration.

***Keywords:*** *Neuroinflammation; Neurodegeneration; Nutrients; Diet*

Many neurodegenerative diseases such as Alzheimer's disease (AD), Parkinson's disease (PD), amyotrophic lateral sclerosis (ALS), and multiple sclerosis (MS) occur as a result of neuroinflammation [1,2]. Neurodegenerative diseases affect tens of millions of people worldwide and this number will increase to triple by 2050, posing an incredible personal, social and economic burden. Neurodegenerative disorders principally are dependent by misfolded protein that promote inflammation by the activation of cascade of inflammatory proteins, such as nuclear factor kappa- light-chain-enhancer of activated B cells (NF-κB), inducible nitric oxide synthase (iNOS), and cyclooxygenase (COX), and inflammatory cytokines, which drives to neurodegeneration. Recently have identified multiple neurodegenerative pathways closely linked with the inflammatory processes and associated cognitive impairment and decline in the ability to perform mundane activities such as driving, household chores and personal care.

Despite the attempts of research, to date no cure for these diseases are available. The current treatments, often associated with serious side effects, are only partially effective in soothe symptoms [3]. One of the specific challenges in managing neurodegeneration that could lead us to the goal of preventing decline in brain health is understand the processes of neuroinflammation and inhibit inflammatory processes. Thus, there is an urgent need to identify lifestyle to prevent or delay neuroinflammatory conditions and to develop new effective treatment options once symptoms are present.

Research on neuroinflammation is increasingly enriched by studies investigating the effects of nutrition on neuroinflammation and neurodegenerative diseases. Studies are looking at alterations in the gut microbiome and the development of metabolic disorders such as obesity that can indirectly affect the brain due to dietary modifications. If a nutrient-deficient diet may lead to disorders in the central or peripheral nervous system, recently several studies suggested that overnutrition induces inflammation contributing to neurodegeneration and that there is a close relationship between metabolic diseases induced by overnutrition and neurodegenerative diseases [4]. In fact individuals with elevate BMI, have white fat (the adipose tissue) rich in activated macrophages that secrete proinflammatory cytokines, enter in a state of chronic elevated inflammation increasing risk of neurodegenerative diseases. It is known that inflammatory mediators get into the brain and activated the brain microglia and astrocytes perpetuating proinflammatory state in central nervous system.

CNS function was influenced also by the microbiome and that disorders in the microbiota-gut-brain axis may increase the susceptibility to neuroinflammatory disorders. In AD and MS was observed that less anti-inflammatory gut bacteria and an increase in pro-inflammatory gut bacteria are associated with disease [5-7] and that probiotic biotherapies or faecal microbiota transplants may represent an important therapeutic option for neurodegenerative diseases.

Recent studies have shown that ketogenic diet, acting on mitochondrial function, inflammation, oxidative stress, metabolism, autophagy, and microbiota, may be beneficial to neurodegenerative diseases [8].

It has long been known that many foods have anti-oxidant and anti-inflammatory properties, although other mechanisms responsible for the beneficial effects of nutritional interventions have yet to be identified. The effects of diets, nutrients or functional food components on the brain are also studied [9]. Recent studies suggest that diets rich in fruits, nuts, vegetables and spices, in addition to a reduced caloric intake, guarantee a high content of antioxidant and anti-inflammatory components, which may contribute to the reduction of the risk of age-related cognitive decline and neurodegenerative diseases [10]. Furthermore, nutritional interventions are emerging and promising novel approaches in the management also of neurodegenerative diseases sharing additional advantages such as their safety, broad-spectrum utility, and low cost.

Numerous studies on the role of micronutrients in the prevention, prediction, and treatment of neurodegenerative diseases have been conducted and many are ongoing. Research suggests that omega-3 fatty acids, polyphenolic compounds contained in berry fruits, walnuts, curcumin, and fish oils exhibit potent antioxidant and anti-inflammatory activities that may reduce the age-related sensitivity to oxidative stress or inflammation and may alter neurodegeneration [11,12]. Foods with high contents of antioxidants, carotenoids, and tocopherols have greater anti-inflammatory activity. Several compounds, with anti-inflammatory properties, such as bioactive peptides, fatty acids, pigments, alkaloids, and polysaccharides, were isolated from marine source and may play a key role in the treatment and prevention of neuroinflammatory disorders [13].

In conclusion, if the daily healthy diet, balanced in macro- and micro-nutrients, is believed a regulating risk factor for neurological disorders, foods and nutrients are promising tools which could be used as additional treatment, prevention and slowing down a progression to full-blown of neurodegenerative diseases is confirmed. Thus, the next step is the formulation of personalized dietary interventions as prevention and therapy.

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