The Role of Food in Maintaining Immune Health in Ageing

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Part 1: Introduction to the Ageing Immune System

Healthy Ageing – an Increasing Global Dilemma

The global population is currently undergoing unprecedented demographic changes. The number of older persons (aged 60 years or over) is expected to more than double, from 841 million people in 2013 to more than 2 billion in 2050 [1]. This demographic shift is, in part, due to an increase in life span. In 150 years, the average global life span has increased from 40 years to approximately 80 years [2]. Although the news that we are living longer is positive, this situation presents new challenges to individuals and to society as a whole. Ageing is often associated with chronic disease and an increased susceptibility to infection that can negatively impact an individual's quality of life. In addition to this, there are rising healthcare costs and economic consequences associated with this demographic shift. For this reason, interventions that can either slow or reverse the negative effects of ageing, thereby increasing health span would have major benefits for individuals and society.

During the process of ageing, the human body accumulates damage at the molecular, cellular and organ levels, which results in diminished or dysregulated function and increased risk of disease and death. Advancing age is associated with an increased susceptibility of developing infections, frailty cardiovascular disease, autoimmune diseases, metabolic syndrome, type 2 diabetes and cancer [3]. These age-related changes are well exemplified in the immune system.

The Ageing Immune System

Ageing leads to marked changes in the composition, function and competence of both the innate and adaptive immune systems. Ageing is associated with increased risk of infection, however the severity and morbidity associated with these infections also increases with age. This is evidenced by the fact that over 90% of deaths associated with influenza occur in individuals aged over 65 years [8]. This problem is exacerbated by the fact that there is an age-related decline in response to vaccinations [9]. The overall change to the immune system with age is termed immunosenescence and has a multifactorial aetiology, a consequence of the complexity of the immune system as well as multiple genetic and environmental influences. In addition to increased risk of infection, immunosenescence may also have a role in cancer risk (more than 60% of new cancers and more than 70% of cancer deaths occur in elderly subjects >65 years)[10] and autoimmunity [11].

Inflammation is beneficial as an acute, transient immune response to harmful conditions such as traumatic tissue injury or an invading pathogen. This response also facilitates the repair, turnover, and adaptation of many tissues. However, acute inflammatory responses to pathogens become impaired during ageing, leading to increased susceptibility to infection. Chronic inflammation has many features of acute inflammation but is usually persistent and of low grade, resulting in responses that lead to tissue degeneration. Increased circulating levels of inflammatory biomarkers such as C-reactive protein, TNF-α and IL-6 are commonly found in older individuals [12]. This chronic, low grade inflammation is referred to as 'Inflamm-ageing' and has been hypothesised to contribute to the pathogenesis of most age-associated diseases including sarcopenia, inflammatory bowel disease (IBD), cardiovascular disease and Alzheimer's disease [13].

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