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Nutrition and immunity in the elderly

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Ageing is a universal process that may be defined as a progressive, endogenous and irreversible accumulation of adverse changes that increase vulnerability to disease and finally to death. The aging process is very heterogeneous, showing different rates of physiological changes in the various systems of the organism and in the diverse members of a population of the same chronological age. This diversity justifies the introduction of the concept of 'biological age', which is very useful in assessing the level of aging experienced by each individual and therefore his life expectancy. Currently, it is known that immune functions change with age. Since the functional capacity of the immune system is a marker of health and longevity, several immune functions (Table) have been proposed as markers of biological age and predictors of longevity. These immune functions have been standardized at different ages in mice and human subjects and show similar changes with aging in leucocytes from both species. Moreover, a model of premature aging in mice as well as very high longevity in mice and human populations (very old mice and centenarians) has been used. In the prematurely-aging mice the functional variables investigated have been shown to have values characteristic of chronologically-older animals, and these mice also show a significantly decreased lifespan. In very old mice and centenarians these immune functions have values similar to those for adults (6 months and 30 years respectively). The cause of immunosenescence has also been investigated, and since the oxidation theory is now the most widely accepted explanation of the ageing process, the age-related imbalance between free radical production and antioxidant defences has been analysed, with a higher production of the former, denominated oxidative stress, in the immune cells from subjects throughout ageing (Table). Since free radicals are needed for many physiological processes including immune function, prevention of an imbalance is required to maintain good health. Oxidative stress is responsible for a large number of pathologies, many of which occur more frequently with ageing. The immune cells from prematurely-ageing mice show oxidative stress whereas leucocytes from very old mice and centenarians show values of oxidant and antioxidant compounds similar to those in cells from adults. One of the mechanisms involved is the activation of NF-κB. A diet with adequate amounts of antioxidants neutralizes the oxidative stress of immune cells in ageing and therefore the function of these cells improves, both in mice and human subjects, showing values close to those in adults (Table)[1–3]. Mice consuming a diet with antioxidants for only 5 weeks increase their lifespan. Thus, good nutrition with compounds rich in antioxidants can prevent the age-related deterioration of the immune system and help to achieve a healthy longevity.

	Aging	Antioxidant supplementation
Functions		
Chemotaxis, phagocytosis	Decrease	Increase (=adult)
Lymphoproliferation in response to mitogens	Decrease	Increase (=adult)
IL-2 release, NK activity	Decrease	Increase (=adult)
Adherence, TNFα release	Increase	Decrease (=adult)
Oxidant compounds		
Extracellular superoxide anion, PGE2	Increase	Decrease (=adult)
Oxidized gluthatione	Increase	Decrease (=adult)
Antioxidant defences		
Reduced gluthatione	Decrease	Increase (=adult)
Superoxide dismutase and catalase activities	Decrease	Increase (=adult)
Gluthatione peroxidase and reductase activities	Decrease	Increase (=adult)

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