What are the Strategies for Healthy Aging?

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An increase in the average life expectancy from birth over the last century from about 45 to nearly 80 years has increased the proportion of older people in the population, and has fuelled a tremendous interest in "anti-aging" research. (Note: while this sounds like we live longer than our parents, these numbers are misleading. Seventy five percent of the increase in life expectancy from birth is due to the prevention of the death of infants from food and water-borne infectious disease. For a person aged 65, the increase in longevity the past 100 years is fewer than five years.(1)) In developed countries there has been a shift in the etiology of disease, from an infectious origin to more chronic, degenerative and metabolic processes, accompanied by the goal of not only living longer lives, but maintaining a high level of function and wellness throughout life (i.e., having longer "health-spans"). Naturopathic medicine and natural health products are perfectly suited to address this goal, given their orientation toward promoting health and encouraging vitality.

In the August issue of Vitamin Retailer magazine, I wrote in some detail about telomeres, the caps on the end of our chromosomes that shorten with age, and have a direct relationship with age related degeneration as well as with a healthy lifespan. I explained how these structures are affected by our lifestyles, toxin exposure, free radical damage and mitochondrial health, and briefly discussed ways to protect these structures. In this month's issue, I'd like to describe some of the other known contributors to the aging process, and some strategies to promote healthy aging.

Insulin Resistance and Blood Glucose

The most well-established means of extending lifespan in animal populations is known as caloric restriction with adequate nutrition (CRAN), i.e. reducing total calorie intake while ensuring adequate intake of both macro- and micronutrients, in contrast to malnutrition or starvation. Although we are lacking data for the effect of CRAN in humans, reducing calorie consumption does induce many of the metabolic and hormonal changes found to be beneficial in animal studies, and also protects against many prevalent chronic diseases, prevalent such as diabetes and cardiovascular disease.(2)

CRAN is thought to be effective for a number of reasons, including reductions in blood glucose levels and changes in insulin sensitivity. Elevated blood glucose levels are known to increase the glycosylation (binding by sugar) of many proteins and lipids in the body, thereby impairing their function and contributing to age-related decline. Known as AGEs (advanced glycation end-products); these compounds increase inflammation, reactive oxygen species formation, and disrupt normal cellular function. Elevated blood sugar is a major contributor to their formation, but a diet high in fat and protein can also contribute, as can cooking foods at high heat or for long periods.(3)

In addition to the adverse effects of elevated glucose levels, insulin resistance is thought to promote several aspects of age-related loss of function, including shortened telomere lengths, inflammation and reactive oxygen species generation.(4) In an analysis of the genetic factors involved in human longevity, researchers found that "25-32 percent of the overall difference in human lifespan for survival after the age of 60 years is accounted for by genetic polymorphisms".(5) They reported that the insulin/insulin-like growth factor-1 (IGF-1) signaling (IIS) pathway is one of the most studied and probable influences on longevity, with elevated levels of insulin and IGF-1 influencing expression of genes involved in cellular metabolism and proliferation, tumor suppression and oxidative stress.

In animal studies, a calorie-restricted diet reduces IGF-1 levels, and is thought to at least partly explain the benefit of CRAN for extending lifespan. However, in humans, caloric restriction does not appear to influence the levels of IGF-1, rather, a reduction in protein intake is a key factor in reducing IGF-1.(6) I think the bottom line is to maintain good glycemic control, optimize insulin sensitivity and have a moderate intake of protein (the authors in this study found a reduction in IGF-1 at a daily intake of just under 1g of protein per kg of body weight).

Inflammation

A consistent research finding is that inflammation plays a role in nearly every chronic disease, and age-related decline is no exception. Recent evidence suggests that a state of chronic, low-grade inflammation is likely to be the link between normal aging and the pathogenesis of age-related diseases. Many studies have documented elevations in numerous inflammatory mediators with aging and age-related disease.(7) For example, activation of NFkB (a transcription factor and the key inflammatory component of many chronic diseases) plays an important role in cardiovascular aging, including aging in arteries and atherosclerosis. Indeed, it has been suggested that the anti-aging benefits of both physical activity as well as caloric restriction may at least in part be mediated by reducing NF-kB activation.

Very recently (published September 2010) the molecular mechanism of omega-3 fatty acids was discovered, and it appears to involve the prevention of NF-kB activation.(8) Specifically, a new receptor was discovered (GPR120) to which omega-3 fatty acids bind, and ultimately prevent activation of NF-kB, having both anti-inflammatory as well as insulin-sensitizing effects. Although the use of omega-3 fatty acids to promote a greater health-span has not been evaluated, they have certainly shown benefit on both a cellular level, as well as for the prevention and treatment of many chronic and age-related diseases.

Lastly, as I mentioned in the August issue, mitochondrial dysfunction is certainly a component of aging, and we now know that inflammation, particularly chronic inflammation, is closely tied to mitochondrial oxidative stress.(9) Many observations point to an associated decline in mitochondrial function being both caused by and contributing to systemic inflammation, as well as the aging process.(10) Here, too, caloric restriction has benefit, as it has been shown to reduce mitochondrial reactive oxygen species production and inflammatory markers, and increase the generation of new mitochondria.(11)

Strategies

At this point, most available research for promoting healthy aging points to adopting an appropriate diet and maintaining physical activity, as well as using specific supplementation to address some of the molecular causes of aging. Specifically, diets which are low in calories, promote insulin sensitivity, have a low glycemic index, are anti-inflammatory and high in antioxidants are probably the best choice. Fortunately, a number of healthy diets such as the Mediterranean diet and the DASH (Dietary Approaches to Stop Hypertension) diet have many of these features in common, as does the Okinawan diet. This latter diet has been in the spotlight because the people of Okinawa are among the oldest people alive anywhere. This diet has been shown to be not only lower in calories, but among the lowest in fat intake and highest in complex carbohydrate intake, and rich in antioxidant foods such as root and green leafy vegetables.(11) This diet is also very close in nature to the Ornish diet, which I mentioned before has been shown to increase the activity of telomerase (the enzyme that lengthens telomeres) in just three months.(12) As mentioned above, avoiding excessive protein intake is probably a good idea.

Resveratrol probably has received the most attention for influencing the aging process, because in animal studies it has been shown to reproduce many of the benefits of a calorie restricted diet, most importantly activation of Sirt1, a nuclear protein and key regulator of lifespan in several organisms.(13) Just a few weeks ago, a study was published showing that vitamin D may be an activator of Sirt1 as well, perhaps accounting for some of its benefit for a wide variety of chronic diseases.(14) Vitamin D also has an anti-inflammatory component, so along with omega-3 fatty acids an optimal intake of this nutrient can help fend off "inflammaging."(15,16)

In future articles I hope to address treatments designed to improve insulin sensitivity, increase intracellular and production of the antioxidant glutathione and optimize mitochondrial function—all key components of healthy aging.

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