

# Anti-Aging Medicine

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Anti-aging medicine is a medical specialty founded on the application of advanced scientific and medical technologies for the early detection, prevention, treatment, and reversal of age-related dysfunction, disorders, and diseases. It is a healthcare model promoting innovative science and research to prolong the healthy human lifespan.

The anti-aging medical model aims to both extend lifespan as well as prolong health span - the length of time that we are able to live productively and independently.

Hundreds of scientific research studies clearly prove that modest interventions in diet, exercise, nutrition and single-gene modulation in the laboratory setting beneficially and significantly impact healthy function in old-age.

It was found that the longest-living Americans are Asian-American women residing in Bergen County, New Jersey USA. They live longer than any other ethnic group in the United States to an average lifespan of 91.1 years. In contrast, the Harvard team found that the shortest-living Americans are Native American populations in South Dakota, despite receiving free or low-cost government provided medical care, living an average lifespan of 66.5 years. A distinguishing characteristic of the Bergen County women's longevity is that they are availing themselves of the armament of state-of-the-art biomedical technologies in advanced preventive care, including preventive screenings, early disease detection, aggressive intervention, and optimal nutrition - all of which are cornerstones of the anti-aging medical model [1].

Kaplan and his colleagues, (2008) utilized the Health Utilities Index Mark 3 (HUI3), a multidimensional measure of health status, to examine the maintenance of exceptionally good health among 2,432 elder Canadians enrolled in the Canadian National Population Health Survey from 1994 to 2004. The researchers found that

the most important predictors of excellent health over the entire decade were; absence of chronic illness, income over US \$30,000, having never smoked, drinking alcohol in moderation, maintaining a positive outlook, and managing stress levels. Many of these factors can be modified when young or middle-aged [2].

## Anti-Aging Medicine

A number of products, including diets, drugs and supplements, are promoted to have anti-aging properties. Presently, there is no proven way to delay, even if slightly, the human aging process.

## Caloric Restriction

Caloric restriction (CR) is one of the ways that might be able to delay human aging. Given the large body of research on CR, there are many products trying to emulate its effects.

In humans, there are no conclusive studies but some results suggested that CR might be beneficial, at least in some groups of people. Fontana et al., (2004) found that CR has a protective effect against atherosclerosis in people [3]. Another study reported beneficial effects on cardiac function [4]. Racette et al., (2006) found some benefits of CR in reducing weight and adiposity, though the benefits were similar to those obtained by exercising [5]. CR may also improve memory in the elderly [6]. Finally, CR appears to have beneficial effects on some biomarkers of longevity in overweight individuals [7], though the observation that reducing calories is beneficial to overweight patients is not surprising.

Side-effects of CR includes, the mental stress for being hungry all the time, which can lead to depression. Even in food restricted rats, depression- and anxiety-like behaviors have been observed [8]. CR makes exercise impossible and makes people feel less energetic, less alive. Finally there are sexual problems:

diminished libido is a common side-effect in people under CR.

### **Hormonal Therapies**

The levels of many hormones go down with age. Growth hormone (HGH) has a long history as an anti-aging treatment and some evidence suggests HGH has beneficial effects in elderly people: HGH supplements might increase muscle mass, strengthen the immune system and increase libido.

A review on the use of human growth hormone as an anti-aging treatment in healthy elderly people published in the *Annals of Internal Medicine* concluded the risks of HGH significantly outweigh the benefits, noted soft tissue edema as a common side effect and found no evidence that the hormone prolongs life [9], also because HGH stimulates growth, concerns have also been raised as to whether HGH could stimulate cancer growth and whether it will contribute to cancer development in patients with existing malignant or pre-malignant tumors.

Insulin-like growth factor 1 (IGF-1) is another hormone that may play a role in aging and can be purchased as a supplement. IGF-1's production is induced by GH and, like GH, IGF-1's levels decline with age and, in mice, low levels of IGF-1 appear to correlate with longevity. In fact, there is some evidence that little people with low levels of IGF-1 live longer [10]. Interestingly, anti-aging therapies based on lowering IGF-1 may be possible. IGF-1 does appear to play a role in aging, but whether it can be used in anti-aging is pure speculation at this stage. Clearly, however, IGF-1 injections are unlikely to extend lifespan and, like HGH, may even be harmful.

Other hormones whose production decreases with age include, Dehydroepiandrosterone (DHEA) and melatonin. DHEA has been reported to improve the wellbeing of the elderly by a variety of ways: improved memory, immune system, muscle mass, sexual appetite, and benefits to the skin. Protection against cancer has also been argued but there is really no strong scientific evidence

for this. Minor side effects such as acne have also been reported. One clinical study in elderly women found no evidence of benefits from DHEA [11]

Melatonin is a hormone mostly involved in sleep and circadian rhythms, the latter hypothesized by some to be associated with aging and life-extension [12]. Some of its proponents claim it delays the aging process and many age-related diseases, though this is far from proven. In mice, melatonin can increase lifespan but also appears to increase cancer incidence. In humans there is no data to determine whether melatonin extends longevity, though it might have benefits in some patients [13]. Although it can be used for jet lag and some sleep disorders, it may also cause sleep disorders such as nightmares and vivid dreams.

For women, estrogen is a popular anti-aging therapy. This hormone is generally used in conjunction with others in hormone replacement therapy. It does appear to reduce some of the effects of menopause by protecting against heart disease and osteoporosis. On the other hand, it could increase risk of breast cancer and may lead to weight gain and thrombosis as side effects. In the context of aging, there is no evidence that estrogen is a viable anti-aging therapy. For men, testosterone has also been touted as anti-aging but, again, there is no evidence it has anti-aging benefits even if it might have some benefits like, say, increased sexual function and muscle mass [14].

### **Antioxidants**

A number of prospective cohort studies and case-control studies have reported that increased intake of dietary antioxidants including vitamin E, vitamin C, and B-carotene, are associated with reduced risk of atherosclerotic diseases [15]. Antioxidants seem to prevent the development and progression of arteriosclerosis [16].

However, a randomized controlled trial, enrolling more than 35,000 healthy women aged 45 years and older, showed no beneficial effect from vitamin E supplementation (600 IU on alternate days

for a mean of 10.1 years) for the prevention of major cardiovascular events, cancer, total mortality, and cardiovascular mortality [17]. Similar results were also obtained from The Heart Outcomes Prevention Evaluation (HOPE) and the Heart Outcomes Prevention Evaluation -- The Ongoing Outcomes (HOPE-TOO) trials Investigators, 2005[18], where a possible increased risk of heart failure was also hypothesized in the intervention group (vitamin E 400 IU daily).

On the other hand, the effect of vitamin E on Alzheimer's disease patients shows considerable variations both in its antioxidant function and in its capacity to improve cognitive functions. Therefore, the determination of the oxidant-antioxidant status of the patient is particularly important to test the effect of antioxidants on given functions [19].

### **Telomere-Based Therapies**

Telomerase is an enzyme that, at least in some cell lines, appears to overcome cellular senescence by extending the tips of the chromosomes called the telomeres. Some have argued that if telomerase can avoid aging in cells in vitro, maybe it can be used to combat human aging [20]. A number of companies and labs are developing telomerase-based therapies to fight aging and at least one product, a natural product-derived telomerase activator called TA-65, is already available. One study reported that taking TA-65 may result in a decline of senescent immune system cells [21]. TA-65 can also increase telomerase levels in some mouse tissues and was reported to improve some health indicators in mice but it did not increase mean or maximum lifespan [22].

### **Stem Cells**

In recent years stem cells have received widespread attention. The possibility of using stem cells to treat diseases of aging and for rejuvenation is also exciting. While depletion/dysfunction of stem cells are thought to play a role in aging [23], there is no evidence that stem cell-based anti-aging treatments will work. Harvesting and/or preparing stem cells for treatments is complex and much work remains to

optimize protocols. In some areas indeed stem cells have been shown to be useful. For example, blood- and marrow-derived stem cells have been used successfully in some autoimmune and cardiovascular diseases. Interestingly, mesenchymal stem cells, transplanted from young donors were found to extend lifespan in mice [24]. Yet stem cell applications are still in their infancy and a long way before physicians can employ stem cells to delay aging.

### **Future Therapies**

One exciting finding in anti-aging research was the discovery that feeding rapamycin, also known as sirolimus, to middle-aged mice extends lifespan by 9-14%. When fed to younger mice, rapamycin extend lifespan by 10-18% [25]. Rapamycin is also an immunosuppressant, used to prevent organ rejection, with serious side-effects and so it is not suitable as an anti-aging drug. However, rapamycin works by inhibiting a complex pathway called TOR (Target of Rapamycin) and a number of labs and companies are now trying to target more specific downstream nodes of the pathway to develop anti-aging drugs without the side-effects of rapamycin [26].

One gene that appears to influence aging in mice is *klotho*. High levels of *klotho* increase lifespan by about 30%, though it is not entirely clear if aging is delayed, and low levels appear to foster aging. Human longevity has also been linked to allelic variants in this gene [27]. Its functions are still largely a mystery but since the gene encodes one secreted form that acts as a hormone, it could be synthesized and presented as an anti-aging therapy.

The American Academy of Anti-Aging Medicine (A4M) believe that an "anti-aging transformation" can be produced by a combination of interventions, which include hormones, antioxidants, lifestyle modifications and exercise [28]. A 2002 presentation produced by Klatz highlights many widely recommended interventions to maintain health in old age, such as staying slim, avoiding smoking, regular exercise, maintaining an active social and sex life, continued mental stimulation, avoiding stress, a healthy diet, and

moderate alcohol consumption. The presentation also recommends consuming antioxidant supplements [29]. The A4M argues that the application of this set of interventions can produce "practical immortality", which are human lifespans in excess of 150 years, and predict future lifespans ranging up to 200 years old before the year 3000. Klatz predicted that such dramatic increases in lifespan will be produced by emerging technologies such as nanotechnology or stem cell therapy, which he states "shows ubiquitous promise for everything from stroke to spinal cord injury." With the discovery of such future technologies, Klatz believes that "Humankind will evolve toward an Ageless Society, in which we all experience boundless physical and mental vitality."

Several of the anti-aging methods recommended by the American Academy of Anti-Aging Medicine (A4M) have wide support among experts in the field, such as exercise and a healthy diet, but others, such as hormone treatments, do not have support from a consensus of the wider medical community. Many scientists studying aging dissociate themselves from the claims of A4M [30]

## Conclusion

There is no magic pill at present that will retard aging. But that is simple lifestyle and dietary adjustments that can make you live longer. Most components of a healthy lifestyle are well-known already. Diet rich in fruits and vegetables and low in carbohydrates and fat together with regular exercise, avoiding smoking and stress are likely to make man live longer.

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