THE MORINGA ANTIOXIDANT ASSORTMENT, TELOMERES AND AGING

by

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As an anti-aging physician, awareness of the factors that will decrease the length or quality of life is necessary knowledge in order to determine which actions may be able to intervene in this damage. The negative effects of oxygen can be witnessed throughout the realm of biological interactions and yet it is the most essential element for life. Cells can last no more than four and a half minutes without oxygen as it leads to cellular death however it is essential for the production of energy in mitochondria. Combine this with toxins prevalent in our air, food and water accumulating in our bodies and add to it the further discovery that a great deal of the damage (disease and aging) was being carried out by free radicals (oxidants) in our system.[1] [2] The problem with these positively charged ions is that they are looking for an electron to steal. Free radicals search the body seeking an electron indiscriminately, not considering the source, or the potential damage caused, and our immune systems had been overwhelmed in the process of trying to handle this onslaught. This is known as oxidative stress.

So what interventions can be affected? We have all heard of anti-oxidants. Science has progressed to the point that availability of antioxidants will allow the body to eliminate and or decrease the damage caused by free radicals (oxidative

[1] Blackburn et al. Telomeres and telomerase: The path from maize, *Tetrahymena* and yeast to human cancer and aging. *Nature Medicine*. 2006;12:p.1133-1138.

[2] Shirahata S, Kabayama S, Nakano M, Miura T, Kusumoto K, Gotoh M, Hayashi H, Otsubo K, Morisawa S, Katakura Y. Electrolyzed-reduced water scavenges active oxygen species and protects DNA from oxidative damage. Biochemical and Biophysical Research and Communication. Academic Press 1997. v.234. p.269-274.

stress). Anti-oxidants are substances that are generally ingested and provide electrons to bind with dangerous free radicals and neutralize them in order for the body to dispose of them.

Different parts of the body are protected by different antioxidants. Structures containing lipids (fats) are mainly protected by the fat soluble vitamins A and E, whereas the water-soluble vitamin C helps us against free radicals in the blood, body fluids and within cells. If there was a method by which countless negatively charged ions could be delivered into your body (most of us aren't getting it from our cooked processed food diets anymore) would it not be totally beneficial. In the recent past, everyone was scrambling to find powerful anti-oxidants. The cause of aging, along with most of humanity's diseases, has been determined to be due, in large part, to actions of free radicals on our body.

The relationship between telomeres, aging and disease was recently brought to light by Blackburn et al (2006).[3] She and her co-authors were awarded the Nobel Prize in Physiology and Medicine in 2009 for their discovery of the protective cap at the end of chromosomes, telomeres. They shorten every time a cell divides and when they become too short, the cell can no longer divide and the cell dies.[4] [5] The pace at which telomeres shorten is associated with the cell's ability to withstand oxidative damage,[6] therefore the more antioxidants present in

[3] Blackburn et al. Telomeres and telomerase: The path from maize, *Tetrahymena* and yeast to human cancer and aging. *Nature Medicine*. 2006;12:p.1133-1138.
[4] Allsopp R C, Harley C B, Evidence for a critical telomere length in senescent human fibroblasts. *Experimental Cell Res*. 1995;219:p.130-136.
[5] Harley C B, Futcher A B, Greider C W. Telomeres shorten during ageing of human fibroblasts. *Nature*. 1990;345:p.348-350.
[6] Souzo P D, Kirkwood T B. A stochastic model of cell replicative senescence based on telomere shortening,oxidative stress, and somatic mutations in nuclear and mitochondrial DNA. *J Theoretical Biology*.2001;213:p.573-576.

one's body, the less damage that occurs to the chromosome.[7]

To bring this into more relevance examine the comments by Dr. Sandy Chang of the Yale University School of Medicine about the telomere protein tankyrase 1 regulates DNA damage responses at telomeres.[8] The proliferative potential of cells is critically dependent upon the maintenance of functional telomeres, the protein-DNA complexes that cap the ends of chromosomes. A paper published in this issue of Aging describes that the telomere protein tankyrase 1 regulates DNA damage responses at telomeres.

Telomeres are composed of a six-protein telomere-specific complex termed shelterin.[9] The shelterin complex comprises the physical ends of chromosomes and serves to prevent chromosomal ends from being recognized as DNA double-strand breaks (DSBs). The synthesis and maintenance of telomeres are mediated by telomerase, a specialized ribonucleoprotein complex.[10] In the absence of telomerase, the failure of DNA polymerase to fully synthesize terminal ends of the lagging DNA strand leads to progressive telomere shortening with each round of replication. In human tissues, the strict down-regulation of telomerase accounts for the age-dependent decline in telomere lengths in somatic cells. Studies have documented a decrease in telomere length in several human epithelial cell types.[11] This rate of telomere

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[7] Serra V, Grune T, Sitte N, Saretzki G, von Zglinicki T. Telomere length as a marker of oxidative stress in primary human fibroblast cultures. *Annals of the New York Academy of Sciences.* 2000;908:p.327-330.

[8] Chang S. The telomere protein tankyrase 1 regulates DNA damage responses at telomeres. Aging (Albany NY). 2010 ;October; 2(10): p.639–642

[9] De Lange T. Shelterin: the protein complex that shapes and safeguards human telomeres. Genes Dev 2005; 19:p.2100-2110.

[10] Greider C W. Telomeres ; Telomerase and Senescence. Bioessays 1990; 12:p.363-369.

[11] Harley C B, Kim N W, Prowse K R, Weinrich S L, Hirsch K S, West M D, Bacchetti S, Hirte H W, Counter C M, Greider C W, et al. Telomerase, cell immortality, and cancer. Cold Spring Harb Symp Quant Biol 1994; 59:p.307-315.

length attrition would be significant in long-lived organisms such as humans.

Antioxidants, outside of the carotenoids, enter the electron cascade, which means their combined effect is more than the sum of effect of the single components. Antioxidants such as vitamins A, C, E and selenium (all present in *Moringa oleifera*) will release an electron to a free radical and bind it, transforming it into a relatively harmless molecule fit for excretion. The trace elements zinc and selenium are essential for our antioxidant enzyme system. *Moringa oleifera* contains ample amounts of forty-six bioavailable enzymatically active different antioxidants including Vitamin A and the carotenoids [12] [13] [14] [15]. A proprietary formula containing assorted parts of the *Moringa oleifera* tree (leaf, leaf puree, fruit, fruit puree and seed cake) insures a diverse assortment of bioavailable antioxidants. If you want to protect your ability to reproduce existing cell lines, it is critical to protect your chromosomes. The antioxidants found in *Moringa oleifera* afford a protective shield to do so.

[6} Greider C W. Telomeres ; Telomerase and Senescence. Bioessays 1990; 12:p.363-369.

[7] Harley C B, Kim N W, Prowse K R, Weinrich S L, Hirsch K S, West M D, Bacchetti S,

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[12] Kumar N A, Pari I. Antioxidant action of Moringa oleifera Lam (drumstick) against antitubercular drug induced lipid peroxidation in rats. *J Medicinal Foods.* 2003;6(3):p.255-259.

[13] Bharali R, Tabassum J, Azad M R H. Chemomodulatory effect of *Moringa oleifera*, Lam, on hepatic carcinogen metabolizing enzymes, antioxidant parameters and skin papillomagenesis in mice. *Asian Pacific Journal of Cancer Prevention* 2003;4:p.131-139.

[14] Njoku O U, Adikwu M U. Investigation on some physico-chemical antioxidant and toxicological properties of *Moringa oleifera* seed oil. *Acta Pharmaceutica Zagreb.* 1997;47(4): p.87-290.

[15] Siddhuraju P, Becker K. Antioxidant properties of various solvent extracts of total phenolic constituents from three different agroclimatic origins of drumstick tree (*Moringa oleifera* Lam.) leaves. *Journal of Agricultural and Food Chemistry.* 2003;51:p.2144-2155.

Hirte H W, Counter C M, Greider C W, et al. Telomerase, cell immortality, and cancer. Cold Spring Harb Symp Quant Biol 1994; 59:p.307-315.