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Editorial

Tales of the Telomeres

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Human telomeres are made up of two complexes*:* a telomeric DNA and a protein complex sheltrin. Telomeres are the genomic portions positioned at the end of the linear DNAs. They are consisted of thousands of double stranded tandem (TTAGGG) repeats forming cap like configuration to shield the terminal end of chromosomes from disintegration and fusion. Telomeres truncate with every cell cycle, as they reach a critically short length, cell cycle stop and cellular aging occur. Short length telomeres incapable to bind with adequate telomere-capping proteins and are recognized as exposed DNA ends, which activate the DNA Damage Response (DDR), a signaling pathway which blocks the cell cycle progression through the cell cycle inhibitors p16 and p21, inducing cellular senescence. Previous observations recommended the strong relationships of telomere length with mortality or age related diseases [1].

Many epidemiological studies have tested this hypothesis and observed that increased rate of telomere attrition are associated with increased oxidative stress causing number of metabolic and endocrine diseases. Hormones may play a pivotal role in the telomere attrition resulting in cellular senescence and development of disease. It was explored that increased levels of IGF-1 are believed to be involved in telomeres attrition and cellular senescence in patients with acromegaly [2]. Glucocorticoids also influence the Telomere length (TL) in stressful conditions by producing the reactive oxygen species and mobilizing the energy towards survival mechanisms as compare to the telomere maintenance [3]. Moreover, postmenopausal reduction in estrogen level is crucial in the biology of senescence and was surely correlated with leukocyte telomere length (LTL) shortening [4]. Telomeres shortening in ovarian follicles could result in cellular senescence leading to reduced proliferation of primordial germ cells and impaired female reproduction [5].Vitamin D also has an effect on TL because vitamin D involves in cell proliferation, cell aging and cell death [6]. However, the molecular mechanism of vitamin D interaction with the TL is not clearly understood. Previous studies reported that vitamin D supplements increase the telomerase activity which increases the length of telomeres [6]. But another study showed no association of vitamin D with TL shortening in men [7]. Some studies reported potential impact of Endocrine disrupting chemicals (EDCs) on the TL shortening. It has been observed that in Type II Diabetes Mellitus patients increased BPA levels are associated with cellular senescence and shortened telomeres [8].

It has been reported by recent studies that TL shortening has been associated with old age, caucassian race, male gender and atherosclerosis while association with hormone and other factors showed ambiguous results. As TL is inheritable and could be affected by unidentified risk factors. Conflicting data have been observed about TL shortening, either it is a biomarker of overall aging or a biomarker of cellular senescence [9]. However, broad extensive researches are required to study the extremes of the population over extended timeframes, aging related functional measures, to assess the telomere length (which telomere length measure is the most appropriate and suitable marker) as well as genes that could influence TL and role of telomere length in living a healthy, long life.

Keywords*:* Telomere length (TL), Aging, DNA Damage Response (DDR) pathway,

References

1. Chakravarti D, LaBella KA, DePinho RA. Telomeres*:* history, health, and hallmarks of aging. Cell *20*21*;* 184(2)*:* 306-22.

2. Matsumoto R, Fukuoka H, Iguchi G, Odake Y, Yoshida K, Bando H, *et al*. Accelerated Telomere Shortening in Acromegaly*;* IGF-I Induces Telomere Shortening and Cellular Senescence. PLoS One *20*15*;* 10(10)*:* e0140189.
3. Zane L, Ensminger DC. Short-term elevations in glucocorticoids do not alter telomere lengths*:* A systematic review and meta-analysis of non-primate vertebrate studies *20*21*;* 16(10)*:* e0257370.
4. Shin Y-A, Lee K-Y. Low estrogen levels and obesity are associated with shorter telomere lengths in pre- and postmenopausal women. J Exerc Rehabil *20*16*;* 12(3)*:* 238-46.
5. Khosla S, Farr JN. The role of cellular senescence in ageing and endocrine disease *20*20*;* 16(5)*:* 263-75.
6. Yang T, Wang H, Xiong Y, Chen C, Duan K, Jia J, *et al*. Vitamin D Supplementation Improves Cognitive Function Through Reducing Oxidative Stress Regulated by Telomere Length in Older Adults with Mild Cognitive Impairment*:* A 12-Month Randomized Controlled Trial. Journal of Alzheimer's disease *:* JAD *20*20*;* 78(4)*:* 1509-18.
7. Julin B, Shui IM, Prescott J, Giovannucci EL, De Vivo I. Plasma vitamin D biomarkers and leukocyte telomere length in men. European journal of nutrition *20*17*;* 56(2)*:* 501-8.
8. Soundararajan A, Prabu P, Mohan V, Gibert Y, Balasubramanyam M. Novel insights of elevated systemic levels of bisphenol-A (BPA) linked to poor glycemic control, accelerated cellular senescence and insulin resistance in patients with type 2 diabetes. Molecular and cellular biochemistry *20*19*;* 458(1-2)*:* 171-83.
9. Vaiserman A, Krasnienkov D. Telomere Length as a Marker of Biological Age*:* State-of-the-Art, Open Issues, and Future Perspectives. Frontiers in genetics *20*20*;* 11*:* 630186.

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