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Telomeres Promise Biological Anti-Aging Potential of Human Life

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Abstract:
The telomeric shortening is linked to aging process. Telomerase reverses biological aging. Human body after the age of 35 years starts shrinking with reduction in number of cells. The body fights against aging, the harder it fights, the more tired it gets. The telomere is a biological clock, ticking down as we age and eventually leads to cell mortality. The life expectancy, life-span, and longevity are interrelated terms. They are basically anti-mortality and anti-aging. The maintenance of the genomic stability, DNA integrity and regulation of anti-aging cell physiology are biological foundation of immortality and anti-aging potential. The telomeric length (TL) is maintained by dynamic equilibrium between processes that lengthen and those that shorten telomeres. The cellular senescence perturbs this balance, fastens the aging and directs the mortality. The telomerase boosters and longevity enhancers natural products extend life-span and reduce the rate of biological aging. Their anti-mortality potentials and possible reasons of biological immortality which are beyond Hayflick limitation would be examined.

Key words*: Biological aging, DNA, Longevity, Mortality, Natural products, Telomeres, Telomerase boosters*

1. Objective of Study

The birth destines the mortality. Everyone expects to live as long as possible, likes to have disease- free life-span and age gracefully. The longevity is an opportunity to enjoy the bests of the future. This publication may educate people about biological margins of safety to prolong disease free life-span with use of anti-aging boosters and modification of life style.

2. Introduction

The telomeric shortening is linked to aging process[1-2]. The life-span, longevity, or life-expectancy can be extended by preserving or restoring the telomeric lengths with telomerase. The longevity refers to long lived people whereas life-expectancy is statistically defined as the average numbers remaining at a given age. Demographically[3], they are synonym. The biological aging[4-6] is attributed to unwanted genetic changes (chromosomal aberration) and telomeric shortening is blamed for much age-related pathology with weakening of immune system. Hayflick[7] developed a theory for telomeres known as Hayflick[8] potential life-span of human 120 years, the time at which many cells cannot replicate and divide to keep on going. The reliability theory of aging[9-10] and longevity is about system failures. It predicts age-related failure kinetics for system of given reliability structure (composed of aging elements). The aging elements have constant failure rate, therefore aging is a direct consequence of system's redundancy, leading to late life mortality. Gompetz law (initial flows/defects in newly formed system) and Weibull (power) law (failure of technical devices for age-related pathologies), mathematically interpret aging and longevity.

The idea of high intial damage load (the HIDL hypothesis[11]) explained aging and longevity differently. The idea of early life programming of aging and longevity implied that early-life-health damages (germ cell's DNA damage) should not allowed

accumulating in later adult life survival. The optimizing early developmental process with healthy habits[12] and eradication of pathogenic genomics gives remarkable prevention from many age-related diseases in later life with significant extension of healthy life-span.

Evidence based studies indicated that longevity and aging is based on two major factors:-

- Genetics[13]
- Life-style[14]

Life-span is only (20-30%) related to genetics[15]. The longevity map[16] data base has more than 200 genes feasible variant[17], so, heritability has fractional role in longevity. Individual's environmental and behavioral factors play 70-80% roles in aging and longevity. They are modifiable. The males are subjected to more civilization damage than females. This endows greater life-expectancy to females than males.

3. Theoretical Methodology

The telomeric shortening is linked to the aging process. Telomerase reverses aging. The life-span can be extended by preserving or restoring the telomere lengths with telomerase[18-22].

The geriatric studies suggested two types of biological aging.

- **Primary aging** = Physiological declines. (The functions of organs decline as time passes).
- **Secondary aging =** Caused by disease or injury.

Human body attains the biological and physical maturity by age 25 to 30 years. The psychological aging (capacity to learn, to remember, to love and enjoy etc.) and social aging (habit systems or social roles) are not complimentary to biological age or old age. A person may be quite young although become aged or old.

Human body after the age of 35 years starts shrinking with reduction in number of cells. The cells store dull or inert materials e.g. calcium, fats, lipofuscin (metabolic wastes) which interfere with circulation. The body fights against aging, the harder it fights, the more tired it gets. The organ's aging is confirmed by comparing the tissues of young and old.

The characteristics of aging[23-24] are:-

- Loss of elasticity in elastin and collagen due to cross linking.
- Aging tissues keep on becoming non-reproducing.
- The cell lines lose reproductive capacity.
- Blood vessel and bone marrow do not cause aging.
- Liver and gut sustain reproducing cell lines.
- Brain, muscles, kidney and lungs have profound aging effects, as their cell lines do not reproduce.
- Somatic genome becomes erratic increasing risk of cancer and metaplasia (age spots).
- Oxidative stress due to oxy-free radicals greatly contributes to aging.

Telomerase is the pivotal of novel theory of human aging[5,25]. The evidences supporting telomeres/telomerase theory of aging are:-

- Telomeres are shorter in many tissues of older people than younger.
- Children born with Progeria (early aging syndrome) have shortened telomeres.
- Many ages related pathologies are due to deficiency of telomerase e.g. immune senescence, hepatic disease increased risk of cancer, bone marrow failure and chemotherapy intolerance.

Therefore, there is direct relationship between telomeres and aging[2-5]. As person ages the rate of catabolism suppresses rate of anabolism due to reduction in cell-division & DNA damage. The bits of telomeres are lost in each cell division because telomerase activity is missing- Telomerase Reverse Transcriptase (TERT) gene is switched off.

Recently people are divided into two groups based on telomere length. The half with longer telomeres lives an average of five years longer than those with shorter telomeres. This suggested that life span can be increased five years by increasing length of telomeres in people with shorter ones. After age 60, the risk of mortality doubles every 8 years. Interestingly when telomere length, chronological age and gender correlated, it was found that women live longer than men.

4. Discussion and Result

The telomerase boosters[26-28], gene nutrients[29], immunomodulators and immunopotentiators promise human anti-aging potential by slowing down age-related genomic aberrations and pathologies.

The biological clock or genetic mechanism determines how we age. The aging clock/cell lines caused by telomeric shortening. Telomeres are the ends of the chromosomes become unravel as aging progresses. Telomerase fails to maintain telomeric length and chromosomal aberration occurs. The telomere shortening signals cell's senescence, cell's mortality and neoplastic pathology.

Telomere length depends on telomerase activity. Telomere lengths are at equilibrium when the average loss is compensated by telomerase-mediated extension[20-30].

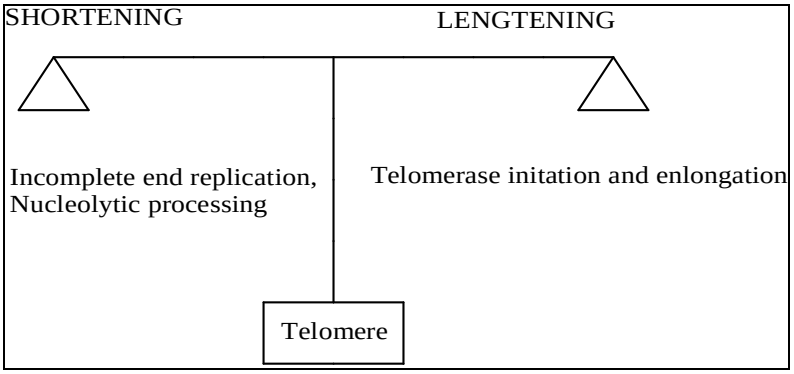

Figure 1: Balanced equilibrium between the rates of telomeric lengthening and shortening. Here telomeric homeostatis is maintained

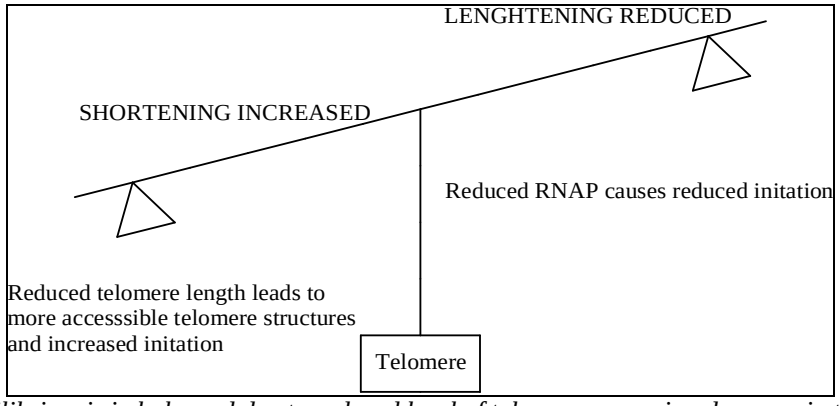

Figure 2: Equilibrium is imbalanced due to reduced level of telomerase causing decrease in telomere length

Telomerase boosters (TA-65)[31-32] is developed by California- GERON CORPORATION stops the erosion of chromosomes and lengthens the shortened telomeres. It helps to maintain homeostatis of telomeric extension. It contains an unique structure, called Cyclostragenol. It prevents loss of telomeres in immune cells, inhibit cellular aging and enhance anti-viral potential of immune cells.

Astragaloside IV[33,34]: - It has multiple bioactions such as anti-fibrotic, anti-inflammatory, cardioprotective and neuroprotective. The most remarkable benefit of this is its ability to boost production of telomerase which replenishes small bits of telomeric DNA, lost during cell division.

Marine-omega-3-fatty acids[35,36]: - Eicosapentaenoic acid (EPA) and Docasahexaenoic acid (DHA) increase telomeres length.

Anti-aging natural products[37] are longevity enhancers and extend life- expectancy. They impart centenarian status. The majority of anti-aging natural products (Acacia Catechu, Bacopa Mannieri, Emblica Officinalis, Echinacea and Ocimum Sanctum etc.) have anti-oxidative and free radical scavenging activities which are responsible for anti-aging actions by preventing lipid peroxidation. The mechanism of anti-oxidant related to aging is briefed below:-

$OH^{\cdot}$ is very active in abstracting hydrogens from the double bonds present in polyunsaturated fatty acids of biological membrane. It becomes a peroxide radical, and initiates a chain reaction resulting in cross linking of DNA and formation of Lipofusin pigment in the cells. The mutagenic change causes breakage of DNA strands leading to cell mortality. The anti-oxidative polyphenolic structure of natural products scavenges the free radicals and protects DNA damage.

Ubiquinol (CoQ 10)[38]:- is a dietary supplement and used by every cell to produce cellular energy and reduce the signs of aging. Less than 25 years of age human body is capable to convert CoQ 10 from oxidized to reduced form. As the aging advances this conversion becomes difficult. CoQ 10 is basically has potent anti-aging effect and maintain youthfulness up to very end of life. It improves cardiac health, muscle functions, memory and locomotor activity.

The stressors accelerate the rate of telomeres shortening and speed up biological aging due to inflammation, oxidative stress and immune cell aging. All this is reflected by lower quality function of telomeres and lacking repair efficiency of DNA. Evidence- based studies indicated that longevity and aging potential is improved by gene nutrients and oxidative stress free life-style. They protect telomeric DNA from free radical damage and maintain genome's healthiness.

Holistic life-style maintains telomere strands for longer time in healthy cells. The comprehensive life-style changes affect the efficacy of telomerase enzyme for DNA repair and compensation. The pro-inflammatory, pro-depressive and pro-negativity type of life-style endangers telomeric integrity and safety. Recently three life-style characteristics that promote longevity and reduce aging are; limiting alcohol consumption, sleeping 7 to 8 hours per night, and not snacking (eating between meals). To age gracefully[39] and achieve centenarian[40-41] status liberal and moderate philosophy of life is important. Few tips are suggested here:-

- Avoid stress
- Have big heart
- Have sunny disposition

- Sheer lust for life
- Eat and work in moderation
- Enjoy regular sex life
- Moderate quantity of drink, yogurt, honey, garlic and little tea.

They describe the physical quality of life which can extend life-expectancy and retard the aging.
Our study proposed the following hypothetical reasons for the biological immortality[42-43] beyond Hayflick limit.

- DNA does not undergo damage
- Gene nutrients protects genomic integrity
- Living in stress free environment
- Cellular senescence is almost absent
- Telomeric length remains constant
- Body has strong immune defense mechanism, so that pathological degeneration of cell is eradicated
- The rate of metabolism is quite low
- Physical activity is high profiled
- Spiritual rationality maintains strong introvert strength
- The bio-energy and tissue functional competency have high biological order
- Least or no mitochondrial lipid peroxidation
- Age-related deteriorations are absent

We assumed that above mentioned criterions are indispensible for anti-aging potential.

5. Conclusion

Telomere length is marker of biological aging. The telomeric shortening is linked to aging process. The life-expectancy, life-span, and longevity are interrelated to anti-aging. The genomic stability, DNA integrity, and prevention of cellular senescence are the biological foundation of anti-aging potential. The telomeric length is maintained by dynamic equilibrium between processes that lengthen and those that shorten telomeres. The telomerase activators, gene nutrients, and modifiable life-style changes assure genomic healthiness. The anti-aging natural products have anti-oxidative activity for enhancing longevity and prevent telomeric DNA from oxidative stress. The cumulative inflammatory and free radical damages predict long term life-style of poor health due to aging immune cells by telomeric shortening.
The genomic and life-style essentials of biological immortality were assigned on hypothetical basis. It is a innovative insight of anti-aging potential. Telomeres/telomerase has catapulted in anti-aging lime-light. They offer viable anti-aging strategy and potential for extreme life-extension by regenerating functional capacity of cells and telomeric healthiness.
A life annuity is a form of longevity insurance.

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