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Nutritional Destiny and Lifestyles Influence Telomeric Biomolecules

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Abstract:

The telomere and telomerase are anti-aging biomolecules. Telomerase is an immortal enzyme. It maintains telomere length and promotes longevity. Telomerase holds future for anti-aging medicines. The anti-aging therapy has dramatic impact on public health by reducing the burden of age-related health difficulties- dementia, stroke, cancer and prolonging the quality of life. TA-65 (10-15 mg daily) is first formulation¹⁻², derived from Chinese herb. Astragalus, for the activation of telomerase and maintenance of telomere healthiness. The nutritional destiny offers biochemical preventions against multiple pathologies related to telomere shortening. The life style free from the oxidative stress, anxiety, alcoholism, and spurious addictions prevent chromosomal abbreviations.

Key words: Anti-aging, Life style, Nutrition, Telomere, Telomerase, youthful

1. Objective of the Study

Anti-aging medicine is the promising hope for the geriatric people. The comprehensive life style changes and nutritional diets lengthen the telomeres. They contribute to disease free longevity, and youthful life-span. The prime objective of our publication is to explore practical and simple way for healthy telomeres.

2. Introduction

Telomeres are protective DNA protein complexes at the end of chromosomes³⁻⁵. They are essential for DNA replication and protection of chromosomes from nuclease degradation, end-to-end fusion and cellular senescence. Telomerase is an enzyme that synthesizes the specific DNA sequence at telomeres, the terminal DNA at the ends of all chromosomes. It repairs the damaged tissues and enhance tissue's competency by reversing the sign of aging. The cell-division keeps on shortening telomeres and eventually cells stops working or goes in suspended state called "senescence". This process defined aging⁶⁻⁷.

Telomeres are essential genetic material for protecting chromosome end from broken DNA. Telomeric DNA cannot be fully replicated by DNA polymerase because telomere may subject to degradative process and liable for the oxidative damage. This result in gradual telomeric shortening with age and cell-division, unless optimal telomerase activity maintains telomeric length. This confirms that telomerase activators⁸ and telomeric lengtheners should be part of our nutritional habits. The comprehensive life-style changes⁹ least for three months are desirable to improve telomere maintenance capacity immune cells, and to decline risk of cancer and cardiovascular disorders.

3. Theoretical Methodology

The genetic destiny belongs to our pliable genes. They are affected by many factors, known as epigenetic setting¹⁰. They determine how genes display their functions. The telomere length is epigenetically regulated and influenced by nutritional status. Genetically superior nutrients eradicate gene weakness. Malnourished mothers impart great risk of cardiovascular disorders in their children due to large number of short telomeres. It implied that optimal telomere length is vital for the health quality of children. The telomere length and integrity are essential for the prevention of pathological inductions.

The short telomeres are risky factors for diseases e.g.

- Decreased immune response against infection.
- Cardiovascular disorders (Atherosclerotic lesions, hypertension, heart failure).
- Neurodegenerative disorders (Parkinsonism, Alzheimer etc.).
- Metabolic disorders (Diabetes etc.)
- Testicular, splenic, intestinal atrophy.

The genetic cause is DNA damage. As we grow older, telomeres get shorter and DNA repair mechanism fails. The short telomere is the marker of mortality. Modern research found that telomerase expression has anti-aging secret. The small genetic alterations in the mammalian genome and protein expression patterns for enhanced telomerase expression to keep healthy DNA, can grant longer life-span, longevity, and life expectancy through reduction in age-related diseases. Telomerase is the future target for the genetic alterations to safeguard human mortality. To achieve human life-span of 150 years or longer synergism of nutrition, diet and life style is vital for telomeric lengthening.

The nutraceuticals, diets and life style changes^{9, 11-16} were reviewed for rationalizing their positive effects on telomere lengthening and telomerase activation.

4. Nutraceuticals

Classifiable in following categories:-

- Vitamins
- Antioxidants
- Micronutrients
- Omega-3-fatty acids
- Sulphur containing amino acids

5. Diets

They should be of following types:-

- Folate rich diet
- Plant based diet (vegetables/fruits)
- Reduction in carbohydrate diet

6. Life-Style Changes

- Decrease psychological stress
- Decrease inflammation, especially, periodontal
- Decrease oxidative stress
- Intermittent fasting
- Meditation
- Regular and moderate exercises
- Rest and sleep
- Skin-vitalization/ fortification

Nutraceuticals, diets and life style changes provide basic nourishments for healthy function of telomeres.

7. Discussion and Result

Keeping telomeres intact longer and increase their length, inhibit aging. It gives a clue to check how “old” is body, simply by counting telomeres in samples of blood, tissue or hair.

The shortened telomeres may become genetically stable by enzyme telomerase which adds telomeric repeat sequences to chromosomal DNA ends, preserving telomere length.

Health maintenance programs oriented for genomic healthiness should prescribe the diets, rich in gene nutrients which include telomerase activators. The gene nutrients have DNA protective effects. Vitamins and micronutrients influence telomeric rejuvenation.

GENE NUTRIENTS	TELOMERIC ACTIVITY
A.) VITAMINS Vitamin A	Telomere length is positively associated with dietary intake of vitamin A in women, who do not take multivitamins. It improves immune response because infection causes telomere shortening
Vitamin B ₉ (folate) 800 mcg/daily + vitamin B ₁₂	Enhance telomere length in both men and women. It maintains DNA's integrity and DNA's methylation, prevent depression and brain's atrophy.
Vitamin B ₁₂	Energy vitamin, energy production, blood formation, DNA synthesis.
Vitamin C (1-3 g/daily)	Shows the shortening of telomeres.
Vitamin D	It affects DNA through vitamin D receptors (VDR _S) which binds to specific location of human genome. About 3000 genes are influenced by vit D and VDR _S . High levels of vit D in females have longer telomeres vice-versa. It proves that high levels of vit D age more slowly than people with low levels of vit D. To optimize vit D through safe sun exposure which produces vit D. Leucocytes have receptors for active vit D ₃ . It has direct effect on these cells.
Vitamin E (Mixed tocotrienols) About- 800 IU/day	Restore the length of telomeres and prevent their loss by helping to produce telomerase.
Vitamin K ₂ (45 mcg/daily)	People live 7 years longer than people having 12 mcg/daily
B.) MICRONUTRIENTS Magnesium (400-800 mg/daily)	Mg ⁺⁺ influences telomeric length by involving in DNA replication, repair and RNA synthesis. Deficiency leads to telomeric shortening and chromosomal abnormalities. It positively increases telomeric length in women.
Selenium	It is extremely important to maintain and grow telomeres. Dietary form is the most helpful. It is also required for biosynthesis of glutathione (GHS).
Zinc (25-50 mg)	Vital for DNA replication/cell division. Lacking causes telomere shortening and DNA damage

Table 1: Gene Nutrients and Telomeric Activity

Marine omega-3-fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) slow the rate of telomere shortening¹⁷. There are certain amino acids Methionine, Threonine, Cysteine, Arginine, Glycine, Glutamate, and Tryptophan are partial precursors for GHS biosynthesis. GHS and by products of amino acids can triple the amount of telomere length that's lost during cell-division. Homocysteine is an amino acid which fastens the rate of reduction in telomere length during cell-division. It is biosynthesized from methionine. High levels of homocysteine in blood increase the shortening of telomeres. Folic acid lowers the level of homocysteine. Folate rich diet maintains telomere's length in healthy men without activating telomerase. Plant based diet; rich in vegetables and fruits protect DNA and telomeres from oxidative damage.

Reduction in carbohydrates diet is desirable as aging advances. The glycation of DNA, proteins, and lipids impairs the functions of these biomolecules, followed by malfunction of tissues which causes disease.

8. Antioxidants

They are polyphenols and their bioactions are:-

- Anti-aging
- Enhance telomere length in males
- Prevent obesity and cardiovascular disorders
- Repair DNA damage done by free radicals

8.1. *Astaxanthin*¹⁸⁻¹⁹:-

It is the most powerful carotenoidal antioxidant, being 550x more active than vitamin E. It is an effective singlet oxygen quencher. It protects DNA damage by gamma radiation. It possesses unique ability to protect the entire cell from damage- both water soluble and lipid soluble portions. This is due to unique physical characteristics that allow it to reside within cell membrane- protecting inside the cell and outside the cell.

8.2. *Green Tea*²⁰:-

Green tea is potent healthy tea of polyphenols (epigallocatechins)

8.3. *Resveratrol (Grapes)*²¹:-

A dietary antioxidant: It penetrates nuclear membrane and gives time to DNA for repair the damage done by free radicals. It also activates a gene called Sirtuin during calorie restriction, thus linked to longevity. It reduces endothelial cell senescence through augmentation of telomerase activity.

There is natural way to stop telomere shortening by glutathione level (GHS). GHS²² is biosynthesized inside the cell from its amino acids precursor- glycine, glutamate and cystine- whey protein (super food) increase GHS levels. Diet and foods should be rich in sulphur amino acids to synthesize GHS. Whey protein²³ of high quality, from grass-fed cow is the dietary miracle. Anti-aging does not be profitable due to processed and preserved fragile amino acids.

9. Life-Style Changes

The prime objective of life modifiers is to impart healthy genomics. It is reflected at behavioral level by optimism, hope, vigor, endurance, strength, happiness, larking spirit, and enhanced self esteem and confidence. Genetically stress, anxiety, negativity etc. adversely affect chromosomal integrity.

Adult human loses telomeric DNA at modest rate of about 15-60 base pairs per year, in order to compensate this loss and maintain the homeostatis of genes, comprehensive life-style changes are important by avoiding.

- Alcohol abuse
- Anxiety, depression
- Environmental negativity
- Lack of exercise
- Illicit drugs
- Oxidative stress
- Radiation
- Toxins in food

They accelerate telomere loss by increasing cell turn over and amount of telomeric DNA lost per cell-division. Healthy DNA requires positive life style changes, as briefed below:-

9.1. *Decreased Oxidative Stress*

The pro-oxidative stress dietary pattern is the root cause of life style illnesses. The incidence of life style diseases²⁴- obesity, diabetes, hypertension, and cardiac disorder, has increased and slowed the life- expectancy. Obesity is linked with inflammation because white adipose tissue has inflammatory cytokines. The loss of weight increases the telomeric length, suggesting obesity linked to telomere loss and may be reversible. The oxidative stress related pathologies can be avoided by prudential dietary habits which include vegetables, fruits, legumes, fish and whole grains. They protect genomic biomolecules from oxidant damage.

9.2. *Decrease Inflammation and Infection*

Healthy life span of 120 years as suggested by Hayflick²⁵ demands an effective management of cellular wear and tear by the inflammatory processes and infections. The chronic viral infections speed up telomeric loss and immune cell aging. The leukocyte telomeric length (LTL) is the predictor for age- related diseases. When LTL becomes short, the inflammatory response intensifies leukocyte turn over. The concentration of vitamin D is reduced with aging and C- reactive protein (mediator of inflammation) increases, causing autoimmune diseases. e.g. rheumatoid arthritis. Vitamin D is a potent inhibitor of inflammatory response and decrease turnover of leukocytes. The optimization of vitamin D levels prevents telomere shortening, caused by inflammation and infection.

9.3. *Exercises*²⁶⁻²⁷

- Regular exercise upregulate antioxidant defense. Moderate exercise has protective effect on PBMC telomeric length, by activating telomerase for maintaining telomere length.
- Moderate aerobic walking for 30 minutes per day.
- Daily exercise improves oxidative stress, nitric oxide availability, blood pressure, and metabolic profile.
- Gentle yoga based stretching breathing, imaginary, and relaxation.
- High intensity/vigorous exercises for 20 minutes inhibit telomere shortening, improve aerobic fitness, and slow down aging by reducing telomere shortening

9.4. Intermittent Fasting²⁸⁻²⁹

The life span is extended by reducing carbohydrates/calorie intake. By doing so gene governing youthfulness and longevity are activated.

9.5. Meditation³⁰

Three months span of meditation showed positive mental shifts with greater production of telomerase. The beneficial psychological effect decreases negativity and neurotic outlooks.

9.6. Reduction in Psychological Stress³¹

The psychological stress release stress hormones (catecholamines and cortisol) which shorten telomeres and lower telomerase activity in PBMC. The chronic stress, negative mood and oxidative stress cause short telomere in healthy women.

9.7. Rest and Sleep³²

Slow the shortening of the telomeres.

9.8. Skin Vitalization/Fortification³³

Skin health is predictor of telomeres status, reflecting the biological age. Youth and body growth are reflective of healthy telomeres. The skin looks fresh and new.

10. Conclusion

21st century has ushered new health concepts. Telomere health is the most active area of research. Longer telomere grants healthier life. Telomere length is a key indicator of mitotic cell aging and viability. A new anti-aging nutritional principle is predictor of telomere status. The nutritional power is the true anti-aging strategy for growing younger day by day. The gene nutrients maintain optimal cell physiology and regulate mitotic kinetics to sustain the equilibrium between telomere shortening and lengthening. The methylation of genetic material of telomere by methyl donor nutrients³⁴ (methione, choline, trimethylglycine etc.) maintains healthy cell- physiology. DNA methylation protects genetic damage by mutations or free radicals. Prudentially futuristic health principle would be preservation of healthy telomeres for bestowing youthful genomics without pharmaceutical interventions.

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