Editorial

TELOMERE LENGTH- A BIOLOGICAL MARKER OF AGEING

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ABSTRACT
Telomere length is an indicator of biological age, influenced mainly by oxidative stress and inflammatory conditions. Telomere length shortens with advancing age, however in certain situations this shortening expedites with early senile changes while in other situations it can be delayed resulting in slowing of ageing. Ageing is a factor associated with a number of diseases and also treatment decision of lethal diseases is directly influenced by the age. However, understanding the difference of chorological versus biological age is essential. It is also essential to determine cut-offs of the age by using telomere length.

Key Words: Telomere Length, Ageing

INTRODUCTION

Telomere length is known as a biological marker of ageing, it is used to assess the cellular aging process in humans. Telomeres are repetitive DNA sequences that protect the ends of chromosomes from damage during the process of cell replication. Thus, telomere play a crucial role in preserving chromosome stability, replication, and gene regulation. As human cells divide, telomeres shorten due to incomplete replication, oxidative stress and environmental damage, and eventually reach a critical length that triggers cell senescence or death. Therefore, telomere length can suggest cellular aging, thereby predicting biological age and health status.

Telomere length influencing factors

Research studies have identified several factors that can affect telomere length, including age, diet, exercise, smoking, alcohol consumption, and chronic stress. There is evidence available which suggests that telomere length shortening was associated with insulin resistance (1). There was a multi-center randomized controlled trial reported that shortening of telomere length was linked with depression and cognitive decline in elderly population (2). There are studies which have found that chronic stress can expedite telomere shortening, raising risk of cardiovascular disease (3). While a healthy lifestyle and adaptation of relaxing strategies have shown to preserve telomere length. There was an open label single arm exploratory study which has linked meditation and yoga with improved cellular ageing (4). There was a women exclusive study which explored association of endogenous oestrogen and telomere length, as it is already suggested that longer reproductive life has been shown to be associated with less number of senile diseases, thus it was reported that high endogenous oestrogen level was associated with longer telomere length (5). The DNA from CARDIOPREV study was explored for telomere length and intake of vitamin E and anti-oxidants. It was interesting that low vitamin E intake expedited the telomere length shortening (6). Similarly, PREDIMED-NAVARRA study showed that diet which triggers inflammation causing early telomere shortening, was associated with high risk of cardiovascular disease (7). It is interesting from explanation point of view that telomere length is influenced by the oxidative stress at cellular level. Thus, antioxidants like vitamins may improve cellular senescence. This hypothesis was attempted to be tested in a rural community based cross-sectional study from China, which showed that the oxidative stress and inflammation were associated with early shortening of telomeres and mitochondrial dysfunction (8). There was an interventional study where micronutrients

improved cellular ageing and 25% increase in telomere length by adopting antioxidant provision by micro-nutrient supplement diet (9).

Use of telomere length in clinical practice and caveats

The Helsinki's Birth cohort study has shown that the telomere length appeared to be associated with ageing (10). It was further elaborated that it be used as a marker of ageing in women (10). Till date the available literature suggests that telomere length can provide reliable information on an individual's biological age, disease risk, and overall health status. However, it gets influenced by life style, stress, diet thus the biological age and chronological age differ between individuals. There are certain situations where it is utmost important to understand the biological age to advice interventions such as malignant diseases. There is a long debate for use of aggressive therapy in elderly women with breast cancer, given the chronological age of patients over 70 years, it is assumed they might not be fit, but clinically they are often fit enough to tolerate the therapy, other way round a 55 years old women might be biologically weak with a number of co-morbidities not allowing her to tolerate aggressive therapy. Thus American Society of clinical Oncology revised guidelines suggesting screening should be done till the women is a candidate to receive therapy. Now the question arises how to decide if the women is able to tolerate the therapy or she is fit enough. No such biological marker or test available in clinical practice till date. However telomere length has potential to determine. Thus, determining biological age appears to be the only answer. Since telomere length has shown its association with age it could be used. Nevertheless, till date the literature is so scare that clinical guidelines cannot be designed. Further research directed to make cut offs for ageing so that such novel marker can be used appropriately in clinical practice.

CONCLUSION

In conclusion, telomere length is an essential biological marker of aging that has gained increasing interest over the years. It can provide valuable insights into an individual's cellular aging and health status, as well as serve as a predictor of age-related diseases. Maintaining telomere length is likely to become an essential factor in future healthcare for age-related illnesses, especially for managing chronic diseases and extending lifespan.

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