

Stopping Aging: Dream or Reality?

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SUMMARY

As people get older, their bodies start to break down. This can greatly reduce people's quality of life. However, some people claim that there are ways to stop the aging process. The question is whether this is true or not. The methods proposed for stopping aging are good diet and exercise, taking medications to reduce the effects of aging, and replenishing good cells in the body to allow for repair. These are all great solutions and do have the potential to slow down the aging process. Yet, they are not enough to stop it altogether. Nonetheless, these techniques should still be implemented in society while research continues in this field to improve anti-aging mechanisms in the future.

ABSTRACT

Aging is a reality and is associated with the progressive physiological breakdown of the body. This can cause many health problems such as heart disease, cerebrovascular disease, diabetes, etc. However, some claim that the aging process can be stopped. Proposed mechanisms for stopping aging include good nutrition and exercise, pharmacological interventions, and stem cell therapy. These have shown good prospects for slowing down the aging process but not for stopping it altogether. It may also not be possible to stop aging for a long time, considering that it is polygenic and complex in nature. This piece provides clarification for the current state of modern science in terms of its ability to stop aging, as well as an outlook for what to expect in the future.

Keywords: Anti-aging, lifespan, stem cells, telomerase, exercise, drugs

INTRODUCTION

Aging is defined as the “progressive accumulation of changes with time that is associated with or responsible for the ever-increasing susceptibility to disease and death”.¹ These changes deteriorate many different body systems. Most notably, aging progressively deteriorates the cardiovascular system leading to conditions such as hypertension and atherosclerosis, which increase the risk of heart disease and cerebrovascular disease.² In fact, heart disease is the leading cause of death in the world and thus the biggest complication of aging.

Overtime, the life expectancy of people around the world has increased but this has been primarily due to better management of symptoms of diseases and their pathophysiology.³ The root of these problems have not been tackled as effectively. However, with emerging research, it is claimed that certain techniques can stop the aging process, but this sounds rather too good to be true and warrants a thorough analysis.⁴

NUTRITION AND EXERCISE

The end of a DNA strand is called the telomere, and it is made up of thousands of repeating nucleotides.⁵ Due to the nature of DNA replication, a small amount of the telomere is cut in each cell replication cycle. This telomere serves to protect the functional DNA. However, when the telomere is depleted, portions of genes start to be lost. This has been linked to the pathogenesis of several diseases.⁵ However, there is an enzyme called telomerase that can elongate telomeres. Research shows that good nutrition and exercise can increase telomerase activity in the body.⁵ This includes a calorie-limited and balanced diet, along with regular low- to mid-intensity endurance training.⁵ With that being said, this primarily slows down the pathogenesis of diseases and the aging process still continues.

PHARMACOLOGICAL INTERVENTIONS

There are some drugs that have gained interest by researchers, as anti-aging mechanisms. Many of these

focus on calorie restriction as this has shown a large potential for slowing down the aging process.⁴ For instance, there are four proposed pathways that are active during calorie restriction and are associated with increased life expectancy. These pathways include the activation of AMP protein kinase, activation of sirtuins, inhibition of insulin-like growth factors-1, as well as the inhibition of the mammalian target of rapamycin.⁴ These pathways can be pharmacologically stimulated through the use of the drugs metformin, resveratrol, peganol, and rapamycin, respectively. These mimic the effects of calorie restriction within the body, to harness its anti-aging properties.⁴ There is also research to show that hormonal replacement can be used as an anti-aging mechanism. This is because hormone levels generally decrease with age which can lead to cardiovascular disease, thromboembolic events, etc.⁶ As such, replenishing hormones to optimal levels can reduce the effects of aging. Furthermore, there is also research to show that the gut microbiota is key for maintaining optimal functioning of the immune system.⁷ With age, the gut microbiota becomes remodelled with more pro-inflammatory constituents. This can result in the exacerbation of many auto-inflammatory diseases such as atherosclerosis.⁷ Pharmacological interventions can re-establish a healthy gut microbiota and reduce the impacts of age-related diseases.⁴ Likewise, there is research pointing towards the potential of vitamin D as an anti-aging supplement.⁴ Vitamin D deficiency is common in elderly people and is associated with neurodegenerative diseases such as Alzheimer's disease, as well as reduced muscle mass.^{8,9} Supplementing vitamin D can reduce the risk and effects of these diseases, and thus act as an anti-aging mechanism.⁴ However, the fact still remains that all these mechanisms are still limited in the sense that they can only slow down the aging process, rather than suspending it.

STEM CELL THERAPY

Stem cells are cells that are able to divide and differentiate into specific cells.¹⁰ This is vital for maintaining the body's functional cells, as well as for repair. For example if someone has a bone fracture, periosteal stem cells and bone marrow mesenchymal stem cells are involved in the healing process.¹¹ However, the regenerative properties of stem cells generally decrease with age resulting in the progressive deterioration of body systems, and a reduced ability to withstand injury.¹⁰ As such, stem cell therapy can be used to replenish healthy stem cells within the body and this can act as an anti-aging mechanism. This has the greatest potential to arrest aging but the process of generating stem cells is still error prone and can lead to the development of cancer.

CONCLUSION

Overall, there are many promising techniques to slow down the aging process but few that are viable for stopping it altogether. On top of that, aging is polygenic in nature which means that there are many factors at play in its progression.¹² Targeting all of these at the same time is unrealistic which means that some form of aging will persist despite treatment. As such, the concept of stopping aging still seems like a distant dream rather than a currently attainable goal.

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REFERENCES

- (1) Harman D. The aging process. *Proceedings of the National Academy of Sciences*. 1981 Nov 1;78(11):7124-8.
- (2) North BJ, Sinclair DA. The intersection between aging and cardiovascular disease. *Circulation research*. 2012 Apr 13;110(8):1097-108.
- (3) Crimmins EM. Lifespan and healthspan: past, present, and promise. *The Gerontologist*. 2015 Dec 1;55(6):901-11.
- (4) Son, D. H., Park, W. J., & Lee, Y. J. (2019). Recent Advances in Anti-Aging Medicine. *Korean journal of family medicine*, 40(5), 289–296. <https://doi.org/10.4082/kjfm.19.0087>
- (5) Balan E, Decottignies A, Deldicque L. Physical activity and nutrition: two promising strategies for telomere maintenance?. *Nutrients*. 2018 Dec 10(12):1942.
- (6) Zouboulis CC, Makrantonaki E. Hormonal therapy of intrinsic aging. *Rejuvenation research*. 2012 Jun 1;15(3):302-12.
- (7) Vaiserman AM, Koliada AK, Marotta F. Gut microbiota: A player in aging and a target for anti-aging intervention. *Ageing research reviews*. 2017 May 1;35:36-45.
- (8) Balion C, Griffith LE, Striffler L, Henderson M, Patterson C, Heckman G, Llewellyn DJ, Raina P. Vitamin D, cognition, and dementia: a systematic review and meta-analysis. *Neurology*. 2012 Sep 25;79(13):1397-405.
- (9) Janssen HC, Samson MM, Verhaar HJ. Vitamin D deficiency, muscle function, and falls in elderly people. *The American journal of clinical nutrition*. 2002 Apr 1;75(4):611-5.
- (10) Ullah M, Sun Z. Stem cells and anti-aging genes: double-edged sword—do the same job of life extension. *Stem Cell Research & Therapy*. 2018 Dec 9(1):1-7.
- (11) Ono N, Kronenberg HM. Bone repair and stem cells. *Current opinion in genetics & development*. 2016 Oct 1;40:103-7.
- (12) Wehby GL, Domingue BW, Wolinsky FD. Genetic risks for chronic conditions: Implications for long-term wellbeing. *The Journals of Gerontology: Series A*. 2018 Mar 14;73(4):477-83.

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