Effects of caloric restriction on aging and metabolic health.

Olusola Aremu*

Department of Food Science, North-West University, South Africa

Introduction

Caloric restriction (CR) is defined as a reduction in calorie intake without malnutrition, and it has garnered significant attention in the field of aging and metabolic health research. Studies across various species, from yeast to primates, have suggested that CR can lead to a longer lifespan and improved healthspan, the period of life spent in good health. This article explores the mechanisms through which caloric restriction influences aging and metabolic health, the potential benefits, and the implications for human health [1].

One of the primary mechanisms by which caloric restriction impacts aging is through its effects on cellular and metabolic processes. Caloric restriction has been shown to reduce oxidative stress, which contributes to cellular aging and the development of age-related diseases. By lowering the intake of calories, the production of free radicals—reactive molecules that can damage cellular components—is diminished, leading to healthier cells and tissues [2].

Research indicates that caloric restriction can extend lifespan in a variety of organisms. For example, studies on yeast, worms, flies, and rodents have demonstrated significant lifespan extension with CR. The underlying biological processes involve alterations in gene expression, particularly those associated with stress responses, metabolism, and growth. In mammals, these effects may translate into similar benefits, although the mechanisms are more complex and less well understood [3].

Caloric restriction has been associated with numerous benefits to metabolic health. In humans, studies show that even moderate caloric restriction can lead to improvements in body weight, fat mass, and blood lipid profiles. By reducing caloric intake, individuals can experience lower levels of triglycerides and cholesterol, reducing the risk of cardiovascular disease [4].

Moreover, CR is linked to improved glucose metabolism. Research indicates that caloric restriction can lead to better control of blood sugar levels, reducing the risk of developing type 2 diabetes. This is particularly relevant in the context of an aging population, as age is a significant risk factor for the development of metabolic disorders [5].

Caloric restriction also induces significant hormonal changes that can affect aging and metabolic health. For instance, levels of growth hormone and insulin-like growth factor 1 (IGF-1) tend to decrease with caloric restriction. Lower levels of IGF-1 are associated with reduced cellular proliferation and growth, which can contribute to longevity. These hormonal changes may help mitigate age-related diseases and promote healthy aging [6].

While the benefits of caloric restriction are promising, it is essential to consider potential risks. Severe caloric restriction can lead to malnutrition, loss of muscle mass, and other health issues, particularly in older adults. It is crucial for individuals to approach caloric restriction thoughtfully, ensuring they still obtain adequate nutrition to support overall health [7].

In light of the challenges associated with caloric restriction, researchers are exploring caloric restriction mimetics (CRMs)—compounds that can mimic the beneficial effects of CR without the need for reduced caloric intake. Substances such as resveratrol, metformin, and certain polyphenols have shown promise in preclinical studies, indicating they may activate similar pathways that promote longevity and metabolic health [8].

Implementing caloric restriction in daily life can also be influenced by social and psychological factors. Cultural attitudes toward food, dietary habits, and psychological well-being can impact an individual's ability to maintain a caloric restriction regimen. Understanding these factors is essential for developing effective strategies for promoting caloric restriction as a means of enhancing health [9].

Future research is needed to better understand the long-term effects of caloric restriction on human aging and metabolic health. Large-scale human studies that explore the nuances of caloric intake, nutrient quality, and individual variability are essential to establish clearer guidelines for caloric restriction in different populations. Investigating the role of genetics in determining individual responses to caloric restriction may also provide valuable insights into personalized approaches for promoting healthspan and lifespan [10].

Conclusion

Caloric restriction presents a fascinating approach to understanding the biology of aging and metabolic health. While the benefits of CR are supported by extensive research across various species, translating these findings to humans remains a complex challenge. With a focus on moderation, adequate nutrition, and ongoing research, caloric restriction

***Correspondence to:** Olusola Aremu, Department of Food Science, North-West University, South Africa, E-mail: olusola.a@nwu.ac.za

***Received:** 01-Oct-2024, Manuscript No. AAINM-24-151458; **Editor assigned:** 02-Oct-2024, PreQC No. AAINM-24-151458 (PQ); **Reviewed:** 15-Oct-2024, QC No. AAINM-24-151458; **Revised:** 22-Oct-2024, Manuscript No. AAINM-24-151458 (R); **Published:** 27-Oct-2024, DOI: 10.35841/aainm-8.6.237*

***Citation:** Aremu O. Effects of caloric restriction on aging and metabolic health. Insights Nutr Metab. 2024;8(6):237*

could serve as a powerful tool in the pursuit of healthy aging and improved metabolic health in an increasingly aging population.

References

1. Bales CW, Kraus WE. Caloric restriction: implications for human cardiometabolic health. J Cardiopulm Rehabil. 2013;33(4):201-8.
2. Anderson RM, Weindruch R. The caloric restriction paradigm: implications for healthy human aging. Am J Hum Biol. 2012;24(2):101-6.
3. Lee C, Longo V. Dietary restriction with and without caloric restriction for healthy aging. F1000Research. 2016;5.
4. Most J, Redman LM. Impact of calorie restriction on energy metabolism in humans. Exp Gerontol. 2020;133:110875.
5. Anton S, Leeuwenburgh C. Fasting or caloric restriction for healthy aging. Exp Gerontol. 2013 Oct 1;48(10):1003-5.
6. Fontana L. Calorie restriction and cardiometabolic health. Eur J Prev Cardiol. 2008;15(1):3-9.
7. Lamming DW, Anderson RM. Metabolic effects of caloric restriction. eLS. Wiley. 2014;10(9780470015902):a0021316.
8. Weindruch R, Keenan KP, Carney JM, et al. Caloric restriction mimetics: metabolic interventions. J Gerontol A Biol Sci Med Sci. 2001;56(suppl_1):20-33.
9. Kessler K, Pivovarova-Ramich O. Meal timing, aging, and metabolic health. Int J Mol Sci. 2019;20(8):1911.
10. Anderson RM, Weindruch R. Metabolic reprogramming, caloric restriction and aging. Trends Endocrinol Metab. 2010;21(3):134-41.

Citation: *Aremu O. Effects of caloric restriction on aging and metabolic health. Insights Nutr Metab. 2024;8(6):237*