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Food Antioxidants: A Way to Healthy Aging

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Abstract

Ageing is not a disease as everyone experiences it. Studies on nutrition have advanced our understanding of how to live a healthy lifestyle. A general scientific consensus is that diet rich in antioxidant plays a significant role in improving and maintaining human health status, particularly when it comes to preventing diseases associated with ageing. This mini review summarizes various studies that have been published in recent decade to relate the role of antioxidants present in food and healthy aging.

Introduction

Aging is a disease? Numerous diseases lead to death and molecular damage in ageing [1]. Though ageing and disease sometimes overlap, ageing is not a disease because everyone experiences it [2]. Should we cure ageing? On a human, organ, and tissue level, ageing is thought to be a biological phenomenon that causes biological function to decline over time and an increase in mortality. Although the idea of ageing in terms of individual ageing has been understood since antiquity, the new perspective on ageing as a "population scenario" that concentrates on the entire population has just recently emerged [3]. Research on ageing is being driven by a high life expectancy and an increase in the old population globally. Studies on nutrition and how genes interact (nutrigenomics) have advanced our understanding of how to live a healthy lifestyle. And the processes involved in acquiring and preserving the functional capacity that promotes well-being in old age are collectively referred to as "healthy ageing"[4]. A general scientific consensus is that diet plays a significant role in improving and maintaining human health status, particularly when it comes to preventing diseases associated with ageing [5]. Despite the fact that many investigators

continue to focus on aging-related research in line with historical and present trends, it is still hard to define the word since it is a fluid notion with shifting meanings throughout time. There are already more than 300 ideas that explain how ageing is caused by a variety of documented mechanisms [6]. Generally, these consider it a programmed development, though many disagree and the debate is still ongoing [7]. Despite prior attention in the subject, there is still uncertainty over the understanding and positioning of the connection between food, food antioxidant, and the ageing process. Since there is a connection between food antioxidants and the ageing process, this review seeks to organize that understanding.

Discussion

ROS/redox mechanism of aging

It appears almost certain that the composition of the human diet has a significant impact on ageing based on the findings of the numerous cohort studies that looked at the impact of diet on the risk of ageing and death [8]. Most of these previous studies are based on the concept of "oxidative damage theory". Among



the various theories of aging, the oxidative damage theory has been one of the most popular theories in aging research, with much quantitative experimental evidence being reported from the past to the present [6]. There is growing evidence that ROS may act as signaling molecules that not only induce oxidative stress but also ultimately extend the lifespan [9]. Such trends led to the concept of “mitohormesis”, which states that ROS promotes aging but, in the appropriate concentrations, can enhance the biological defense system [10, 11]. Consequently, aging may be the result of a deregulation of the ROS signaling pathways and not of the reactive species themselves [12].

Prevention of aging/Antioxidants

Several foods have recently been marketed as “antiaging,” primarily due to their anti-inflammatory and antioxidant qualities [13]. Numerous bioactive substances included in food are crucial for preserving human health. Therefore, humans typically and regularly provide their bodies with nutrients through dietary consumption. Although there is still no evidence to support the hypothesis of ageing, it has long been hypothesised that some diets, or specific dietary molecules, have therapeutic and preventive properties against disease. Several studies have suggested that

eating foods reasonably high in antioxidants can lower mortality, despite the fact that no specific meals or compounds in foods connected to lifespan have yet been found [8]. Most polyphenols can decrease the production of free radicals, reactive oxygen species (ROS), oxidative stress, DNA damage, inflammation, senescence, and age-related illnesses. Dietary polyphenols' antioxidant and anti-inflammatory properties may be able to increase lifespan [14].

It appears practically apparent that the composition of the human food has a major impact on ageing based on the findings of the numerous cohort studies that have explored the relationship between diet and the risk of ageing and death, as shown in [Table 1]. However, it is still unclear which molecular, cellular, and physiological alterations are the key causes of ageing in certain organisms and how they interact [7]. However, antioxidants are used to prevent age-related physiological decline, dysregulated metabolic processes, and many age-related illnesses. Polyphenolic antioxidants may postpone the start of age-related diseases, but it is too early to determine their clinical value. No of the outcome, a shortage in antioxidant vitamins or enzymatic antioxidant defenses can cause numerous diseases and disrupt the redox equilibrium in various disorders [15].

Table 1: The Role of Antioxidants in Age-Related Health.

Sr no.	Antioxidant	Common Food Source	Reported studies	Year	Ref.
1	Vitamin C	Oranges, tomato, sweet pepper, lemon	· Improvement in the appearance of aging skin by improving elasticity and collagen synthesis leading to reduction in the appearance of wrinkles and fine lines	2013	[16]
			· protective role in Alzheimer's disease by acting as a stress response modulator in endoplasmic reticulum	2015	[17]
			· supports epithelial barrier function against pathogens by promoting oxidant scavenging activity of the skin and protecting against environmental oxidative stress	2017	[18]
			· Acts as pro-oxidant by upregulation of DNA repair.	2020	[19]
			· Reduction in aging related oxidative stress induced progression of frailty and sarcopenia	2020	[20]
			· regulate redox status in human body	2022	[21]
2	Vitamin E	Vegetable oils, non-citrus fruits and seeds	· deficiency associated with Alzheimer's disease and cognitive function	2012	[22]
			· Positive correlation between dietary Vit E and lung function	2016	[23]
3	Carotenoids	Fresh tomato	· Higher serum β -carotene levels reduced mortality from cardiovascular disease, heart disease, stroke, cancer, and all causes.	2018	[24]
4	Astaxanthin	Citrus fruits	· Astaxanthin consumption from a young age increases superoxide dismutase (SOD) and catalase gene expression and protects mitochondria and nuclear organelles through DAF-16 protein nuclear transfer, extending longevity.	2011	[25]
			· anti-aging in the D-galactose-induced rat brain aging model by the maintenance of antioxidant enzyme activity, the suppression of oxidative enzyme expression, and an increase in brain-derived neurotrophic factor (BDNF)	2014	[26]
5	Quercetin	Red leaf lettuce, asparagus, and onions	· Suppression of apoptosis and the elevation of inflammatory markers in the D-galactose-induced rat aging model by inducing age related anti-apoptotic markers in the pancreas and kidneys of rats.	2020	[27]
6	Anthocyanins		· Improves total antioxidant capacity and may amend process of aging	2019	[28]

7	Chlorogenic acid	tea and coffee	· Suppression of post-myocardial infarction response of the aged heart animal model	2018	[29]
8	Resveratrol,	fruit peels	· Reduction of inflammatory factors expression, inhibition of apoptosis and oxidative stress in the mouse pancreas against age-related pancreatic damage.	2017	[30]
9	Curcumin	rhizome of <i>Curcuma longa</i>	· Anti-aging potential through an anti-inflammatory effect	2018	[31]
			· Prevention of brain aging and neurodegeneration via mitochondrial dysfunction	2015	[32]
			· suppressed the aging process by affecting anti-aging markers (decreased C-reactive protein levels, increased malondialdehyde levels, and nitric oxide levels) in aged albino rats	2017	[33]
			· In middle-aged monkeys, improved the spatial memory, suggesting the anti-aging effect of curcumin might be dependent upon the stage of aging	2017	[34]
			· Delay in the aging of oocytes in the mice model through(SIRT1 and SIRT3) anti-aging genes	2020	[35]
			· Potent antioxidant and anti-aging effect shown via combination of in vivo experiments and computer simulations to show upregulation of antioxidant enzymes and improved memory by binding to β -secretase 1 and amine oxidase A	2022	[36]
10	Coenzyme Q	Meat, fish, nuts, and some oils	· Delayed aging effect by the suppressing of secretory phenotype gene associated with aging, inhibition of intracellular ROS production, increasing nitric oxide (NO) production by increasing endothelial nitric oxide synthase (eNOS) expression, and promoting mitochondrial function	2018	[37]

Conclusion

Our review suggests that antioxidants are essential for lowering oxidative stress and fending off the negative effects of free radicals [16-27]. Antioxidants aid in the prevention of cell damage and maintain the maximum performance of our cells by neutralizing these unstable chemicals [28-32]. This results in a slower rate of ageing and a lower risk of developing age-related disorders [33-37].

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Conflict of Interest

The authors declare no conflict of interest.

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