ACADEMIA | Letters

Type 2 Diabetes and Aging: Do Dietary Phytochemicals & Antioxidants Matter?

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Abstract

Most of recent research articles on relevant areas confirmed that phyatochemicals and antioxidants have positive impact on removing the free radicals from the human body, alleviation and prevention of the chronic disease – type 2 diabetes mellitus (T2DM); they act as anti-aging agents as well. Excess free radicals in the body have been recognized as important factors in the process of aging and in age-associated degenerative disease like diabetes mellitus. It was confirmed by most of the articles that mechanism to reduce the rate of aging and the risk of T2DM is to avoid the formation of free radicals and reduce oxidative stress by consuming phytochemical and antioxidant rich foods, diets and herbs. This review confirmed that Phytochemicals present in fruits, vegetables, grains, and other foodstuffs have been linked to reducing the risk of oxidative stress-induced chronic diseases like T2DM and hence act as anti-aging agents.

Even though very few articles are still in debating situation on the positive impact of phytochemicals and antioxidants, most of the articles agree and become at conclusion on their importance in alleviating and prevention of T2DM, their ability to reduce oxidative stress, and their effect as anti-aging agents.

Keywords: Aging, anti-aging, type 2 diabetes, phytochemicals, antioxidants, Free radicals and Oxidative stress

1. Objective

This paper aimed at to overview, discuss and summarize the impact of antioxidant and phyotochemicals on aging , oxidative stress and Type 2 Diabetes Mellitus.The most recent advancement in phytochemicals and antioxidants, their impact on oxidative stress, aging and

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Diabetes Mellitus (T2DM) will be discussed . Relevant sources from systematic reviews, meta analysis, experimental research outputs and original articles will be used as reference.

2. Method

In this review paper , the most recent and relevant articles were selected, discussed and summarized. Nutrition Science is a multidisciplinary field of study which interacts with broad areas of fields. Thus, the source of the reference used was from plenty of areas of study. The databases from

Journal of Nutrition, SCI-HUB, Pubmed, WHO web, International Diabetic Federation (IDF), American Society for Nutrition (ASN), Journal of aging, Journal of Toxicology and Pharmacology, Journal of Medicine, Journal of Biochemistry and Molecular Sciences were used as source of reference . Publications in the last 5 years

(2014 to 2018) had been referred; however, I did not exclude very few commonly referenced and highly regarded older publications. Searching tools like BOOLEAN Logic, NESTING, Truncation, Phrase Searching and Limits refining were used to collect and organize data.

3. Introduction

3.1. Aging

Aging is physiologically characterized as a progressive, generalized systematic dysfunction of almost all organs, giving rise to the escalated vulnerability to environmental challenges and resulting in increased risks of disease and death. Indeed, aging in humans is associated with a greatly increased incidence of a number of degenerative diseases including cardiovascular disease, Type 2 diabetes, cancer and Alzheimer's disease **[1,41].** Thus, preventing or delaying the pathogenesis of these chronic diseases is an essential strategy to promote healthy aging. Dozens of researches believe that both aging and chronic diseases are highly associated with increased metabolic and oxidative stress, elevated chronic, low-grade inflammation, and accumulated DNA mutations as well as increased levels of its damage **[4-6, 21, 22, 24, 26,28].**

3.2. Phytochemicals

They are defined as bioactive non-nutrient compounds in fruits, vegetables, grains, and other plants. So far, about 10,000 phytochemicals have been identified, and still a large percentage remains unknown **[3,4,9]** . Phytochemicals are grouped into seven main categories , including

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phenolic compounds, terpenes, betalians, organosulfides, indoles/glucosinolates/sulfur compounds, protein inhibitors and other organic acids **[1-3]**.Most phytochemicals are secondary plant metabolites which are present in a large variety of foods including fruit, vegetables, cereals, nuts and cocoa/chocolate as well as in beverages including juice, tea, coffee and wine.

Phytochemicals exert a protective effect against the development of chronic type 2 diabetes millets **[10-19,41].** The protective role of phytochemicals may be associated with their antioxidant activity, since overproduction of oxidants in the human body is involved in the pathogenesis of many chronic diseases like diabetes type 2 **[18-34,37,41].**

Many Reviews and Original researches indicate that caloric restriction delays age-associated organ disorders and increases lifespan in a wide range of species, suggesting that targeting nutrient-sensing and energy metabolism pathways may be an effective approach to delay aging process and age related diseases **[5,6,8,37**]. Emerging studies showed that some phytochemicals have potential in reducing risk of chronic diseases like Type 2 diabetes , although they are not considered essential nutrients **[7,37].**

3.3. Free Radicals and Oxidative Stress

The potential deleterious effects of increased reactive oxygen and nitrogen production include oxidative damage to ribonucleic acids, proteins, and lipids by the mechanisms of nitration, carbonylation, peroxidation, and nitrosylation **[3, 4, 10,21,35].**

Oxidative stress occurs whenever the release of reactive oxygen species (ROS) exceeds endogenous antioxidant capacity **[10,35].** Peroxisomes and mitochondria are the main intracellular sources for reactive oxygen species. At the same time, both organelles are critical for the maintenance of a healthy redox balance in the cell. Consequently, failure in the function of both organelles is causally linked to oxidative stress, chronic disease like diabetes type 2 and accelerated aging **[15, 16, 27, 29, 30, 31, 38,40,41].**

3.4. Type 2 Diabetes Mellitus (T2DM)

According to the International Diabetes Federation (IDF) fact sheet data 2017, approximately 425 million adults (20-79 years) were living with diabetes; and it was projected that by 2045 this data will rise to 629 million adult persons **[42].** Diabetes caused at least USD 727 billion dollars in health expenditure in 2017 – 12% of total spending on adults. The greatest number of people with Type 2 Diabetes Mellitus (T2DM) was adults between 40 and 59 years of age **[42]** . Dietary restriction is one of crucial roles in the prevention and management of diabetic conditions **[5, 8, 34,36,42] .**Observational studies and randomized controlled trials confirm

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that unhealthy diet has been considered a major contributor to diabetes development **[5, 8, 13-16, 33, 34,36,42].**

4. Conclusion

This outlined review paper provide the current understanding of the impact of antioxidant and phytochemicals on aging and T2DM. Antioxidants and phytochemicals are among the most potential agents to reduce the oxidative stress, to alleviate and prevent T2DM and have anti-aging effect.

Antioxidant and phytochemicals have the ability to reduce oxidative stress by scavenging excess free radicals, and act as anti-inflammatory action. Therefore, this action of pyhtochemicals has protective capability of Type 2 diabetes mellitus (T2DM) , and thereby increases the life span. Though most of the scholars agree on the positive impact of phytochemicals, very few articles argue those impacts in alleviating T2DM, their ability to reduce oxidative stress,and their effect as anti-aging agent .Thus ,this controversial idea enforce the relevant researchers and scholars to perform further investigation and experiment.

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