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## Superfoods and their role in disease prevention

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### Abstract

#### Introduction and purpose

Functional food also known by the term “superfoods” are rich in bioactive compounds with specific biological properties and due to that beneficial effects within the human body. Nowadays chronic degenerative diseases such as diabetes, cardiovascular disease, obesity and cancer are increasingly common in the population. Therefore the need to support treatment but also reduce the risk of these diseases in the first place increases as well. This is the reason for the great interest and growing trend in the consumption of superfoods, especially in Europe and the United States. The purpose of this article is to demonstrate the impact of selected superfoods on human health.

#### State of knowledge

Superfoods are considered nutrient-dense and rich in bioactive compounds that are beneficial for physical and mental health. Antioxidant activity is one of the most important properties for human health improvement. This activity is scavenging free radicals, thus preventing the development of various degenerative diseases. Today, more and more products are considered superfoods. Fruits, the examples of superfoods which will be discussed in this work, are well-available and require no heat treatment therefore incorporating them in one's diet seems to be an easy way to improve health as a consequence.

#### Summary

The potential beneficial role of superfoods is considered in health promotion and even preventing the development of diseases. However, this can only be possible if superfoods are part of a balanced diet and healthy lifestyle.

The following article is a review of current knowledge and data available in publications in Pubmed and Google Scholar databases related to correlation between selected superfoods consumption and disease prevention.

**Key words:** antioxidants; chronic disease; nutrients; free radicals

### **Introduction and purpose**

Health awareness has increased significantly in recent years. It may be related to education and people's desire to protect themselves more efficiently against diseases but also to improve the quality of life without much effort. The potential answer to these desires could be superfoods, and as such we are recently seeing a surge in scientific interest in this topic. The majority of authors define them as food products containing abnormally high amounts of any nutrient [1]. Superfoods consumption can not only provide the human body with polyunsaturated fatty acids  $\omega$ -3,  $\omega$ -6, a variety of vitamins (A, B, C, K), minerals, antioxidants, essential amino acids, probiotic microorganisms, polysaccharides and various enzymes [2] but also increase the production of serotonin and other hormones within the human body [3]. Due to that, superfoods are considered exceptionally nutritious and rich in bioactive compounds with positive effects in both physical and emotional health [4] [5]. Antioxidant activity is one of the most important properties thanks to which these goals can be achieved. The creation of free radicals in the body is a result of physiological biological processes, but the overproduction has a deleterious effect, destroying healthy cells, speeding up the aging process and significantly increasing the likelihood of various diseases. Antioxidant components in which superfoods are rich inhibit these processes, scavenging the free radicals and due to their anti-inflammatory, anti-carcinogenic [6], anti-allergic, anti-arthritic, anti-microbial, anti-oxidant, and anti-hypertensive activities prevent a variety of degenerative diseases development [7]. Among the most essential antioxidants of the superfoods are phenolic compounds, flavonoids, vitamins A, C, E, selenium,  $\beta$ -carotene, zinc, lycopene, albumin, coenzyme Q10, uric acid and anthocyanidins [8] [9].

Expansion of scientific research into these ingredients leads to the constant extension of the list of products considered superfoods. Based on the evidence gathered from many studies, the following superfoods seem to be particularly significant for our health and well-being:

vegetables (broccoli, spinach), fruits (blueberries, raspberries, pomegranate, goji berries, acai berries, strawberries, hippophaes), seaweed (spirulina, chlorella), nuts and seeds (walnuts, almond, chia seeds, hemp seeds), milk products (kefir, camel milk), herbs (ginger, tea, ginkgo biloba, tumeric, moringa), pulses (red beans, cocoa, sweet potatoes), bee products (royal jelly, honey)[5] [10] [11].

In this study some of the most important superfoods belonging to the fruit group, according to the scientific literature are presented, such as hippophaes, acai berries, goji berries and cranberries.

### **State of knowledge**

#### **Hippophaes**

Hippophaes are about 0,5 m height shrubs growing commonly in Europe and China. *Hippophae rhamnoides* can be consumed fresh or dried. The fresh fruit should be consumed immediately because otherwise its nutrient value decreases. Refrigeration may preserve it for a while. However the most common form found in stores is the dried fruit, due its nutrient values are preserved for a long period of time [12]. The moderate consumption of the hippophaes as the addition to a balanced, healthy diet appears to offer benefits to human health. Due to its B-complex content as well as calcium, magnesium, iron, phosphorus, selenium, zinc and other minerals it enhances the function of the nervous system. Hippophaes can also play a role in cardiovascular disease prevention, because of its phytosterols and polyunsaturated fatty acids content [13]. Antioxidants such as flavonoids and carotenoids take their part in free radical scavenging therefore the cancer protection is enhanced. Strong anti-inflammatory [14] and analgesic action is caused by high vitamin C content [15] (on average level of 695 mg per 100 g which is even 15 times higher than orange), vitamin E and also polyunsaturated fatty acids.

#### **Acai berries**

Acai berries (*Euterpe oleracea*) are dark blue fruits of an acai palm tree growing in Amazon forest in Brazil. The acai berries are rich in polyphenols which strengthen the human immune system and have anti-inflammatory action: anthocyanins and flavonoids. Cyanidin 3-glucoside, cyanidin 3-rutinoside, quercetin, orientin, and proanthocyanidins are the major polyphenols found in açai [16]. The scientific data proves what is written above- blood and urine samples at 12 and 24 hours after the consumption of acai berries had high concentration of antioxidants [17]. Also with the participation of twelve healthy people, improvements to metabolic levels and protection against cancer cells were noticed [3] [18]. What is more, they contain high amounts of polyunsaturated fatty acids, electrolytes, fibers, sterols, vitamin A, B1, C and E, iron, calcium, potassium and zinc [19]. Acai berries can be consumed both raw and dried and due to the scientific data incorporating them into a balanced diet seems to benefit significantly one's health. Its biological effects include antioxidant, anti-inflammatory, cardioprotective, and a neuroprotective action as well as improving dyslipidemia and obesity. Besides, consumption of acai berries seems to prevent cell destruction by free radicals and protect against cancer cells development [3].

#### **Goji berries**

Goji berries (*Lycium barbarum*) also called “berries of happiness” are one of the richest natural sources of nutrients, such as antioxidants, amino acids, a variety of vitamins, carotene, minerals and trace elements. They also contain a high percentage of polyunsaturated fatty acids such as linoleic acid, carbohydrates, phytosterols such as beta-sitosterol and fiber [20]. Their carotenoids content is outstanding (45,550 µg/100g) even in comparison with other superfruits like acai berries and passion fruit [21]. The fruits are easily oxidized, and they are almost never fresh, except in the production areas (they are endemic fruits of Tibet). The degree of drying is differentiated depending on the species.

Goji berries contribute multiple benefits to the human organism. The most important action documented by many studies is the strong antioxidant protection against the free radicals. Due to that goji berries consumption can decrease the risk of cardiovascular disease and diabetes, which pathophysiology is promoted by the presence of free radicals. Goji berries contribute to the reduction of LDL by increased production of enzymes such as superoxide dismutase which also concerns the effect on cardiovascular prevention. The presence of germanium and various antioxidant substances also enhances the potential protection against cardiovascular diseases. What is more, the regulation of blood sugar level and prevention of insulin resistance is scientifically recognized, since these are the key factors for the prevention of type II diabetes. The presence of polysaccharides in the form

of glycosides appears to be associated with possible protection against cancer, although the data is not clear yet. Beta-sitosterol of Goji berries seem to significantly inhibit stomach cancer, suppressing the reproduction of cancer cells. However further research for safer conclusions are needed [3]. Another action of the goji berries being studied is the enhancement of sexual function, by increasing testosterone levels. Goji also contributes to improved vision due to its high content of zeaxanthin, lutein, polysaccharides and polyphenols. *Lycium barbarum* fruit has been shown to stimulate metabolism and enhance gastrointestinal tract regularity [22]. Last but not least is the inflammation reduction as well as the strengthening of the immune system.

Cranberries

Cranberries (*Vaccinium oxycoccos*) are red acidic fruits that can be consumed either fresh, dried or frozen as well as dietary supplements. They are very rich in vitamin C, E and K, fiber, manganese and antioxidants such as phenolic compounds. High concentration of proanthocyanidins, flavonols, quercetin, myricetin, ellagic acid and chlorogenic acid provide strong protection against free radicals [23]. Potential beneficial effects being discussed in the research data include cardiovascular disease prevention, urinary tract support, metabolism acceleration and even carcinogenesis prevention.

Cardiovascular disease prevention is most likely achieved by retardation of the atherosclerotic process in arteries and improving lipidemic profile. Cranberry consumption decreases LDL and increases HDL cholesterol in mice fed a high fat diet [24]. Not only animal but also clinical studies indicate positive influence in terms of cardiovascular diseases, for example improvement of the lipidemic profile in the population including patients with type II diabetes [25], obese men [26] and patients with low HDL and hypertriglyceridemia [27] has been shown. What is more, an in vitro study indicates that by inhibiting the angiotensin-converting enzyme, cranberries contribute to blood pressure lowering [28].

In a meta-analysis, with data from 10 studies with a total of 1,049 participants for a period of 12 months, results showed that the consumption of cranberry decreased the overall incidence of urinary tract infection by 35%, especially for women with recurrent urinary tract infections [29]. In a randomized trial 113 children with UTIs were randomly allocated to drink either cranberry-lingonberry juice or a placebo juice for 6 months. The children drinking CLJ had a different urinary and gut microbiome from those receiving a placebo juice and due to that their susceptibility to UTIs decreased [30]. High antioxidant content in particular proanthocyanidins shows activity against bacteria such as *E. coli* making cranberries support prevention and treatment of urinary tract infections. Although the data is not yet clear, it seems that consumption of cranberries is likely to have a possible effect on cancer pathophysiology. Due to their ellagic acid and antioxidants content they may contribute to the prevention of breast, colon, prostate and lung cancer. Moreover research shows an improvement of mood and skin diseases relief by affecting hormonal levels [3].

## Summary

Superfoods consumed in moderate quantities are beneficial for the overall health improvement and treatment of certain diseases. The most important advantage of superfoods seem to come from their high antioxidant content, such as carotenoids, polyphenols, vitamin A, C and E on one hand and their synergistic action on the other. What is more, they typically have low caloric content. However it should be noted that scientifically documented health benefits of superfoods should be used as an addition to the well-balanced, varied diet. Only then can the inclusion of superfoods contribute to reduce the risk of various degenerative diseases and overall health improvement.

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