

## Superfoods: A Holistic Approach for Healthy Life

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### Introduction

Superfoods are known to have high nutritional and biological value, as they embedded with exceptional concentration of nutrients and bioactive components having bioavailability within the body. They have potential to boost physical vitality and a smart choice for boosting immune function and overall health. Polyunsaturated fatty acids (-3, -6), vitamins, minerals, probiotic microorganisms, antioxidants, essential amino acids, polysaccharides, and different enzymes are the most significant bioactive components of superfoods that have been shown to be beneficial to the human body. Since antioxidant activity is the most important characteristic of superfoods, vitamins A, C, and E, flavonoids, selenium, -carotene, zinc, lycopene, albumin, uric acid, bilirubin, coenzyme Q10, and polyphenols like anthocyanidins are among the most significant antioxidants found in superfoods. The number of superfoods keeps growing year after year as a result of scientific interest being sparked by the tracking of important nutrients and the comprehension of how those nutrients interact within the human body. In particular, the most important superfoods according to the data obtained from several studies, are presented in Fig 1.









































Fruits	Nuts and seeds	Roots and tubers
 Goji berry  Mangosteen	 Chia seed	 Ginger  Ginseng
 Açaí berry  Jackfruit	 Flaxseed	 Turmeric  Yam
 Chokeberry  Acerola	 Hemp seed	 Maca  Burdock root
 Pomegranate  Cape gooseberry	 Carob seed	 Chicory root  Ashwagandha
 Avocado  Camu camu		
 Passion fruit  Dragon fruit		
 Blackberry  Lucuma		
 Bilberry  Baobab		
	<b>Grains</b>	<b>Others</b>
	 Buckwheat	 Pollen
	 Amaranth	 Chlorella
	 Quinoa	 Spirulina
	 Cocoa	
	 Oat	
		 Kale
		 Reishi
<b>Herbs, spices and condiments</b>		<b>Vegetables including fungi</b>
 Matcha tea  Moringa		

Fig 1. Some important examples of superfood (Source: Fernández-Ríos et al., 2022)

## Categories of superfoods

### Fruits

Generally, the so-called ‘superfruits’ are deemed ‘super’ by nutritional scientists due to their extremely high levels of antioxidants (carotenoids, flavonoids, and phenolic compounds), fiber, vitamins and minerals. For instance, baobab, passion fruit, or lucuma have twice the fiber content of other conventional fruits, such as pear or banana. Regarding the bioactive compounds, goji berries stand out mainly for their carotenoids content, an extremely high concentration even in comparison with other rich superfruits like passion fruit, açai berries or chokeberries. However, the latter present important TPC, 1116 mg GAE/100g, as well as camu-camu, 1196 mg GAE/100 g. In terms of vitamins, oranges and lemons are commonly known for their high content in vitamin C; however, these values, respectively, seem low compared with acerola or camu-camu. Finally, in relation to minerals, baobab appears to be the most complete superfruit, with significantly larger contents of K, Ca, Mg, Fe, and Zn than most of the traditional fruits. Nevertheless, some ‘superfruits’ also stress for other nutrients, as is the case of avocado, lucuma or goji berries that are high in vegetable proteins.

### Grains

With regard to grains, both cereals and pseudo-cereals are attracting attention as new food sources mainly due to the quality and nutritional value of their proteins, fiber, phytochemicals, and minerals profile. Quinoa, amaranth, oat and buckwheat highlight for their high protein content, larger than traditional cereals that usually present between 6% and 12% of this nutrient. Specifically, quinoa, which is usually compared with rice, exhibits other important advantages from a nutritional perspective; its fiber content is significantly larger (7 g vs 0.2 g/100g), and all minerals are available in greater quantities, as well as bioactive compounds and most of vitamins. Likewise, oat, amaranth and buckwheat have an outstanding mineral and vitamin profiles, especially K, P, Ca, and Fe, and B complex vitamins, which are the richest in cereals.

### Vegetables and fungi

Regarding vegetables, differences are observed between the nutritional properties of vegetables themselves and foods of the fungi classification. Proteins available in reishi are far superior to other fungi species, such as mushrooms, and unquestionably to any vegetable. The

same can be said for fiber, lipids, phenolic compounds, and an important part of minerals, such as Zn, Fe or P. Its unusual composition has led some Asian countries to call it ‘the mushroom of immortality’, reporting many therapeutic activities. For its part, kale can be considered a good source of Ca, as well as of vitamins A, B<sub>1</sub>, B<sub>3</sub>, B<sub>9</sub>, and C that makes it stand out among cabbages. Besides, its protein content is noteworthy among vegetables, 3.4 g/100g, and its bioactive compounds reach values even higher than those of superfruits.

### **Nuts and seeds**

Legumes, nuts, and seeds are considered a good substitute of animal derived products such as meat, fish, and eggs since they are especially rich sources of protein, fiber, and vitamins (De, 2020). Hemp seeds have become a crop with growing interest due to its nutritional value and pharmaceutical potential. They can provide an important intake of proteins (31.6 g/100g), as well as of most of minerals (especially P or K), some vitamins (B<sub>1</sub>, B<sub>3</sub> and B<sub>9</sub>) and phenolic compounds (2224 mg GAE/100 g). For its part, fiber available in chia and flaxseeds is between 27% and 34%, twice the percentage of high fiber beans or nuts (e.g., 11 g/100g of sesame or 14.9 g/100g of chickpeas). Likewise, minerals content in these products is quite significant, specifically P and Ca in both foods, and K and Mg, and TPC in the case of flaxseeds.

### **Roots and tubers**

Roots and tubers are characterized for containing little protein content (1–2%) but significant concentrations of minerals, some vitamins, fiber and antioxidants, all of them food compounds with associated health benefits that give them an immense potential as functional foods and nutraceutical ingredients. Despite being their “weak point”, some roots present an extraordinary protein profile, such as turmeric, maca or ginseng. In fact, turmeric (usually presented as powder) appears to be the most complete superfood of this classification, presenting also desirable amounts of fiber, carbohydrates, all minerals, and part of vitamins, reaching their concentrations even five times higher than those of potatoes. Likewise, practically all tubers seemed at ‘super’ have a mineral profile far superior to that of other more consumed roots, especially in K and Mg.

### **Herbs and spices**

Polyphenols and carotenoids are the most prominent compounds in herbs and spices; TPC of matcha tea powder reaches 7975 mg GAE/100 g, whereas that of moringa 2942 mg

GAE/100 g. For its part, TCC of matcha tea was not available in literature, but that of moringa got up to 6390 µg/100 g, a fairly important concentration. On the other side, matcha tea can also stress for its protein and fiber content, 27.95% and 13.34%, respectively, which are very high compositions considering that it is a plant product. The health benefits and the compounds responsible for it are enlisted in Table 1.

**Table 1: List of some superfoods' components and their related health benefits**

Superfoods	Health benefits	Compounds associated
Tea	reduced relative risk of cancer neurological diseases and aging reduce the incidence of arthritis	polyphenols, green tea catechins, and black tea thioflavins, tea polyphenols catechins
Hippophaes	enhancement of the function of the nervous system strong anti-inflammatory, antimicrobial, analgesic, anti-inflammatory and healing action	vitamins of the B-complex as well as all necessary for the human body minerals and trace elements vitamin C, omega-3 and omega-6 fatty acids and vitamin E
Blueberries	cerebral function and reduction of neurodegenerative diseases and blood pressure prevention of various types of cancer	polyphenols and especially anthocyanins phenolic compounds, tannins, flavones, flavonoids kaempferol and luteolin
Royal jelly	elderly disorders, insomnia, increase appetite better mental and psychological functioning of the elderly	vitamin B1, the phosphorus and tryptophan
Spirulina	antiviral effect antimicrobial and antioxidant activity	polysaccharide spirulane β-carotene, vitamin E, selenium and polyphenols
Maize	nutrients absorption and inflammation suppression Improvement of the lipid profile and regulation of blood sugar levels	soluble proteins, fiber and monounsaturated fatty acids high fiber and amino acid content

Maca plant	improvement of sexual function and iIncreased fertility improving the symptoms of menopause antimicrobial and detoxifying action	high amino acid content amino acids such as phenylalanine, tyrosine and histidine vitamins B1, B2, B12, C and E, zinc, alkaloids, tannins and saponins
Acai berries	anti-inflammatory action protection against cancer cells	$\omega$ -3 and $\omega$ -9 fatty acids vitamins A, B1, C and E and anthocyanins
Goji berries	prevention of cardiovascular diseases and diabetes stomach cancer prevention improve vision	polysaccharides in the form of glycosides, germanium and various antioxidant substances beta-sitosterol zeaxanthin, lutein, polysaccharides and polyphenolic compounds
Pomegranate	antioxidant activity hypertension prevention and endothelial function improvement	phenolic compounds especially punicalagin, polyphenols, ellagitannins and vitamins Punicalagin
Ginger root	cardiovascular disease prevention digestion antimicrobial and anti-inflammatory activity	polyphenols inorganic compounds vitamin C, potassium, zinc and polyphenols

## Conclusion

Superfoods are becoming a popular diet style across the globe due to their particular health claims, presenting an interesting option to fight against food insecurity. However, in a current context in which climate change, water scarcity and other environmental problems are issues of major concern, these products could also play a key role. For that reason, this article combines nutritional and environmental aspects, examining the current state-of-art of superfoods life cycle assessment studies, in order to provide an advance in filling the gaps related to this scientific field.