



Antioxidant Properties of Traditional Spices

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Spices are mainly used to improve the sensory characteristics of foods and beverages [1]. Their trade is probably the most ancient one practiced by man. Its importance is demonstrated by values and quantities (\$2000 million and 500,000 tons [2]. According to the Food and Drug Administration, spices are "aromatic vegetable substances, in the whole, broken, or ground form, whose significant function in food is seasoning rather than nutrition. They are true to name, and from them no portion of any volatile oil or other flavouring principle has been removed" [3].

The phytochemicals responsible for the spice food enhancing properties are synthesized by plants to the aims of attracting beneficial organisms, repelling harmful organisms, resisting pathogens, serving as photoprotectants, and responding to environmental changes. Such compounds are products of the secondary metabolism in plants, mainly belong to classes such as terpenes and derivatives, phenylpropanoids, isothiocyanates, sulfur compounds, and are often present as glycosides [4].

Beyond their ability as food flavouring and preservatives, spices have been in use for thousands of years, especially in the Oriental traditional medicine, for the treatment of various diseases. Several medicine properties of spices have been recognized for long time including antioxidant, anti-inflammatory, analgesic, hypoglycemic, and hypolipidemic ones. Other benefits are represented by the protection against cardiovascular and neurodegenerative diseases, cancer, and type 2 diabetes. Despite the relatively low intake of culinary spices, their potential biological impact cannot be ignored [5].

Most of the health benefits of spices are mediated by their ability to prevent free radical formation, remove radicals, repair oxidative damage, eliminate damaged molecules, i.e. by their antioxidant ability [6]. The spice antioxidant activity is related to a variety of chemical compounds. The most effective antioxidants act interrupting the free radical chain reaction. These compounds donate H radicals to the free radicals formed during oxidation becoming radicals themselves that are stabilized by the resonance delocalization of the electron within the aromatic ring [7]. Many of the phenolics also lack positions suitable for molecular oxygen attack or quench free radical oxygen [8].

Among the traditional spices, wasabi, horseradish, turmeric, and ginger are newly gaining attention worldwide both for their sensory characteristics and health benefits. Wasabi is used as a seasoning on raw fish. The true wasabi derives from the rhizome of *Wasabia japonica* (Miq.) Matsum, a plant of the Brassicaceae family mainly cultivated in Japan. It is also called Japanese horseradish, although horseradish is a different plant used as a more economic substitute for wasabi. Its pungent flavour, released with grinding, is determined by the volatile allyl isothiocyanate. Isothio-

cyanates are unsaturated sulphur compounds that are known to exert anti-inflammation, anti-microbing, detoxification, anti-blood clotting, treatment of asthma, increasing the immune response, and anti-cancer effects [9,10]. Horseradish (*Armoracia rusticana* L.) is another plant of the Brassicaceae family with a pungent flavour, whose antioxidant characteristics can be attributed to their polyphenols [11] and their isothiocyanate contents that also exert anti-bacterial and anti-fungal activities [12]. Turmeric (*Curcuma longa* L.) is a plant belonging to the *Zingiberaceae* family, mainly cultivated in India, Bangladesh, China, Cambodia, Malaysia, Thailand, Philippines, and Indonesia [13]. The major bioactive compounds in turmeric are three curcuminoids (curcumin, demethoxycurcumin, and bisdemethoxycurcumin), whose biological activities include antioxidant, antiprotozoal, antimicrobial, antineoplastic, anti-HIV, antitumor, anti-inflammatory, anticancer, and anticarcinogenic [14-17]. Ginger (*Zingiber officinale* Rosc.), native of South-East Asia, belongs to the family of *Zingiberaceae*. The ginger health-promoting effects concern the treatment of degenerative, digestive, and cardiovascular disorders. Furthermore, it has anti-inflammatory, antimicrobial, anti-oxidative, and antitumorogenic properties. Most health effects are related to the content of non-volatile pungent compounds such as gingerols, shogaols, paradols, and zingerone [18].

In conclusion, besides their use in kitchen, more and more people prefer use spices for their health benefits, preferring natural based bioactive ingredients to the products obtained from chemical synthesis whose side effects can't be ignored.

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