Spices Bioactive Components

Subjects: Others

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Spices, condiments and extra virgin olive oil (EVOO) are crucial components of human history and nutrition. They are substances added to foods to improve flavor and taste. Many of them are used not only to flavor foods, but also in traditional medicine and cosmetics. They have antioxidant, antiviral, antibiotic, anticoagulant and antiinflammatory properties and exciting potential for preventing chronic degenerative diseases such as cardiomyopathy and cancer when used in the daily diet.

Keywords: spices ; antiviral properties ; antioxidant properties ; nutricosmetic

1. Introduction

Spices and condiments have played an essential role in human nutrition and participated in developing most cultures worldwide. The use of curry was known in 2000 B.C.E. in India. In Egypt and Babylon, spices such as garlic, cumin and coriander were considered magical. The Greeks and Romans used anise, savory, basil, garlic, hyssop, fennel, mustard, capers, cumin, coriander, oregano, myrtle, parsley, verbena in the kitchen, medicine and cosmetics. Marco Polo in the 13th and the European colonization of Africa, America and Asia during the 15th to 17th centuries improved and spread condiments and spices worldwide [1]. Spices and cooking processes contribute to the ethnic identity of food [2]. Ethnic foods have increased their popularity among consumers worldwide since tourism, international trade and immigration raised the possibility of tasting them. Social media and the opportunity to share culinary experiences also contributed [3][4][5][6]. Partly driven by the improved popularity of ethnic food consumption, the global seasoning and spices market was USD 136.24 billion in 2019 and its growth rate is probable to grow by 4.8% from 2015 to 2025 steadily. The global seasoning and spices market size was valued at USD 13.77 billion in 2019 and is expected to grow at a compound annual growth rate (CAGR) of 6.3% from 2020 to 2027 [7]. The nutrients and phytochemicals in spices, extra virgin olive oil and flavorings are widely used in traditional medicine, pharmaceuticals, dental preparation, aromatherapy and nutraceuticals [8]. The Dietary Supplement and the Education Act have defined “nutraceuticals” as supplements containing herbs, plant products, metabolites, or extracts singly or combined [9]. Currently, the cosmetics industry uses spices and extra virgin olive oil to prepare food supplements and topical skincare cosmetics to combat blemishes from the inside and outside simultaneously [10][11][12][13].

2. Curry

Curry is a combination of spices (turmeric, cumin, coriander, paprika, cardamom and other spices) and herbs and its composition varies between regions [14]. It contains fat, protein, minerals (e.g., iron, calcium, sodium), carbohydrates, fiber [15] and phytochemicals such as flavanols (e.g., catechin), flavonols (e.g., quercetin, kaempferol) [16], carbazole (murrayanol, murrayagetin, marmesin-1”-O-rutinoside, mukoenine-A, -B and C, murrastifoline–F, bis–2-hydroxy-3-methyl carbazole, bismahanine, biskoeniquinone-A and bismurrayaquinone A, koenoline, mukoline, mukolidine). Phytochemicals in curry have antioxidant, antidiabetic, cytotoxic, anticancer, immunomodulatory, antiobesity, antihyperlipidemic, hepatoprotective [17] and skincare activities [18].

3. Tumeric

Turmeric (*Curcuma longa*) is considered the golden spice of India. It is obtained from the rhizome of a herbaceous plant that belongs to the ginger family *Zingiberaceae*. [19]. Tumeric is widely used as a spice, coloring material, food and preservative in South East Asia, Africa and Brazil. The bright yellow spice is obtained by boiling and drying rhizomes. Turmeric spice has a hot, bitter flavor and a minor fragrance of ginger and orange. It is used to make a curry spice and mustard [20]. The rhizomes contain vitamin C, minerals (e.g., iron, calcium and sodium) [21], flavanols (e.g., catechin), flavonols (e.g., kaempferol and myricetin) [16], curcuminoids (e.g., curcumin, 5-methoxycurcumin, demethoxycurcumin, bis-demthoxycurcumin, cyclocurcumin and dihydrocurcumin), sesquiterpenes (e.g., germacrone, ar-, α, β-turmerones, turmerone, β-bisabolene, zingiberene, α-curcumene, bisacurone, β-sesquiphellandene, curcumenone, procurcumadiol dehydrocurdinone, bisacumol, isoprocurcumenol, curcumenol, epiprocurecumenol, curlone zedoaronediol and turmeronols A and B), steroids (e.g., β-sitosterol, stigmasterol, cholesterol, 2-hydroxymethyl anthraquinone and anthraquinone) and essential oils (e.g., α-phellandrene, cineol, sabinene, sesquiterpenes with turmerones skeleton and borneol) [22]. Tumeric rhizomes are used as stimulants, stomachs and blood purifiers to prevent anorexia, diabetic wounds, hepatic disorders, rheumatism, sinusitis, bronchitis, asthma, skin infections and eye infections [22].

4. Fenugreek

Fenugreek (*Trigonella foenum-graecum* Linn.) belongs to the *Fabaceae* family. The leaves, seeds and flowers are used dry. The seeds release a maple–curry–nutty flavor by crashing. Leaves and sprouts have a sweeter taste than the seeds and are eaten as a vegetable and mixed into dough, stews and beans. It contains amino acids (glutamic acid, aspartic acid, leucine, tyrosine, phenyl cysteine and alanine), fatty acids (e.g., mono- and di-galactodiacylglycerols, oleic acid, linolenic acid, linoleic acid, glycolipids, phosphatidylethanolamine and phosphatidylcholine), vitamins (e.g., A, B1, B2, C, niacin, nicotinic acid and folic acid) and minerals (e.g., Fe, P, Ca, Mg, S, Cu, Co, Zn, Mn and Br) [23]. The phytochemical analysis of fenugreek has revealed the presence of furostanols (e.g., protodioscin derivatives) and spirostanols (e.g., dioscin derivatives) saponins, steroids, alkaloids (e.g., trigonelline), flavonols (e.g., quercetin-3-O-rhamnoside), flavons (e.g., vitexin-7-O-glucoside, apigenin-6-C-glucoside, apigenin-6-C-glucoside, apigenin-8-C-glucoside, apigenin-6-C-xyloside-8-C-glucoside, apigenin-6 and 8-C-diglucoside), isoflavonoids (e.g., maackiaian and medicarpin), terpenes and phenolic acid derivatives (e.g., caffeic acid, p-coumaric acid and chlorogenic acid, hymecromone, trigocoumarin, trigoforin, scopoletin and γ-schizandrin) [23]. Pharmaceutical employment of fenugreek is related to diabetes, obesity, hyperlipidemia, inflammation damages, cancer, oxidative stress reparations and improving women's health [23].

5. Garlic

Garlic (*Allium sativum*) is an herb of the Liliaceae family. *Allium* is derived from the Celtic word al (burning, pungent). The bulb is widely used as a culinary spice and in traditional medicine [24]. It contains vitamins (e.g., A and C) [25] and some bioactive compounds such as flavanols (e.g., catechin), flavonols (e.g., kaempferol, myricetin and quercetin) [16], organosulfur compounds (e.g., allicin, diallyl sulfide, diallyl disulfide, diallyl trisulfide, S-allyl-cysteine, E/Z-ajoene and alliin), phenolic compounds (e.g., β-resorcylic acid, pyrogallol, gallic acid and protocatechuic acid), saponins (e.g., proto-desgalactotigonin, desgalactotigonin-rhamnose, proto-desgalactotigonin-rhamnose, sativoside B1-rhamnose, voghieroside D1 and sativoside R1) and polysaccharides [26][27][28][29][30]. Garlic has antioxidant, antiinflammatory, antiobesity, antidiabetic, anticancer, cardiovascular protective, immunomodulatory and antibacterial properties [31]. The antioxidant properties of garlic are related to organosulfur compounds, flavonoids and saponins. Garlic improves and regulates the antioxidant enzyme activities (heme oxygenase-1 and the glutamate-cysteine ligase modifier) and the nuclear erythroid 2-related factor 2 (Nrf2-ARE) pathway [32][33]. Garlic could constrain inflammation by impeding inflammatory mediators' action (e.g., nitric oxide, tumor necrosis factor-α and interleukine-1). It decreases nitric oxide production and prostaglandin E-2 by reducing the expression of inducible NO synthase, cyclooxygenase-2 and the transcription of the nuclear factor-kappa B [34][35]. The main immune-modulating components in garlic are polysaccharides. They have an immunomodulatory effect and regulate the expressions of tumor necrosis factor-α, IL-6, IL-10 and interferon-γ in macrophages. Polysaccharides in fresh garlic exhibit a more potent activity on the immune system than fermented garlic since the fructans degrade during processing [36]. Garlic's cardiovascular protective effects are related to inhibition of oxidative stress and lipid peroxidation, control of angiotensin-converting enzymes and NO and H_2S production. Moreover, garlic powder can reduce blood pressure, cholesterol (total and low-density lipoprotein cholesterol) and platelet aggregation [31]. It decreases hypertension by reducing oxidative stress, improving NO and hydrogen sulfide production and inhibiting the angiotensin-converting enzyme [32]. Garlic prevents different cancer pathologies by regulating carcinogen metabolism, decreasing cell growth and proliferation, inducing apoptosis, destructing angiogenesis and preventing invasion and migration [31]. Garlic enhances gastrointestinal functions and relieves gastric ulcers and colitis, by decreasing inflammation, oxidative stress and Helicobacter pylori levels [31]. Finally, fermented garlic reduces obesity by impeding lipogenesis and controlling lipid metabolism [31].

6. Ginger

Ginger (*Zingiber officinale*) rhizome is consumed as a fresh paste, dried powder, slices preserved in syrup, crystallized ginger, or tea flavoring. It contains carbohydrates, protein, free amino acids, fatty acids, triglycerides, ash, crude fiber [37][38][39], minerals (e.g., potassium, copper, magnesium, silicon, manganese), vitamins (e.g., A, E, C, B1, B2, B3, B5, B6, B9 and B12) [40][41], flavanols (e.g., catechin), flavonols (e.g., myricetin) [16], oleoresin (e.g., sesquiterpene hydrocarbons), phenolic compounds (e.g., gingerole, shogoals), diasyleheptanoids (e.g., gingerenone), curcuminoids (e.g., curcumin), alkaloids, carotenoids, tannins, flavonoids, saponins, cardinolides and steroids [40]. Ginger has antioxidant, antiinflammatory, anticancer, hypocholesterolemic, cardio preventive, antibiotic and antimicrobial effects [42].

7. Chilli Pepper

Chilli pepper (*Capsicum annuum*) is a well-known domesticated species of the genus *Capsicum*. It contains vitamin C, carotenoids (e.g., β-carotene, antheraxanthin, violaxanthin, zeaxanthin, capsanthin, capsorubin and lutein), capsaicinoids, phenolic acids (e.g., chlorogenic acid, caffeic acid, ferulic acid, coumaric acid), flavonols (e.g., rutin and quercetin) and flavanones (e.g., hesperidin), [43][44]. Health-promoting chilly pepper activities are associated with antioxidants and antiinflammatory activities of carotenoids and phenols [44]. It has chemopreventive, antidiabetic, antiobesity, cardioprotective, hepatoprotective and photoprotective skin properties [44].

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