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**Mini Review**

**Sumac (Rhus coriaria L.) a spice and medicinal plant - a mini review**

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**Abstract**

Sumac is a famous spice in the Middle East, which is made from berries from a bush of the same name. In order to produce the spice from the plant, its fruit is dried and crushed into a thin red-purple powder. The red berries are tangy and delicious, containing malic acid which is found in apples. As a spice, it is delicious on meat, in salad dressings, and makes a delicious infused vinegar if you macerate it in apple cider vinegar. The most important phenolic acids and flavonoids are catechin, ferulic acid, gallic acid, apigenin, gentisic acid, chlorogenic acid, P-coumaric acid, caffeic acid, isorhamnetin, quercetin, cinnamic acid, taxifolin, epicatechin, kaempferol, P-hydroxybenzoic acid, vanillic acid, vanillin, anisic acid, pyrogallol, sinapic acid, syringaldehyde, syringic acid and benzoic acid. Organic acids of Sumac are malic acid, citric acid, tartaric acid and fumaric acid. The fatty acid composition of sumac fruits are myristic acid, palmitic acid, palmitoleic acid, stearic acid, oleic acid, linoleic acid and linolenic acid. The vitamin content of sumac fruits are thiamin, riboflavin, pyridoxine, cyanocobalamin, nicotinamide, biotin, and ascorbic acid. The most important health benefits of sumac are 1) anti-cancer: a super anti-oxidant, and packed with vitamin C which means it can help ward off diseases like diabetes, cardiovascular diseases and cancer, 2) anti-inflammatory: inflammation is thought to be the cause of most diseases and Sumac is an anti-inflammatory spice that helps fight various disorders, colds and the Flu, 3) it has been studied to be effective in regulating cholesterol levels and treating diabetes by reducing blood sugar, 4) anti-fungal and anti-microbial: Sumac is anti-microbial and anti-fungal spice which can help treat skin inflammation and disorders, it has also been studied to be effective in fighting bacteria like Salmonella and can be used to safely disinfect fruits and vegetables, 5) it can increase breast milk production and ease menstrual cramps, 6) Sumac is a diuretic which means it helps remove toxins from the body through urine and has been used traditionally to treat urine infections and digestive problems.

**Key-words:** Sumac, Functional Food, Herbal Remedy, Traditional Medicine

**Introduction**

Spice and herbal remedies have been used since ancient times to treat a variety of disorders (Shahrajabian et al., 2019a,b,c,d,e; Sun et al., 2019a,b; Shahrajabian et al., 2020a,b). The word "sumac" is used to refer to the product of (Rhus coriaria L.) spice recognized in Iran and other areas of the Middle East as a very popular flavoring spice. Sumac comes from a shrub native to the Mediterranean, and its history dates to ancient times (Zargari, 1992). The Romans used sumac berries as a souring agent and flavoring before citrus fruits reached the region. Sumac still grows wild around the Mediterranean; major sources today include Turkey and the Middle East. There are many varieties of the
shrubs, and some of them are poisonous. However, Native Americans traditionally used sumac to make a refreshing drink, and they also used both leaves and berries in tobacco mixtures (Matloobi and Tahmasebi, 2019). Sumac is widely used in cooking in Turkey and the Middle East, especially in Lebanon, Iran, and Iraq (Moerman, 1998; Mohammadi et al., 2010). The dried whole berries must be soaked or ground before use; occasionally, the berries are soaked to soften them and then are strained out, pressed to release all their juices, and the liquid used as part of the cooking medium for a stew or other dish. A simple salad of sliced onions seasoned with ground sumac is popular throughout the Middle East. Sumac flavors kebabs and grilled meats, fish, and chicken, and it is added to marinades for foods that will be roasted or grilled. It can be stirred into yogurt to make a marinade, or the seasoned yogurt can be served on its own as a dip or a condiment. Sumac is also sprinkled over rice, hummus, or baba ghanoush, along with a drizzle of olive oil, as a garnish and flavoring (Lakshmi, 2016). Native Americans used the split bark and stems in basket-making and the roots for a yellow dye. In Iran, sumac is grown in Mazandaran, Azadbayegan, Khorasan, Shiraz, Ghazvin, Ghom and Hamedan. This study showed that the water extracts of sumac could inhibit the microbial growth in ground beef meat during refrigerated storage. Because the sumac is commonly used as seasoning ingredients in muscle foods (kebab, chicken meat meal and so on), the application of their extracts in these foods not only can improve sensory characteristics but also extend the shelf life. Meanwhile, these extracts might have health-promoting effects on the consumers due to their potential antimicrobial activities (Kamalinejad et al., 2019). Studies have been done on fruit and leaf oil mentions that the Sumac fruit contains flavonoids, phenolic acid, anthocyanins, and organic acids. The sour taste is also due to the presence of organic acids such as malic acid, citric acid and tartaric acid (Chakraborty et al., 2009; Heydari et al., 2019). Syrian sumac (Rhus coriaria L.) is famously used in Mediterranean region and the Middle East as a spice, sauce and drink and Chinese sumac (Rhus typhina L.), is indigenous to the Eastern area of North America, is not extensively cultivated in China, s North, Northwest and many other regions such as Lanzhou, Beijing, Hebei, Shanxi where it is usually called huojushu (Kossah et al., 2009). The plant serves as a traditional medicine, which has pharmacological blood purifier, diuretic, stomachic and tonic. Citric acid is a hydroxy acid and is used in the beverage, juice, cosmetics and pharmaceutical industries and flavoring, it also uses to regulate pH.

**Sumac as a medicinal plant**

Sumac has been applied as a medicinal plant or a spice for hundreds of years. It contains a wide range of medicinally active components, including organic acids, phenolic acids, flavonoids, anthocyanins, hydrolysable tannins and terpenoids (Morsheedloo et al., 2018). Its scientific names are *Rhus glabra* L., Anacardiaceae, and Cashew family. Its common names are Blue glabrum, Dwarf sumac, Mountain sumac, Indian salt (the powder on the berries), Pennsylvania sumach, Scarlet sumac, Sleek sumach, Smooth sumac, and Upland sumach.

**Identified metabolites of Sumac fruit**

All parts of the plant, including its fruit, contain significant amounts of tannin (Glutamine). In a general study of compounds found in sumac fruit, anthocyanins and fats have been identified as major constituents of sumac fruit (Fabroni et al., 2016).

**Botany**

Anacardiaceae (the sumac family) includes flowering plants, with about 80 genera and about 870 species. Several species are economically important fruit and nut crops. The fruits are commonly fleshy drupes. Sumac, (genus Rhus), the genus of shrubs and small trees, native to temperate and subtropical areas of the world. Sumac leaves are characteristically arranged in spirals and are usually compound, though some species have simple leaves. The minute flowers have five petals and are borne in dense panicles or spikes. The fruits are red drupes and also are borne in dense upright clusters. All sumacs have a milky or resinous sap. Many species can spread asexually by rhizomes. The smooth, or scarlet, sumac (*Rhus glabra*), native to the eastern and central United States, is a common species. It grows to a height of 6 meters (20 feet), with an open, flattened crown and a few stout spreading branches. A cultivated variety has dissected fern-like leaves. Sumac (*R. typhina*), grow up to 9 meters (29.5
feet), fall foliage is orange-red to purple. It also has a variety of finely cut leaves. Edible sumac varieties include smooth sumac (*Rhus glabra*), staghorn sumac (*Rhus typhina*), sweet sumac (*Rhus aromatica*), dwarf or winged sumac (*Rhus copallina*), lemonade berry (*Rhus integrifolia*), southwestern sumac (*Rhus microphylla*), sugar bush (*Rhus ovata*), and squaw berry (*Rhus trilobata*). All nonpoisonous species contain red berries when ripe and are sometimes inaccurately and collectively called red sumac. *R. coriaria*, the only species of *Rhus* genus that is most prevalent in Iran, is a large shrub or small tree (1–3 m high), with pinnately compound leaves, greenish-white flowers, and brown to red fruits. Sumac fruit consists of pulp (outcrop and shortcut), the endocarp and nuclei, which reportedly have the highest percentage of oil, the endocarp has the lowest oil content (Ahmad et al., 2014). In China, millions of tons of sumac are produced annually. Sumac fruit contains 12 to 20.8% oil that linoleic acid is the predominant fatty acid (47.4%). Linoleic acid is an unsaturated fatty acid and can reduce cholesterol and the risks associated with heart disease. In Turkey, the sumac fruit's oil content has been reported in the range of 10% to 15%, but in other studies, oleic acid has been identified as the dominant fatty acid content of 34-40%. Oleic acid (Omega-9), an essential fatty acid in the body which forms a major part of the body's fatty acids, but it is low in the liver and neurons.

**Sumac chemical component**

Studies mention that a high degree of variation was found in the chemical characteristics and the results revealed significant differences among the accessions in Sumac. Titratable acidity by variation from 2.01 to 7.84% and pH ranged from 2.66 to 3.90 (r = 0.56). Ascorbic acid ranged from 10.00 to 45.00 mg per g of dry weight, phenolic content varied from 77.54 to 389.30 mg gallic acid equivalents per g dry weight (r = 0.32). The flavonoid content ranged from 2.19 to 7.54 mg quercetin equivalents per g dry weight, while tannin content ranged from 52.00 to 189.80 mg gallic acid equivalents per g dry weight. Free amino acid content ranged from 25.01 to 166.38 mg glycine equivalents per g dry weight, while anthocyanin content varied from 3.57 to 66.14 mg cyanidin-3-glucoside equivalents per g dry weight. Furthermore, antioxidant capacity ranged from 1.55 to 11.09 mg ascorbic acid equivalents per g dry weight (Fereidoonfar et al., 2019). The aqueous and aqua-methanol extracts of Sumac parts were analyzed by HPLC to unfold the different tannins derivatives, gallotannins methyl gallate, digallic acid, tri-gallic acid, and ellagic acid, and dodecagalloyl glycoside derivatives as representative tannins present in *R. coriaria* (Regazzoni et al., 2013). The components of sumac ethanolic extract gained by GC/MC is shown in Table 1.

**Sumac as a spice**

*Rhus coriaria* has long been used as a spice. Sumac has long been used as a pure spice or in combination with other spices, as a complement to drinks, sauces and as a natural stimulant in food recipes (Abu-Reidah et al., 2015). It is also of particular economic importance due to its use in the cosmetics, dyeing, food preservation, and animal skin processing technology (Abu-Reida et al., 2014). The sumac oil could be mixed with vinegar or olive or sesame oil, depending on the type of native recipes. Nowadays, the most common edible consumed form of sumac is as an additive to food as a spice or water.

**Traditional usages**

A vast proportion of the important metabolites for nutrients and pharmacology (such as tannins, phenolic acids, anthocyanins, organic acids, proteins, essential oils, fatty acids, fiber, and minerals) have already been identified from various parts of sumac. Based on the Canon of Medicine of Avicenna (Ibn-Sina) Sumac as a remedy plant used in the treatment of stroke. Sumac has been utilized in traditional medicine for the treatment of blood disease as diabetes diuresis, stroke and cancer, gastrointestinal diseases such as ulcer, diarrhea, stomach tonic, stomachache, and hemorrhoids pain, Hemorrhoids, anorexia, measles, smallpox, hyperglycemia, atherosclerosis, hypertension Diarrhea, Conjunctiva, Hematosis, Hemoptysis, and Leukorrhea, Dermatitis, Ocular, and Liver Disease (Wu et al., 2020). Other medicinal usages have also been studied, including weight loss, skin treatment, hair, burns, digestive tract, headache, and temperature reduction (Ali-Shtayeh et al., 2013). In traditional Iranian medicine, sumac has been used as a hemostasis factor, anti-diarrhea, anti-pus, and trachea treatment, and also pre.
vvention of smallpox in the eye (Tohma et al., 2019). Studies have shown the effects of the hyperglycemic and uric acid lowering effects of sumac (Candan, 2003). Sumac inhibits the α-amylase enzyme significantly. Alpha-amylase is responsible for breaking down starch into simpler sugars and inhibiting this enzyme increases glucose tolerance in diabetic patients. In addition, the sumac can indirectly inhibit xanthine oxidase, which is one of the ways to reduce blood uric acid levels in patients with gout. In recent years, due to the emergence of microbial resistance, the global tendency to investigate the antimicrobial effects of biological materials has been increasingly increased and Sumac has also been no exception (Mahdavi et al., 2018). Sumac reduces blood sugar and uric acid (Cowman, 1999).

### Modern Pharmaceutical Science

The methanol extract of Sumac fruits as a rich source of natural antioxidant phenols and tannins, utilized as an inhibitory function on vascular smooth muscle cell migration. Studies have shown that tannins have anti-carcinogenic effects. Sumac has been utilized as anti-bacterial, anti-fungal, antioxidant, anti-inflammatory, antidiabetic and anticholinergic, vascular smooth muscle cell migration inhibition (Schulze-Kaysers et al., 2015), hypoglycemic, and hypolipidemic activities, tumor growth inhibitor on breast cancer (Isik et al., 2019). Ahmadi et al. (2017) showed that the water extract of sumac has retention effect against Bacillus cereus in soup and can be considered as a natural preservative in some foods. Shidfar et al. (2014) found that the favorite effect of sumac consumption on serum glycemic status, apoB, apoA-I and TAC levels in type 2 diabetic patients. The sumac ethanolic extract showed a high antioxidant effect, the predominant compounds in the essential oil were malate (39.7%), Butanedioic acid, and diethyl ester (22.01%); on the basis of their findings, the possibility of using the fruit of R. coriaria L. as a novel source of natural antimicrobial and antioxidant agents for the food and pharmaceutical industries are suggested. Abdallah et al. (2019) concluded that R. coriaria extract could potentially induce its anti-cancer effects, and it is a promising to involve R. coriaria as a therapeutic drug candidate for uterus cervix cancer. The most important health benefits of sumac is presented in Table 2.

### Industry

Some herbal plants are also use in Industry (Shahrajabian et al., 2019). In the past, the leaves, skin, roots, and branches of the sumac were used as natural dyes in dyeing. In the food industry, on the other hand, antioxidants are used to prevent oxidative degradation of fats by inhibiting the formation of free radicals. Synthetic antioxidants such as butylated hydroxy anisole (BHA), butylated hydroxy toluene (BHT) and propyl gallate (PG) are widely used. However, the use of synthetic antioxidants in food products has been abused (Kizil and Turk, 2010).

### Table 1. The components of sumac ethanolic extract gained by GC/MC.

<table>
<thead>
<tr>
<th>Name of component</th>
<th>Percent of Total</th>
<th>Retention Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trans-Caryophyllene</td>
<td>7.84</td>
<td>12.858</td>
</tr>
<tr>
<td>Butanedioic acid, diethyl ester</td>
<td>22.01</td>
<td>13.87</td>
</tr>
<tr>
<td>1,7-Nomadien-4-ol,4,8-dimethyl Malate</td>
<td>1.06</td>
<td>15.869</td>
</tr>
<tr>
<td>Tricyclo[6.3.1.02,5]dodecane-8-ol</td>
<td>39.7</td>
<td>17.873</td>
</tr>
<tr>
<td>Cembrone</td>
<td>1.18</td>
<td>17.941</td>
</tr>
<tr>
<td>Palmitate</td>
<td>7.64</td>
<td>19.088</td>
</tr>
<tr>
<td>9-Octadecenoic acid</td>
<td>2.61</td>
<td>21.78</td>
</tr>
<tr>
<td>Ethyl Linoleic acid</td>
<td>4.04</td>
<td>22.187</td>
</tr>
<tr>
<td>Ethyl Linoleolate</td>
<td>6.32</td>
<td>22.743</td>
</tr>
<tr>
<td>Phytol</td>
<td>1.76</td>
<td>22.858</td>
</tr>
</tbody>
</table>
Table 2. The most important health benefits of sumac.

<table>
<thead>
<tr>
<th>Benefit</th>
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<tbody>
<tr>
<td>Balance blood sugar levels</td>
</tr>
<tr>
<td>Reduce cholesterol</td>
</tr>
<tr>
<td>Rich in antioxidants</td>
</tr>
<tr>
<td>Reduces the chance of bone depletion</td>
</tr>
<tr>
<td>Calms muscle aches</td>
</tr>
<tr>
<td>Can help in the fight against cancer</td>
</tr>
</tbody>
</table>

Based on revealed fumaric acid on Sumac. Tohma et al. (2019) suggested that sumac may have health-enhancing effects and act as inhibitors of certain enzymes or interfering with some cellular pathways.

**Conclusion**

It is a small tree or shrub with thick branches and smooth gray bark. It has large, deciduous, compound leaves with 11-31 sawtoothed, hairless leaflets.

Dense cone-shaped clusters of whitish male and female flowers grown on separate plants. The fruits are dark red, fuzzy berries in similar dense clusters. The most important medicinal properties of bark and leaves are astringent, antiseptic, alternative and tonic, and the berries have refrigerant, diuretic, emmenagogue, diaphoretic and cephalic medicinal characters.

Root bark is useful in the treatment of gonorrhea, gleet, leucorrhea, scrofula, diarrhea, restless fever, scrofula, and profuse perspiration from debility.

Combined with the barks off white pine and slippery elm and applied externally, used effectively to treat syphilitic ulcerations, old sores, canker sores, wounds, and ulcers. All in all, the most important health benefits of Sumac are a) it is a powerful antioxidant, b) fights fungal infections, c) fight germs, d) it is good for diabetes, e) it is a diuretic, f) fight with cancer, g) it is beneficial for women's health. Sumac tea is a source of vitamin D, it is a good cure for colds and flu; sumac tea is also considered to be a mixture for asthma, shortness of breath, diarrhea, cough, sore throat, and infections.

The results of this review manuscript demonstrates that Sumac can be a safe and effective natural and sustainable medicine for treatment and prevention of so many diseases in a sustainable life.

**Conflict of interest:** All authors declare no conflict of interest.

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