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Review article

Properties of Sumac Plant and Its Importance in Nutrition

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Abstract

Sumac is the common name of the *Anacardiaceae* family, belonging to the *Rhus* genus, with more than 250 species of flowering plants, and the most known among these species is *Rhus coriaria*. When the general characteristics of the *Anacardiaceae* family are examined, it is seen that there are plants in the form of bush or shrub, which find themselves naturally distributed in temperate and warm climates. Sumac can also grow in areas that are not suitable for agriculture, and this shows the potential for commercialization of sumac plants without competing for land uses. Sumac, a natural source of bioactive compounds; It has significant potential with components that can be used in many different fields such as organic acids, fatty acids, amino acids, vitamins, minerals, anthocyanins, and phenolic acids. It also shows a strong antioxidant effect due to the phenolic compounds it contains, especially gallic acid and its derivatives. In the food industry, sumac (*Rhus coriaria* L.) is used as a spice and sumac sour to give aroma and flavor in many dishes. It is also considered a valuable raw material for the food industry due to its bioactive components. Today, increasing the usage areas of sumac plant in the food sector and knowing its contribution to human health are increasing the interest of consumers for sumac every day. In this review article, information is given about the properties of sumac plant and its importance in nutrition.

Keywords: Sumac, *Rhus coriaria* L., Sumac plant, Importance in nutrition

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INTRODUCTION

Sumac is a common name given to flowering plants within the genus *Rhus* belonging to the *Magnoliophyta* division, the *Magnoliopsida* class, the *Spindales* group, and the *Anacardiaceae* family (USDA, 2016). Two species of economic value are grown in our country, namely, *Rhus coriaria* L. and *Rhus cotinus* L. but as for a spice and sumac sour *Rhus coriaria* L. type comes to the fore (Caliskan, 2011).

Sumac plant is found in temperate and tropical regions around the world and generally grows in marginal agricultural capacity areas (Sakhr and Khatib, 2020). Looking around the world, sumac; grows widely in the Middle East, West Asia, Southern Europe and North Africa (Basoglu and Cemeroglu, 1984; Baytop, 1999). Sumac is grown extensively in Turkey's western and southern parts. It is also found individually or in groups in the coastal parts of the Marmara and Black Sea regions. It is commonly found in Adana, Ankara, Antalya, Artvin, Çanakkale, Denizli, Gaziantep, Gümüşhane, Hakkari, İzmir, Kastamonu and Kütahya (Basoglu and Cemeroglu, 1984; Kurucu et al., 1993).

Sumac is a rich source in terms of tannin, phenolic compound, anthocyanin, organic acid, vitamin, mineral, oleic and linoleic acid (Zargham and Zargham, 2008; Kossah et al., 2009; Kossah et al., 2010). *Rhus coriaria*, being rich in phytochemical, has become an important plant for researchers; leading to various bioactivity studies, and as a result of these studies, some important biological effects of sumac such as antidiabetic, antibacterial, antifungal, hypolipidemic and antioxidant effects were determined (Under and Saltan, 2019).

Apart from the production of food products for human consumption, there is a need to use agriculturally suitable land worldwide to produce naturally sourced, industrial and healthy chemicals (Ignaciuk et al., 2004; Berndes, 2006). Therefore, studies to identify and research industrially valuable plants that require very little fertilizer use, have little or no irrigation need, can grow on marginal soils, have a rich potential in terms of bioactive components continue (Berndes, 2006; Perlack, 2006). Sumac can also be grown in areas that are not agriculturally suitable, and its various species are used by local people for medicinal and other purposes, demonstrating the potential of these plants to commercialize their bioactivity without competing in land using for food production (Van Wyk and Wink, 2004).

Sumac is of high economic value, and its consumption is increasing day by day around the world. In economic terms, the fruits and leaves of sumac are extensively used in the food, pharmaceutical, leather, and dye industries (Abu-Reidah et al., 2014; Kizil and Turk, 2010; Shabbir, 2012). Sumac in the food industry (*Rhus coriaria*) is used as a spice or sumac sour in many dishes to give aroma and flavor due to its sour taste caused by the organic acids it contains. Besides, sumac oil is rich in oleic and linoleic acids and therefore sumac can be considered a valuable raw material for the oil industry (Mavlyanov et al., 1997; Unver and Ozcan, 2010).

Sumac is a product subject to foreign trade and is exported to various countries such as the USA and Belgium (Anonymous, 2016). Turkey Statistical Institute indicates the figures obtained from records as sumac, according to foreign trade figures between the years 2009-2018 in Turkey; it can be seen that sumac is exported to foreign countries and the total exports are 15.354.927 kg and the amount of revenue is 34.216.110 dollars. Besides, it has been determined that in this decade, without being affected by the global crisis, the amount of sumac export has increased over the years, and the amount of import increased or decreased varying in years, depending on the domestic demand (Karadas, 2019).

Sumac plant (*Rhus coriaria*) is seen as a valuable source in terms of nutrition, as it has rich in oil, fatty acids, minerals, vitamins and phenolic compounds. With this review, the necessity of increasing agricultural production and extending the use in nutrition due to the properties of the sumac plant and its important compounds has been revealed.

Sumac Plant and Its Composition

Sumac plant can grow naturally in temperate and hot climates, at 600 - 1900 m altitude, in stony and rocky areas, roadside slopes, bushes and forest areas. (Basoglu and Cemeroglu, 1984; Baytop, 1999). Sumac kernel is very hard, brown-gray in color and covers the fruit flesh with a sour taste around the kernel. Sumac fruits are in the form of round or slightly flattened lentils and have a single core and the fruits turn a dark red color when ripe (Basoglu and Cemeroglu, 1984).

Some physical properties of the plant have special importance in post-harvest processes. These features are useful for designing processing, storage and handling equipment. For example, seed size and shape are important factors in choosing the appropriate sieve (Ozguven and Vursavus, 2005; Oke et al., 2007).

Ozcan and Haciseferogullari of (2004) in Turkey; Mazaheri et al. (2017), as a result of a study they conducted with sumac harvested in Iran, some physical and chemical properties of sumac fruits are shown in Table 1. The values obtained from samples of sumac that grew in Turkey and Iran were found to be roughly similar.

Table 1. Some physical and chemical properties of sumac fruits (Özcan and Haciseferogullari, 2004; Mazaheri et al., 2017).

Physical Property	**Sumac (Turkey)**	**Sumac (Iran)**
Length (mm)	4.72	4.84
Width (mm)	3.90	4.27
Thickness (mm)	2.64	2.4
Weight (g)	0.018	0.016
Average Diameter (mm)	3.64	3.67
Volume (mm³)	19.49	19.51
Sphericity	0.77	0.74
Chemical Property	**Sumac (Turkey)**	**Sumac (Iran)**
Moisture (%)	10.6	9.9
Crude Oil (%)	7.4	7.1
Crude Protein(%)	2.6	2.43
Crude Fibre (%)	14.6	-
Energy (kcal/100g)	147.8	-
Ash (%)	1.8	1.86
Water Soluble Extract (%)	63.8	-
Acidity (%)	4.6	-
pH	3.7	2.71

Sumac plant leaves; while they contain flavonoid, bi-flavonoid, gallotanene, gallic acid, sugar, wax and essential oil (Kurucu et al., 1993), sumac fruits contain tannin, flavone, organic acid, anthocyanin, vitamins, minerals and fixed oil (Brunke et al., 1993). Table 2 shows the main fatty acids, mineral substance and vitamin contents of sumac fruits.

Table 2. Fatty acid composition, mineral substance and vitamin contents of sumac fruits (Ozcan and Haciseferogullari, 2004; Kossah et al., 2009; Kizil and Turk, 2010)

Fatty Acid	**Quantity (%)**	**Mineral**	**Amount (ppm)**	**Vitamin**	**Amount (ppm)**
Oleic Acid	37.7	K	7963.35	Vitamin B6	69.83
Linoleic Acid	27.4	Ca	3661.57	Vitamin C	38.91
Palmitic Acid	21.1	P	1238.74	Vitamin B1	30.65
Stearic Acid	4.7	Mg	855.95	Vitamin B2	24.68
Other Fatty acids	9.1	Fe	144.53	Nicotinamide	17.95

Kizil and Turk (2010) determined at the end of their study that the main fatty acids contained in sumac oil are oleic acid (37.7%), linoleic acid (27.4%) and palmitic acid (21.1%). It is thought that the use of sumac oil in the diet can create a healthy composition for nutrition, especially due to the high amount of oleic acid (Kizil and Turk, 2010; Duru and Bozdogan Konuskan, 2014).

Ozcan and Haciseferogullari (2004) determined as a result of their study the mineral content of sumac: (7963.35 ppm), calcium (3661.57 ppm) and phosphorus (1238.74 ppm) and stated that the fruits of sumac contain more potassium than different fruits. As can be understood from here, it can be seen as a good food source to increase the dietary intake of some minerals such as potassium and calcium.

In a study examining the vitamin contents, it was found that sumac contains high levels of vitamins B6 (69.83 mg/kg), C (38.91 mg/kg) and B1 (30.65 mg/kg). When the amino acid content of sumac fruits was examined, it was determined that they were rich in essential amino acids leucine and lysine, and non-essential amino acids in aspartic and glutamic acids (Kossah et al., 2009).

The sour taste of sumac fruit depends on the organic acids (malic, citric, etc.) it contains (Brunke et al., 1993). When examining the organic acid content of sumac fruits grown in Syria, Kossah et al. (2009) determined malic acid as 1568.04 mg/kg, citric acid 56.93 mg/kg, tartaric acid 2.15 mg/kg and fumaric acid 3.40 mg/kg. When Yuksel (2018) examined the organic acid content of sumac collected from different districts of Tunceli province, it was found that the highest rate belongs to malic acid.

Ardalani et al. (2016), as a result of a study they conducted with sumac grown in Iran, 191 compounds were identified in *Rhus coriaria*. These were as follows: 78 hydrolyzable tannins, 59 flavonoids, 9 anthocyanins, 2 isoflavonoids, 2 terpenoids, 1 diterpene and 40 other unidentified compounds. According to this study, hydrolyzable tannins constituted the highest percentage in sumac fruits, followed by flavonoids. These determined compounds affect the antioxidant capacity of the sumac fruit.

Conclusion

As a result of this compilation; it has been observed that it is a rich source of the mineral, vitamin, and organic acid contents and can be considered as a potential source of unsaturated fatty acids, especially oleic acid. Therefore, sumac can be considered a good source of ingredients for the food industry.

Besides, sumac (*Rhus coriaria* L.) is a plant that can be consumed by the public safely and healthily as long as the correct storage and conserving conditions are provided, and it is recommended to increase the production of sumac, which is collected from nature, and to increase its conscious use among the public.

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