CHAPTER 4

ROSEHIP: IS IT A MIRACLE FOR HEALTH?

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1. Introduction

Rosa canina is a species with great potential for distribution in Türkiye's forests. For this reason, rosehip is of great economic, ecological and social importance in Turkey. Its fruits contain bioactive components, many of which are known as phytochemicals, such as ascorbic acid, flavonoids, dimethyl sulfur, protein, tannin, Na, K, P, Mn, Mg, C, A, B, K, P vitamins, flavones, malic acid, pectin, stronelol. Besides, its seeds contain vanillin. It is known that the fruits are used to calm the blood, strengthen the blood, relieve whooping cough, cold, cough and pain, prevent cardiovascular diseases, cancer, prevent gastritis and ulcers, against diabetes, and the leaves are used against constipation and malaria. Its fruit is dried and used as tea. Its flowers and fruits are used in making jam, syrup, marmalade and liqueur. There is also information that a type of medicine used in the treatment of rabies was used in the past.

The great physician Ibn Sina (980-1037 AD) mentioned Rosa as alighol-kalb in his book "The Law of Medicine" and stated that it could cure ulcers, including mouth ulcer, and give strength to the gums and the body (Sharafkandi 2008). With these properties, it is considered the most easily accessible medicinal plant in rural areas in terms of public health (Yücel et al. 2019). In addition, it is known as the most effective remedy against hemorrhoids and diabetes mellitus in Turkish folk medicine (Orhan et al. 2009). Additionally, the roots and leaves of the plant have also been used against bronchitis (Fujita et al. 1995).

Rosa is very popular in traditional medicine. Boiled fruits are used as a diuretic and strengthener. When consumed with honey, Rosa juice can act as a diaphoretic and relieve colds, hypertension and liver disorders. Local people of Central Asia make jam from wild rose petals and use it as a heart strengthening and sedative. Boiled Rosa galls are used in the treatment of stomach ulcers, duodenal ulcers, malaria and pulmonary tuberculosis (Sokolov et al. 1977). Boiled rosehip treats stomach cancer. Boiled hips helps eliminate hemorrhoids, soothes pain and burning.

Hippocrates used rosehip in the treatment of gallbladder disease. Dioscorides also used it for abdominal pain. In Chinese traditional medicine, Rosa roots are used as an anthelmintic. In Tibetan traditional medicine, Rosa flowers are used to treat neurasthenia, atherosclerosis and tuberculosis. In

Mongolian traditional medicine, Rosa is used to treat headaches, dizziness, skin burning. In Bulgarian folk medicine, fruits and Rosa flowers are used as a diuretic and sedative (Jordanov et al. 1972; Tolekova et al. 2020).

2. Botanical Classification and General Herbal Evaluations

Rosehip is known as the fruit of the *Rosa canina* L., which belongs to the *Rosacea* family. The color of the fruit varies from red to orange, and approximately 71% of the fruit consists of pericarp and 29% seeds. Its average weight is between 1.25 and 3.25 g. Its fruit; It is rich in bioactive compounds such as vitamin C, carotenoids, tocopherol, phenolic acid, bioflavonoids, tannin, pectin, organic acids, amino acid, essential oil and unsaturated fatty acids. Additionally, rosehip is considered an alternative source of lycopene, containing 2.9-35.2 mg of per 100 grams fruit. Therefore, it can be used as effective antioxidants because it contains significant amounts of phenolic compounds (Yilmaz and Ercişli 2011). Dog rose, or *Rosa canina* L., grows wild over large areas in Europe, North Africa and Western Asia.

The genus *Rosa* includes approximately 100 species that are widespread in Europe, the Middle East, Asia and North America (Nilsson 1997) (Figure 1). It is a perennial, deciduous shrub with a thorny, thin stem, varying between 2-3 meters in height. The colors of its flowers vary from light pink to dark pink and white. The flowers are 4-6 centimeters in diameter and turn into red orange fruits when ripe. Rosehip, which is particularly well adapted to poor, dry and rocky soils and drought, can be propagated by many different methods (such as seeds, bottom shoots, cuttings, dipping and tissue culture).



Figure 1. Distribution area of wildrose on different contries (Tolekova et. al. 2020).

The name "dog rose" is its oldest name, as there are records that it was used in the treatment of dog bites for the first time in history. In addition, Avicenna (980-1037 AD), one of the oldest and most famous physicians in history, mentions *Rosa canina* L. as alighol-kalp in his work "The Canon of Medicine" and states that it can heal ulcer, including mouth ulcer. It states that it can strengthen the gums. Rosehip, an important source of vitamin C, is an effective medicinal plant used in the treatment of gingivitis and swollen or bleeding gums, which are the main clinical symptoms of scurvy (vitamin C deficiency) (Tolekova et al. 2020; Khazaei et al. 2020).

3. Considerations for Traditional Medical Use

As it is known, since vegetables and fruits are an important source of phytochemicals and other bioactive compounds, they are also considered as a serious source of therapeutic products that can prevent, alleviate or cure many diseases. Reactive Oxygen Species (ROS) play an important role in the development of these diseases. Sometimes the presence of ROS in the organism is beneficial because they are used in the immune response to kill extracellular

bacteria. However, ROS can also contribute to undesirable effects because they trigger oxidation processes. When free radicals are produced in a living organism, many antioxidants act to protect the organism from oxidative damage.

The organism has three lines of defense in combating oxidative stress. The first line of defense consists of peroxidases and metal-binding proteins and prevents the formation of ROS. Secondly, it has been stated that polyphenols obtained from *R. canina* fruit have anti-cancer properties. This may also be due to the abundance of the carotenoid lycopene. Finally, the organism's third line of defense consists of enzymes that repair lipids, proteins, sugars and DNA from oxidative damage (Okuda 2005; Gupta et. al. 2012; Charles 2013) .

It is naturally found in vegetables, herbs, fruits, spices, tea, coffee and cocoa. Different epidemiological studies have shown that this plant-based distribution of disorders can reduce the risk of chronic disease and mortality disorders (Ebrhardt et al. 200; Ganesan et al. 2011).

Nowadays, more importance is given to herbal raw materials as a source of biological active substances. As a result of this great scientific interest, rosehip, a genus of wild plants belonging to the *Rosaceae* family, is widely used medicinally, as a source of vitamins and as a food raw material. The most valuable part of the fruit is known as pericarp and is used in products such as medicinal products, herbal teas, jam and marmalade. It is also used in probiotic drinks (Ahmad et. al. 2016).

Many studies have been conducted to examine the dynamics of vitamin accumulation depending on the forms and types of rose hips. In these studies, geographical location, meteorological conditions, soil, fertilizer application and other environmental factors create more or less differences in bioactive components (Tolekova et al. 2020). With increasing altitude of plants above sea level, the content of ascorbic acid, carotene, catechins, leukoanthocyanins, anthocyanins and flavonols increases, but the content of tannins in fruits decreases (Kotenko et al. 2011). It was determined that the species, change status and harvest time were important in the bioactive profile of rosehip. Ripe fruits contain high tocopherol and β-carotene, while mature fruits have high levels of ascorbic acid. This situation is supported by the literatures (Barros et al, 2011; Roman et al. 2013; Demir et al. 2014). At the same time, rosehip fruit as well as its leaves have a rich chemical composition. Leaves rank second in

ascorbic acid content relative to the vegetative part of the plant. The presence of biologically active substances such as carotenoids, chlorophyll, tocopherols and flavonoids is evident in the leaves (Ghazghazi et al. 2010) (Fig.2).

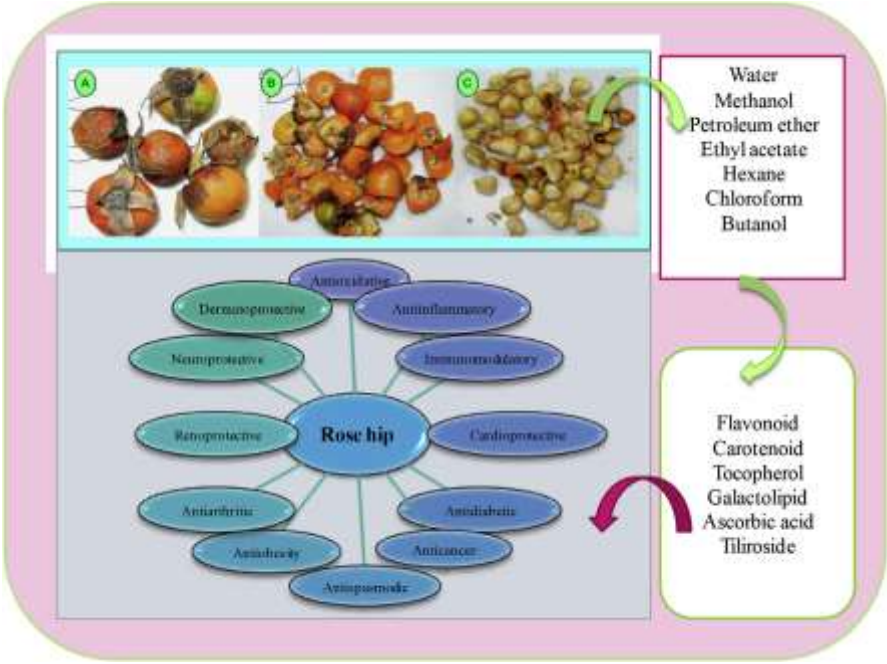


Fig. 2. (A) Ripe rose hips (B) Fragmented rose hips (C) The seeds. The solvents used for extraction of bioactive fractions, the phytochemicals and the biological benefits (Patel 2017).

Moreover; since *R. canina* has antioxidant properties, the possible protective effects of its fruits against the genotoxic effects of ethyl methanesulfonate were investigated by *Drosophila* wing somatic mutation and recombination test. Test results revealed the potential of *R. canina* as a natural genoprotective product (Kasimoğlu and Uysal 2016). A study on six plant species in 2010 year, including Rosa, collected from Southern Europe, showed that this plant has excellent antioxidant properties, so it can be used as an alternative to synthetic antioxidants (Egea et al. 2010).

Rosehip is rich in polyphenolic compounds such as proanthocyanidins and flavonoids such as quercetin and catechin (Türkben et al. 2010). It has been observed that the high phenolic and flavonoid content of rosehip is associated with antioxidant activity (Wenzig et al. 2008), and rosehip extract containing

these phenolics shows significant antioxidant activity even when deprived of vitamin C (Daels-Rakotoarison et al. 2002) (Table 1). This activity includes protective effects against oxidative stress, increased activity of antioxidant enzymes such as superoxide dismutase and catalase, and protective effects on intercellular communication (Yoo et al. 2008).

Tablo 1. *Rosa* species, the phytochemicals in the rose hips and biological functions (Patel 2017).

Biological function	**Rosa species**	**Phytochemicals**
Antioxidative (Hepatoprotective, prevent schemic stroke, antidepressant, prevent kidney stone)	*R. laevigata* Michx *Rosa damascena* Mill. *R. canina*	Flavonoids Tiliroside
Immunomodulation and anti-inflammation (Prevent osteoarthritis and rheumatoid arthritis pain; protect gut mucosa)	*R. canina* *R. roxburghii* *R. multiflora* *R. moschata*	Triterpene acid Galactolipid Unsaturated fatty acids
Cardiovascular	*R. laevigata* Michx	Flavonoids
Anti-obesity and antidiabetic.	*R. canina* L.	Tiliroside
Anticancer and antimicrobial	*R. canina* *R. nutkana* *R. woodsii*	Polyphenols Phenolic contents Lycopene
Cosmetics	*R. canina*	Proanthocyanidins

Rosehip also has anti-inflammatory, anti-diabetic and anticancer effects. Much of the anti-inflammatory effect that rosehip has has been attributed to its high amounts of galactolipids, a class of compounds that have recently been shown to have antitumor-promoting and anti-inflammatory activity both in

vitro and in vivo. Rosehip and its constituent galactolipids have also been found to inhibit the production of inflammatory mediators and provide chondroprotective effects in vitro. Unlike nonsteroidal anti-inflammatory drugs (NSAIDs) and aspirin, rosehip has anti-inflammatory effects that do not have ulcerogenic effects and do not inhibit platelets or affect the coagulation cascade or fibrinolysis, thus preventing potential side effects (Cohen 2012). In addition to having a high content of polyunsaturated fatty acids, R. canina has also been found to have significantly high antioxidant components (Kayahan et al. 2022).

Phenolic compounds and ascorbic acid found in rose hips provide health benefits. Ascorbic acid has positive effects on cognitive decline and Alzheimer's disease. Rosehip is also rich in vitamin C, carotenoids, tocopherol, bioflavonoids, tannins, essential oils and pectin. (Fig. 3 and 4) (Ercişli et al. 2007; Demir et al. 2014), these pseudo-fruits are It is thought that it can constitute an alternative antioxidant source for the food industry and can also be used for therapeutic purposes. The distinctive orange to red color of rose hips occurs as a result of various carotenoids. The most abundant of these are β-carotene and lycopene, followed by β-cryptoxanthin, rubixanthin, zeaxanthin, and lutein (Hodisan et al. 1997; Anderson et al. 2011).

Carotenoids and tocopherols are compounds important to human nutrition. Carotenoids can prevent some diseases and cancer by acting as provitamin A, while tocopherols have vitamin E activity and have the ability to scavenge free radicals. These compounds are natural antioxidants important for human health (Mayne 1996; Marmol et al. 2017). The antioxidant properties of tocopherols in rose hips are based on their ability to form stable, small reactive radicals as a result of the dissociation of a hydrogen atom from a hydroxyl group after interaction with active radicals (Smirnova et al. 2008).

Another important phytochemical in the species known as rosehip is quercetin. Quercetin is the most abundant flavonoid that forms glycosides with different sugar structures and accumulates in higher plants (Schieber et al. 2003). Quercetin and its derivative quercetin-3-O-glucuronide provide chemoprotection of mitochondrial function through antioxidative effects by preventing excessive production of reactive oxygen species (Guo et al. 2013). As a matter of fact, many researchers have found in their studies on Rosa species in different geographies that vitamin C, quercetin and ellagic acid are

the most abundant phenolic compounds (Ercişli et al. 2007; Fuji and Saito 2009; Tumbas et al. 2012).

Rosehip seeds contain oil and minerals. The fatty acids in the seed are mainly represented by linoleic, oleic, linolenic, palmitic, stearic and arachidonic acid (Özcan, 2002). The amount of oil in the seeds varies between 5% and 18% depending on the species. In rosehip, 97% of the seed oil consists of linoleic, oleic, palmitic and stearic acid; The remaining 3% consists of 12 minority fatty acids (Novak 2005). The oils in its seeds are mainly used in the cosmetic industry and pharmaceutical industry. Its fruits increase the biosynthesis of collagen, stimulate the immune system, and increase body resistance against constant effort (Kılıçgun and Dehen, 2009; Orhan et al, 2009). It has been determined that rosehip oil components such as citrenellol, geraniol and nerol mediate antibacterial effects (Boskabady et al. 2011). In many studies conducted on mice with rosehip extracts, it has been reported that *R. canina* extract has anti-dementia properties and improves spatial learning and memory (Daneshmand et al. 2016).

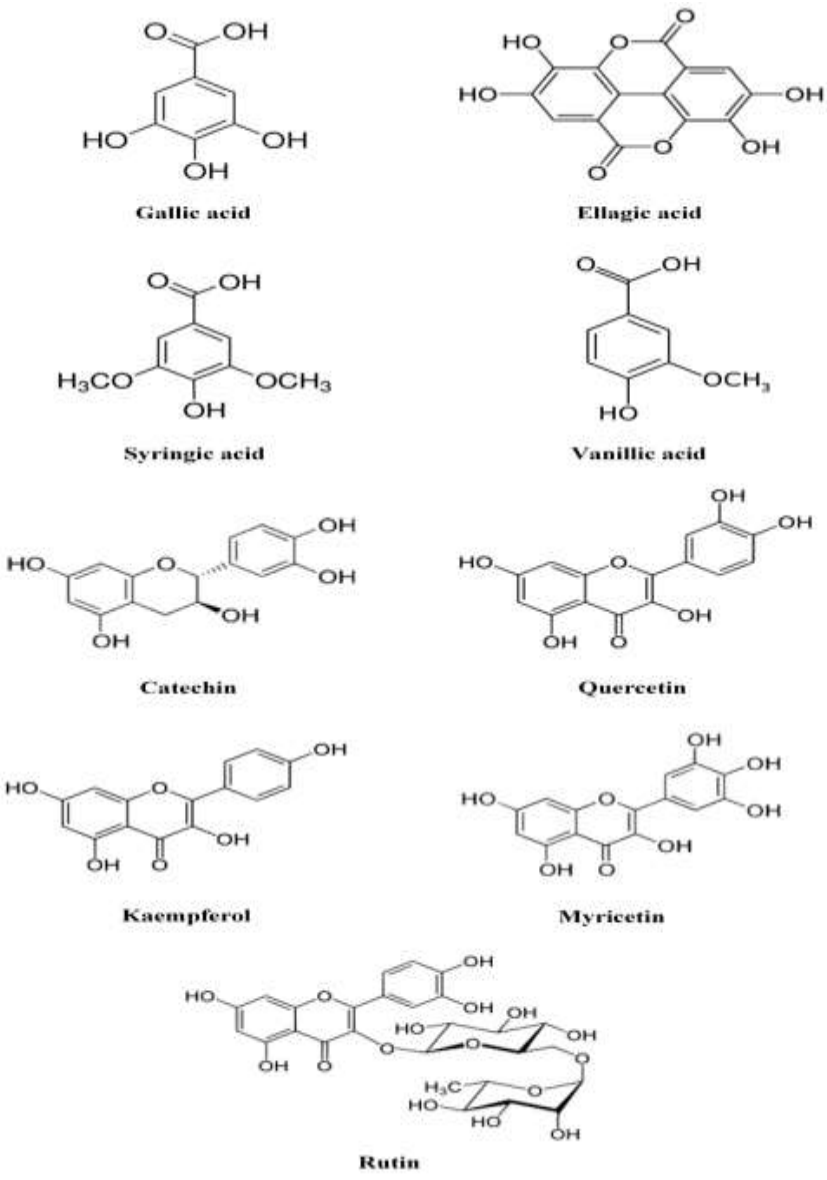
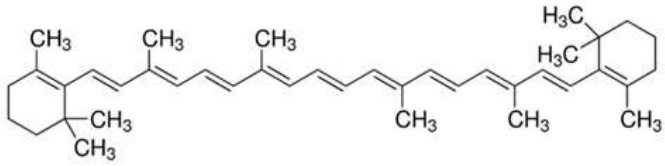
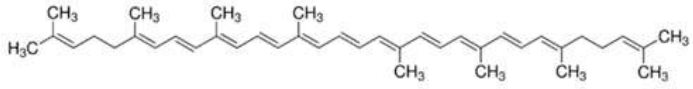


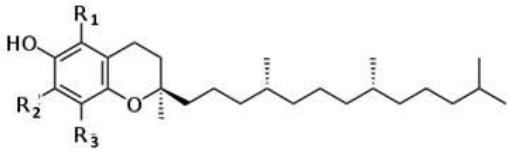
Figure 3. Chemical formulas of hydrosoluble phenolic compounds of rose hips.



β-Carotene



Lycopene



	R_1	R_2	R_3
α-Tocopherol	CH_3	CH_3	CH_3
β-Tocopherol	CH_3	H	CH_3
γ-Tocopherol	H	CH_3	CH_3
σ-Tocopherol	H	H	CH_3

Figure 4. Chemical formulas of lipid-soluble antioxidants of rose hips.

Reproductive system disorders have become one of the important health problems all over the world in recent years and their incidence is rapidly increasing. Synthetic drugs cause high costs and serious side effects. Research has shown that herbal products can be used effectively in the management and treatment of male and female reproductive disorders (Farzana et al. 2017). As a result of an in vivo study on the effects of *R. canina* extract on body and testicular weights, serum testosterone levels, number of germ cells and Sertoli cells, sperm parameters, average testicular seminiferous luminal and tubular and epithelial height in mice, it was determined that the extract had protective effects against reproductive toxicity. (Nowrouzi et al. 2019).

Rosehip may achieve promising results in cancer treatment. The antitumor effect of this fruit is related to its phytochemical composition, and

studies conducted in different regions have yielded different results. It has been proven that *Rosa canina* has a stopping effect on cancer cells with its phenolic contents. (Thanan et al. 2014; Guimarães et al.2015).

Rosehip (Rosa canina L.) is prominently used in the prevention and treatment of rheumatoid arthritis (RA) (Kirkeskov et al. 2011). In particular, rosehip powder reduced symptoms associated with rheumatoid inflammation in clinical studies (Kharazmi and Winther 1999; Cohen 2012). Some phytochemicals found in plants provide positive effects in the treatment of osteoporosis. In related studies; The high antioxidant content of Rosa canina reduced the damage caused by excessive ROS in bone tissue and increased bone formation by stimulating collagen matrix synthesis and osteoblast differentiation (Devareddy et al.). 2008).

Rosa canina also has anti-aging activity. Positive results have been reported in many studies on this subject. These positive effects are related to their antioxidant content. So that; Some phytochemicals act by scavenging reactive oxygen species produced by UV radiation and thus reducing skin damage. Of these, vitamin C may have multiple effects in protecting the skin, as it plays a direct role in collagen formation along with its antioxidant effect. In addition, some components of *Rosa canina* may have a protective effect against UV-induced inflammation and damage, as they have an anti-inflammatory effect. Moreover; Antioxidant compounds and polyunsaturated fatty acids both prevent cell membrane damage This effect explains the effects of *Rosa canina* in extending the lifespan of red blood cells (Marmol et al. 2017).

Studies on the contents of rosehip roots are too limited. A study conducted on the roots of *R. canina* and *R. pimpinellifolia* species, traditionally consumed in the Eastern Anatolia Region of Turkey, has shown that rosehip root parts contain quite high levels of phenolic compounds. Although current studies have mostly focused on rosehip fruit, cyanidin has been detected in the roots of black rosehip (*Rosa pimpinellifolia* L). Indeed, this substance is a major component of the anthocyanin class of flavonoids. Unlike the fruit parts, phenolic compounds such as epicatechin, gallic acid, syringic acid, quercetin dihydrate and naringenin have been determined in the roots of *R. canina* and *R. pimpinellifolia*. It has been observed that catechin and its derivatives are concentrated in both the fruit and root parts of both species. In the study, it was

observed that the roots of *R. pimpinellifolia* and *R. canina* contained higher amounts of phenolics compared to the fruits (Macit et. al. 2023).

In light of all the issues tried to be explained above; Due to all the phytochemical composition it contains, rosehip can be considered an interesting treatment option that should be considered for problems involving oxidative stress and/or pro-inflammatory state in humans.

3. CONCLUSION

Phenolic compounds and ascorbic acid stand out among the water-soluble phytochemicals found in rose hips. Studies have proven that rose hips have a higher vitamin C content than most edible fruits. Although rosehip extract cannot alleviate complex metabolic, autoimmune, and degenerative diseases, it can support the body's healthy redox state. The extracts have been confirmed to be beneficial against fatty liver, osteoarthritis, rheumatoid arthritis, obesity, cancer, kidney stones, depression, skin problems and other pathologies. Consumers' increasing use and demand for nutritional supplements today further increases the importance of this plant. Although potential functional food resources are being wasted before our eyes, food insecurity has become critical, especially in developing countries. However, it is true that additional research is needed on the differentiation of the contents of fruits, leaves, seeds and roots according to species, altitude, ecology and even ripening periods. Therefore, to ensure that rosehip consumption does not cause any adverse health effects, additional empirical analyzes regarding the nutritional profile of rosehips are needed.

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