

## Review Article

# Medicinal Properties of *Rosa canina* L.

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## Abstract

Dog rose or *Rosa canina* L. is a perennial shrub that belongs to Rosacea family. It grows wild at the margin of forests, puddles of water, shrubberies and pastures. *Rosa canina* L. has been used for long years as a source of vitamins, medicinal supplements, and food throughout the world. It contains various vitamins (especially vitamin C) and other valuable compounds such as polyphenols, carotenoids, carbohydrates and fatty acids. The medicinal properties of rose hip in the symptomatic treatment of osteoarthritis, rheumatism and common cold are discussed in this paper. Moreover, there are evidences about anti-bacterial, anti-cancer, anti-diabetic and anti-obesity properties of this medicinal plant that have been reviewed in this article.

**Keywords:** *Rosa canina* L., antioxidant, diabetes, obesity, antibacterial, vitamin C

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## Botanical and Historical Aspects

Roses are among the most important horticultural and industrial products with multiple uses. They can be used as cut or garden flowers (1). Moreover, roses have been used for long years in the production of foods and perfumes and in cosmetics industry (2). Rose hip is the fruit of *Rosa canina* L. plant that belongs to Rosacea family. The color of rose hips particularly varies from red to orange, comprised of approximately 71% pericarp and 29% seed. It weighs 1.25 to 3.25 g. These fruits are rich in bioactive compounds including vitamin C, carotenoids, tocopherol, phenolic acid, bioflavonoids, tannin, pectin, organic acids, amino acid, essential oil and

unsaturated fatty acids (3-5). Furthermore, rose hip has been considered as an alternative source of lycopene which contains 2.9-35.2 mg lycopene per 100 g (6). Therefore, rose hips are capable of being used as efficient antioxidants mainly due to the presence of considerable amounts of phenolic compounds (3).

Dog rose, or *Rosa canina* L., grows wild in wide areas in Europe, North Africa and West Asia. It is a perennial and deciduous shrub, ranging in height from 2-3 meters that has slender stems with thorns. The colors of its flowers vary from light pink to dark pink and white. The flowers are 4-6 centimeters in diameter with 5 petals that finally mature into red-orange fruits. This plant is highly resistant to environmental problems such as poor and dry rocky

soils (7).

The multiplication of this plant takes place via its seeds or basal shoots as well as through layering, cutting and tissue culture (8). It is used as the most important stock of ornamental roses in that it is resistant to drought stress.

Pliny the Elder (23-79 AD) was the first person who described the medicinal properties of *R. canina* as he observed its use among French ethnic groups in the treatment of dog bites. Its usage in the treatment of dog bites gave it the name “dog rose” (9). *R. canina* was also used by a German woman in Europe to make a kind of tea that could treat some diseases. Since high concentration of vitamin C in rose hip enabled it to be the main source of this vitamin in Britain during World War II, the government organized its immense harvest (10). Moreover, the great Iranian physician, Avicenna (980-1037 AD), refers to *Rosa canina* L. in his “The Canon of Medicine” as alighol-kalb (the gross of dog) and explains that it is capable of healing ulcers, including mouth ulcers, and strengthening the gum (11). As a wonderful source of vitamin C, rose hip is an efficient medicinal plant to be used in the treatment of gingivitis and swollen or bleeding gums (12-15), which are of the main clinical manifestations of scurvy (vitamin C deficiency).

The significance of *R. canina*. was confirmed in a research which maintains that 23 kinds of stamps with pictures of this plant have been published in 19 countries (16). It has to be noted that different parts of this plants have been traditionally used to treat various diseases. Its root, for instance, has been used to cure cough, hemorrhoid and dysuria. Its leaves are used in the treatment of the common cold, influenza and cough, and its branches are useful in the treatment of urolithiasis. Furthermore, its fruit has been utilized in the treatment of asthma, bronchitis and the common cold. Finally, its seeds have been used to treat osteoarthritis, rheumatism and gout (17). Traditionally, *R. canina*. hip has been used for making marmalades and soups in Scandinavia. It is also used in some parts of Europe as tea (17). Moreover, it has traditionally been used fresh in some areas in Iran, including Lorestan and Ardabil to make tea, foods or drinks.

### **A Comparison between the Compounds in Seeds and Peel of *R. canina*. Hip**

Rose hips are known to have the highest vitamin C content (30–1300 mg/100 g) among fruits and vegetables (18). They also contain other vitamins and minerals, carotenoids, tocopherols, flavonoids, fatty acids, tannins, pectin, sugars, organic acids, amino acids and essential oil (19, 20).

The amount of efficient compounds varies in different parts of rose hip. Different parts of rose hip (seeds and peel) were separately examined in order to determine the amount of vitamin C. The results indicated that this plant contained a considerable amount of vitamin C, especially in the peel, while the seeds contained the greatest amount of oil (21).

Schwager *et al.* compared the compounds of rose hips that contained seeds with seedless rose hips. The content of fatty acids (FAs) in rose hips with seeds was four times as much as seedless rose hips. Likewise, polyunsaturated fatty acids (PUFAs) and linoleic acid in rose hips with seeds were 7 times as much as seedless rose. The seeds contained a greater amount of FAs. However, the amount of vitamin C and  $\beta$ -Carotene was approximately the same in both products; whereas, the amount of triterpenoids, galactolipids, lycopene and vitamin E was greater in seedless rose hips (22).

### **The Composition of Rose Hip Essential Oil**

Seventy nine compounds were identified from the volatile oil of rose hip via GC/MS. The main compound was vitispirane (isomer) (10.3%). Other characteristic compounds were hexadecanoic acid (>7%),  $\alpha$ -E-acaridial,  $\beta$ -ionone, dodecanoic acid and linoleic acid (>5%) (23).

In another study, the volatile compounds of *R. canina* hip included alcohol, aldehyde, ketone, monoterpenoid and sesquiterpenes. Among alcoholic compounds, 2-hexen-1-ol and 1-hexanol were identified as the major compounds, and their amounts were (4.95-35.13  $\mu$ g/kg) and (10.93-48.02  $\mu$ g/kg) respectively; whereas 2-hexenal (39.93-219.95  $\mu$ g/kg) was recognized as the main compound of aldehydes. Among ketone compounds, two cases were identified, namely 4-octen-3-one (3.09- 6.03  $\mu$ g/kg) and 6-methyl-5-hepten-2-one (39.93-219.59  $\mu$ g/kg). Among sesquiterpenes,  $\beta$ -elemene (1.26-42.91  $\mu$ g/kg) and  $\alpha$ -



**Figure 1.** *Rosa canina* L. flower in Sarab-e Robat, Lorestan, Iran.

humulene (1.01-10.16  $\mu\text{g/kg}$ ) were identified (24).

### Antioxidant Activity

*Rosa canina* L. is rich in vitamins (especially vitamin C) and phenolic compounds. The beneficial properties of *R. canina*. May, to some extent, be related to the phenolic compounds and high amount of vitamin C. Phenolic compounds are capable of having a wide range of biochemical characteristics, including antimutagenic and anticarcinogenic properties. Furthermore, ascorbic acid, as the main water-soluble antioxidant within the body, has anticarcinogenic and other biological properties. Furthermore, ascorbic acid has a significant regulatory function throughout the body because it is engaged in the synthesis of hormones, hormone-releasing factors and neurotransmitters (25).

The amount of vitamin C and phenolic content in 8 kinds of *R. canina* were examined. It varied from 112.20 to 360.22 mg/100 g, and the total phenolic content in the samples varied from 575 to 326 mg/100 g. Moreover, the antioxidant activity of the rose hips, evaluated via DPPH method, exhibited a remarkable correlation to these compounds (26). It is noticeable that the amount of these compounds and the antioxidant properties of this plant depend on its geographical location, growth stage, weather conditions, the time of its harvest, and the methods which are used to store and extract it (27). Another study indicated that the flavonoids of *R. canina*. have significant antioxidant properties too (28).

The antioxidant defense system in five plant species including *R. canina*. was examined. The results

showed that glutathione reductase had a major role in the protection of chloroplast against oxidative damages. It is also effective in the destruction of hydrogen peroxide (29). The antioxidant properties of the phenolic compounds in *R. canina*. hip has been explored too. The results revealed that these compounds could control oxygen radicals in both cellular and non-cellular systems (30).

A study, carried out in 2010 on six kinds of plants, including *R. canina*. that had been collected from South Europe, indicated that *R. canina*. hip had great antioxidant properties and could be used as an alternative for synthetic antioxidants (31). Since plants are among rich sources of antioxidant compounds, the amounts of antioxidant compounds in dietary plants including different kinds of fruits, berries, vegetables, cereals, nuts, and beans were examined. The results indicated that there were over 1000-fold difference among the entire antioxidants in different dietary plants. Rose hip, sour cherry, blackberry, strawberry, raspberry, sunflower seeds and pomegranate were the plants with the greatest amount of antioxidants (32).

Twenty-five kinds of rose hips were collected in Turkey to be examined in terms of their antioxidant properties. The results revealed that the selected genotypes which are highly rich in phenolic compounds revealed great antioxidant properties (33). Rose hip contains higher amounts of different antioxidants compared to many other fruits. Furthermore, some studies have indicated that the amount of carotenoids in rosehips exceeds many fruits; e.g., this level in rosehips is 6 to 7 times as much as blackberry (34).



**Figure 2.** Rose hip of *Rosa canina* L.

### Antibacterial Activities

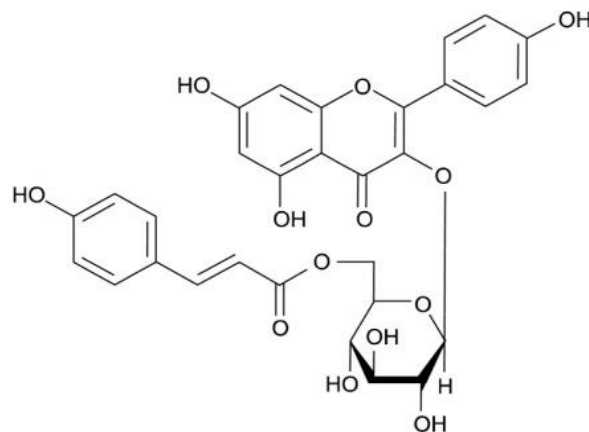
The antibacterial activities of *R. canina*. hip have been confirmed in many scientific researches. A study conducted in Turkey to examine the antibacterial activities of some rose species (*Rosa pisiformis*, *Rosa canina*, *Rosa villosa*) revealed that antibacterial activities varied in the ethanolic extracts that had been achieved from different species of rose hips. Meanwhile, the minimal inhibitory concentration (MIC) for *Yersinia enterocolitica*, *Enterococcus faecalis* and *Bacillus cereus* ranged from 9 to 11 mm. The results of this research indicated that *R. canina*. had the greatest antibacterial activity compared to other examined species (35).

The studies carried out concerning the antibacterial activities of different rose species showed that their significant antibacterial activities resulted from their phenolic and some other compounds (36-37). Antimicrobial effects of ethanolic and methanolic extracts of *R. canina*. dry petals were examined in another study. Five types of microorganisms including two species of Gram-negative bacteria (*Escherichia coli* CCM 3988 and *Pseudomonas aeruginosa* CCM 1960), and three fungi, namely *Aspergillus niger*, *Fusarium culmorum* and *Alternaria alternate* were utilized. The greatest antimicrobial effect of the ethanolic extract of *R. canina*. was discovered to be primarily against *Pseudomonas aeruginosa* CCM 1960 and *Escherichia coli* CCM 3988, and then against the *Aspergillus niger*, *Fusarium culmorum* and *Alternaria alternata* fungi respectively (38).

### Anti-diabetic Properties

Rose hip has been traditionally used in the treatment of diabetes in Iran (39). It has been indicated that *R. canina*. fruits contain volatile compounds, phenolic compounds and other antioxidant compounds which might be efficient in the treatment of diabetes mellitus (24). A clinical trial was carried out to analyze the impact of the aqueous extract of rose hip on patients with type 2 diabetes. The results indicated that the administration of rose hip aqueous extract in patients with type 2 diabetes for three successive months might result in the reduction of fasting blood glucose and serum total cholesterol/HDL-C without any side effect in patients (39). Moreover, a significant hypoglycemic effect at 250 mg/kg dose of ethanolic extract was observed in streptozotocin-induced diabetic rats (40). In another study, the intraperitoneal administration of hydroethanolic extract of rose hip with doses of 50-300 mg/kg to aloxan-induced diabetic rats, decreased serum levels of glucose, LDL-c, triglyceride, total cholesterol, urea, uric acid, creatinine and alkaline phosphatase (ALP), and at once increased serum HDL-c levels (41). Taghizadeh *et al.* examined the antidiabetic and antihyperlipidemic effects of rose hip extract in streptozotocin-induced diabetic rats. The extract was administrated orally once a day for six weeks in doses of 250 or 500 mg/kg. Rose hip administration led to a significant reduction in both serum glucose and triglyceride levels. Furthermore, there was remarkable improvement in islets necrosis in diabetic rats treated with rosehip extract (42). Fattahi *et al.* proposed, in the

ir *in-vitro* study, that the antidiabetic effects of this plant might be related to the enhanced proliferation of



**Figure 3.** The Chemical Structure of Tiliroside.

pancreatic  $\beta$ -cell (43).

### The Effects of *Rosa canina* L. on the Risk of Cardiovascular Diseases

Some studies have indicated that consumption of Rose hip can contribute to a healthy heart. The possible antihyperlipidemic effects of this plant in diabetic patients or animals were discussed above. In addition, in another study, 31 obese persons received 40 g of *Rosa Canina* fruit powder on a daily basis for more than 6 weeks. Compared to the control drink, the intake of rose hip led to a considerable reduction of systolic blood pressure, total plasma cholesterol, LDL and the ratio between LDL/HDL. Finally, it was concluded that the daily consumption of rose hip powder could noticeably decrease the risk of cardiovascular diseases in obese individuals without any side effects (44).

### The Effects on of *Rosa canina* L. on Osteoarthritis, Rheumatoid Arthritis and Back Pain

One hundred patients with hip or knee osteoarthritis received 2.5 g standard rose hip powder or placebo twice a day for 4 months. The results revealed that, compared to placebo, rose hip powder could remarkably reduce the pain (45). Furthermore, ninety-four patients with osteoarthritis of the hip or knee, who were over 35 years old, were randomly divided into two groups including the placebo group. The members of another group received 5 g rose hip powder daily for 3 months. The results indicated that, compared to the placebo group, treatment with rose

hip could lead to a considerable pain reduction (46).

Another experiment included 112 patients with osteoarthritis of the hip, knee, hand, shoulder or neck. They were divided into two groups. The first group received 5 g rose hip powder daily but the members of the second group were given placebo. The results showed that the first group experienced a significant reduction in pain and stiffness. Moreover, factors such as mood, well-being, and sleep quality were significantly improved in the first group (47).

Other clinical trials also have proved that the consumption of rose hip can result in the reduction of the signs of osteoarthritis and other joint diseases such as rheumatoid arthritis (48). It was reported in a systematic review, that the reduction of osteoarthritis signs through the consumption of rose hip was much greater than those of glucosamine which is a widely used medicine (49).

The reduction of joint osteoarthritis signs has been associated with the anti-inflammatory properties of *R. canina*. The anti-inflammatory properties of this plant have been confirmed in both *in-vivo* and *in-vitro* studies via different methods (50). The main compound of this plant which has anti-inflammatory properties is a galactolipid. It has been shown in an *in-vitro* study that this galactolipid could inhibit chemotaxis of human peripheral blood neutrophils (5). It has also been proved that *Rosa canina* fruit can inhibit both cyclooxygenase-1 (COX-1) and cyclooxygenase-2 (COX-2) which are involved in the inflammation process (51).

### The Anticancer Properties of *Rosa canina* L.

The impacts of various fractions of *Rosa canina* fruit on human colon cancer cells (Caco-2) were examined in an *in-vitro* environment. The data obtained from this study revealed that rose hip extract is an efficient antioxidant capable of having antiproliferative effect in this type of cancer cells (52). The efficacy of *Rosa canina* extract on colorectal cancers has been confirmed in another new study which depicted the selective cytotoxic effect of this extract on human colon adenocarcinoma (WiDr) cell lines compared with normal colon (CCD 841 CoN) cells. The cell cycle arrest was at the S phase. The extract induced apoptosis and repressed telomerase expressions (53). Both studies concluded that rose hip had the potential for the development of new natural anticancer agents.

Another *in-vitro* study showed that rosehip extracts were capable of decreasing cell proliferation in 3 different human glioblastoma cell lines. This inhibitory effect was higher than that of temozolomide, a chemotherapeutic agent which is used to treat human glioblastoma (54).

Furthermore, Lijie Zhong, indicated, in her doctoral thesis, the anti-cancer effects of bioactive compounds from *Rosa canina* fruit in human breast cancer cell lines. It was concluded that xanthophyll esters might be candidates in future breast cancer therapy (55).

In addition, Tumbas *et al.* showed that rose hip flavonoids could have greater cell growth inhibitory effects on HeLa, MCF7 and HT-29 cell lines than other investigated fractions (28).

### Anti-obesity Effects of *Rosa canina* L.

Recent studies have indicated that the main constituents of rose hip seeds have anti-obesity and anti-diabetic properties. These properties results from the rise of fatty acids oxidation in the liver and skeletal muscles (56). The research conducted by Ninomiya *et al.*, demonstrated that *Rosa Canina* fruit aqueous extract contained an active glycosidic flavonoid compound named trans-tiliroside that exhibited a significant inhibitory effect on weight gain in mice. The consumption of tiliroside at a dose of 10 mg/kg in mice might activate the fatty acids oxidation through its effect on the liver (57). It has also been indicated in an *in-vitro* environment that

rose hip extract could have an inhibitory effect on lipid accumulation in fat cells (48). A randomized, double-blind, placebo-controlled clinical trial showed that, daily intake of 100 mg/kg rosehip extract for 12 weeks, could decrease abdominal visceral fat in pre-obese subjects [body mass index (BMI)  $\geq 25$  but  $< 30$ ], and both body weight and BMI decreased significantly in the rosehip group compared to their baseline levels (58).

### Other Effects

Consumption of rose hip tea for three weeks in volunteers increased some of the beneficial bacteria of the bowel (59). Moreover, consumption of rose hip drink was beneficial in the reduction of the abdominal pain of IBS (Irritable Bowel Syndrome) patients (60). Rose hip extract administration for 7 days reduced, probably due to its antioxidant and anti-inflammatory properties, renal ischemia-reperfusion injury in a rat model (61). The protective effects of rose hip against ischemia-reperfusion induced renal functional and structural injuries that were confirmed in another animal study (62). More interestingly, hydroalcoholic extract of *Rosa canina* fruit decreased both urinary calcium contents and the size and number of calcium oxalate calculi in the kidneys in a rat model of experimentally induced nephrolithiasis (61). The hepatoprotective effects of *Rosa canina* fruit extract have been documented in a rat model of carbon tetrachloride-induced hepatotoxicity too (63).

## Conclusion

This review indicates that *R. canina*. is rich in beneficial compounds that can contribute to the maintenance of human health. Since *R. canina*, especially its hip, is rich in vitamin C and phenolic compounds, it has been used for its antioxidant properties to prevent or even treat various ailments. The beneficial effects of the consumption of *R. canina*., however, are not limited to its antioxidant properties. It is indeed valued for its antibacterial and antidiabetic properties too. Moreover, it has been approved in a variety of researches that *R. canina*. is capable of reducing cardiovascular diseases through decreasing blood pressure and LDL without having any side effect. It is also an efficient plant against osteoarthritis and rheumatoid arthritis, especially with

regard to its anti-inflammatory properties and its capacity to reduce pain. Rose hip is even effective against certain kinds of cancer because its consumption can reduce the proliferation of cancer cells. Hence, *R. canina*, is a valuable plant which has significant medicinal properties that have been confirmed in various studies.

## Conflict of Interest

The authors declare that they have no conflict of interest.

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