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Exploring the nutritional and health benefits of Rosa fruit (Hip)

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Abstract

Rosehips the cherry-sized red fruits of a Rose, have been used for eating and other purposes since the ancient times. The Rose fruits (hip) have natural content of vitamin C along with antioxidants, carotenoids, flavonoids, polyphenols, leuco-anthocyanins and catechins. Through recent studies it has found that consumption of Rosehip results in improved joint mobility, thus reinforcing the popular belief that that rosehip can be used effectively to manage osteoarthritis. Through various studies it has been concluded that Rosehips extract has an active anti-inflammatory component GOPO (glycoside of mono and diglycerol) which is most effective in significantly and rapidly reducing crippling joint pain and improving mobility in case of arthritis. It has been reported that that consumption of rosehip discourages accumulation of white blood cells in the joints, thus resulting in significant improvement in individuals suffering from osteoarthritis.

Extracts made from rosehips help in reducing proliferation of cancer cells in addition to serving as an alternative to current chemotherapeutic regimens for glioblastomas. Further fruit acids and pectin in rose hips have been found to have mild diuretic and laxative effect. It has also been found to improve and provide relief to kidney disorder and is helpful in mild constipation.

Keywords: Rosehip, aesthetic value, nutraceutical, anti-inflammatory, antioxidants

Introduction

The genus *Rosa* of Rosaceae family is found in Northern hemisphere with temperate and subtropical climate having 200 different species and 20,000 cultivars ^[1]. Half of the species are found in Asia, whereas rest are distributed around Europe and North America. Thus it is characterized by its great diversity ^[2]. The four subgenera of *Rosa* species are, *Platyrhodon*, *Hesperhodos*, *Hulthemosa* and *Rosa*.

As per Wissemann, V., ^[3] *Rosa canina*, *Rosa multiflora*, *Rosa sellata*, *Rosa gigantea*, *Rosa persica*, *Rosa gigantea*, *Rosa gallica*, *Rosa laevigata*, *Rosa roxburghii*, *Rosa rugosa*, *Rosa woodsii* and *Rosa virginiana* are some of the wild species of rose.

Genus *Rosa* is accompanied by polyploidy, favouring rate of diversification and thus showing hybridity. Ritz *et al.* ^[4] suggested that this was due to its peculiar reproduction of *Rosa Canina*.

Importance of Rosehips

Although rose is an ornamental flower, used worldwide but the wild rose species, in spite of its common occurrence and climatic adaptability they are neglected, due to their unattractive flowers and colour ^[5]. Most of wild rose species has important nutraceutical value. Rose petals are rich in anthocyanin and have high anti-oxidant properties. Rosehips, the cherry-sized red pseudo fruits of a Rose have been used for eating and other purposes since the ancient times. The Rose fruits (hip) is rich in carotenoids, a bioactive compound, ^[6] polyphenols, polyphenols and carotenoids, ascorbic acids, and fatty acids ^[7-8]. Rose hips have antioxidant, hypoglycaemic and antidiabetic activities ^[9].

R. canina fruits have been used as a traditional treatment therapy for the treatment of diabetes in Turkey ^[10]. *Rosa canina* L., the Dog rose, having prophylactic and therapeutic activities can be used to treat different ailments. Arthritis, sciatica, rheumatism, fever, cold or infectious diseases like influenza, gastro-intestinal disorders, disorders of kidney can be treated. ^[11] Patients with osteo-arthritis can efficiently be relieved from stiffness and reduce pain on using Rose hip powder ^[12].

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Rosehips possess high antioxidant activity, due to high content of ascorbic acid present are rich in important dietary antioxidants (3 g/kg to 40 g/kg), thus making them an important dietary constituent. Presence of Betulinic acid helps in inhibition of human immunodeficiency bacteria and viruses. It also has antimalarial, antibacterial, anthelmintic and antioxidant activities. Further as suggested by *in vitro* and *in vivo* experiments, Triterpenoic acids present in rose hip has immunomodulatory properties and Ursolic and Oleanolic acids have hepato protective, antitumor, antihyperlipidemic and anti-inflammatory properties. In addition Galactolipids present had anti-inflammatory, antioxidant, antiviral and antitumor activities.



As per study by Barros *et al.*,^[13] where DPPH radical scavenging effects was seen, it was found that maximum concentration of sugar was seen in petals, galls had greatest anti-oxidant activity, unripe hips showed highest levels of ascorbic acid whereas ripe hips showed maximum content of tocopherols and β -carotene.

Nagatomo (2015)^[14] reported that rosehip extract shows anti-obesity effects and rose hip extract was helpful in decreasing visceral fat and body weight gain. Volatile content of rosehip fruits showed high concentration of alcohol and aldehydes. The aroma in rose hips was related to the presence of high amount of terpenes and sesquiterpenes.

Lipid-Soluble Antioxidants and Pigments in Rose hips

Rosehip constitutes of lipid soluble vitamins namely, A, D, E and P and associated pigments, Tocopherols, tocotrienols and α , β , γ and δ -isomers show vitamin E activity and can scavenge free radicals. A and γ tocopherols are most important natural antioxidants.

Seed oil of various Rosaceae species was studied by Fromm *et al.*^[15] who suggested that the composition of tocopherols was different not only in species of different genera but also in the cultivars of same species. The concentration of tocopherol and tocotrienol was studied by Andersson *et al.*^[16] in four different species of rose, namely *Rosa dumalis*, *Rosa spinosissima*, *Rosa pimpinellifolia* and *Rosa rubiginosa*. They found α and γ tocopherol in fleshy rose hip. The content of tocopherol and vitamin E varied as per harvesting time, species and part of the year.

Carotenoids, which are rich in provitamin A, give the distinctive orange to red colouration to rose hip and is able to prevent chronic diseases and cancer in humans. The carotenoid present in rose hip is lycopene, β -carotene with traces of lutein, β -cryptoxanthin, rubixanthin, zeaxanthin

and lutein^[17-18]. Rose hips also contain lycopene, an important and strong antioxidant. It is helpful in preventing oxidation of Low Density Lipoprotein (LDL) and a number of cellular membranes. Lycopene of rose hips mainly differ in their isomer distribution as compared to that of tomatoes and pink grapefruit.

Bhave *et al.*, 2017^[19] evaluated Rosehip genotypes of *Rosa dumalis*, *R. dumalis* hybrid, *Rosa rubiginosa* and *Rosa spinosissima* and found that β -carotene ranged from 8 mg/kg-373 mg/kg and lycopene was in the range of 13 mg/kg-176 mg/kg, whereas *R. spinosissima* exhibited no lycopene content. *Rosa arvensis*, *R. multiflora* and *Rosa pulverulenta* were in the range from 32 mg/kg-167 mg/kg for β -carotene and from 21 mg/kg-141 mg/kg for lycopene. Carotenoid accumulation in rose hips is characterized by distinct yellow and red colour. Ripening is associated with increase in red coloration indicating increase in carotenoid content^[20]. In middle and late ripening stages seeds of rose hip can be used in cosmetic industry and are effective in removing wrinkles due to its elastase inhibitory activity^[21].

Water soluble Vitamin in Rosehip

Rose hips of the *Rosa* genus have a high content of antioxidants^[22] shows antimicrobial action due to the presence of polyphenols, vitamin C, B, E, all having synergistic effects.

Rosehips are rich source of vitamin C and if in the range of 250-2700 mg/100 g. Fruits also have high ascorbic acid content (160.30 mg/100 g of dry weight). The concentration of vitamin C varies in concentration as it depends on several factors. *Rosa rugosa* was found to have 1200 mg/L of vitamin C whereas *Rosa canna* had 600 mg/L. This was six times higher than that found in *Rosa canina* of Siberia, as studied by Tumbas *et al.*^[23].

The functional characteristics of *R. corymbifera*, *R. alba*, *R. rugosa* and *R. canina* were evaluated by Kayahan *et al.*^[24] Maximum amount of vitamin C was found in *R. corymbifera*, *R. alba*, so these could be the raw material for production of vitamin C.

RP-HPLC assay of rose hips have revealed wide range of L-ascorbic acid ranging from 0.03 to 1.3%. The content of vitamin C depends on biotype of rose hip and altitude. It also depended on geographic area of its origin where higher altitudes showed higher values^[25].

Sugar in Rose Hip

The sugar content in rose hips varies as per species and in fruits and seeds. The major sugar found was glucose followed by fructose. Due to high levels of sugar rose hips have a good taste and can be used in food industry. Seeds of rose species had higher levels of sucrose and maltose than in fruits^[26]. *R. dumalis* and *R. rubiginosa* showed increased amount of glucose and fructose with maturity but decreased on excessive maturity^[21].

Other active compounds of rose hip

High degree of unsaturated lipids are found in pseudo fruit of various rose species (around 5-18%). 97% of oil in seed of rose hip is due to the presence of acids like, oleic, palmitic, linolic, and atearic whereas rest 3% is of fatty acids. In addition to above components rose hip also has considerable amount of vanillic, p-coumaric and ferulic acid^[27]. Linoleic acid is around 40-56%, oleic acid 14-20% and α -linoleic and its derivatives 20-30% of seed oil. In addition

the therapeutic effect on skin disorders by seed oil of rose hip makes for its usage in cosmetic industry.

Microwave sub and supercritical fluid extraction method was used by Syentmihalyi *et al.* [28] to extracted oil from rose hip when a large amount (35.9-54.7%) of unsaturated fatty acids namely

Galactolipids, momogalactosyl-diacylglycerols and digalactosyl-diacylglycerol were also isolated from *Rosa canina* hips having high levels of unsaturation in their fatty acids and having 90% α -linolenic acid of total fatty acids. Some galactolipids were found to have anti-inflammatory property as found by Lopes *et al.* and anti-tumorigenic role as seen by Maeda *et al.* [29]

Larsen *et al.* [30] and Cohen [31] by using bioassay guided fractionation, used dried and milled fruit of *Rosa canina* for isolation of (2S)-1,2-di-O-[(9Z,12Z,15Z)-octadeca-9,12,15-trienoyl]-3-O- β -D-galactopyranosyl glycerol. Further isolation of galactolipid 12-di-O- α -linolenoyl-3-O- β -D-galactopyranosyl-sn-glycerol was done by Christensen (2009) [32] from *Rosa canina* hip.

R. canina, *R. Rugosa*, *R. Corymbifera*, and *R. Alba* were evaluated for their functional characters by Kayahan, *et al.* [33]. when *R. Canina* had most favourable content of higher fatty acid along with high antioxidant content. Though *R. Rugosa* has medium level of oil content it is used in cosmetic and dermatological industry. *R. Canina* and *R. Corymbifera* have high phenolic and DPPH antioxidants, therefore can be used as raw material for providing phenol content.

As per studies, biological activities and their bioactive compounds are influenced by factors like, climate, geographic conditions, harvest time, soil and fertilization. Ioana Roman (2013) [34] found variability in active compounds namely vitamin C, flavonoids content and total polyphenols of *Rosa canina* L. biotypes.

Phenolic compounds in Rosehip

Phenolic compound are secondary metabolites having one aromatic ring with more than one hydroxyl groups. Phenolic compounds are helpful in protecting body against oxidative stress and inflammation. They are synthesized via carbohydrates in plants as a defence against pathogens and protection from uv-radiations. Flavonoids, Ellagitannins, Gallic acid, Catechins and Procyanidins are some of the phenolic compounds found in Rose hip.

Flavonoids in Rose hips comprise of quercetin, kaempferol, hesperidin, rutin and catechins which are linked to improved immune system, they help in reducing inflammation in addition to improved cardiovascular health.

Rosa canina, *Rosa gallica*, *Rosa rugosa* and *Rosa spinosissima* were the four rose species studied by Locza, N. (2018) [35] for comparing their total polyphenolic content by Folin-Ciocalteu's method. *Rosa spinosissima* was found to have the highest phenolic content and antioxidant capacity as compared to other species. This was followed by *Rosa canina*, *Rosa rugosa* and *Rosa gallica*.

Demir Nurullah (2014) [36] demonstrated that the phenolic content of rose hip fruits were to a great extent influenced by the rose species and total flavonoids present in them. Rosa fruit was found to have ascorbic acid and gallic acids as the main phenolic constituent. Shameh, 2019 [37], compared different genotypes of *Rosa* fruits for its phytochemical composition and color parameters.

Rose hip of some wild species was evaluated by Arisa Osada [38]. *R. davurica* was found to have high antioxidant activity and also showed high content of ASA and DHA (40.8-103.1 g/kg DW) and total polyphenols (119.2-161.5 g quercetin eq/kg DW) irrespective of years collected.

Both Tumbas *et al.* [22] and Hosni [7] found that rose species had high concentration of quercetin and ellagic acids. Fujii and Satio [39] in their study isolated quercetin from *Rosa canina* hips among other compounds. It was a strong inhibitor of melanogenesis in melanoma cells of B16 mouse as, it inhibits tyrosinase activity.

Study of chemical composition of fruits of *Rosa canina*, *Rosa dumalis* sub sp. boissiere, *Rosa pisiformi*, *Rosa villosa*, *Rosa dumalis* sub sp. antalyensis and *Rosa pulverulenta* was carried out by Ercisli *et al.* [8] They found phenolic content to be maximum in *Rosa canina* (96 mg gallic acid equivalent/gm DW) followed by *Rosa pulverulenta* (94 mg gallic acid equivalent/gm DW), whereas maximum ascorbic acid was found in *Rosa dumalis* sub sp. boissiere (943 mg ascorbic acid/100 mL) and *Rosa pulverulenta* (923 mg ascorbic acid/100 mL).

Recently Demir *et al.* [17] while studying five species of rose in Turkey, found that maximum phenolic compounds were present in *Rosa dumalis* sub sp. boissiere (943 mg gallic acid/gm DW). Ripening stages also affected the concentration of bioactive compounds in rosehip [40].

Conclusion

Rosehip is a fruit that comes from the rose plant and is commonly used in traditional medicine due to its many potential health benefits. The study shows that indigenous rose species are rich in antioxidants such as vitamin C, phenolic compounds, carotenoids and flavonoids. These antioxidants help relieving oxidative stress and damage to cells. Rose hips have anti-inflammatory properties due to the presence of polyphenols and other bioactive compounds which is good for inflammatory conditions like arthritis. They have bioactive compounds such as flavonoids and carotenoids which reduce blood pressure by improving lipid profile and help in reducing inflammation.

The high vitamin C content in rose hip helps to enhance the immune system by stimulating the production of white blood cells and other immune cells. Vitamin C is essential for the production of collagen, which helps to maintain the elasticity of the skin, and also has antioxidant properties that can protect the skin from damage caused by UV radiation and other environmental factors.

Rose hip may have anti-cancer properties as it has bioactive compounds like polyphenols and carotenoids. These compounds inhibit growth of cancerous cells, thus reducing risk of certain types of cancer.

Overall, rose hip is a nutrient-rich fruit [27] with a wide range of potential health benefits. It is important to produce such varieties of rose hip species which can be beneficial. Ingul M, 2021 [41] encapsulated *Rosa canina* with pea protein biopolymers and successfully accomplished corn extrudates manufacturing.

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