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Determination of fatty acid profile and antioxidant activity of Rosehip seeds from Turkey

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Abstract

Rosa canina is a less known horticulture plant that its fruits are the source of phytochemicals and have medicinal properties. However, it can be cultivated commercially like other fruit trees. In this study, fatty acid composition and antioxidant capacity of rosehip seeds were investigated. The results indicated that seeds are rich in Omega-6 fatty acids (51.49%). Linoleic acid, oleic acid, α-linolenic acid, and palmitic acid are the main fatty acids in rosehip seed oils, respectively. Moreover, the ratio of ω-6 fatty acids: ω-3 fatty acid ratio which is in desirable range for qualified oil. The seeds also showed high antioxidant activity (130.64 mgTE/100g).

Keywords: Rosehip, Fatty acids, Omega-6, Antioxidant activity

Introduction

Recently, the interest for plant origin oils has increased due to high nutritious value (Nwosu et al., 2017). Processing of fruits by-products and wastes such as seeds can lead to evaluate the new source of oil for the fulfillment of growing population needs (Kamel et al., 1985).

Rosa canina L. (Rosehip or dog rose) belongs to the Rosaceae family, *Rosa* genus which has around 100 species distributing in North America, Europe, the Middle East, and Asia (Ercisli, et al., 2007). Rosehip species is resistant to environmental stress factors and can be grown at low soil fertility or a harsh climate wherever from valleys to high altitude plateaus, even above 1,500 m altitude (Okatan et al., 2019). Among all, 25 species are spread throughout Turkey (Ercisli, 2004). Turkey has different climatic characteristics, therefore, viticulture activities are distributed to different geographical regions and these differences directly affect biochemical compounds of plants (Gundesli et al., 2018). Two species of *Rosa* are common species in Turkey, *Rosa canina* L. (dog rose, rosehip) and *Rosa damascena* Mill. (damask rose). Rosehip (dog rose) fruits are a rich source of healthy contents such as polyphenols, sugars, organic acids, bioflavonoids, carotenoids, tocopherol, vitamins, minerals, tannins, amino acids, pectin and volatile oils (Cınar and Colakoglu, 2005, Ercisli et al., 2007). Polyphenols as the secondary metabolites of plants promote health. It is proved that these compounds have anti glycemic, antiviral, anticancer and anti-inflammatory activities and also antiallergic and antimicrobial properties (Gundesli et al., 2109). Rosehip fruits have been used in folk medicine and have economic value (Ercisli, 2005). Due to having laxative and diuretic properties, rosehip fruits are useful for regulating the menstrual cycle (Nojavan et al., 2008). The fruits are also used for the treatment of flue, inflammatory disease and infections (Demir et al., 2014). Rosehip fruits are consumed in different forms such as marmalades, tea, jellies and jams and also as dried fruits (Yildiz and Alpaslan, 2012). Rosehip fruits are the rich source of antioxidant compounds such as α-tocopherol, ascorbate, glutathione, β-carotene, anthocyanins and other phenolics (Tumbas et al., 2012). Antioxidant nutrients play an important role in controlling free radicals. Degenerative diseases such as cancer, cardiovascular and nervous diseases are caused by free radicals that are produced by normal metabolism conditions or external factors in the body (Zarifikhosrohahi et al., 2018). Although the seeds of Rosehip have both monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs), more than 50% of total lipid is composed of polyunsaturated

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fatty acids. The major fatty acids in the rosehip are linoleic acid, linolenic acid, oleic acid, palmitic acid and stearic acid (Fofana et al., 2013). It is proved that oleic acid from the group of MUFAs decreases triacylglycerol of plasma and cholesterol concentrations (Murathan et al., 2016). PUFAs are also effective in the prevention of cancer, atherosclerosis, diabetes and heart disease (Gogus and Smith, 2010). So, the risk of cardiovascular disease can be reduced if 20% to 30% of daily intake comprised of plant fatty acids (Engelfriet et al., 2010).

In this study, it was aimed to determine the fatty acid profile and also antioxidant activity of rosehip seeds obtained from a commercially producing rosehip oil company to evaluate the oil quality for medicinal besides industrial usage.

Materials and methods

Rosa canina L. seeds provided by the commercial company were used in this study. The analyses were done at 5 replicates and the approximately 450-gram seed was used.

Oil extraction

The extraction of total lipids was done by an automatic soxhlet device. One hundred fifty grams of dried were used for oil extraction. The solvent was hexane and extracted oil was weighted for determination of the oil percent in the samples.

Determination of fatty acids

The fatty acids were analyzed by a GC ((Perkin Elmer, Shelton, USA). Chromatographic separation was done using a (30 m×0.25 mm) column equipped with a flame ionization detector (FID). The oven temperature was 120 ºC for 2 min, raised to 5 ºC /min to 220 ºC, which was held for 10 min, while the injector and the detector temperatures were set at 280 ºC and 260 ºC, respectively. The results were expressed in GC area % as a mean value and ± standard deviation.

Determination of DPPH radical scavenging capacity

The free radical scavenging activity of the seed extracts was analyzed using 2,2-diphenyl-1- picrylhydrazyl (DPPH) assay (Kostiæ et al., 2013). The color loss of DPPH solution was measured at 517 nm scavenging the reaction of DPPH radical with the sample. One hundred microliters of methanolic extract of seed samples were reacted with fresh methanolic DPPH solution and incubated 30 min at room temperature. Then, the absorbance was read at 517 nm against the blank. The ability of the extracts to inhibit DPPH (% RSC) was computed from the decrease in absorbance. The data were expressed as milligram of Trolox equivalent (TE) per 100 g of sample.

Results and Discussion

Total fat, fatty acid composition and antioxidant activity of Rosehip seeds are shown in Table 1. The total lipid of analyzed rosehip seeds was determined as 5.56 %. Kazaz et al., (2009) and Ilyasoglu (2014) reported the total lipid of *Rosa canina* seeds as 7.15 and 6.29%, respectively. Ercisli et al., (2007) determined that the total fat of *Rosa canina* fruit flesh without seed is 1.78%. Murathan et al., (2016) studied the total fat of rosehip species fruit with seeds between 5.38-7.84%., *Rosa canina* as 6.92%. Furthermore, Szentmihalyi et al., (2002) reported the oil content of rosehip from different extraction methods such as Soxhlet extraction, ultrasound water bath, microwave extraction, supercritical fluid extraction and subcritical fluid extraction as 4.85, 3.25, 5.26, 5.72, 6.68%, respectively. As mentioned, the results of this study are confirmed by the findings of previous studies and are at the same range, although this study result is lower than Kazaz et al., (2009), Ilyasoglu (2014) results are higher than Szntimihalyi et al., (2002). Murathan et al., (2016) reported higher total fat of fruit because used both fruit flesh and seeds together. The total fat amount may be affected by the extraction method (Szentmihalyi et al., 2002) and environmental conditions (climate and altitude, etc.) (Ilyasoglu 2014).

The results showed that linoleic acid, oleic acid, and α-linolenic acid and palmitic acid are the main fatty acids in rosehip seed oils, respectively (Figure 1). Rosehip seeds had a high amount of total poly saturated fatty acids comprising Linoleic acid (51.49%), α-Linolenic acid (13.46%) and g-linoleic acid (0.07%). Linoleic acid, the omega-6 fatty acid, is known as an essential fatty acid because the human body cannot synthesize it. Therefore, rosehip seed oils are greatly nutritious oils reducing serum cholesterol and can be used for the remedy of cardiovascular disorders (Nicolosi et al., 2004, Manzoor et al., 2007). Omega-6 fatty acids: omega-3 fatty acid ratio is the scale of oil value for being healthy by controlling blood cholesterol. The accepted range is 1:1 to 4:1 (Yehuda, 2003). According to this study result, the ratio of 3.82 is in the ideal ratio and makes the rosehip seed oil as a valuable candidate for omega fatty acids. While the results of linoleic acid in this study are similar to the results obtained Ilyasoglu (2014) (54.05), the results from Kazaz et al., (2009) (48.84%) and Murathan et al., (2016) (27.97%) were lower. Comparing Ercisli et al., (2007) results showed that that the amount of linoleic acid in fruit flesh (51.18%) and the seeds from this study are (51.49%) compatible. Szentmihalyi et al., (2002) reported the oil content of rosehip from different extraction methods between 35.94% and 54.75%. Comparing the results obtained from the method used in this study showed that the result also is higher than data from Szentmihalyi et al., (2002). However, the amount of α-Linolenic acid in this study is lower than previous studies except Murathan et al., (2016) study.

Ten saturated fatty acids were detected at rosehip seed oil in this study which the main ones were palmitic acid (4.22%) and stearic acid (2.66). The results of saturated fatty acids are in the range of data obtained from other studies (5.031-11.06%). The amount of total saturated fatty acids (8.81%) was lower than poly saturated fatty acids (87.65%) in studied rosehip seed oil. According to previous studies PFA is higher than data obtained from this study Ercisli et al., (2007) (91.27% of fruit flesh), Kazaz et al., (2009) (91.63%), Ilyasoglu (2014) (92.92%). The oleic acid (22.49%) was the predominant monosaturated fatty acid in rosehip seed oil which is in accordance with previous studies. The differences among studies may be due to different cultivar and genotypes used along with different oil extraction methods. DPPH radical scavenging capacity of studied rosehip seed was determined as 130.64 mgTE/100 g. There is limited study on the antioxidant capacity of rosehip seeds. Ilyasoglu (2014) reported that the antioxidant activity of methanolic extract of rosehip seeds was 10.40 µmol TE/g (260.3 mgTE/100 g) with TEAC method. Okatan et al., (2019) studied DPPH antioxidant capacity of different genotypes of rosehip fruits. They reported the average DPPH activity of rosehip fruits as 169.1 µg/ml. The results showed that the antioxidant capacity of studied rosehip was lower than Ilyasoglu (2014) which may be due to different genotypes besides different methods. Roman et al., (2013) studied the antioxidant activity of *Rosa canina* biotypes whole fruits from Transylvania. The researchers reported that DPPH antioxidant activity among biotypes varied from 63.35 to 127.8 µM Trolox/100 g. The result of this study is in this range that proves different biotypes and locations affect the antioxidant capacity of fruits.

Table 1. Total fat, fatty acid composition and antioxidant activity of Rosehip seeds

DPPH	130.64 mg TE/100 g
Total fat	5.56 g/100 g
Myristic Acid (C14:0)	0.23±0.001
Palmitic acid (C16:0)	4.22±0.12
Stearic acid (C18:0)	2.66±0.08
Arachidic acid (C20:0)	1.20±0.04
Caprylic acid (C8:0)	0.05±0.002
Behenic acid (C22:0)	0.20±0.01
Tricosanoic acid (C23:0)	0.04±0.001
Lignoseric acid (C24:0)	0.10±0.004
Margaric Acid (C17:0)	0.08±0.003
Pentadecanoic acid (C15:0)	0.03±0.001
ΣSFA	8.81
Palmitoleic acid (C16.1)ω−7	0.05±0.002
Oleic acid (C18:1n9c)ω−9	22.49±0.17
Eicosenoic acid (C20:1n9c)ω−9	0.09±0.003
ΣMUFA	22.63
a-Linolenic acid (C18:3n3) ω−3	13.46±0.002
Linoleic acid (Cl8:2n6c) ω−6	51.49±0.35
g-Linolenic acid (Cl8:3n6c) ω−6	0.07±0.002
Σ PUFA	65.02

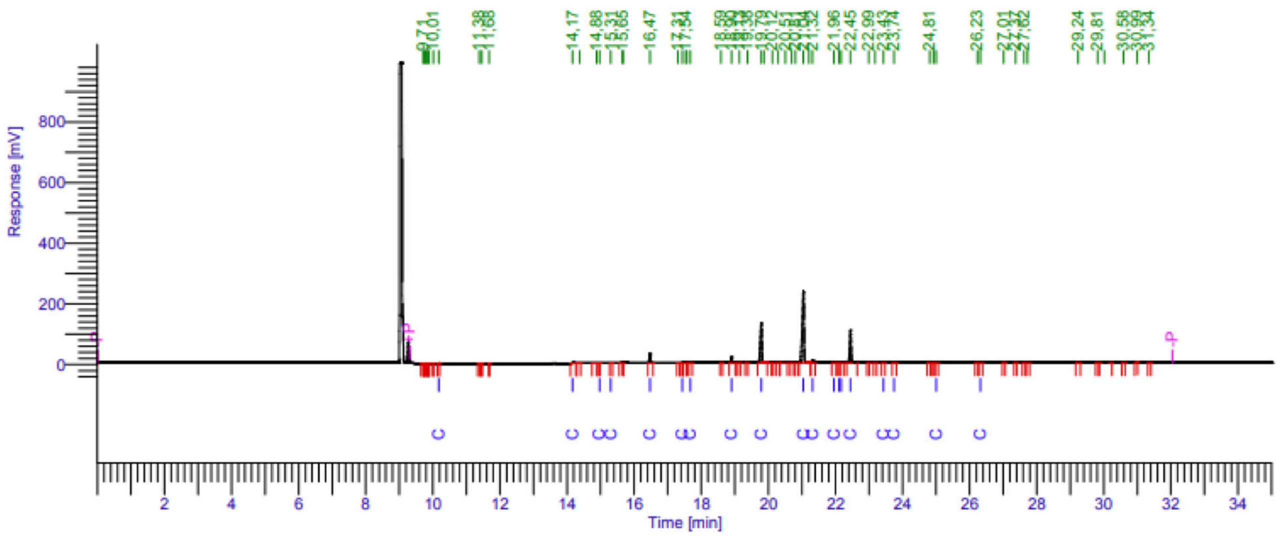

Figure 1. The chromatogram of fatty acid profile of *Rosa canina* L

Conclusion

The results of this study proved that the rosehip seeds from the commercial company producing rosehip oil are a good source of high omega-6 fatty acid. Moreover, the seeds have high antioxidant capacity which is the key to controlling free radicals causing cancers and inflammatory disease. Therefore, seed oil can be evaluated as a highly notorious and healthy source in the human diet and also as bio-fuels.

Compliance with Ethical Standards

Conflict of interest

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author contribution

The author read and approved the final manuscript. The author verifies that the Text, Figures, and Tables are original and that they have not been published before.

Ethical approval

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Data availability

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Consent for publication

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