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Determination of Antioxidant Vitamins and MDA Content in Petals of Rose Species Used in Food

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Abstract
Roses are one of the most essential flowers of the traditional Van gardens. It is known that a great number of classical garden roses are grown in the gardens of Van. Using these garden roses, the skillful women of Van have developed a rose culture. The traditional rose jams and syrups developed by these women is the prime example of this culture. The two most commonly used rose varieties by the local people for the jams are *Rosa* x *damascena* Miller (known as the jam rose) and the *Rosa* x *damascena* var. *semperflorens* [Loisel. Et Mitchel] (known as the repeat-flowering), while the rose syrup is made using the petals of *Rosa heckellana* Trott. Subsp. *vanheurckiona* [Crepin], also known as the Hoşap Rose. In the study, the antioxidant vitamin (Vitamins A, E, C), beta carotene, and malondialdehyde contents – which is an indicator for lipid peroxidation- of the rose petals used in the production of these jams and syrups were investigated. The results have revealed that rose petals are significantly rich in terms of Vitamins A and E. This would mean that the traditional kitchen of the city of Van, which acts as a crossroad in its region, could offer great delights for healthy diets.

Keywords: Rose jam, Gül syrup, traditional food, healthy food, Van culinary culture,

Gıda Olarak Tüketilen Gül Yapraklarının Antioksidan Vitaminler ve MDA Miktarlarının Belirlenmesi

Özet
Gül, geleneksel Van bahçelerinin en önemli çiçeklerinden biridir. Van bahçelerinde çok sayıda eski bahçe gülü yetiştiği bilinmektedir. Bahçede yetişen güllerden Van'ın maharetli kadınları kendine has gül kültürü geliştirmişlerdir. Vanlı kadınlar etrafında yetişen gülleri kullanarak, kendine has gül reçel olmak üzere gül şurubu tarifine geliştirmişlerdir. Van'daki reçel yapımında, halk arasında reçellik gülü *Rosa x damascena* Miller ve yediveren gül olarak bilinen *Rosa* X *damascena* var. *semperflorens* [Loisel. Et Michel] Rowley iki gülün yaprakları kullanılırken gül şurubunda ise Hoşap gülü *Rosa heckellana* Trott. subsp. *vanheurckiona* [Crepin]'in petallari kullanılmaktadır. Çalışmada, geleneksel Van bahçelerinde yetişen ve gül reçeli ve gül şurubunun yapımında kullanılan gül yaprakları (petallerin) antioksidan özelliğe sahip vitaminler (Vitamin A, E, C), Beta Karoten ile lipit peroksidasyonunun bir göstergesi olan Malondialdehit (MDA) miktarlarının araştırılmıştır. Yapılan çalışmada vitamin A ve E bakından gül yapraklarının dikkat çekici bir zenginliğe sahip olduğu tespit edilmiştir. Bölgede önemli bir kavşak

noktasında bulunan Van ili, yerel kültür açısından zengin mutfağının sağlıklı beslenme açısında kullanılabileceği ortaya konulmuştur.
Anahtar kelimeler: Gül reçeli, Gül şurubu, Geleneksel gıda, Sağlıklı beslenme, Van Mutfak kültürü,

1. Introduction

In order to achieve increased plant-based production in the 20th century, the use of chemical fertilizers became increasingly popular and the traditional production processes were replaced with industrial approaches. The change in agricultural production has reformed the social structure and severed its ties with the traditional food culture, and caused the development of new culinary habits. As a result of this change, more people began eating outside their homes as cooking at home lost its charm, and consumption of fast, ready-to-serve foods increased (Kocatepe and Tırıl, 2005; Sönmez et al., 2008; Akın, 2014).

Pesticide and antibiotic residues, trans fats, salts, and additives inside the ready-made foods influence the biochemical structure of the human body and cause various health problems. With an ever-increasing consumption rate, readymade foods bring along with them a plethora of medical issues. The increased rate of health problems that affect all layers of the society, like cancer, allergies, obesity, and heart attack cases in the recent years, have encouraged the society to return to traditional nutritional habits (Kocatepe and Tırıl, 2005; Akın, 2014).

Traditional food is based on the basic processing methods that have been used for centuries and hold a significant place in the local kitchen cultures of societies. The most important differences between the traditional and fast foods are the significantly lower amount of additives of the traditional food, and its much shorter shelf duration due to having no preservatives, except for natural ones like salt, vinegar, and various species (Kocatepe and Tırıl, 2005; Akın, 2014).

The city of Van is located at an important crossroads of its region. This positioning acts as a source for its cultural richness. A part of this richness is due to the rose species and the traditional foods that are made of rose products. Old roses hold an important place in the traditional garden culture of Van and the nearby regions. The people of Van use roses in a plethora of ways and have brought the culture of rose and rose products to this day by introducing them to their kitchens, particularly by making rose jams out of them. By doing so and producing jams, syrups, and aromatic teas out of roses, they have also introduced significant values to the culinary culture of Van.

The city of Van and its vicinity have a wide variety of plants due to their climatic and ecologic properties. Of the 25 wild rose species found in Anatolia, 12 are of the old garden variety, and 10 of these can be found in the city of Van and nearby regions. The petals of Rosa X *damascena* Miller, also known as the jam rose among the people, and *Rosa* X *damascena* var. *semperflorens* [Loisel. Et Michel] Rowley, known as the rose of seven blooming, are the more commonly used roses to make the traditional Van rose jams. Furthermore, the syrup is being made using the petals of *Rosa heckellana* Trott. subsp. *vanheurciona* [Crepin] (Alp, 2007; Alp and Koyuncu, 2008).

Vitamins are nutritional materials that are necessary for various biochemical processes, and have to be obtained through diet as they can't be produced in the body (Bingöl, 1977; Ognjanovic et al., 2003). The leaves of many plants are being used as sources for vitamins. The aim of this study was to investigate the *R. damascena* petals, which are used to make the traditional rose jam and provide the aroma and taste to it, the *R. damascena* var. *semperflorens* petals, which give the color, and the *R. heckellana* subsp. *vanheurckiona* petals in terms of their antioxidant vitamin contents (vitamins A, E, and C), and malondialdehyde(MDA) amounts, which is an indicator of the lipid peroxidation.

2. Materials and Methods

2. 1. The Study Material

The rose species that are grown in the city of Van and its vicinity and used for making traditional rose jams and syrups were used as the study material. The taxa analyzed in the study and their properties are as follows:

***Rosa* X *damascena* Miller**

The local names for this plant are "the rose of Muhammed" and the "jam rose". It is pink or red in color and provides scent, aroma, and taste to the jams. The plant itself can reach up to a length of 2 meters and is a bush with dense thorns. It is believed to have originated from Syria (Damascus) (Baytop, 2001; Alp, 2007; Alp and Koyuncu, 2008).

***Rosa* X *damascena* var. *semperflorens* [Loisel Et Mitchel] Rowley)**
The local names of this plant are the "kırmızı kat katı" and yediveren (repeat-flowering). It is a repeat-flowering and is pink in color, providing the color to the jams. The plant itself can reach up to 1 meter and is a bush with dense thorns. It is one of the ancient rose varieties (Baytop, 2001; Alp, 2007; Alp and Koyuncu, 2008).

***Rosa heckellana* Trott. subsp. *vanheurckiona* [Crepin])**
The local names of this taxa rose are the "şuribi rose" and "hoşab rose". This is a single pink flower, and is used to make the rose syrup. The bush can grow up to 18-60 cm in length. The plant grows naturally in the mountains of Hakkari and Van. It is also used as a fence plant in the gardens of Hoşap (Baytop, 2001; Alp, 2007; Alp and Koyuncu, 2008).
The rose petals of the same types of flowers at the same ripeness were collected from different locations and were used as study materials. The collected leaves were wrapped in aluminum foils and kept in -20ºC until the analysis was conducted (for approximately 10 days). All the chemical materials used in the analysis were of analytical purity and were obtained from Merck Company. Deionized water was used throughout the study.

2. 2. Study Method
2. 2. 1 Determination of Vitamins A and E and β-carotene
One gram of rose petal was taken from each of the samples and treated with 2.5 ml ethyl alcohol. After the mixtures were vortexed, they were centrifuged for 3 minutes at 3000 rpm, and the supernatant on their surface layers was filtered using filter papers. These filtrates were then introduced 0.2 ml n-hexane and stirred, extracting the vitamins A and E and the β-carotene in the n-hexane phase. This extraction step was repeated twice for each sample and the obtained filtrates were combined, which were then evaporated under nitrogen gas environment. The residues in the tubes were then solved using 0.2 ml methanol, and prepared for analysis in HPLC. A mobile phase consisting of ODS-2 colon and methanol acetonitryl chloroform (47:42:11, v/v) was used to determine the vitamins and β-carotene. The flow rate of the mobile phases was set to 1 $ml.min^{-1}$. Vitamin E was determined at 296 nm, Vitamin A at 326 nm, and β-carotene at 436 nm (Miller at al. 1984; Çetinkaya, and Özcan 1991).

2. 2. 2 Determination of Vitamin C and Malondialdehyde**:**
One gram of leaf was taken from each of the samples and treated with 1.0 ml 0.5M $HClO_4$, precipitating the proteins. Using pure water, the total volume of the samples was completed to 5 ml, and the mixtures were centrifuged. The supernatant floating to the top was removed from each of them and filtered using filter paper (Whatman No 1) (Cerhata at al. 1994). 20 µL of the filtrate was then collected and transferred to the HPLC (CECIL 1100 brand). The flow rate of the mobile phase 3.7 mM KH_2PO_4 (pH: 4, with H_3PO_4) was set to 1ml min-1. Wavelength: using C18 column, vitamin C was determined at 245 Nm (Tavazzi at al. 1992). 20 µL of the same filtrate was then used in HPLC as mobile phase mixture of 30 mmol KH_2PO_4 and methanol (65%-35%, pH=4 with H_3PO_4). The flow rate of the mobile phase was set to 1.5 ml/min, and malondialdehyde was determined at 254 nm (Karatas at al., 2002). A cecil 1100 series HPLC device, a UV detector, and Mistral 2000 brand centrifuge were used in the determination of Vitamin levels.

2. 2. 3 Statistical analysis
All experiments were repeated three times. The results were analyzed using the standard error of the mean. SPSS 10.0 Windows software was used for this purpose.

3. Findings
As a result of the analyses of the inspected parameters, vitamin A, E, C, β-carotene, and MDA levels of the roses were found to be dependent on the taxon. The retrieval rates for Vitamins A, E, C, β-carotene, and MDA were 98.3%, 95.7%, 98.6%, 93,8% and 96.5%, respectively.

Table 1 Antioxidant vitamin, beta-carotene, and MDA amounts in different Rose leaves

	R. damascena var. *semperflorens*	*R. damascena*	*R. heckellana* subsp. vanheurckiona
Vitamin A (µg/g)	1.78 ± 0.18	4.0±1.11	2.54± 0.87
Vitamin E (µg/g)	0,62 ± 0,16	0,45±0,15	0,58±0,17
Vitamin C (µg/g)	28,22 ± 6,20	17,84±4,47	20,65±5,42
β-Karoten(µg/g)	2,35±0,65	2,65±0,70	3,95±0,93
MDA (µg/g)	1,50± 0,22	1,55±0,28	1,76±0,30

As can be seen in Table 1, the amount of vitamin A in the petals of rose taxa varies between 1,78 ± 0,18 µg/g and 4,02±1,11. This result indicates that the roses are rich in Vitamin A. Vitamin E content of the petals were found to vary between 0,62 ± 0,16 and 0,45±0,15 µg/g. It can be seen that the Vitamin E content of the petals is very close to each other. Our findings indicate that Vitamin C content of the rose petals is between 28,22 ± 6,20 and 17,84±4,47 µg/g. The β-carotene amount in the petals of the rose taxa was reported to be between 3,95±0,93 and 2,35±0,65 µg/g. β-carotene is a pigment that is light yellow or orange in color, and even though it acts as a precursor for Vitamin A, no correlation between β-carotene and Vitamin A contents of petals were detected. Representing the most important reactive carbon compound, the amount of MDA in petals were quite similar to each other, varying between 1,76±0,30 and 1,50± 0,22 µg/g.

4. Results and Discussions

In this study, vitamin A, E, C, β-carotene and MDA levels of the petals of the studied rose taxa were determined. The levels of vitamins were found to be different between the taxa. We believe that the identification of biological molecules in the structure of the petals of the inspected rose taxa has contributed to the accumulated plant literature.

Vitamin A, which is responsible for cell division and increasing body resistance, was determined as 0.70 µg/g in fresh strawberries, 0.19 µg/g in fresh red cherries and as 0.15 µg/g in firethorn fruit. Vitamin E, which protects the cells against oxidation caused by free radicals, was determined as 0.70 µg/g in cherries, between 0.69 µg/g and 0.73 µg/g in strawberry fruits, and as 0.22 µg/g in fresh firethorn fruit. (Aksoy, 2000; Ognjanovic et al., 2003; McCune et al., 2011; Tuncer and Karataş, 2011; Çöteli et al., 2017). The fact that rose petals have vitamin A and E contents varying between 1,78 ± 0,18 µg/g and 4,02±1,11µg/g makes them quite strong in this regard comparatively, and the roses will surely contribute to healthy diets that involve traditional Van rose jams.

Every society takes advantage of the traditions and customs inherited from its ancestors while shaping its everyday culture. In shaping contemporary Van cuisine culture, rose jam and syrups, which are inherited from the local culinary culture of the past, contribute to a healthy diet with their diverse contents and can help shape the reformation of the eating and drinking habits of the society in a healthy way.

As in all areas of life, dietary choices are also being influenced by the media and the consumption of ready-to-eat foods is increasing every day. Today, local governments need to develop policies to raise awareness on healthy nutrition by focusing on the importance of traditional rose jams and syrups, and to develop a better culinary understanding in the minds of the young population for which unhealthy nutrition is becoming an increasingly prevalent problem. While the policies that will be developed for healthy nutrition will encourage the production of traditional foods, traditional foods, in turn, will promote healthy nutrition.

The city of Van has a rich cultural heritage, along with a considerable amount of accumulated knowledge on the use of natural plants grown in the vicinity. The rose jams and syrups made from the petals of traditionally grown rose species in the Van region will contribute to a healthy diet, as well as representing an important cultural element that will connect the past to the present when used in the Van breakfast culture.

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