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Determination of Antioxidant Properties of Dry Rose Tea

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Abstract: The rose takes part the fragrant plant section used in the field of medicinal and aromatic plants. It has an important role in food, perfumery and cosmetic industry. For this purpose, tea made by using 3 different dried bud roses and 3 different dried rose leaf purchased in Isparta and İzmir, were investigated in terms of antioxidant properties. The roses were kept in boiled water at 98 °C for 5 minutes and filtered at the end of the time. Total phenolic content by Folin-Ciocalteu method, antioxidant capacity by TEAC method and total flavonoid determination were done in the samples which arrived at room temperature. When the results of the analyses were examined, the total amount of phenolic material 5,24-166,36 mg GAE/200 mL tea, the total amount of flavonoids 2,02-14,83 mg CE/200 mL tea and the antioxidant capacity values 0.64-10.78 µM trolox /200 mL tea were found. In all analyzes, dry bud results were found to be lower than dry leaves. In addition, there was a statistically significant difference between the varieties ($p<0.05$). Besides its pleasant smell and comfortable drink, it also has antioxidant properties that rose tea can be an alternative to other herbal teas, it is thought that the consumption can be widespread and the usage areas can be expanded with the works to be done.

Keywords: Antioxidant capacity, tea, phenolic substance, rose

1. INTRODUCTION

Since ancient times, people have benefited from plants to obtain food and to solve health problems. The first written sources concerning the use of plants for medicinal purposes belong to Sumerians and Chinese. In spite of the rapid developments in modern medicine in recent years, alternative therapies methods and therapies with medicinal plants are still being updated. Even especially in developed countries, the important is increasing [1]. It can be demonstrated that the pharmaceutical industry takes a large share in R & D expenditures made as a result of the increase in the importance of pharmaceuticals and aromatic plants. Data from the World Health Organization show that 70-80% of the world's population benefits from traditional medicine. In this direction, approximately 20,000 in the world; in our country, there are plants used for about 500 medical purposes [2]. Medicinal and aromatic plants in traded is used in 50% food, 25% cosmetics and 25% pharmaceutical industry [3].

The rose takes part the fragrant plant parts used in the field of medicinal and aromatic plants. It has an important role in food, perfumery and cosmetic industry [2,4]. Besides this usage roses are curtained some benefits such as sedative, anti-stress property, hemostatic,

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stomach, liver, intestines, fever and skin disease therapeutic and anti-inflammatory functions [5-7].

Various pharmacological studies have been carried out to evaluate the effects on the central nervous system of *R. damascena*. These assessed effects have been examined in different studies. It is seen that it has antibacterial effect against both gram-negative and gram-positive bacteria [6]. It has been stated that it has beneficial effects on brain function. Awale et al. (2011) found showed neurite growth activity of rose extract, the chloroformic extract significantly induced neurite growth activity and inhibited amyloid β (Aβ), and thus that *R. damascena* may be useful in dementia patients [8]. There are limited studies related the effects on the respiratory system of *R. damascena*. Boskabady et al. (2011) found significant reductions in the number of coughs induced by citric acid in their study [9]. They have also reported that a newly isolated compound from *R. damascenea* buds may be effective in improving cardiovascular function. Among the works are made that *R. damascena* has also been shown to exhibit an anti-diabetic effect [10].

Phenolic compounds are a group of substances that encompass a large number of different property, which are the most common compositional elements of the plant kingdom [11]. Due to their positive effects on nutrition, phenolic compounds are also called bioflavonoids. Epidemiologic findings indicate that consumption of foods containing high amounts of phenolic substances is a reducing effect on cardio- and cerebrovascular diseases and cancer cases and delayed aging [12].

Flavonoids have antioxidant, enzyme inhibitor, anti-inflammatory, antimicrobial, anti-ulcerogenic, antiviral effect. It has also been reported that these compounds are effective on blood components, increase erythrocyte formation and leucocyte count, lower cholesterol level [12]. Flavonoids play an important role in vasodilatory properties, reducing capillary permeability and fragility [13]. *R. damascena* contains various components such as flavonoids and terpenes [14]. There is evidence that these compounds have hypnotic effect. Therefore, it has been asserted that these compounds may be responsible for *R. damascena* hypnotic effect [15] Flavonoids have been reported to have an anxiolytic and / or antidepressant activity [15, 16].

Today in food technology, it is inevitable to use antioxidants so that food can last longer without deterioration and the shelf life can be prolonged. With this obligation, antioxidants of plant origin are preferred with consciousness of consumers and increase in demand for natural components in foods [17]. Antioxidants also play a role in preserving the sensory qualities of foods such as color, taste, and smell. *R. damascena* showed antioxidant properties such as many medicinal and aromatic plants [9].

General usage areas of rose in our country; used as raw material in the production of products such as dried rose, rose oil, rose syrup, rose jam, rose water and the use of flavouring and colouring agents in the formulation of delight products etc. [12]. In addition, dry rose petals are used by adding in yoghurt to alleviate digestive system problems in some countries [9].

As a result of literature review, antioxidant properties of different rose species were examined. But no studies have been done to determine the antioxidant properties of rose tea. With this study, it was aimed to determine some quality characteristics of teas obtained by using different dried rose buds and dried rose petals and to compare and to obviate the deficiencies in this literature.

2. MATERIAL and METHODS

2.1. Material

In the study, as plant material were used as plant material were used 3 different dried rose buds and 3 different dried rose petals supplied from Isparta and İzmir markets. In Figure 1 are given dried rose buds and dried rose petals used in the study. It was used Rose buds (RB) for dried rose buds, Rosa petal (RP) for dried rose petals short codes. The roses were kept in boiled water at 98 °C for 5 minutes and filtered at the end of the time. Thus, dry rose tea was obtained. Total phenolic substance, total flavonoid substance and antioxidant capacity analyzes were carried out in teas that came to room temperature.

Figure 1. Dried rose buds and dried rose petals used in study

2.2. Determination of Total Phenolic Content

The determination of total phenolic materials is based on the complexation with the Folin-Ciocalteu solution of the phenolic materials and the measurement of the resulting color by colorimetric analysis [18]. Phenolic analysis was performed by the method proposed by Rodriguez et al. (2015) [19]. For this purpose 500 mL of the sample by addition of 250 µL 1 N Folin- Ciocalteu reagent was mixed with 30 seconds of vortexing. Then this mixture was thoroughly mixed with the addition of 1.250 µL (20%) of saturated sodium carbonate ($Na_2 CO_3$) solution. Obtained mixture was waited at room temperature for 2 hours in the dark and the resulting color absorbance was read at 760 nm on Multiskan Go Microplate Spectrophotometer reader (Thermo Scientific, USA) and the results were calculated using the calibration graph prepared.

2.3. Determination of Total Flavonoids

Total flavonoid substance determination was made with modification of the method proposed by Rodriguez et al. (2015). Volumes of 500 µL of each sample were taken and were added 1.250 µL of water, followed by 75 µL NaNO2 5% w/v and allowed to stand for 6 min. Then, 150 µL AlCl3 10% w/v was added and again let stand for 5 min. Finally, 500 µL NaOH (1 M) was added. Obtained mixture was waited at room temperature for 30 minute in the dark and the resulting color absorbance was read at 510 nm on a Multiskan Go Microplate Spectrophotometer reader (Thermo Scientific, USA) and the results were calculated using the calibration graph prepared. After each addition, the tubes were vortexed for 5 seconds.

2.4. Determination of Total Antioxidant Substance by ABTS Method

TEAC (trolox equivalent antioxidant capacity) method was used to determine the antioxidant activity of the rose samples. This method has become an effective factor in selecting the method in the study conducted because it is easier, practical and faster than other antioxidant activity assay methods used in *in vitro* experiments. It does not require any equipment except UV-vis spectrophotometer. In addition, since the $ABTS^{\cdot +}$ radical used in this method is soluble in both water and organic solvents and is not influenced by ionic forces, this method can be applied in multiple media. Besides it can be also used for the determination of not only hydrophilic but also lipophilic antioxidants [20]. According to the method proposed by Cemeroglu (2007), 7 mM ABTS solution containing 2.45 mM potassium persulfate was prepared in the antioxidant activity assay [21]. This solution was allowed to stand at room temperature and in a dark place for at least 12-16 hours to form $ABTS^{\cdot +}$ Radical solution. The radical solution prepared in this way is stable for 2-3 days. Before the assay was started, the radical solution was diluted with PBS (Phosphate buffer saline: saline phosphate buffer) solution to give an absorbance value of 0.700 (± 0.02) at 734 nm. Initial absorbance value of this diluted ABTS. + Radical solution was recorded. Then 1 mL of the $ABTS^{\cdot +}$ radical solution was added, 10 µL of sample extract was added to it, mixed lightly and then the chronometer was run and after 6 minutes the absorbance values were read and recorded. The percent reduction of the ABTS. + Solution by the initial absorbance value was calculated. This value is called the "inhibition rate" at the end of 6 minutes. This procedure was repeated twice and the inhibition rates were calculated and their averages were determined. Then, the same procedures were repeated by changing the sample volume (2.5, 5, 7.5 and 10 µL). 4 different volumes were used for each sample. In this way are determined the inhibition rates and their averages, which are dependent on the amount of each sample. Then were calculated sample concentrations corresponding to sample quantities (volumes). Thus, the mean percent inhibition values determined at the end of 6 minutes were transferred to a plot against the sample concentrations and linear regression analysis was applied to achieve the sample curve and the equation defining this curve. The TEAC (trolox equivalent antioxidant capacity) value of sample calculated as the sample slope/the standard slope.

2.5. Statistical Evaluation

All analytical determinations were performed in duplicate. Statistical analysis was performed using SPSS (version 22). The differences of mean values among samples was determined using one-way analysis of variance (ANOVA) followed by Tukey.

3. RESULTS and DISCUSSIONS

The total phenolic content and total flavonoid amount values of the dried rose tea samples are given in Table 1. The amount of total phenolic substance varies between 5.24-166.36 mg/200 mL tea and the total flavonoid amount is 2.02-14.83 mg/200 mL tea. When analyzed statistically, in two analyzes; dry bud results are lower than dry petals. There was also statistically significant difference between the varieties ($P<0.05$). The effect of different rose varieties on the phenolic substance content was statistically significant ($F(108,599) = 0.0..01, P <0,05$). The effect of different rose varieties on flavonoid contents was statistically significant ($F(1597,282) = 0.0..01, P <0.05$). For the standard calibration graphs, concentration range of 0.002-0.016 mg/mL for the gallic acid standards and concentration range of 0.002-0.012 mg/mL for the catechin standards were measured using the same method. The calibration curves were both obtained $R^2 = 0.999$. The results of total phenolic content are given as gallic acid, and the results of total flavonoid amount are given as catechin equivalent.

Table 1. Total phenolic and total flavonoid contents of rose tea samples*

Product	The total phenolic content (mg GAE/200 mL)	Total flavonoid content (mg CE/200 mL)
RP-1	166.36±14.67[a]	14.83±0.35[a]
RP-2	101.91±13.92[b]	14.70±0.26[a]
RP-3	86.86±1.88[b]	13.54±0.23[b]
RB-1	31.72±4.56[c]	2.86±0.24[c]
RB-2	8.62±2.75[c]	2.06±0.01[c]
RB-3	5.24±0.30[c]	2.02±0.22[c]

*The different letters indicate that there is a difference in P<0.05 significance level between the averages.

Baydar and Baydar (2013) conducted a total phenolic substance and total flavonoid analysis using *Rosa damascena* Mill. type plant materials [22]. For this purpose, they used fresh and dry pink rose flowers and green rose petals. In addition, hot and cold extraction methods are compared in the study. The total amount of phenolic substances in dry rose flowers were found as 211.92-268.72 mg GAE/g, total flavanol values 28.01-28.96 mg CE/g and total flavonol values 43.77-52.46 mg RE/g. The highest values in this study found in the cold extraction method performed on the leaves. In addition, they found that the waste of rose by-products containing fat rose can be evaluated for natural antioxidant resources.

Sener (2012) studied the quality characteristics of fresh rose leaf and some of the products obtained from these leaves [12]. The amount of total phenolic substance in Isparta rose was 481.54 μg GAE/mg as a sample. As a result, the fresh rose leaf contains significant levels of phenolic material. Ercisli (2007) studied the chemical properties of 6 different rose species (*Rosa spp*.) [23]. When phenolic substance values were examined, it was stated that it changed between 73-96 mg GAE/g dry substance and *Rosa canina* had the highest value.

Kumar et al. (2009) investigated total phenolic substances values in *R. damascena* and found 14.5 ± 0.14 g GAE/100 g on fresh weight basis [24]. Ouerghemmi et al. (2016) studied the phenolic composition and antioxidant activity of leaf extracts from 3 different species of *Rosa* [25]. The total phenolic substance content in the extracts is reported to be range from 147-464 μg GAE/mg dry matter.

The antioxidant capacity values range from 0.64-10.78 μM trolox/200 mL tea. When analyzed statistically, the antioxidant capacity values of dry buds were found to be lower than the antioxidant capacity values of dry petals. There was also statistically significant difference between the varieties (P<0.05). The antioxidant capacity effect of different rose varieties was statistically significant (F (91,149) = 0.0..01, P<0.05). Antioxidant activity values of the rose tea samples are given in Table 2.

Sener (2012) studied antioxidant capacity values of fresh rose leaf and some products obtained from these leaves and found it to be 9.36 μg/mL with equivalent antioxidant capacity of trolox (IC50). As a result, rose of Isparta determined that the laugh has a high level of antioxidant activity [12].

Shikov et al. (2012) examined the change in antioxidant capacity of canned strawberries, depending on the addition of polyphenol-enriched extracts from rose leaf (*Rosa damascena* Mill.) leaf by-product [26]. The results obtained have been reported to be promising for the application to strawberry-grown strawberry cultivars of rose petals to strengthen antioxidant capacity and thus to develop new functional food products. Ouerghemmi et al. (2016) compared the phenolic composition and antioxidant activity of leaf extracts from 3 *Rosa* species [25]. The antioxidant capacity values were reported to be 0.4-3.0 mmol TE g^{-1} dry matter.

Table 2. Antioxidant activity values of rose tea samples*

Product	Antioxidant Activity (μM trolox/200 mL)
RP-1	10.78 ± 0.08^{a}
RP-2	8.40 ± 1.44^{ab}
RP-3	8.11 ± 0.69^{b}
RB-1	2.38 ± 0.07^{c}
RB-2	0.75 ± 0.19^{c}
RB-3	0.64 ± 0.08^{c}

*The different letters indicate that there is a difference in $P<0.05$ significance level between the averages.

4. CONCLUSION

In this study, some quality characteristics of dry rose tea made by using 3 different dried rose buds and 3 different dried rose petals were determined and then compared. The total phenolic substance, the total flavonoid substance and antioxidant capacity were determined to be higher in dry petals than in dry buds. As a result, it has been seen that dry rose tea, as well as pleasant smell and comfortable inside, may be a natural antioxidant source. This study also showed that dry rose tea can be used as a functional food and functional food additive.

Conflict of Interests

Authors declare that there is no conflict of interests.

5. REFERENCES

[1] Arslan, N., Baydar, H., Kızıl, S., Karık, Ü., Şekeroğlu, N., & Gümüşçü, A. Tibbi Aromatik Bitkiler Üretiminde Değişimler ve Yeni Arayişlar.

[2] Anon. (2017). Retrieved from: http://oran.org.tr/materyaller/Editor/document/ PlanlamaBirimi/ Dokmerkezi/Tıbbi%20Aromatik%20Bitkiler.pdf.

[3] Faydaoğlu, E., & Sürücüoğlu, M. S. (2011). Geçmişten günümüze tıbbi ve aromatik bitkilerin kullanılması ve ekonomik önemi. *Kastamonu Üniversitesi Orman Fakültesi Dergisi*, *11*(1), 52-67.

[4] Jabbarzadeh, Z., & Khosh-Khui, M. (2005). Factors affecting tissue culture of Damask rose (Rosa damascena Mill.). *Scientia horticulturae*, *105*(4), 475-482.

[5] Bardakçi, B. (2006). Isparta Bölgesindeki Gül Yağinin Kimyasal Içeriğinin Gc-Ms ve FTIR Spektroskopisi Tekniği ile Incelenmesi. *SDÜ Fen Dergisi*, *1*(1).

[6] Ulusoy, S., Boşgelmez-Tınaz, G., & Seçilmiş-Canbay, H. (2009). Tocopherol, carotene, phenolic contents and antibacterial properties of rose essential oil, hydrosol and absolute. *Current microbiology*, *59*(5), 554.

[7] Demircioğlu, H. (2010). *Kesme gülde (Rosa hybrida first red) farklı 1-mcp dozu uygulamalarının ve farklı depolama koşullarının vazo ömrü üzerine etkiler* (Yayımlanmamış Yüksek Lisans Tezi). Çukurova Üniversitesi Fen Bilimleri Enstitüsü, Adana Türkiye.

[8] Awale, S., Tohda, C., Tezuka, Y., Miyazaki, M., & Kadota, S. (2011). Protective effects of Rosa damascena and its active constituent on Aβ (25–35)-induced neuritic atrophy. *Evidence-based complementary and alternative medicine*, *2011*.

[9] Boskabady, M. H., Shafei, M. N., Saberi, Z., & Amini, S. (2011). Pharmacological effects of Rosa damascena. *Iranian Journal of Basic Medical Sciences*, *14*(4), 295.

[10] Gholamhoseinian, A., Fallah, H., Sharifi-far, F., & Mirtajaddini, M. (2008). The inhibitory effect of some Iranian plants extracts on the alpha glucosidase. *Iranian journal of basic medical sciences*, *11*(1), 1-9.

[11] Cemeroğlu, B. S. (2013). Meyve ve Sebze İşleme Teknolojisi Cilt1. *Nobel Akademi. 728p*.

[12] Şener, D. (2012). *Isparta gülü (Rosa Damascena Mıller) ve bazı ürünlerinin antioksidan kapasiteleri ve fizikokimyasal özelliklerinin belirlenmesi* (Yayımlanmamış Yüksek Lisans Tezi). Atatürk Üniversitesi Fen Bilimleri Enstitüsü Erzurum, Türkiye.

[13] Kaya, B. (2009). *Alchemılla l. (rosaceae) cinsi türlerinde flavonoid bileşiklerinin tayin edilmesi ve bu bileşiklerin taksonomik olarak kullanılması* (Yayımlanmamış Doktora Tezi). Kırıkkale Üniversitesi Fen Bilimleri Enstitüsü, Kırıkkale Türkiye.

[14] Shafei, M. N., Rakhshandah, H., & Boskabady, M. H. (2010). Antitussive effect of Rosa damascena in guinea pigs. *Iranian Journal of Pharmaceutical Research*, 231-234.

[15] Rakhshandah, H., & Hosseini, M. (2006). Potentiation of pentobarbital hypnosis by Rosa damascena in mice.

[16] Rakhshandah, H., Hosseini, M., & Dolati, K. (2010). Hypnotic effect of Rosa damascena in mice. *Iranian Journal of Pharmaceutical Research*, 181-185.

[17] Çolak, H., & Ulusoy, B. (2005). Bitkisel Orijinli Gıdalarda Bulunan Bazı Doğal Antioksidan Maddeler ve Etkileri. *Gıda ve Yem Bilimi Teknolojisi Dergisi*, (8).

[18] Çağındı, Ö. (2016). Mikrodalga Uygulamasının Kırmızı Üzüm Suyunun Antosiyanin İçeriği ile Bazı Fizikokimyasal Özellikleri Üzerine Etkisi. *Akademik Gıda*, 14(4), 356-361

[19] Rodríguez, M. M., Rodriguez, A., & Mascheroni, R. H. (2015). Color, Texture, Rehydration Ability and Phenolic Compounds of Plums Partially Osmodehydrated and Finish-Dried by Hot Air. *Journal of food processing and preservation*, *39*(6), 2647-2662.

[20] Sanchez-Moreno, C. (2002). Methods used to evaluate the free radical scavenging activity in foods and biological systems. *Revista de Agaroquimica y Tecnologia de Alimentos*, *8*(3), 121-137.

[21] Cemeroğlu, B. (2007). Gıda Analizleri, *Gıda Teknolojisi Derneği Yayınları*, 535s.

[22] Baydar, N. G., & Baydar, H. (2013). Phenolic compounds, antiradical activity and antioxidant capacity of oil-bearing rose (Rosa damascena Mill.) extracts. *Industrial Crops and Products*, *41*, 375-380.

[23] Ercisli, S. (2007). Chemical composition of fruits in some rose (Rosa spp.) species. *Food chemistry*, *104*(4), 1379-1384.

[24] Kumar, N., Bhandari, P., Singh, B., & Bari, S. S. (2009). Antioxidant activity and ultra-performance LC-electrospray ionization-quadrupole time-of-flight mass spectrometry for phenolics-based fingerprinting of Rose species: Rosa damascena, Rosa bourboniana and Rosa brunonii. *Food and chemical toxicology*, *47*(2), 361-367.

[25] Ouerghemmi, S., Sebei, H., Siracusa, L., Ruberto, G., Saija, A., Cimino, F., & Cristani, M. (2016). Comparative study of phenolic composition and antioxidant activity of leaf extracts from three wild Rosa species grown in different Tunisia regions: Rosa canina L., Rosa moschata Herrm. and Rosa sempervirens L. *Industrial Crops and Products*, *94*, 167-177.

[26] Shikov, V., Kammerer, D. R., Mihalev, K., Mollov, P., & Carle, R. (2012). Antioxidant capacity and colour stability of texture-improved canned strawberries as affected by the addition of rose (Rosa damascena Mill.) petal extracts. *Food research international*, *46*(2), 552-556.