BÜSAD 2022; 3(2): 151 - 156
BUSAD 2022; 3(2): 151 - 156

Araştırma Makalesi
Original Article

BİNGÖL ÜNİVERSİTESİ SAĞLIK DERGİSİ
Bingol University Health Journal

Hakkari'den Toplanan Çölemerik Ahlatının (*Pyrus hakkarica* Browicz.) Bazı Biyokimyasal Değerlerinin Tespit Edilmesi*

Determination of Some Biochemical Values of Çölemerik Ahlat (*Pyrus hakkarica Browicz.)*

Collected from Hakkari*

Aydın Şükrü BENGÜ[1], Mehmet Şirin ŞENKUL[2], Mahire BAYRAMOĞLU AKKOYUN[3]

ÖZ

Çölemerik ahlatı (*Pyrus hakkiarica*) Rosaceae familyasından *Pyrus* cinsi mensubudur. *Pyrus* cinsinin 22 türü olduğu bilinmektedir. Çölemerik ahlatı Türkiye endemiği olan *Pyrus hakkiarica*'dır. Ülkemizde özellikle Hakkari ve çevresinde yaz mevsiminde severek tüketilen bir meyvedir. Bu çalışma, *P. hakkiarica'* nın temel element seviyelerini ve antioksidant özelliklerini analiz etmek için yapıldı. ICP-MS analizlerine göre Na, Mg, K, Ca, Mn, Fe ve Co seviyeleri sırasıyla 200595,55, 177410,39, 2311755,45, 348756,55, 1329,79, 5557,61, 21,45 ve 1242,81 ppb olarak belirlendi. Zn ve Se ise tespit edilmedi. Antioksidan testleri olarak, 37,49±3,37 mg gallik asit g^{-1}' lik toplam fenol içeriği, 10,25±1,80 mg kuercetin g^{-1}' lik toplam flavonoid içeriği, 161,53±8,83 mM askorbik asit g^{-1}' lik toplam antioksidan kapasite ve 47,32±2,16%' lik DPPH inhibisyonu tespit edilmiştir. Element ve antioksidan değerleri bir meyve açısından yeterli olduğu gözlenmiştir.

Anahtar Kelimeler: *Pyrus hakkiarica*, Çölemerik ahlatı, ICP-MS, element, Antioksidan değerler

ABSTRACT

Çölemerik berry (*Pyrus hakkiarica*) is a member of the Pyrus genus from the Rosaceae family. It is known that the genus *Pyrus* has 22 species. Çölemerik berry is *Pyrus hakkiarica*, which is endemic to Turkey. It is a fruit that is consumed fondly in our country, especially in Hakkari and its surroundings, during the summer season. This study was performed to analyze the basic element levels and antioxidant properties of *P. hakkiarica*. According to ICP-MSanalyses, the levels of Na, Mg, K, Ca, Mn, Fe and Co were detemined as 200595.55, 177410.39, 2311755.45, 348756.55, 1329.79, 5557.61, 21.45 and 1242.81 ppb, respectively. On the other hand, Zn and Se were not detected. As antioxidant tests, total phenol content of 37.49±3.37 mg Gallic acid g-1, total l flavonoid content of 10.25±1.80 mg quercetin g-1, total antioxidant capacity of 161.53±8.83 mM ascorbic acid g-1 and DPPHof 47.32±2.16% nhibition were determined. Element and antioxidant values were observed to be sufficient for a fresh fruit.

Keywords: *Pyrus hakkiarica*, Çölemerik ahlat, ICP-MS, element, Antioxidant values

* *Bu yayın Yüksek lisans tez çalışmasından üretilmiştir.*

[1] Doç. Dr. Aydın Şükrü BENGÜ, Biyokimya, Bingöl Üniversitesi SHMYO, abengu@bingol.edu.tr, ORCID No: 0000–0002–7635–4855
[2] Hemşire, Mehmet Şirin ŞENKUL, Sağlık Bakanlığı, msirinsenkul@hotmail.com, ORCID No: 0000-0002-5061-1593
[3] Doç. Dr. Mahire B. AKKOYUN, Siirt Üniversitesi Veteriner Fakültesi, mahireakkoyun@siirt.edu.tr, ORCID No: 0000-0001-5150-5402

İletişim/Corresponding Author: Aydın Şükrü BENGÜ
E-posta/E-mail: abengu@bingol.edu.tr

Geliş Tarihi/Received : 13.12.2022
Kabul Tarihi/Accepted: 21.12.2022
Yayın Tarihi/Published: 31.12.2022

INTRODUCTION

Çölemerik berry (*Pyrus hakkiarica*) is a plant species belonging to the Rosaceae family, the *Pyrus* genus. The Rosaceae family is an angiosperm family containing about 3000 species and 90 genera, including widely consumed fruits such as apples, pears and cherries, and decorative flowers such as roses (1,2). It is known to be a well-dispersed family worldwide, especially in the temperate areas of the Northern hemisphere. *Malus* (apple) and *Pyrus* (pear) genus constitute the most economically valuable fruits in *Rosaceae* family (3). The most consumed *Pyrus* species (*Pyrus* communis, *P. pyrifolia*, *P. usuriensis*) are preferred as food sources. Some members of the other *Pyrus* genus are used for decorative and landscape purposes worldwide. *P. calleryana*, *P. koehnii*, *P. nivalis* varieties are used to produce perry pear wine. The genus *Pyrus* is categorized under the subfamily Pomoideae in the Rosaceae family in terms of plant systematics. It is generally accepted that there are 22 species under the genus *Pyrus* (4). It is possible to find all species naturally in the temperate regions of the old world. However, it is difficult to determine the exact number of the genus *Pyrus*. On the other hand, Çölemerik berry is *Pyrus hakkiarica*, which is endemic to Turkey (5).

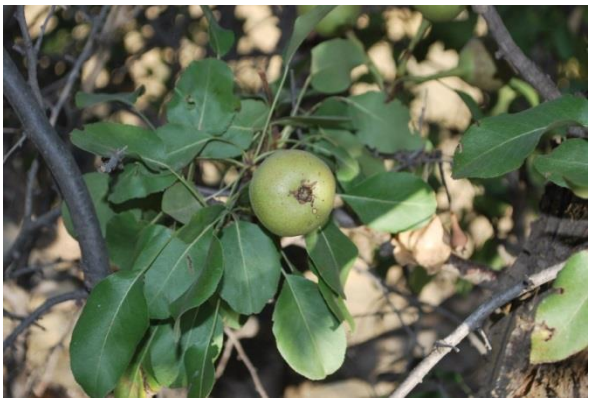

Figure 1.1. Tree form and fruit view of *Pyrus hakkiarica* fruit

Today, it is possible to see members of the *Pyrus* genus all over the world, since they are popular fruits. *P. hakkiarica*, on the other hand, is endemic to Turkey and only occurs in Hakkari.

Pyrus fruit is an essential mineral source for human health (6,7). As with many fruits, it is well known that the mineral content of this fruit is affected after harvest and storage (8-10). Mineral concentration of the fruit; They differ from fruit to fruit depending on the orchard they are obtained from, their location in the shade and the harvest year (7,11,12). An antioxidant is a substance that protects cells against free radicals (FR) and delays or prevents oxidation.

Antioxidants are molecules related to the protection of DNA and cell from oxidative damage and are valuable dietary components. They are called free radical scavenging because they reduce oxidative DNA damage and oxidative stress (13). The degree of DNA damage; It is known to be significantly reduced by antioxidants such as superoxide dismutase (SOD), Catalase (CAT) and Glutathione (GSH).

A variety of nutrients are derived from fruits and vegetables, including antioxidant vitamins such as carotenoids, tocopherols, vitamin C, and flavonoids (14). Antioxidants; It plays a very important role in protecting cells from damage by scavenging free radicals, preventing or delaying oxidation, and can reduce the level of oxidative stress in

the body. On the other hand, the lack of antioxidants leads to increased production of free radicals due to increased oxidation, which can be responsible for oxidative DNA damage, which can lead to diseases such as breast cancer. Antioxidant deficiencies lead to increased levels of oxidative stress. In addition, the increase of free radicals in the body is associated with environmental factors such as pollution, infection, inflammation, smoking and radiation (15).

MATERIAL AND METHOD

The samples of this study were collected from Hakkari province and their chemical analyzes were carried out jointly by Bingöl University Central Research Laboratory and Yüzüncü Yıl University Chemistry Department.

In this study, fruit samples belonging to *P. hakkiarica Browicz.* species of *Pyrus* genus of Rosaceae family, which grows endemic in Hakkari region, were used. After the samples were harvested at the end of October 2021, they were brought to the laboratory, dried at room temperature for a week in the shade, and used for analysis.

Mineral Analysis with ICP – MS

Firstly, 0.5 g of the sample was weighed on a precision scale and transferred to the teflon containers of the microwave device. Sufficient hydrochloric acid was added and the lid was closed. Extraction process was performed in microwave device at 400-1800 W power and 200 ^{0}C for 30 min. After teflon tubes were opened, necessary dilution was made with ultrapure water. The samples were given to the ICP-MS (Perkin Elmer Nexion 2000C) device for elemental analysis. Samples were read against the standard graph of 0.5, 1, 5, 10, 50, 100, and 200 ppb. It was read in 3 repetitions by the ICP-MS device and the average was reported.

Preparation of Fruit Extracts

P. hakkiarica Browicz. dried in the shade. The fruits were ground and powdered using the Kenwood Multi-Mill. Firstly, 5 g of the fruit sample was weighed and transferred to colored bottles. Then, 80% methanol was added to the fruit sample, the bottle was kept in a hot water bath at 35°C for 24 hours with the lid tightly closed. After 24 hours, the extracted samples were subjected to centrifugation at 5000 rpm for about 10 min. After centrifugation, the mixture was filtered using whatman filter paper. The methanol in the filtrate was removed using a rotary evaporator. The methanol extract obtained was stored at -20^{0}C until the time of analysis (16).

Determination of Total Phenol Content

Determination of total phenol content of fruit extracts, was carried out according to the method of Gamez et al (1999). For this purpose, 3 mL of 2% Na_2CO_3 solution was added to the fruit samples diluted with methanol. Then, 150 µL of Folin-Ciocelteu reagent was added. After 30 min of incubation period, absorbance of fruit samples was read against control sample at 765 nm wavelength and recorded. Gallic acid solution was used in the preparation of the standard graph (16,17).

Determination of Total Flavonoid Content

Determination of the total flavonoid content of fruit extract was performed spectrophotometrically (18,19). In brief, 1 mL of fruit extract diluted with methanol was taken and 1 mL of $AlCl_3$ solution was added. This resulting mixture was allowed to incubate for 10 min. After the incubation period, the samples were read at 394 nm against the control sample. The flavonoid contents of fruit extracts were determined as mg g $^{-1}$. Quercetin was used to prepare the standard graph.

Determination of Total Antioxidant Capacity

The total antioxidant capacity of fruit extract was determined using the spectrophotometric method developed by Prieto et al. (20). According to this method, 2 mL of reagent solution was added to 0.2 mL samples of fruit extracts diluted in methanol at different concentrations. The mixture was then incubated at 95 °C for approximately 90 min. After the incubation, the samples were cooled to room temperature. The control was then read against the sample at a wavelength of 695 nm. Ascorbic acid was used for the preparation of standard graph. Results were calculated as mM ascorbic acid g^{-1}.

Capacity to Sweep DPPH Radical

The DPPH (2.2 diphenyl-1-picrylhydrazil) free radical scavenging activity of fruit extract was determined using spectrophotometric method at a wavelength of 517 nm (21). In brief, 5 mL of DPPH solution at 0.004% concentration was added to the extract samples, which were diluted with methanol and prepared at different concentrations, and the mixtures were then incubated for 30 minutes. After the incubation periods, the absorbances of the samples were read at 517 nm wavelength. Inhibition values were calculated with the help of the equation given below. Then, the concentration that inhibited the DPPH radical by 50% was calculated.

% Inhibition: $[(A_{control} - A_{sample}) / A_{control})] \times 100$

Acknowledgement

We would like to thank Dr. Muzaffer MÜKEMRE for their help in the supply of fruit, and the Bingöl University Central Research Laboratory and Van Yüzüncü Yıl University chemistry department for additional analyses.

FINDINGS AND DISCUSSION

Antioxidant tests listed below were applied to *Pyrus hakkiarica Browicz.* fruit extract and the results are given in Table 1. Among the elements, the highest content (2311755,45 ppm) was measured for K followed by Ca (348756,55 ppm). In addition to K and Ca, fruit samples were determined to have also high contents of Na (200595,55 ppm) and Mg (177410,39 ppm). On the other hand, Zn and Se were not determined in fruit samples.

Table 1. Antioxidant tests from Pyrus hakkiarica Browicz. fruit extract

Minerals	Results(ppm)
Na	200595,55
Mg	177410,39
K	2311755,45
Ca	348756,55
Mn	1329,79
Fe	5557,61
Co	21,45
Cu	1242,81
Zn	ND
Se	ND*

ND* not detected

ICP-MS technique with *Pyrus hakkiarica Browicz.* The important mineral content of the fruit extract was determined and listed in Table 2.

Table 2. Mineral Content of Pyrus hakkiarica browicz (ppb)

Antioxidant Tests and Unit	Results
Total Flavonoid Content (mg quersetin g^{-1})	10,25 ± 1,80
Total Antioxidant Capacity (mM Ascorbic Acid g^{-1})	161,53 ± 8,83
DPPH %Inhibisyon IC50 µg mL^{-1}	47,32 ± 2.16
Total Phenol Content (mg Gallik Acid g^{-1})	37,49 ± 3,37

Fruits and vegetables are rich sources of antioxidants. With adequate consumption of antioxidants, there are many health benefits such as reducing the risk of eye diseases that may occur in later ages, preventing the development of cataracts, preventing

blindness, strengthening the immune system, and preventing cancer.

Protein, fat, water, carbohydrates, vitamins and minerals that our body needs for a balanced diet can be met with fruit consumption. If we list the necessity of fruits in terms of health:

Fruits rich in vitamins and minerals are essential for health. It has an important role in providing and protecting the internal balance of the body.

It meets the needs of the body thanks to the vitamins and minerals they have. It takes part in many events that provide structure in the body, such as bone and tooth formation (22).

Fruits with high fiber content prevent constipation, hemorrhoids and many intestinal and digestive system diseases. In this context, fruit consumption is recommended in the light of studies and clinical findings (23).

CONCLUSION AND SUGGESTIONS

Since there is a deficiency in the literature about Çölemerik berry, this study was conducted in order to raise awareness about this issue and to determine the levels of some of the nutritional values.

We believe that it would be beneficial to determine the other nutritional contents of the Çölemerik berry with more comprehensive studies.

It is seen that the mineral values of our Çölemerik berry fruit are rich compared to the average mineral values of other pears in the pear family to which it belongs.

Elements are of great importance for human health. It is known that they play a role in maintaining the water and electrolyte balance in the body, the passage of nutrients through the cell wall, and the healthy functioning of muscle and nerve functions. We see fruits as the source of elements that are important for human health.

Antioxidants are compounds produced in the body or prevent cell damage caused by food. It reduces or eliminates the harmful effects of free radicals in our body.

Although there is no accepted dosage about the daily amount of antioxidants, it is undisputed that it is beneficial.

The fact that this fruit is a rich source of fiber will also help in regulating the health of the digestive and excretory system.

REFERENCES

1. Potter, D. Eriksson, T. Evan, RC. Oh, S. Smedmark, JEE. Morgan, DR. Campbell, CS. (2007). Phylogeny and classification of Rosaceae, Plant systematics and evolution *266*(1-2), 5-43.
2. Christenhusz, MJ. Byng, JW. (2016). The number of known plants species in the world and its annual increase, Phytotaxa *261*(3), 201-217.
3. FAOSTAT (2021) FAO statistics database on the World Wide Web http://www.fao.org .
4. Bell, RL. Quamme, REC. Layne, RM. Skirvin. (1996). Fruit Breeding Vol I: Tree and Tropical Fruit, John Wiley & Sons Inc New York NY.
5. Kutzelnigg, H. Silbereisen, R. (1995). *Pyrus* Illustrierte, Flora von Mitteleuropa *4*(2B): 278-298.
6. Chen, J. Wang, Z. Wu, J. Wang, Q. Hu, X. (2007). Chemical compositional characterization of eight pear cultivars grown in China, Food Chemistry *104*(1), 268-275.
7. Kiczorowska, B. Kiczorowski, P. (2011). Comparison of basic chemical and mineral composition in edible parts of chosen pear cultivars produced in Podkarpackie Province, Acta Scientiarum Polonorum Hortorum Cultus *10*(4), 153-169.
8. Sharples, RO. (1980). The influence of orchard nutrition on the storage quality of apples and pears grown in the United Kingdom In Symposium on Mineral Nutrition and Fruit Quality of Temperate Zone Fruit Trees *92* (pp 17-28)
9. Marcelle, R. (1993). Mineral nutrition and fruit quality, Mineral Nutrition of Deciduous Fruit Plants 383, 219-226.
10. Tagliavini, M. Zavalloni, C. Rombolà, AD. Quartieri, M. Malaguti, D. Mazzanti, F. Marangoni, B. (1998). Mineral nutrient partitioning to fruits of deciduous trees, In XXV International Horticultural Congress Part 2: Mineral Nutrition and Grape and Wine Quality 512 (pp 131-140)
11. Fallahi, E. Righetti, TL. Raese, JT. (1988). Ranking tissue mineral analysis to identify mineral limitations on quality in fruit, J Amer Soc Hort Sci *113*(3), 382-389.
12. Cao, G. Prior, RL. (1998). Comparison of different analytical methods for assessing total antioxidant capacity of human serum, Clinical chemistry *44*(6), 1309-1315.
13. Dan, Y. (2008). Biological functions of antioxidants in plant transformation, In Vitro Cellular & Developmental Biology-Plant *44*(3), 149-161.
14. Ambrosone, CB. (2000). Oxidants and antioxidants in breast cancer, Antioxidants & redox signaling *2*(4), 903-917.
15. Pan, SY. Zhou, J. Gibbons, L. Morrison, H. Wen, S W. (2011). Antioxidants and breast cancer risk-a population-based case-control study in Canada, BMC cancer *11*(1), 1-12.
16. Bayramoğlu, M. Ekin, S. Kızıltaş, H. Oto, G. Susen, E.A. & Özgökçe, F. (2016). Antioxidant properties of Rosa pisiformis and its protective effect against isoproterenol-induced oxidative stress in rats. *Turkish Journal of Biochemistry*, *41*(4), 232-242.
17. Gamez-Meza, N. Noriega-Rodriguez, J. A. Medina-Juarez, L. A. Ortega-Garcia, J. Cazarez-Casanova, R. & Angulo-Guerrero, O. (1999). Antioxidant activity in soybean oil of extracts from Thompson grape bagasse. *Journal of the American Oil Chemists' Society*, *76*(12), 1445-1447.
18. Lamaison, JL. Petitjean-Freytet, C. & Carnat, A. (1990, January). Rosmarinic acid, total hydroxycinnamic derivatives and antioxidant activity of Apiaceae, Borraginaceae and Lamiceae medicinals. In *Annales pharmaceutiques francaises* (Vol. 48, No. 2, pp. 103-108).
19. Kiziltas, H. Ekin, S. Bayramoglu, M. Akbas, E. Oto, G. Yildirim, S. & Ozgokce, F. (2017). Antioxidant properties of Ferulago angulata and its hepatoprotective effect against N-nitrosodimethylamine-induced oxidative stress in rats. *Pharmaceutical Biology*, *55*(1), 888-897.
20. Prieto, P. Pineda, M. & Aguilar, M. (1999). Spectrophotometric quantitation of antioxidant capacity through the formation of a phosphomolybdenum complex: specific application to the determination of vitamin E. *Analytical biochemistry*, *269*(2), 337-341.
21. Cuendet, M. Hostettmann, K. Potterat, O. & Dyatmiko, W. (1997). Iridoid glucosides with free radical scavenging properties from Fagraea blumei. *Helvetica Chimica Acta*, *80*(4), 1144-1152.
22. Bengü AŞ, Yılmaz HÇ. (2021). Dengeli Beslenme ve Mantar Tüketimi, Tıp ve Sağlık Araştırmaları Teori, Yöntem ve Uygulama, Livre De Lyon, 1, 277-307.
23. Bengü AŞ, Keleş MS. (2021). İnsan Sağlığı ve Mineraller ile İlişkisi, Tıp ve Sağlık Araştırmaları, Araştırma ve Uygulama Kitabı, Livre De Lyon, 1, 1377-150.