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Araştırma Makalesi

Determination of Some Biochemical Values of *Crataegus orientalis* (Easthern hawtorn) Fruit Obtained from Genc District of Bingol[¥]

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ABSTRACT

Crataegus orientalis grows in the Mediterranean region, Türkiye and Iran; It is a kind of fruit that may have yellow, red, orange colors. It is a fruit that is loved and consumed especially in our country and in Eastern Anatolia in autumn. Bingöl is a geography that consumes this fruit fondly with its districts and thinks that this hawthorn species is healing. *Crataegus orientalis* (Eastern hawtorn) used in our study was collected by us from Genç district of Bingöl in September 2021. As chemical analysis, some important element levels and some antioxidant tests were performed. Among the analyzed elements, sodium is 33512,50 ppb, magnesium is 432871,44 ppb, potassium is 2925823,19 ppb, calcium is 1623360,05 ppb, manganese is 1691,45 ppb, iron is 57778,99 ppb, cobalt is 117,62 ppb, copper is 1121,00 ppb and selenium is 6,61 ppb found. It has been observed that it has a very rich amount of element content. The antioxidant test results were observed as follows; total phenol content 79.76 ± 0.95 mg gallic acid g^{-1}, total flavonoid content 43.04 ± 1.67 mg quercetin g^{-1}, total antioxidant capacity 203.76 ± 12.28 mM ascorbic acid g^{-1}, DPPH radical scavenging capacity 61.6 ± 0.57 % inhibition. Eastern hawthorn is a fruit that is beneficial for health with its rich element content and strong antioxidant values, as well as being a fibrous food. We think that understanding the value of this fruit, which is grown and consumed only in a limited time period of the year, such as a few weeks, will be beneficial for public health.

Key words: Antioxidants, Bingol, *Crataegus orientalis*, element, hawthorn

Bingöl'ün Genç İlçesinden Temin Edilen *Crataegus orientalis* (Doğu Alıcı) Meyvesinin Bazı Biyokimyasal Değerlerinin Tespit Edilmesi

ÖZ

Crataegus orientalis, Akdeniz bölgesi, Türkiye ve İran coğrafyasında yetişen; sarı, kırmızı, turuncu renklere sahip olabilen bir meyve çeşididir. Özellikle ülkemizde ve Doğu Anadolu'da sonbaharda sevilerek tüketilen bir meyvedir. Bingöl de ilçeleri ile beraber bu meyveyi severek tüketen ve bu alıç türünün şifalı olduğunu düşünen bir coğrafyadır. Çalışmamızda kullanılan *Crataegus orientalis* (Doğu alıcı) 2021 yılının eylül ayında Bingöl'ün Genç ilçesinden tarafımızca toplanılmıştır. Kimyasal analiz olarak bazı önemli element seviyeleri ve bazı antioksidan testleri yapılmıştır. Analiz edilen elementlerden sodyum 33512,50 ppb, magnezyum 432871,44 ppb, potasyum 2925823,19 ppb, kalsiyum 1623360,05 ppb, manganez 1691,45 ppb, demir 57778,99 ppb, kobalt 117 ,62 ppb, bakır 1121,00 ppb ve selenyum 6,61 ppb olarak tespit edilmiştir. Oldukça zengin miktarda element içeriğine sahip olduğu gözlemlenmiştir. Antioksidan test sonuçları şu şekilde gözlendi; toplam fenol içeriği 79.76 ± 0.95 mg gallik asit g^{-1}, toplam flavonoid içeriği 43.04 ± 1.67 mg quercetin g^{-1}, toplam antioksidan kapasitesi 203.76 ± 12.28 mM askorbik asit g^{-1}, DPPH radikal yakalama kapasitesi 61.6 ±

0.57 % inhibisyon. Doğu alıcı, zengin element içeriği ve kuvvetli antioksidan değerlerinin yanı sıra lifli bir gıda olması ile de sağlık açısından faydalı bir meyvedir. Birkaç hafta gibi yılın sadece sınırlı zaman periyodunda yetişen ve tüketilebilen bu meyvenin değerinin anlaşılması toplum sağlığı açısından faydalı olacağını düşünmekteyiz.
Anahtar kelimeler: Alıç, antioksidan, Bingöl, *Crataegus orientalis,* element

INTRODUCTION

Crataegus orientalis belongs to Rosaceae family and is grown in Türkiye, Iran and Mediterranean regions; It is a variety of hawthorn with yellow, orange and red colors. Nuts, leaves and flowers of the *Crataegus* bush have been observed to be effective in curing hypertension and cardiovascular diseases (Nabavi et al., 2015). Hawthorn is a wild plant species and is among the autumn fruits. It grows in mountainous areas, stream beds, rocks, forest areas. Hawthorn is a woody plant variety that is deciduous in winter, rarely semi-evergreen, mostly found in thorny shrubs or dwarf trees (Davis et al., 1972; Kayacık, 1981; Seçmen et al., 1989; Pamay, 1992). Mostly in April and May, the hawthorn blooms in white or pinkish colors and emits a very nice fragrance during these periods. At the end of the summer months, the fruits begin to emerge and in the autumn season, they are fully mature and ready to be collected. Hawthorn fruit, which is usually collected at the end of September and the beginning of October in Bingöl, is consumed raw by the local people as well as by making jam and marmalade. It usually has a sour taste. More mature ones are usually sweet. Hawthorn fruit, which grows in most regions of our country, is named differently from region to region. It is also known as ses/soz in Bingol. In this region, the leaves of the hawthorn fruit can be collected and tea can be made and consumed. Raw and ripened fruit of *Crataegus orientalis* are shown in figures 1 and 2.

Figure 1: Raw fruit of *Crataegus orientalis*

Figure 2: Ripe fruit of *Crataegus orientalis*

Studies have shown that the eastern hawthorn fruit fights free radicals thanks to the antioxidants it contains; It has been shown that it provides detoxification, protects cells against the toxic effects of free radicals and plays an active role in the prevention of diseases (Pham-Huy LA, 2008). Minerals, which are vital inorganic elements that act as catalysts in biochemical reactions in the human body; they are building materials that are not produced in the body but must be taken from outside. The part of the minerals that are divided into two as macro and micro minerals, 250 mg or more of the daily intake is called macro minerals. Among them, sodium (Na), potassium (K) and chlorine (Cl), calcium (Ca), magnesium (Mg), sulfur (S) and phosphorus (P) are macro minerals. Minerals that are 20 mg less than the daily required amount are called trace elements or micro minerals. Minerals in this group; chromium (Cr), fluorine (Fl), copper (Cu), iodine (I), manganese (Mn), iron (Fe), molybdenum (Mo), selenium (Se) and zinc (Zn) (Samur, 2008; Unsal, 2019). Minerals have very important functions in the body. For example, while calcium and magnesium work in the proper functioning of the muscle and nervous system; Calcium, phosphorus and fluorine participate in tooth and bone structure. While iron plays an active role in blood production and oxygen transport, iodine in the production of hormones in the thyroid gland; Minerals such as sodium, potassium and chlorine are necessary in circulatory disorders. Minerals are taken into the body with various foods from the outside; It is excreted in urine, feces, sweat and

tears. Minerals thrown out of the body must be replaced by new ones; because these are elements that cannot be produced by the body (Applegate, 2011; Baysal, 2010; Samur, 2008; Ünsün, 2003; Ünsal, 2019). Hawthorn fruit, which grows abundantly in many regions of Turkey, especially in rural areas, contains high amounts of different mineral substances, primarily calcium (Ca), phosphorus (P), potassium (K), magnesium (Mg) and iron (Fe). (Tüysüz et al., 2020). With the understanding of how important antioxidants are for our lives, scientific research on antioxidants has increased in recent years (Kılıç, 2020). Flavonoids are compounds of vegetable origin and yellow in color. More than 4000 studies have been conducted on flavonoids, which are the most studied phenolic compound group, and the structures of these studied flavonoids have been shown (Naczk and Shahidi, 2004; Öztan, 2006). It is very important to determine the total amount of phenolic compounds in foods, to determine the antioxidant activity and to give information about the hydroxyl groups that provide this activity. Studies have shown that there is mostly a linear relationship between total phenol content and antioxidant activity (Huang et al., 2005; Prior et al., 2005).

MATERIAL ve METHODS

In this study, fruit samples belonging to the *Crataegus orientalis* species were used. The samples obtained from Bingöl province, Genç district Çanakçı village were brought to the laboratory after being harvested at the end of October 2021, kept in the shade for a week at room temperature and dried for analysis. The fruits and leaves of *Crataegus orientalis* dried in the shade were separated from each other. The fruit parts were then ground into powder using Kenwood Multi-Mill (Kenwood Ltd., UK). Approximately 5 grams of the shade-dried fruit sample was weighed and transferred to colored bottles. 80% methanol was added to the fruit sample transferred to colored bottles, and the mouth was tightly closed and kept in a water bath with a stirrer at 35°C overnight. After 24 hours, the extracted samples were centrifuged at 5000 rpm for 10 minutes. After centrifugation, it was filtered using whatman No: 1 filter paper. The solvent in the filtrate was removed using a rotary evaporator. The obtained methanol extract was stored at -20°C until the time of analysis (Bayramoğlu et al., 2016).

ICP-MS Method and Sample Preparation for Mineral Analysis

After weighing approximately 1 gram from the samples obtained for the analyzes to be made by the ICP-MS method, they were taken into the microwave oven, 10 mL of 65% nitric acid was added to each sample separately, transferred to teflon containers and the lids were tightly closed. It was placed in the microwave oven to decompose. The oven temperature was increased to the highest temperature of 200 °C within 15 minutes, and it was kept at this temperature for 15 minutes. The dissolution process was done by keeping it in a closed system for 30 minutes. The oven temperature was brought to ambient temperature. Afterwards, the solution and ultrapure water in the containers were transferred to the flasks (50 mL) after washing the lids of the containers. 10 mL of 1% suprapure nitric acid-ultrapure water mixture was added to 1 mL taken from here, and the necessary analyzes were made after the dilution process was completed.

Determination of Total Phenol Content

Folin-Ciocalteu reagent was used to determine the total phenol content of the fruit extract of *Crataegus orientalis* plant (Gamez-Meza et al., 1999). After 3 mL of 2% Na_2CO_3 was added to the fruit samples diluted using methanol, 150 µL of folin reagent was added. It was then incubated for 30 minutes. The absorbance of the samples was read against the control sample at a wavelength of 765 nm. Gallic acid solution was used in the preparation of the standard graph (Ekin et al., 2017).

Determination of Total Flavonoid Content

Determination of total flavonoid content of *Crataegus orientalis* fruit extracts was performed spectrophotometrically at 394 nm wavelength. 1 mL of $AlCl_3$ solution was added to the 1 mL solutions of fruit extracts diluted with methanol. The mixture was read against the control sample after 10 minutes of incubation. The flavonoid contents of the samples were determined as mg g -1. Quercetin was used as the standard graphic. (Lamaison et al., 1990; Kızıltaş et al., 2017).

Determination of Total Antioxidant Capacity

The determination of total antioxidant capacity was determined using the method developed by Prieto et al., which is based on the reduction of Mo (VI) to Mo (V) in acidic medium and the formation of a green colored complex (Prieto et al., 1999). 2 mL of reagent solution was added to 0.2 mL samples of different concentrations of fruit extracts diluted in methanol. Then, after 90 minutes of incubation at 95°C, the samples were cooled to room temperature in an ice bath. Then, spectrophotometric measurements were performed at a wavelength of 695 nm against the control sample. Ascorbic acid standard graph was used.

DPPH Radical Scavenging Capacity

DPPH (2.2 diphenyl-1-picrylhydrazil) free radical scavenging activity of fruit extracts of *Crataegus orientalis* plant was determined using spectrophotometric method at 517 nm wavelength (Cuendet et al., 1997). After adding 5 mL of DPPH solution with a concentration of 0.004% on the extract samples prepared at different concentrations by diluting with methanol, they were left to incubate for 30 minutes. After the incubation period, the absorbances of the samples were read at 517 nm wavelength. Inhibition values were calculated with the help of the graph given below. Then, the % inhibition values determined against the concentrations were plotted and the concentration that inhibited the DPPH radical by 50% was determined (Ekin et al., 2017).

RESULTS and DISCUSSION

Mineral values of hawthorn fruit obtained from Genç district of Bingöl are given in Chart 1 below.

Table 1. Elemental analysis results obtained with ICP-MS device of samples collected from Genç district of Bingöl

Minerals	**Results (ppb)**
Na (sodium)	33512.50
Mg (magnesium)	432871.44
K (potassium)	2925823.19
Ca (calcium)	1623360.05
Mn (manganese)	1691.45
Fe (iron)	57778.99
Co (cobalt)	117.62
Cu (copper)	1516.79
Zn (zinc)	1121.00
Se (selenium)	6.61

The amount of nine minerals that are considered important for human health were examined. Among the analyzed elements, sodium is 33512.50 ppb, magnesium is 432871.44 ppb, potassium is 2925823.19 ppb, calcium is 1623360.05 ppb, manganese is 1691.45 ppb, iron is 57778.99 ppb, cobalt is 117.62 ppb, copper is 1121,00 ppb and selenium is 6.61 ppb found. It is seen that it contains more precious minerals than ordinary fruit. It was observed that the two most abundant elements were potassium and magnesium with 432871 ppb and 2925823 ppb, respectively. The two least abundant elements were selenium and copper with 6.61 ppb and 1121 ppb, respectively. Among the antioxidant parameters, total phenol content, total flavonoid content, total antioxidant capacity, DPPH Radical Scavenging Capacity were analyzed. The obtained results are given in Chart 2 below.

Table 2. Analyzed antioxidant parameters and their results.

Antioxidant Parameters and Units	**Analysis Results**
Total Phenol Content (mg Gallic Acid g^{-1})	79.76 ± 0.95
Total Flavonoid Content (mg quercetin g^{-1})	43.04 ± 1.67
Total Antioxidant Capacity (mM Askorbik Asit g^{-1})	203.76 ± 12.28
DPPH Radical Scavenging Capacity (% inhibisyon / IC_{50})	61.6 ± 0.57 / 21.43 ± 0.54

The antioxidant test results were observed as follows; total phenol content 79.76 ± 0.95 mg gallic acid g-1, total flavonoid content 43.04 ± 1.67 mg quercetin g^{-1}, total antioxidant capacity 203.76 ± 12.28 mM ascorbic acid g^{-1}, DPPH radical scavenging capacity 61.6 ± 0.57 % inhibition.

SUGGESTIONS and CONCLUSION

Balanced and adequate nutrition is defined as taking the energy necessary for the regular growth, regeneration and protection of our body against diseases, and taking it into the body in sufficient quantities from each nutrient and in proportion to the body's needs (Özcan, 2018). Today, the terms 'Nutraceutical' or 'Functional Foods' are used for foods that are specified as food or a part of nutrition and can provide health-related benefits. Especially with its rich phenolic compounds, fruits are the most important nutritional element of this group (Wildman et al., 2007). In today's world, people have turned to alternative treatment methods and functional food consumption for a healthy life. In fact, the healthy nutritional values found in foods have surpassed people's personal nutritional tastes (Özcan, 2018). Fruits and vegetables; they provide significant benefits in healthy nutrition as they contain vitamins, minerals, dietary fibers, polyphenols and beneficial substances at different levels in terms of nutritional content (Slavin and Lloyd, 2012). Fruits; thanks to the phenolic compounds in its content, it is characterized as a functional food because it provides antioxidative and antimicrobial effects and has positive effects on human health. Phenolic compounds, which are abundant in fruits, are also known as permeability factor or vitamin P. In addition, the feature of phenolic compounds as quality control criteria in some foods reveals how important they are in nutrition (Özgen et al., 2007; Nizamoğlu et al., 2010). As a result of the deterioration of the balance between free radicals and antioxidants, oxidative damage occurs in cells with free radicals being more dominant. It is recommended to consume vegetables and fruits in order to protect against cancer, lymphomas, cardiovascular diseases (such as hypertension, atherosclerosis) caused by free radicals. Foods with high antioxidant content also have high oxygen radical absorbance capacity, ORAC (Oxygen Radical Absorbance Capacity). The antioxidant capacity of fruits and vegetables varies depending on the type and rate of antioxidant substances they contain (Haytowitz and Bhagwat 2010). This ratio is especially high in fiber foods. Food experts state that it is very important to include vegetables and fruits, which are determined to have high ORAC values, in order to have a healthy diet and to protect themselves from diseases caused by free radicals. A high ORAC value in a food is a clear indication that the food has a high percentage of antioxidants. Thus, it can be said that the protection against cancer and the anti-aging effect of that food are high (Özcan, 2018). Dietary fiber found in fibrous foods are compounds that cannot be digested by the gastrointestinal tract but are fermented by probiotics in the intestines, forming the edible parts of plants (Arslan et al., 2014). It has been a good resource for those who want to lose weight, those who want to regulate their bowel habits, and those who want to maintain their health, due to its positive effects such as creating a feeling of satiety in the body and high water holding capacity, and being a factor that prevents colon cancer by diluting toxic wastes in the colon (Salçın et al., 2021). Minerals are inorganic substances that make up approximately 4% of body weight. Minerals, which have an important place in the healthy growth and development of people, reproduction and survival, are among the substances that should not be produced by the body but must be taken from outside. Minerals that can be found in intracellular and extracellular fluids; It plays a vital role in the functioning of the musculoskeletal system, in blood production and oxygen transport, in the functioning of the thyroid glands, and in ensuring

healthy growth and development by participating in tooth and bone structures. Both in the ionic state and due to some organic compounds, minerals break down into ions known as electrolytes in the body. In the absence of minerals, which have very important functions in the body, serious negative symptoms and diseases occur (Gürsoy et al., 2002). This master's thesis study was conducted to contribute to the literature on the nutritional content of the Eastern haworth (*Crataegus orientalis*). Considering the elemental findings of the samples obtained; when a portion of hawthorn fruit is consumed, a significant proportion of the daily requirement will be taken. We think that consuming it in season will be beneficial for the health and balanced nutrition of the people of the region. When we look at the antioxidant results, we see that they have strong antioxidant values. Being a fruit with a fibrous structure, it will also be preferred in terms of health.

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