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Mineral and Heavy Metal Constituents of Three Edible Wild Plants Growing in Van Province

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ABSTRACT: *Malva sylvestris*, *Falcaria vulgaris* Bernh and *Chenopodium botrys* L. are of the usually expended wild palatable plants as nourishment and therapeutic purposes by residents in Eastern Anatolia Region of Turkey. In this manner, the assurance of dietary esteem and minerals of eatable wild plants are basic for nourishment security and human health. Hence, in the present examination nutritional esteem and minerals of chose plant species were researched. Additionally, this study presents useful data (mineral constituents, total ash, dry matter, % N, crude protein, pH and crude fiber) to show the knowledge of the nutritional value of three wild plants traditionally consumed in many areas in Eastern Anatolia. According to the results obtained from laboratory analysis, *Malva sylvestris* is high in crude fiber (44.64%) compared with *Falcaria vulgaris_Bernh* (18.34%) and *Chenopodium botrys* L. (36.04%). Crude protein content of *Falcaria vulgaris* and *Chenopodium botrys* L. were calculated as 21.69% and 12.25%, respectively, while that of *Malva sylvestris* was 8.57%. In terms of total ash content, it was observed that *Chenopodium botrys* L. has higher value (20.84%) than the others. The higher values of mineral elements were observed in *Chenopodium botrys* L. such as sodium (1.24g kg^{-1}), potassium (28.22g kg^{-1}), calcium (46.87g kg^{-1}), phosphor (3.95g kg^{-1}), magnesium (10.61 g kg^{-1}), iron (580.53mg kg^{-1}), manganese (79.54mg kg^{-1}), while the higher values of Sulphur (1.91g kg^{-1}), zinc (43.14mg g^{-1}) and total ash (20.84%) rate were determined in *Malva sylvestris* species.

Key words: Edible wild plant, Heavy metal, mineral composition

Van İlinde Yenilebilir Üç Yabani Bitkinin Mineral ve Ağır Metal Bileşenleri

Ö**ZET:** *Malva sylvestris, Falcaria vulgaris Bernh ve Chenopodium botrys* L, Türkiye'nin Doğu Anadolu Bölgesi sakinleri tarafından besin ve tıbbi amaçla yaygın olarak tüketilen yabani yenilebilir bitkilerdir. Yabani yenilebilir bitkilerin besin değeri ve mineral bileşimlerinin belirlenmesi gıda güvenliği ve insan sağlığı açısından oldukça önemlidir. Bu nedenle, bu çalışmada seçilen bitki türlerinin besin değeri ve mineral bileşimi araştırılmıştır. Bu çalışma, Doğu Anadolu'daki birçok alanda geleneksel olarak tüketilen üç yabani bitki türünün besin değeri bilgisini ortaya koymak için faydalı veriler de (kuru madde, toplam kül,% N, ham protein, ham lif, pH ve mineral içeriği) sunmaktadır. Laboratuvar analiz sonuçlarına göre *Malva sylvestris* (% 44.64), *Falcaria vulgaris* (%18.34) ve *Chenopodium botrys* L. (%36.04) ile kıyasla yüksek ham lif oranı sahiptir. *Falcaria vulgaris Bernh* ve *Chenopodium botrys* L'nin ham protein içeriği sırasıyla %21.69 ve % 12.25, *Malva sylystsis*'in ham protein içeriği ise %8.57 olarak hesaplandı. Toplam kül içeriği açısından, *Chenopodium botrys* L'nin diğerlerine kıyasla daha yüksek bir değere (% 20.84) sahip olduğu görülmüştür. Sodyum (1.24g kg^{-1}), potasyum (28.22g kg^{-1}), kalsiyum (46.87g kg^{-1}), fosfor (3.95g kg^{-1}), magnezyum (10.61 g kg^{-1}), demir (580.53 mg kg^{-1}), manganese (79.54mg kg^{-1}) gibi elementlerin en yüksek değerleri *Chenopodium botrys* L'de gözlenirken, en yüksek kükürt (1.91g kg^{-1}), çinko (43.14mg g^{-1}) ve toplam kül oranı değerleri (% 20.84) *Malva sylvestris* türünde tespit edilmiştir.

Anahtar Kelimeler: Ağır metal, mineral kompozisyon, yenilebilir yabani bitki

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INTRODUCTION

Anatolia has very rich genetic resources. Contingent upon various atmospheres and societies various plant species have been collected from nature and utilized for various purposes. From past to today, humans have been used wild edible plants. Due to increase in hazardous chemical, fertilizers, pesticides etc., in conventionally produced products have lost their natural taste, nutritive values etc. (Ismail and Cheah 2003). Also, these crops may carry some healthy risk for humans such as cancer etc. For the reason, humans prefer to consume wild edible plants and organic products.

Malva sylvestris L. known as regular mallow, is native to North Africa, Asia and Europe. Its traditional consumption has been reported since 3000 BC. It's generally utilized as a part of European and Mediterranean conventional medicine and vegetable. Traditional phytotherapy uses include the treatment of cough, inflammatory diseases of mucous membranes, nonspecific dermatitis, stomach ache, and sore throat (Scherrer, Motti and Weckerle 2005, Kultur 2007). *Falcaria vulgaris* Bernh. is native to Eastern Europe and Western Asia where it is here and there utilized as a nourishment plant and there is some enthusiasm for potential restorative and antifungal properties (Qasem and Aau-Blan 1996, Turan et al. 2003, Khazaei and Salehi 2006). It has been reported that it was utilized for traditionally in the society prescription for recuperating of stomach issue including peptic ulcer, skin ulcer, liver ailments and stones of kidney and bladder (Khazaei and Salehi 2006). *Chenopodium* species have been used for a long time in folk medicine.

These plants are of the most gathered and utilized palatable wild plants as nourishment and therapeutic purposes in Eastern Anatolia Region of Turkey. Researches on chemical constituents and nutritious value of wild consumable plants have been popular everywhere throughout the world. The point of this investigation was to determine some nutritious value and minerals of three wild eatable plants of the Eastern Anatolia in Turkey.

MATERIAL AND METHODS

Malva sylvestris, *Falcaria vulgaris* Bernh and *Chenopodium botrys* L were the plant species, which were investigated for their chemical constituents. The botanical identifications of the plants collected around Van Lake in 2013 were done according to Flora of Turkey (Davis 1972) by Assoc. Dr. Fevzi OZGOKCE at Department of Biology in Yuzuncu Yıl University. The identifying properties of the collected plant species are shown in Table 1.

Table 1. The properties of three wild eatable plants of Eastern Anatolia

Plants' Scientific Name	Family	Local Name	Used Parts	Usage	Locality	Col. No.
Malva sylvestris	Malvaceae	Ebegümeci, Tolik	Above ground parts	Meal, roasted, food	L1	F 9673
Falcaria vulgaris Bernh.	Apiaceae	Pikask, Kaz Ayağı	Above ground parts	Meal, roasted, food	L2	F 12798
Chenopodium botrys L.	Chenopodiaceae	Sirken, Kızılbacak	Above ground parts	food	L3	F 10559

L1:Van, Gevaş, steppe (2800 m) of north inclines of Mountain Alacabük, east of Altınsaç church
L2:Bitlis, Tatvan, steppe (2400 m) of north inclines of Mountain Alacabük
L3:Van, Gevaş, steppe (2800 m) of north inclines of Mountain Alacabük, east of Altınsaç Church

The gathered plant samples were isolated from contaminants, divided into utilized parts and washed by deionized water. In the wake of drying in an airy place under the shade in the laboratory, plant samples were ground and kept in plastic packs for analyses.

The nutritious value was investigated such as total ash, dry matter, %N, crude protein, crude fiber and pH, minerals (Ca, Cu, Fe, K, Mg, Mn, Na, P, S and Zn) and some heavy metals (Cd, Co, Cr and Pb) were additionally determined in the observed plant parts. Dry

matter was determined with the drying of the samples at 105 ºC for 24 hours in laboratorial oven. For the total ash (inorganic matter) determination, an Electrical Muffle furnace set at 550 ºC was used. The total N content of samples was analyzed by Kjeldahl apparatus and method, the crude protein ratio was computed by formula from the total N content (AOAC 2000). A pH-meter was used to monitor the pH of the samples. The crude fiber observations were performed according to AOAC (2000) . The mineral constituents of the plant samples were investigated as follows: at the first, the dried samples were ashed in a furnace with hydrochloric acid and nitric acid (AR) (AOAC 2000). After then, the samples were being added with distilled water (50 ml) in a volumetric flask. All assays were performed triplicate and the standard materials were being utilized for chemical analyses. Atomic Absorption Spectrometry (AAS) was used to determinate the mineral constituents. Phosphorus (P) and sulphur (S) were investigated according to the molybdate–vanadate method with a UV-Visible spectrophotometer (Shimadzu UV-1201 V; Shimadzu, Kyoto, Japan). The results and standard deviations (Sd) of chemical analyses have been shown in Table 2.

RESULTS and DISCUSSION

Eastern Anatolia shows some differences from many regions in terms of climate and topographical conditions. So, due to this diversity, it has many different species of wild plants most of which are endemic. The residents of the region use most of these wild plants in their daily lives. In this study, some nutrient contents of three edible plants that mostly consumed as vegetable were studied and some of their properties were shown in Table 2. The values of total ash, dry matter, nitrogen (N), crude protein, crude fiber contents and pH were shown in Table 2, and the mineral constituents in Table 3. The means were documented as mean ± Sd (Standard deviation).

Table 2. Means and Sd values of chemical constituents of three edible wild plants

Parameters	***Malva sylvestris***	***Falcaria vulgaris*** Bernh	***Chenopodium botrys*** L.
Dry matter (%)	19.26 ±0.86	23.18±0.99	18.32±1.16
Total ash (%)	13.0 ± 1.41	7.00 ± 1.36	20.84 ± 1.57
N (%)	1.37 ± 0.11	2.75 ± 0.16	1.96 ± 0.04
Crude protein (%)	8.57 ± 0.26	21.69 ± 0.42	12.25 ± 0.27
pH	7.22 ± 0.31	5.27 ± 0.33	6.78 ± 0.74
Crude Fiber (%)	44.64 ± 3.16	18.34 ± 1.96	36.04 ± 0.88

The lowest and highest means values of dry matter, total ash, N, crude protein, pH and crude fiber of the plant samples were determined as 18.32–23.18 %, 7.00–20.84 %, 1.37–2.75 %, 8.57– 21.69 %, 5.27–7.22 and 18.34–44.64%, respectively. García-Herrera et al. (2014) recorded that the crude protein, fiber and total ash values of some eatable wild plants consumed in the Iberian Peninsula were ranged between 0.34-6.13 g/100g, 2.34-12.26 g/100g and 1.03-4.35 g/100g, respectively, and Sekeroglu et al. (2006) declared the lower total nitrogen values than ours that ranged between 0.2-0.7%.Tunçtürk, Eryiğit and Kaya (2017) reported that the dry matter, ash, protein and crude fiber content of ten wild plants growing in Eastern Anatolia were 11.23-20.80 %, 4.33-20.7 %, 6.63-10.05 %, 20.72-40.41 %, respectively. Our results were found higher than the researcher's findings. These differences among different plant species may be due to environmental and growth conditions.

According to the analyses results, the chemical constituents of the analysed samples show high variations (Table 3). In general, *Malva sylvestris* and *Chenopodium botrys* L. have the maximum chemical composition, and the minimum values were obtained from *Falcaria vulgaris* Bernh.

In the study, the highest sodium (1.24 g kg^{-1}), magnesium (10.61 g kg^{-1}), calcium (46.87 g kg^{-1}) and manganese (79.54 mg kg^{-1}) levels were determined in *Malva sylvestris* samples and the highest potassium (28.22 g kg^{-1}), phosphorus (3.95 g kg^{-1}) and iron (480.53 mg kg^{-1}) contents were observed in *Chenopodium botrys* L. (Table 2).

Some edible wild vegetables and medicinal plants were evaluated for their chemical compositions, previously. In these researches, Na, magnesium, potassium and calcium concentrations were reported between 0.19 - 8.88 g kg^{-1} (Renna et al. 2015, Tuncturk et al. 2015, Kibar and Temel 2016), 0.14 - 12.28 g kg^{-1} (Ranfa et al. 2015, Renna et al. 2015), 1.08 - 33.9 g kg^{-1} in (Phillips et al. 2014, Tuncturk et al. 2015) and 0.11 - 27.44 g kg^{-1} (Phillips et al. 2014, Renna et al. 2015, Tunçtürk, Eryiğit and Kaya 2017), respectively. Additionally, phosphorus and sulphur contents varied from 0.21 to 35.69 g kg^{-1} (Phillips et al. 2014, Tunçtürk, Eryiğit and Kaya 2017) and 0.31 to 3.38 g kg^{-1} (Tuncturk et al. 2015, Kibar and Temel 2016), respectively. Considering previous investigations on macro chemical constituents of some medicinal and edible wild plants, our findings are in accordance with results of these studies. It is well known that among the number of factors, climate conditions, available water in the soil, characteristics of soil, etc. considerably affect chemical composition of plants species (Sekeroglu et al. 2012). In this study, it was concluded that there is likewise a wide variety for macro components among the observed plant species.

Among the analyzed plant species, while the highest Cu, Zn and Cr concentrations were obtained from *Malva sylvestris* samples, *Falcaria vulgaris* Bernh gave the highest Cd, Co and Pb levels (Table 2). In the previously proposed data, the Mn levels of the medicinal plants and edible wild vegetables were in the ranges of 5 – 244 mg kg^{-1} (Sekeroglu et al. 2008, Jabeen et al. 2010). With regard to the iron (Fe) contents, the mean values ranges were observed to range from 25.0 to 1732.2 mg kg^{-1} (Turan et al. 2003, Renna et al. 2015, Tunctürk and Özgökçe 2015). In the previous studies, mean contents of Cu vary from 1.8 – 46.3 mg kg^{-1} for edible plants (Turan et al. 2003, Indrayan et al. 2005), and also zinc levels reported for edible plants were 6.78 – 68.65 mg kg^{-1} (Renna et al. 2015, Tunctürk and Özgökçe 2015, Kibar and Temel 2016). The aforementioned elements are considered that they are useful for human health and run in a number of physiological functions in living organisms. In this study, determined concentrations of the chemical constituents are in harmony with the previous studies results. Cr, Cd, Co and Pb contents are limited and at trace amount in the analyzed samples (Table 2).

Table 3. Means of chemical constituents of three edible wild plants

Minerals	***Malva sylvestris***	***Falcaria vulgaris*** Bernh	***Chenopodium botrys*** L.
Na (g kg^{-1})	1.24 ± 0.08	1.10 ± 0.01	1.04 ± 0.02
Mg (g kg^{-1})	10.61 ± 1.08	4.90 ± 0.80	1.67 ± 0.12
K (g kg^{-1})	21.17 ± 1.14	27.21 ± 1.57	28.22 ± 1.11
Ca (g kg^{-1})	46.87 ± 1.16	19.78 ± 0.14	6.48 ± 0.12
P (g kg^{-1})	2.50 ± 0.25	3.14 ± 0.06	3.95 ± 0.09
S (g kg^{-1})	1.55 ± 0.11	1.91 ± 0.07	1.31 ± 0.07
Mn (mg kg^{-1})	79.54 ± 4.77	33.73 ± 1.90	28.00 ± 1.40
Fe (mg kg^{-1})	366.26 ± 1.12	305.87 ± 1.97	480.53 ± 12.60
Cu (mg kg^{-1})	59.24 ± 2.55	25.30 ± 1.04	24.67 ± 1.23
Zn (mg kg^{-1})	45.86 ± 6.05	43.14 ± 4.63	30.32 ± 0.70
Cr (mg kg^{-1})	1.22 ± 0.16	0.77 ± 0.17	0.10 ± 0.02
Cd (mg kg^{-1})	0.18 ± 0.06	0.22 ± 0.06	0.21 ± 0.02
Co (mg kg^{-1})	0.77 ± 0.14	1.41 ± 0.07	1.13 ± 0.03
Pb (mg kg^{-1})	0.30 ± 0.05	0.44 ± 0.13	0.38 ± 0.04

The concentrations Chromium in some edible and medicinal wild plants have been reported as 0.35 – 96.15 mg kg^{-1} (Divrikli et al. 2006, Ayessou et al. 2014, Tunctürk and Özgökçe 2015). The amounts of Cadmium were declared between 0.03 – 0.82 mg kg^{-1} for some other medicinal plants and edible wild vegetables (Ayessou et al. 2014, Akgunlu et al. 2016). Cobalt levels of some edible plants were observed in previous studies as 0.12 – 2.18 mg kg^{-1} (Ayessou et al. 2014, Akgunlu et al. 2016), and also Pb levels of edible wild plants screened between 0.04 – 1.40 mg kg^{-1} (Akgunlu et al. 2016). The heavy metal concentrations result of this study are lower than the previous studies.

CONCLUSION

Turkey has a big diversity of plant genetic resources, and diverse plant families normally grow in various parts of the country with different topographical, geological and climatic properties.

Plants are a decent wellspring of valuable chemicals, for example, minerals, vitamins, proteins, filaments and so forth. In spite of the fact that purposes of utilization of edible wild plants are essentially similar, a few diversities might be occurring by local social preferences.

This article, endeavors to contribute in learning of the healthful properties of wild eatable plants. In the present investigation, we observed that *Malva sylvestris* has the richest chemical composition than *Falcaria vulgaris* Bernh and *Chenopodium botrys* L. plant species. In conclusion, it was monitored that all the carried out plant analyses had close mineral and nutritious values in harmony with past studies outcomes.

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