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Evaluation of Some Wild Plants Aspect of Their Nutritional Values Used as Vegetable in Eastern Black Sea Region of Turkey

[1]Nazım Şekeroğlu, [2]Faruk Özkutlu, [1]Metin Deveci, [1]Özbay Dede and [1]Nuri Yilmaz
[1]Department of Field Crops, Faculty of Ordu Agricultural,
Karadeniz Technical University, 52200, Ordu-Turkey
[2]Department of Soil Science and Plant Nutrition, Faculty of Ordu Agricultural,
Karadeniz Technical University, 52200, Ordu-Turkey

Abstract: This study was carried out in the Eastern Black Sea region of Türkiye in 2004. In the study, botanical characteristics of some wild edible plants, consumed abundantly in the region, such as *Trachystemon orientalis*, *Similax excelsa*, *Ornithogalum umbellatum*, *Amaranthus retroflexus*, *Aegopodium podograria* and *Urtica diocia* were firstly determined. Thereafter, some chemical analyses were performed in order to determine nutritive values of these plants. In the study, dry matter, crude oil, ash, protein, nitrogen, Cu, Mn, Fe, Zn and vitamin C contents in the dried plant samples were evaluated. Nutritive values of these plants were compared with the other wild and cropped vegetables aspect of human nutrition. As a result, mineral contents and nutritional values of the plants evaluated in the present study were richer than that of the conventional vegetable crops.

Key words: Wild edible plants, mineral content, nutritive value, vitamin C, Eastern Black Sea Region

INTRODUCTION

Human has obtained their foods both hunting and gathering from nature through the human history. In the course of time, some plant species desired had been cultivated in the gardens and wide fields. Today, further biotechnological methods have been used for obtaining high yielded with high quality crops. Afterwards, genetically modified organisms have been revealed by means of advanced biotechnological researches. These extraordinary organisms have threatened our plant genetic resources. Chemical compositions of the foods are one of the most important factors affecting human physiology whether desired or not. Cultivated plants with high chemical inputs such as fertilizers, plant grow regulators, herbicides etc. has lost their natural taste, appearance and nutritive values which has been reported recent studies (Worthington, 2001; Ismail and Fun, 2003). Furthermore, these technological crops might carry some health risks for humans. From this point of view, there has a big trend for naturally grown products without chemicals as well as wild edible plants and organic products, recently.

Different wild edible plants have been a significant role in all the geographical regions on the world through the human history. In the wartime or famine periods, these plants have been vital positions in the human life like today. Addition to their nutritive values, these plants has been used as traditional medicine curing for some illness. Because of its geographic position, Türkiye has a great deal of plant genetic resources. A number of wild plants have been gathered from nature and used for varying purposes as food, herbal tea, herbal medicine etc. Türkiye is one of the most important medicinal and aromatic plants exporters on the world. Approximately, 347 plant species has been collected from nature, used for local consumption and exported to other countries as raw material every year (Özhatay *et al*., 1997). Approximately 40 plant species have also been gathered from flora and consumed as vegetable at different regions of Türkiye (Abak and Düzenli, 1989).

Because of high amount of rainfall, Eastern Black Sea region of Türkiye has a number of different plant species. In this region, the number and amount of plants collected from nature are considerable high. Wild edible plant species appear especially in early spring at local open markets. There are some studies on chemical composition and nutritive values of wild edible plants consumed locally in different region of Türkiye. The wild edible plant species studied in this study has not been investigated before (Yıldırım *et al*., 2001; Turan *et al*., 2003; Ertuğ, 2004). The aim of this study was to determine chemical composition and nutritional values of some wild edible plants abundantly consumed in the Eastern Black Sea region of Türkiye.

Corresponding Author: Dr. Nazım Şekeroğlu, Department of Field Crops, Faculty of Ordu Agricultural,
Karadeniz Technical University, 52200, Ordu-Turkey Tel: 904522300556-57 Fax: 904522251261

Table 1: Some traits of wild edible plant species

Plant scientific names	Local names	Family	Edible part	Purpose
Trachystemon orientalis	Galdirik	Boraginaceae	Stem and with leaves	Vegetable, pickle
Similax excelsa	Melocan	Smilacaceae	Top shoots with leaves	Vegetable, pickle
Ornithogalum umbellatum	Sakarca	Liliaceae	Bulbous plant	Vegetable
Amaranthus retroflexus	Hoşkıran	Amaranthaceae	Topsoil plant parts	Vegetable
Aegopodium podograria	Baldıran	Apiaceae	Topsoil plant parts	Vegetable
Urtica dioica	Isırgan	Urticaceae	Leaves	Vegetable, herbal tea

Table 2: Some chemical traits of wild edible plant species (%)*

Plants	Dry matter	Ash	Crude Oil	Total N	Protein
Trachystemon orientalis (n = 4)	7.5±0.7	19.0±1.5	1.0±0.2	0.2±0.0	1.4±0.1
Similax excelsa (n = 4)	11.5±1.7	7.1±0.6	1.0±0.2	0.7±0.1	4.2±0.2
Ornithogalum umbellatum (n = 6)	18.5±1.4	4.1±0.5	0.1±0.0	0.2±0.0	1.3±0.1
Amaranthus retroflexus (n = 5)	18.2±1.4	22.8±1.9	1.0±0.2	0.5±0.1	3.4±0.1
Aegopodium podograria (n = 6)	11.1±2.1	14.9±2.0	1.0±0.2	0.6±0.1	3.7±0.1
Urtica dioica (n = 5)	12.4±1.0	15.0±2.2	2.0±0.2	0.7±0.1	4.3±0.1

*In dried plant sample

MATERIALS AND METHODS

Plant materials were obtained from coastal local markets of Ordu in early spring of 2004. In the study six wild edible plants abundantly consumed as vegetable the region such as *Trachystemon orientalis*, *Similax excelsa*, *Ornithogalum umbellatum*, *Amaranthus retroflexus*, *Aegopodium podograria* and *Urtica diocia*. Plant samples varied by species and were 30 samples totally. Some characteristics of investigated wild edible plants were given in Table 1. Botanical identifications of the plants studied were done in the laboratories of Karadeniz Technical University, Ordu Agricultural Faulty according to Davis (1982).

This study were realized in Ordu located in Eastern Black Sea Region of Türkiye and its long term temperature mean, total rainfall and humidity are 13.7°C, 1177 mm and 75% (Anonymous, 2003). A great portion of the rainfall falls as rain during autumn and winter months. The number of snowy days varies between 30-45 days. The soil characteristics of the region were low organic matter, lime and phosphorus, sufficiently potassium. A great deal of the soils was acidic (64.6%) (Yılmaz *et al*., 1999).

Plant parts used as vegetable were dried well ventilated conditions on shade on the floor before analysis. In the dried plant samples some chemical analysis such as vitamin C, dry matter, ash, crude oil, nitrogen and crude protein, Cu, Mn, Fe and Zn were done in the laboratories of Çukurova (Adana) and Sabancı (İstanbul) Universities.

To determine dry matter contents of the edible plant parts, the materials were dried in oven at 105°C until a constant mass. Ash content was determined by burning the material at 550°C. Crude oil contents of the plant were determined by means of solvent extraction method in the Soxhalet Apparatus. Dried at 65°C plant materials were ground and then other chemical analyses were realized. After determining total N content by micro-Kjeldahl method, the data were multiplied by a coefficient of 6.25 and protein contents were calculated (Kacar, 1972). Vitamin C as total ascorbic acid was determined according to Çakmak and Marschner (1992) and mineral (Fe, Cu, Mn and Zn) concentrations of the plant materials were done by using atomic absorption spectrometry (Varian-FS 220) in terms of wet burn method.

RESULTS AND DISCUSSION

As different parts of the plants such as stem, leaf and bulbs were used as food; plant parts analyzed had varying dry matter contents (Table 2). Dry matter content of the plants varies by a lot of factors such as plant species, parts of the plant, growing conditions, soil and environment. In the present study, the highest (18.49%) dry mater content was determined in *Ornithogalum umbellatum* that is consumed with bulbs and the lowest (7.01%) value was obtained from *Trachystemon orientalis* (Table 2). The data obtained from the present study are in harmony with the result of Yıldırım *et al.* (2001) related to dry matter content wild edible plants.

There were a big variation among the ash contents (4.00 and 23.0%) of the plant materials studied (Table 2). The highest and lowest ash contents were obtained from *Ornithogalum umbellatum* and *Amaranthus retroflexus*, respectively. Turan *et al.* (2003) reported that ash contents of some wild edible plant species were 8.83% (*Malva neglecta* Walr.) and 26.70% (*Urtica urens* L.). Furthermore, some cultivated plants' ash contents were 25.5, 15.5 and 8.50% in spinach, lettuce and cabbage, respectively (Table 4). In the present study, ash contents of some wild edible plant species analyzed varied by plants species and used plant parts. Crude oil contents of the plants investigated varied between 0.10% (*Ornithogalum umbellatum*) and 2.00% (*Urtica dioica*).

Table 3: Mineral concentrations of some wild edible plants studied* (mg kg^{-1})

Plants	Cu	Mn	Fe	Zn	Vitamin C
Trachystemon orientalis (n = 4)	9.2±0.2	30.8±3.1	271.0±14.1	30.40±1.97	2.9±0.1
Similax excelsa (n = 4)	21.3±1.8	23.0±1.6	111.6±4.2	58.77±4.67	14.5±1.1
Ornithogalum umbellatum (n = 6)	2.7±2.7	20.7±2.2	482.8±51.6	18.77±3.74	9.7±0.2
Amaranthus retroflexus (n = 5)	11.3±0.7	37.0±1.6	555.8±24.3	59.45±2.42	8.0±0.6
Aegopodium podograria (n = 6)	9.3±0.6	43.0±2.1	24.8±1.9	29.60±2.41	9.4±0.1
Urtica dioica (n = 5)	9.0±0.4	76.8±3.3	148.2±5.8	30.33±2.12	16.0±0.2
Daily requirement (mg)**	1.4	4.5	15	11	60

*In dried plant samples, **EMEA, 2002, n = sample number

Table 4: Mineral concentrations of some cultivated vegetables

				(mg kg^{-1})			
Plants	Ash(%)	Protein (%)	N(%)	Cu	Mn	Fe	Zn
Spinach	25.5	2.2	0.35	0.10	5.00	16.00	5.00
Lettuce	15.5	0.8	0.13	0.10	3.00	7.00	2.00
Cabbage	8.5	1.0	0.16	0.10	2.00	3.00	3.00
Brussels sprouts	-	3.1	0.50	0.20	2.00	10.00	4.00
Mallow	-	-	-	6.70	56.00	20.20	65.90
Basil	-	-	-	23.30	65.10	14.10	85.20

Turan *et al.*(2003). Bear *et al.* (1948), Yıldırım *et al.* (2001), Chizzola *et al.* (2003)

Total nitrogen contents of the some wild edible plants changed in a wide range. The highest and lowest values were obtained from *Urticadioica* and *Ornithogalum umbellatum* in turn in order (Table 2). Similar total nitrogen contents were obtained in the related studies like 0.32-1.70% (Turan *et al.*, 2003) and 0.56-1.08% (Yıldırım *et al.*, 2001). The total nitrogen contents obtained from the present study were in harmony with the mentioned studies above. Related to variation of the total nitrogen contents, crude protein contents of the plants studied changed in similar. The highest and lowest protein contents were calculated in *Urtica dioica* and *Ornithogalum umbellatum*, respectively (Table 2). Some researchers studied in wild edible plants' chemical composition stated that *Malva neglecta* Walr and *Polygonum bistorda* L. had 2.35 and 11.56% protein contents, respectively (Yıldırım *et al.*, 2001; Turan *et al.*, 2003). In the cultivated vegetables such as spinach, lettuce, cabbage and broccoli, protein contents varied in 2.20, 0.80, 1.00 and 3.10, respectively (Table 4). In the present study, it could be stated that plants analyzed for their nutritive values are richer than the cultivated vegetables in the point of their protein contents.

The main minerals that have significant roles in the human nutrition and healthy life and vitamin C contents of some wild edible plants abundantly consumed in eastern Black Sea region of Türkiye were determined and the results were given in Table 3. Playing a significant role in the hemoglobin and enzyme formation in the human body, copper were varying concentrations in the plants studied (Table 3). The richest and poorest plants were *Similax excelsa* (21.00 mg kg^{-1}) and *Ornithogalum umbellatum* (2.70 mg kg^{-1}) aspect of their Cu concentrations. Cu concentrations of the other plants analyzed were average 10 mg kg^{-1}. In the similar studies, copper concentrations varied between 0.05 and 4.70 mg kg^{-1} in the wild edible plants and between 0.10 and 0.20 mg kg^{-1} in the cultivated vegetables, 23.3 mg kg^{-1} in the *Ocimum basilicum* (Yıldırım *et al.*, 2001; Turan *et al.*, 2003; Bear *et al.*, 1948; Chizzola *et al.*, 2003). In the human nutriment for daily diet, copper is obtained from fresh green vegetables and fish. Taking into consideration that daily requirement of humans is 1.40 mg (Emea, 2002); it could be declared that Cu concentrations of the plants studied have sufficient quantities. Cu critic levels in some cultivated vegetables were given in Table 5. According to these values, Cu concentrations of the plants analyzed in the present study were in the limits.

Mn concentrations of the plants studied varied between 21.40 and 77.40 mg kg^{-1} (Table 3). While the highest Mn values were obtained from *Urtica dioica*, the lowest one resulted in *Ornithogalum umbellatum*. In the similar studies, Mn concentrations of some edible plants ranged from 0.40 to 9.00 mg kg^{-1}. Also, the higher Mn concentrations had been obtained 56.0 mg kg^{-1} (*Malva slyvestrys*) and 65.1 mg kg^{-1} (*Ocimum basilicum*) (Yıldırım *et al.*, 2001; Turan *et al.*, 2003; Bear *et al.*, 1948; Chizzola *et al.*, 2003). The Mn findings obtained from present study were higher than the results of the other researchers. Mn critic levels of some cultivated vegetables vary between 15-250 mg kg^{-1} (Table 5) and our

Table 5: Mineral critic levels of some cultivated vegetables (mg kg^{-1})

Plants	Cu	Mn	Fe	Zn
Spinach	5-25	30-250	60-200	25-100
Lettuce	8-25	15-250	50-100	25-250
Cabbage	5-15	25-200	30-200	20-200
Broccoli	5-15	25-200	70-300	35-200

Since: Alpaslan *et al.* (2004)

results were in the limits. Manganese is one of the most important minerals for human physiology and daily requirement for healthy person is 4.50 mg (Table 3). In daily diet Mn is derived from cereals, legumes, spinach, brussel sprouts etc. (Demirci, 2002). For healthy diet, it could be stated that Mn concentrations of the wild edible plants studied had sufficient levels.

In the present study, Fe concentrations of the plants analyzed varied between 25.10 and 556.20 mg kg^{-1} (Table 3). While the highest Fe value were determined in *Amaranthus retroflexus*, the lowest one found in *Aegopodium podograria*. In the literature, Fe concentration of some wild edible plants varied in 1.70-71.2 mg kg^{-1} and that of cultivated vegetables occurred in the levels 3.00-16.00 mg kg^{-1} (Yıldırım *et al*., 2001; Turan *et al*., 2003; Bear *et al*., 1948; Chizzola *et al*., 2003). Some of present findings were higher than the literature results and the critic levels of some vegetables for Fe concentrations (Table 5). This high Fe levels in some wild edible plants studied could be clarified with different soil characteristics of the growing area. A daily Fe requirement of human body is 15 mg and the deficiency causes some illness like anemia. Wild edible plants studied had sufficient and high Fe levels for human health. Considering local cooking methods, stewing and frying, it can be understood easier how the high levels of minerals be eliminated.

The highest Zn concentration found in *Amaranthus retroflexus* (59.46 mg kg^{-1}) and *Similax excelsa* (58.79 mg kg^{-1}). The lowest Zn value was obtained from *Ornithogalum umbellatum* (Table 3). Critic levels of some cultivated vegetables for Zn concentrations vary 25-250 mg kg^{-1} (Table 5). Zn values obtained from the present study were in the limits in Table 5. Daily Zn requirement of human body is 11 mg (Emea, 2002) and is obtained from animal products such as meat, fish, milk, cheese and egg. Additionally, the wild edible plants consumed in the eastern Black Sea region have a sufficient Zn levels for human nutriment.

In the dried plant samples, vitamin C contents varied between 2.87 mg kg^{-1} (*Trachystemon orientalis*) and 16.07 mg kg^{-1} (*Urtica dioica*). The vitamin C values had not sufficient for human daily requirement, 60 mg, in the plants studied. Vitamin C is a highly sensitive and washable chemical affecting a lot factors. Even if high amounts of vitamin C captured from foods, excessive values are sent away from the body. Besides, fruits and green vegetables are a good source of vitamin C, recent studies indicated that organic agricultural products and wild edible plants have the higher vitamin C concentrations (Worthington, 2001; Ismail and Fun, 2003).

As a result, the wild edible plants gathered from flora and abundantly consumed in the eastern Black Sea region of Türkiye were rich in protein and minerals investigated. In the plants studied, while *Ornithogalum umbellatum* had a high amount of dry matter, *Similax excelsa* was rich in Cu concentration. Besides high ash content, *Amaranthus retroflexus* could be a good source of Fe and Zn. *Urtica dioica* had the higher levels of crude oil, nitrogen, protein, Mn and vitamin C among the plants analyzed in the present study. Furthermore, it had the high chemical concentration above the average values. *Trachystemon orientalis* and *Aegopodium podograria* were the poorer chemical concentration among the plants analyzed. However, it is important both rich chemical concentration and good cooking methods for getting high nutrition.

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