A Comparative Study of Chemical Compound of Some Edible Plants of the Eastern Anatolia Region of Turkey

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Abstract

This study was conducted to determine the mineral contents and some nutritional properties of five wild edible plants (Malva neglecta Wallr., Urtica urens L., Rumex crispus L., Rumex scutatus L., and Chenopodium album L.) growing in the grasslands of Eastern Anatolia Region of Turkey and are consumed as vegetable. Moisture (%), total ash (%), pH, and ascorbic acid (mg/100g) content of the plants ranged from 74.8 to 88.38 %, 8.72 to 15.75 %, 5.50 to 6.93, 42.68 to 146.40 mg/100g, respectively. Mineral analysis showed that the wild plants contained considerably high amounts of sodium (21.82-60.93 mg/100g), magnesium (60.41-77.63 mg/100g), potassium (557.53-1025.80 mg/100g), calcium (154.75-340.30 mg/100g), phosphorus (41-93 mg/100g), manganese (0.44-1.18 mg/100g), iron (12.62-53.20 mg/100g), cupper (0.28-0.67 mg/100g), zinc (0.40-1.44 mg/100g). The present study has revealed that these wild plants could contribute significantly to the dietary requirements of the people the Eastern Anatolia region.

Key words: Edible wild plants, Macro-Microelements, Nutrients
**Introduction**

Wild plants have been for a long time part of the human diet. In recent years, there has been an increasing interest to determine nutritional properties and mineral contents of various wild edible plants throughout the world (Aberoumand and Deokule 2009). In folk medicine, wild growing plants have been extensively used due to their curative effects (Gulen 2012). Turkey is one of the most important countries in the world in terms of plant species richness and endemic plants. Turkish flora contains 10,754 plant species, 3,708 of which are endemic (Guner et al. 2000). The diversity in wild species offers variety in family diet and contributes to household food security. Wild edible plants are good sources of proteins, fibers, antioxidants, secondary metabolites, phenolic compounds and they have also medicinal values (Akubugwo et al. 2007). Wild edible plants are rich in terms of minerals and these plants play a great role in supplying the mineral requirements of local populations (Chandran and Parimelazhagan 2012). Wild vegetables are used widely as traditional foods such as soups, pickles, meals, pastries, salad and fried products. Their formulation in Turkey varies according to local consumption habits. Wild vegetables are popular foods for vegetarians. These plants are widely considered a potential rich source of minerals (Na, Mg, K, Ca, P, Mn, Fe, Cu, and Zn etc.), phytochemicals (phenolics, carotenoids, sterols), vitamins (A, B and C) and dietary fibres for human consumption (Simsek et al. 2017). In the present study, mineral compositions and nutritional values of some edible plants commonly used in Eastern Anatolia were investigated. Many wild species as Malva neglecta Wallr., Urtica urens L., Rumex crispus L., Rumex scutatus L., and Chenopodium album L. are common used for human consumption in Eastern Anatolia region.

**Material and Method**

**Collection of Plant Materials**

The five wild edible plant species used as experimental material (Malva neglecta Wallr. Urtica urens L., Rumex crispus L., Rumex scutatus L., and Chenopodium album L.) were collected from various grasslands of Erzurum province, located in the Eastern Anatolia Region of Turkey (Table 1), in June 2017 at optimum growth stage of the plants for consumption. The taxonomic identifications of the plants were made according to Davis et al.(1988). The plants were separated as the edible and the discarded parts. The ground samples were packed in new plastic bags and stored at 4°C in a refrigerator until use for analysis.
Table1. Some traits of five wild edible plants from East Anatolia region

<table>
<thead>
<tr>
<th>Plants' Scientific Name</th>
<th>Family</th>
<th>Local Name</th>
<th>Used Parts</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malva neglecta Wallr.</td>
<td>Malvaceae</td>
<td>Ebegümeci</td>
<td>Aboveground</td>
<td>Oltu/Erzurum, 1275 m</td>
</tr>
<tr>
<td>Urtica urens L.</td>
<td>Urticaceae</td>
<td>Isırgan otu</td>
<td>Aboveground</td>
<td>Oltu/Erzurum, 1275 m</td>
</tr>
<tr>
<td>Rumex crispus L.</td>
<td>Polygonaceae</td>
<td>Kuzukulaği</td>
<td>Aboveground</td>
<td>Tortum/Erzurum, 1450 m</td>
</tr>
<tr>
<td>Rumex scutatus L.</td>
<td>Polygonaceae</td>
<td>Kuzukulaği</td>
<td>Aboveground</td>
<td>Tortum/Erzurum, 1450 m</td>
</tr>
<tr>
<td>Chenopodium album L.</td>
<td>Amaranthaceae</td>
<td>Akkazayağı</td>
<td>Aboveground</td>
<td>Erzurum, 1900 m</td>
</tr>
</tbody>
</table>

Determination of Some Nutritional Properties

The methods recommended by the Association of Official Analytical Chemists (AOAC 1990) were used to determine dry matter, ash, pH, and organic matter of the samples. For the dry matter analysis, samples were weighed and dried at 65-70 °C until constant weight was achieved. Ash content was measured by incinerating the dried sample in a muffle furnace at 550°C for about 8 h until gray white ash was obtained. Organic matter content was calculated by subtracting percent ash content from 100. The pH of the samples was measured using a digital pH meter (Schott G6 840). Ascorbic acid (C vitamin) was analyzed by titration as previously described with some modifications (Raghu et al. 2007). Sodium(Na) and potassium(K) content by Bekman System E2A, calcium(Ca), phosphor(P) and magnesium(Mg) by Automatic Analyzer (Hitachi-705), iron(Fe), copper(Cu), zinc(Zn), manganase(Mn) by Atomic Absorption spectrophotometer (Perkin Elmer A-Analyst 700). All of the samples were analyzed in triplicate.

Statistical Analysis

Mean values and standard deviations were calculated, and the data were expressed as mean±standart deviation.

Results and Discussion

Malva neglecta Wallr., Urtica urens L., Rumex crispus L., Rumex scutatus L., and Chenopodium album L. well-known and abundantly used species (Guler 2004.). These wild edible plant species were screened for their main chemical compositions. The data obtained from chemical analyses were statically analyzed and mean values are given with their standard deviations (Tables 2, 3).
The dry matter, moisture, total ash, pH, ascorbic acid, organic matter contents of five wild edible plants studied are given in Table 2 and Figure 1.

**Table 2.** Mean values of chemical composition values of some wild edible plants

<table>
<thead>
<tr>
<th>Plant names</th>
<th>Malva neglecta Wallr.</th>
<th>Urtica urens L.</th>
<th>Rumex crispus L.</th>
<th>Rumex scutatus L.</th>
<th>Chenopodium album L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td>Dry matter (%)</td>
<td>Moisture (%)</td>
<td>Total ash (%)</td>
<td>pH</td>
<td>Ascorbic acid (mg/100g)</td>
</tr>
<tr>
<td>Dry matter (%)</td>
<td>25.20 ±0.05</td>
<td>74.8 ±0.06</td>
<td>11.44 ±0.04</td>
<td>6.11 ±0.05</td>
<td>53.62 ±0.02</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>21.12 ±0.03</td>
<td>78.88 ±0.06</td>
<td>15.75 ±0.04</td>
<td>6.93 ±0.03</td>
<td>146.40 ±0.05</td>
</tr>
<tr>
<td>Total ash (%)</td>
<td>15.80 ±0.06</td>
<td>84.2 ±0.03</td>
<td>9.24 ±0.03</td>
<td>5.80 ±0.05</td>
<td>134.80 ±0.05</td>
</tr>
<tr>
<td>pH</td>
<td>11.62 ±0.04</td>
<td>88.38 ±0.04</td>
<td>8.72 ±0.05</td>
<td>5.58 ±0.03</td>
<td>42.68 ±0.02</td>
</tr>
<tr>
<td>Ascorbic acid (mg/100g)</td>
<td>20.84 ±0.03</td>
<td>79.16 ±0.02</td>
<td>8.73 ±0.03</td>
<td>5.50 ±0.04</td>
<td>62.00 ±0.06</td>
</tr>
<tr>
<td>Organic matter (%)</td>
<td>88.56 ±0.04</td>
<td>84.25 ±0.02</td>
<td>90.76 ±0.04</td>
<td>91.28 ±0.03</td>
<td>91.27 ±0.05</td>
</tr>
</tbody>
</table>

The dry matter content of these plants varied from 11.62 to 25.20 %. Malva neglecta Wallr. had the highest dry matter content followed by Urtica urens L. while the lowest value was observed in Rumex scutatus L. (Table 2 and Fig. 1). Dry matter content depends on the structure of the plant tissue; for this reason, diversity in the dry matter content for different plant species is expected. The dry matter content was found to be in agreement with the earlier studies in different wild edible plants grown in Turkey (Kibar and Temel 2015; Tuncturk et al. 2015; Yildirim et al. 2001). Tuncturk and Ozgokce (2015) reported dry matter contents of some wild vegetables varied from 59.8 to 11.1 %.
The moisture content followed a reverse trend of dry matter content and varied from 88.39 (Rumex scutatus L.) to 74.8% (Malva neglecta Wallr.) depending on the plant species (Table 2, Fig. 1). As described in other wild food plants and vegetables, the wild plants investigated had high moisture content. The moisture content is a measure of the water content in plant samples. Foods with high moisture content are important for human health because water plays a vital role biologically in excretion through urine which carries wastes from the body (Makarius et al. 2013). Similar results were reported for moisture content of various wild edible plants (Kibar and Temel 2015; Katita et al. 2014). On the contrary, the moisture content obtained in this study was found to be slightly lower than commercial green leafy vegetables such as spinach (93.5%), lettuce (96.1%) and cabbage (90.1%) (Roe et al. 2013).

The highest total ash content was determined in Urtica urens L. (15.75%), and the lowest content was found in Rumex scutatus L. (8.72%). Total ash contents may be thought of as an indicator of total mineral contents in the plant materials. In this content, it could be inferred that Urtica urens L. was the richest plant by means of minerals among the analyzed plant species. (Table 2, Fig. 1). In previous studies, ash content of wild edible plants was reported between 7.33 and 17.12% (Kibar and Temel 2015). However, the ash content of the wild plants examined was considerably higher than those of commercial vegetables (0.4-2.0%) (Roe et al. 2013).

The pH value of the investigated plant species were similar in all the species and pH values ranged from 5.50 to 6.93. Relatively lower pH value was recorded in Chenopodium album L. as compared to other species. However, five plant species tested had slightly acidic pH (Table 2). Our findings were similar to the findings of other researchers for wild edible plants (Yildirim et al. 2001; Turan et al. 2003)
Among the species, the highest ascorbic acid content (146.40 mg/100g) was observed in Urtica urens L... However, Rumex scutatus L. possessed the lowest ascorbic acid content (42.68 mg/100g). Generally, the high value of ascorbic acid was observed in all the plants tested (Table 2, Fig. 1). In previous studies related to some wild edible plants, C vitamins were found in a wide range from 0.22 to 3.75 g/100g (Bouba et al. 2012).

Epidemiological studies have shown high intakes of C-rich vegetables to be associated with decreased incidence of some cancers and cardiovascular diseases (Amr et al. 2013; Slattery et al. 2000). These values are high when compared to those reported for some fruits known as sources of vitamin C such as apples (1.1-3.5 mg/100g fresh samples), grapefruits (28.5-52.0 mg/100 g fresh samples), mangoes (9.1-18.6 mg/100g fresh samples) and oranges (42.1-62.4 mg/100mg) and oranges (42.1-62.4 mg/100g) (Franke et al. 2004).

The range of organic matter content in the plant species analyzed was 88.25-91.28 %. The highest organic matter content was found in Rumex scutatus L. followed by Chenopodium album L., whereas the lowest value was displayed by Urtica urens L., which also had the highest ash content (Table 2, Fig.1). The organic matter content obtained in the plants is in accordance with the findings of Borkataky et al. (2013).

The Na concentrations of the analyzed plant samples varied from 21.82 to 60.93 mg/100g (Table 3, Fig 2). The highest Na concentration was found in Rumex scutatus L., while the lowest value was found in Urtica urens L. samples. Compared with other major elements (K, P, Ca and Mg) examined in this study, the sodium content of the plants was found to be relatively low (<60.93 %) (Table 3, Fig.2). In previous reports, sodium levels of various wild edible plants were in the ranges of 32-633.2 mg/100g (Akgunlu 2012; Tuncturk and Ozgokce, 2015). Sodium is involved in the regulation of acid-base balance, the transport of metabolites, nerve and muscle contraction (Akpanyung 2005; Alegria-Toran et al. 2015). The magnesium levels of the plant samples ranged from 60.41 to 77.63 mg/100g, with the highest and lowest mean values observed in Malva neglecta Wallr. and Urtica urens L., respectively. Magnesium contents of various wild edible plants varied from 30.33 to 864.3 mg/100g (Demir 2006; Seal and Chaudhuri 2015). Both Mg and Ca contribute to the formation of bones, teeth, and tissue helping the growth and maintenance of bodily functions. Mg is present in the green parts of plants as a critical constituent of chlorophyll. Magnesium is involved in more than 300 biochemical reactions in the body. The dietary reference intake (DRI) of magnesium is 310-420 mg/day for adults (Caballero et al. 2015). Potassium contents of the selected plant species were noticeably variable; Rumex crispus L. (1025.80 mg/100g) had the highest potassium level, whereas Malva neglecta Wallr. (557.53 mg/100g) was poor in potassium contents. Potassium content changed from 245.78 to 557.91 g/kg in wild vegetables (Tuncturk et al. 2015). Potassium is a multi-functional mineral and has a special place for human health (Sikorski, 2002). The Ca oncentrations of the analyzed plants ranged from 154.75 to 340.30 mg/100g, with the highest and lowest calcium levels measured in the Urtica urens L. and Rumex crispus L., respectively. Calcium concentrations of some medicinal and edible plants were found in a wide range from 62 mg/100g to 1594 mg/100g in previous studies (Demir 2006; Bouba et al. 2012). Calcium plays an essential role in blood coagulation, the regulation of cell permeability, cleaning of toxins and nerve transmission (Anonim 2015). All the analyzed plants had considerable phosphorus contents, with the highest P level noted in Urtica urens L.(93 mg/100g), whereas the plant samples of Chenopodium album L.(43 mg/100 g) harbored the poorest P levels. P and K are
electrolytes needed for proper cell and organ function (Nelson and Cox 2000); trace elements have a role as catalysts (Lippard and Jeremy 1994).

![Figure 2. Na, Mg, K, Ca and P contents of wild edible plants](image)

The highest Mn contents were found in Chenopodium album L.(1.18 mg/100g), and the lowest level was determined in Rumex scutatus L.(0.44 mg/100g). In previous reports, levels of Mn were in the ranges of 0.9-20.9 mg/100 g (Bouba et al. 2012), 0.32-10.5 mg/100g (Jabeen et al. 2010). Mn is an element of vital importance, contributing to structural components and the activation of several enzymes (Altundag and Tuzen 2011). The recommended Daily dietary intake of Mn is 1.2 mg for children 1-3 years old, and 1.8-2.3 mg for female and male adults. Values are lower for infants and higher for pregnant or lactating women, according to ATSDR (Agency for Toxic Substances and Disease Registry 2008).

According to this results, the Fe levels of analyzed plant samples varied from 12.62(Malva neglecta Wallr.) to 53.20 mg/100g (Urtica urens L.). Based on the report by Basgel and Erdemoglu (2006), Fe concentration of herbs was in the range of 2.24-50.27 mg/100g. Iron is a widely studied microelement and one of the most cited as an important nutrient. The recommended daily intake is approximately 10 mg of iron for men and 20 mg for women (World Health Organization 1996). Iron is a component of haemoglobin in blood, one of the most important functions of iron is to transport oxygen from the lungs to different parts of the body. It also part of many enzymes and is essential for growth, healing, immune function and synthesis of DNA (Kuldeep 2017). Cu contents fluctuated greatly in different plant species. Herein, it was found to vary between 0.28 mg/100g (Urtica urens L.) and 0.67 mg/100g (Rumex scutatus L.). The general mean Cu contents varied between 0.3-0.8 mg/100g for leafy vegetables and 0.3 mg/100g for edible plants (Kabata-Pendias and
Cu is a component of many enzymes and prevents damage to cells due to its antioxidant action. It also helps in production of energy from carbohydrates, protein and fat and for formation of bone, connective tissues and red blood cells (Kuldeep 2017). Cu is vital to many biological systems, affecting at least a part of 13 different enzymes. Considered essential in low concentrations, Cu can be accumulated in plants through soil contamination (Palmieri et al. 2005). Levels of copper in leaves and flowers were below detectable limits and likely would not be supplied in sufficient quantity for human needs (Chandran 2012). With respect to Zn levels, the mean Zn contents ranged from 0.40 mg/100g (Rumex crispus L.) to 1.44 mg/100g (Malva neglecta Wallr.). In previous research, levels of Zn were in the range of 17.38-65.85 ppm in some medicinal plants and were 0.26-4.80 mg/kg in the study conducted by Basgel and Erdemoglu (2006).

Zinc is an essential trace element having role in formation of enzymes; improves immune function, helps in blood clotting, maintains sense of taste and smell keeps skin healthy and enables normal growth and development (Kuldeep 2017; Bertini et al. 2001). Deficiencies in essential mineral cations affect large populations in several parts of the world, as is well-known for Fe and Zn. The importance of P, Cu, Ca, and Mn in the human diet, in addition to Zn and Fe, should also be taken into consideration (Balonch et al. 2014). Mn is an element of vital importance, contributing to structural components and the activation of several enzymes (Alyundag and Tuzen 2011). Manganese helps in the formation and activation of enzymes. It works as an antioxidant, helps in development of bones and heals wounds by increasing collagen production (Kuldeep 2017; Kohlmeier 2015).

The chemical composition of plants is mainly affected by the environmental conditions such as climate, altitude and soil conditions. In literature, there are several studies showing that the contents of plants are environment dependent and therefore, samples of different areas should be investigated (Orazem et al. 2011).
Conclusion

The present study has revealed that Malva neglecta Wallr., Urtica urens L., Rumex crispus L., Rumex scutatus L., and Chenopodium album L. could contribute significantly to dietary requirements of the people in the Eastern Anatolia Region of Turkey. Accordingly, macro-and microelement contents and nutritional value of the analyzed plants were similar and in harmony with previously reported data. Their nutritional value was greater than those of cultivated vegetables like spinach and cabbage. These plants can use for enrichment of diets with low mineral content. Their consumption could help in alleviating the problem of malnutrition at negligible cost; therefore, their cultivation and utilization should be encouraged. Further study is needed to determine how best to exploit its food value promote human health.
References


3. Akgunlu S B. 2012. Mineral content and microbiological analysis of some wild edible vegetables consumed in Kilis and Gaziantep provinces. MSc Thesis, Kilis 7 Aralik University, Graduate School of Natural and Applied Sciences, Department of Biology, Turkey.


