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Determination of the Nutritional Element Concentrations of Evelik Plant (*Rumex crispus* L.)

Taner DASTAN[1*], Handan SARAC[2]

[1] *Sivas Cumhuriyet University, Yildizeli Vocational School, Department of Medical Services and Techniques, Sivas, TURKEY*

[2] *Sivas Cumhuriyet University, Sivas Vocational School, Department of Crop and Animal Production, Sivas, TURKEY*

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Abstract. Evelik plant (*Rumex crispus* L.), which is also known as Labada plant, is a perennial herbaceous plant specie belonging to Polygonaceae family that are mostly a meter in length. Rumex species have a distribution in the Northern hemisphere and have more than 100 species. In Turkey, 24 Rumex species are present. Evelik leaves are used frequently in the Anatolia for the preparation of stuffed wraps. Additionally, it is one of the oldest plants known to be used for herbal remedies. It is believed that this plant is especially potent in gastrointestinal illnesses. Evelik leaves, but especially the roots are used for drugs in medicine. In the present study, determination of macro and micro nutritional elements was aimed in Evelik leaves sampled from naturally grown plants in Sivas province. Phosphor (P) was determined calorimetrically at 882 nm by using spectrophotometer. Potassium (K), Iron (Fe), Manganese (Mn), Zinc (Zn), and Copper (Cu) were determined by using Atomic absorbtion spectrometry. Nitrogen (N) was determined by using Kjeldahl distillation method. Results revealed that the element concentrations determined in Evelik leaves were N (2.59 %); P (0.360 %); K (6.85 %); Mg (0.66 %); Ca (0.48 %); Fe (225.8 mg/kg); Zn (27.5 mg/kg); Mn (30.4 mg/kg); Cu (8.9 mg/kg). In conclusion, it was revealed that the Evelik leaves are sufficient for both macro and micro nutritional elements and have a higher K concentration.

***Keywords*:** Nutritional element, Herbal extraction, Evelik, *Rumex crispus*.

Evelik (*Rumex crispus* L.) Bitkisinin Besin Elementi İçeriklerinin Belirlenmesi

Özet. Evelik otu (*Rumex crispus* L.) olarak da bilinen labada otu Çobandeğneğigiller (Karabuğdaygiller, Polygonaceae) familyasına ait, boyu bir metreyi geçmeyen, çok yıllık otsu bir bitkidir. *Rumex* cinsi, Kuzey yarımkürede yayılış gösterir ve 100 den fazla türü vardır. Ülkemizde 24 türü bulunur. Yaprakları Anadolu'da "Evelik" ismi altında, sebze olarak veya dolması yapılarak, yaygın bir biçimde kullanılmaktadır. Ayrıca bitkisel tedavide kullanılan en eski bitkilerden biridir. Mide ve bağırsak bozukluklarında çok etkilidir. Kökleri öğütülerek diş temizliğinde ve diş eti tedavisinde kullanılır. Yaprakları ve bilhassa kökleri ilaç yapımında tıp dünyasında kullanılmaktadır. Bu çalışmada Sivas ilinde, doğal olarak yetişebilen yaprakları çiğ ve pişirilerek yenilen Evelik bitkisinin yaprak kısımlarının makro ve mikro besin elementleri bakımından incelenmesi amaçlanmıştır. Elementlerden fosfor (P) tayini için kolorimetrik olarak 882 nm'de spektrofotometrede analiz yapılmıştır. Potasyum (K), Demir (Fe), Manganez (Mn), Çinko (Zn) ve Bakır (Cu) elementlerinin konsantrasyonları ise Atomik absorpsiyon spektrofotometre ile belirlenmiştir. Evelik bitkisinin Azot (N) konsantrasyonları ise Kjeldahl destilasyon yöntemine göre belirlenmiştir. Çalışma sonucunda Evelik bitkisinin yapraklarındaki besin elementlerinin %2.59 N, %0.360 P, %6.85 K, %0.66 Mg, %0.48 Ca, 225.8 mg/kg Fe, 27.5 mg/kg Zn, 30.4 mg/kg Mn ve 8.9 mg/kg Cu konsantrasyonları halinde olduğu belirlenmiştir. Sonuç olarak

* Corresponding author. *Email address:* *tdastan@cumhuriyet.edu.tr*

Evelik bitkisinin, makro ve mikro besin elementleri bakımından yeter düzeyde olduğu, özellikle de yüksek K konsantrasyonuna sahip olduğu belirlenmiştir.

***Anahtar Kelimeler*:** Besin elementi, Bitkisel ekstraksiyon, Evelik, *Rumex crispus*.

1. INTRODUCTION

Anatolia, which is situated in the junction of the Europe and the Asia continents, is under the effects of three different climate ranges and, because of this, it is among the most important regions of the world in terms of the diversity of plant life [1-4]. In this region, various wild plants grow naturally [2-3]. Since the ancient times, wild plants have been used by humans for different purposes according to their lifestyles and, therefore, beneficial and hazardous effects of such wild plants have been understood by the human experience [5-6]. As the majority of the Anatolian people is living in rural areas, wild plants are generally used for nutritional purposes while the rest is used for other purposes such as for spicing, remedies, and as dyes. Their properties were understood through such uses [5].

Millions of people in the developing countries are deficient in their daily nutrient intakes and, even more than these people are facing micronutrient deficiency in one or more micronutrients [7-8]. Wild plants, which are known as the most cost-effective and natural sources for nutritional parameters like minerals, fatty acids, vitamins etc. [9], are superior to cultivated counterparts in terms of the mineral composition in their nutritional compositions. The Food and Agriculture Organization (FAO) has been reported that at least a million people around the world is consuming wild plants for nutritional purposes because of the mentioned nutritional superiority [8,10].

The amount of elements in different parts of the plants is quite high. Previous studies have revealed 60 different elements in different parts of the plant. However, only 16 elements are known to be essential for the proper plant development and these are: C, H, O, N, P, K, Ca, Mg, S, Fe, Mn, B, Zn, Cu, Mo, and Cl. Some other studies suggested that some other elements like Al, Na, Si etc. are also necessary for proper plant development. Other than the 16 essential elements, exact functions of various elements in parts of the plants are yet to be known [11].

Essential elements for optimal growth and proper development of plants are divided into two categories; the first 9 elements (C, H, O, N, P, K, Ca, Mg, and S) are known as the Macro elements, and the remaining 7 elements (Fe, Mn, B, Zn, Cu, Mo, and Cl) are known as the Microelements. The distinction between the macro and micro is based on the importance of the element for plant life [11]. Macro nutrients are more thoroughly needed elements as compared to micro nutrients and, thus, micro nutrients are also known as minor elements or as trace elements [12-14]. Deficiencies in intakes of both macro and micro elements result in negative impact in both plant quantity and quality [11].

Nutritional consumption of wild life plants is important for human health due to their nutritional compositions and bioactive properties [8,15]. Epidemiology studies revealed positive correlation between fruit and vegetable consumptions and cardiac, oncological, degenerative diseases [16]. It is also known that the optimal intake amounts of sodium, potassium, magnesium, calcium, manganese, copper, zinc, and iodine help to reduce the risk factors for cardiac disorders [17]. These consumptions also enhance the intakes of non-nutritional beneficial substances such as carotenoids, vitamin C, tocopherols, alpha-linoleic acid, polyphenols, anthocyanins and others [18]. It has reported that the amount of wild life plant species consumed as nutrients is more than 10 thousands [5,19].

Rumex crispus, which is known locally as Evelik, Efelik, or Labada plant, is a perennial herbaceous wild plant specie that is naturally grown in all of the Anatolia. Family of the plant is Polygonaceae, which is referred in Turkish as Çobandeğneğigiller or Karabuğdaygiller. Mostly during the period between April and August, locals collect the dark

green colored fresh leaves that is in sizes of 25 to 50 cm. With its mildly acrid taste, it is a favored substance among Turks for stuffed wraps. In order to avoid sour tasting leaves, it is suggested to collect Evelik leaves from the same roots chosen by snails [20]. Another plant that is known as Kuzukulağı plant is very similar to Evelik in appearance. However, Evelik leaves are known to be harder and have acrid taste. Since this plant grows almost in every place, it has uses in different meals like rice dishes and soups. Its sundried leaves are also sold in the East Anatolian region [21-22].

This study was conducted to determine the concentrations of nutritional elements in Evelik plant leaves which were collected in Sivas province and known to be used by locals for both nutrition and remedies.

2. MATERIALS AND METHODS

2.1. Collection of plant samples

Evelik plant (*Rumex crispus* L.) was chosen as the study material and plant samples were collected during the optimum vegetation period (April to July) in Yildizeli town of Sivas province of Turkey. Plant samples were collected from pastoral countryside and also from the rural road sides. Plant identification was conducted in the Biology department of Cumhuriyet University of Sivas, and one sample was archived in the Herbarium of the Biology department with the label number of 18054.

2.2. Analyses for Macro and Micro elements

Edible parts of the collected samples were separated from their roots and branches. They were washed using fresh water first, then washed again with pure water and dried in drying oven for 48 h until they reach a fixed weight. They were milled in agate mill and were exposed to H_2O_2-HNO_3 for wet decomposition.

N Analysis: Nitrogen (N) concentrations of Evelik plant samples were determined according to Kjeldahl distillation [23].

P Analysis: Phosphor concentrations were determined according to the studies of Murphy and Riley in calorimetric method at 882 nm [24].

K, Ca, Mg, Fe, Cu, Mn and Zn Analyses: Atomic Absorbtion Spectrophotometer (Shimadzu AA-7000, Germany) was used for the determination of concentrations of potassium (K), calcium (Ca), magnesium (Mg), iron (Fe), copper (Cu), manganese (Mn), and zinc (Zn) elements.

3. RESULTS AND DISCUSSION

Macro and micro element concentrations of the collected Evelik plant samples from the road sides of Yildizeli town of Sivas were presented in Table 1 and 2, respectively.

Table 1. Some macro element concentrations of the Evelik plant (%).

N	P	K	Ca	Mg
		(%) ± SD		
2.59 ± 0,59	0.360 ± 0,01	6.85 ± 0,74	0.48 ± 0,02	0.66 ± 0,03

As seen in the Table 1, some of the macro element concentrations determined in Evelik plant samples were as follows: 2.59% for N, 0.36% for P, 6.85% for K, 0.48% for Ca, and 0.66% for Mg.

Table 2. Some microelement concentrations of the Evelik plant (mg/kg).

Fe	Zn	Mn	Cu
	(mg/kg) ± SD		
225.8 ± 2,61	27.5 ± 1,11	30.4 ± 0,89	8.9 ± 0,41

As seen in the Table 2, some microelement concentrations determined in Evelik plant samples were as follows: 225.8 mg/kg for Fe, 27.5 mg/kg for Zn, 30.4 mg/kg for Mn, and 8.9 mg/kg for Cu.

Determinations revealed that Evelik plant is sufficient for both macro and micro nutritional elements. Of these elements, K was found higher than the normal (1-6%) with the determined value of 6.85%, whereas Ca was found as slightly lower than the normal (1-2.5%) with the determined

value of 0.48% (Table 1). In another study conducted to determine the mineral concentrations of Evelik plants collected from areas in East Anatolian region revealed following values: 1.7% for N, 22.33 mg/100 g for P, 624 mg/100 g for K, 82.84 mg/100 g for Ca, 36.47 mg/100 g for Mg, 1.45 mg/100 g for Na, and 75.70 mg/100 g for S [25]. Differences between the present values and the values reported by Turan et al. in 2003 are likely due to ecological and climatic differences between the studied regions [25]

4. CONCLUSION

There are almost no reference studies in literature about the nutritional composition of Evelik plants from other locals or countries. Results of the present study revealed that Evelik plants found in Sivas province is sufficient for macro and micro nutritional elements. Among the macro elements, determined K value of 6.85% is higher than the nutritional norm (1-6%). These results are suggesting that the consumption of naturally grown Evelik plants would supply the mineral needs of humans. It is quite important to determine the nutritional compositions of wild plants that are known to be consumed by people as Turkey has a great diversity in the flora. Even though many researchers are conducting ethnobotanical research, beneficial effects of these plants and their bioactive substances are yet to be revealed. However, not all the plants that are used by locals for nutrition and remedies are known by the scientific community**.** Scientific studies that will be conducted on different wild life plants known to be used by locals for different purposes would reveal scientifically proven and trustworthy results, and at the same time, would contribute greatly to the ethnobotanical literature. Since these plants are insistently used by the people as for remedies and nutrition, experiments on these plants would determine the nutritional importance and benefits of these plants. Consequently, usage of wild life plants for various remedies and nutrition is still popular among the people, especially in rural areas. Edible wild life plants are in an important position for human nutrition due to their nutritional components like minerals, vitamins, and dietary fibers. Turkey has a rich flora and has great diversity in plant life. Since the global hunger rates continuously increasing, studies conducting for the determination of nutritional compositions and medical properties of wild life plants that are known to be used by the people would contribute greatly to human nutrition and to economics [19].

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