

Determination of nutritive value and analysis of mineral elements for wild edible *Stachys lavandulifolia* vahl. var. *lavandulifolia* growing in eastern Anatolia

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Abstract

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The genus *Stachys* (Lamiaceae) is represented by about 300 species found in the world. Turkey is one of the richest countries in *Stachys* diversity being represented by 83 species with a level of 48% endemism. In this study, *Stachys lavandulifolia* Vahl. was collected from Alacabük mountain of Tatvan in Eastern Anatolia. *S. lavandulifolia* Vahl. subsp. *lavandulifolia*, known as “dağ çayı, tüylü çay”, is widely consumed in Anatolia as herbal tea. *Stachys* species belong to one of the oldest medicinal plants that are used both for pharmaceutical purposes and in folk medicine; It is used for the treatment of gastrointestinal and respiratory disorders, and is known as an appetizer, carminative, stimulant, digestive, diuretic, and throat pain reliever. Wild plants gathered from nature are cheaper food and important for human health. Thus, in the present study, nutritional value and mineral composition of used parts of selected *S. lavandulifolia* Vahl. var. *lavandulifolia* was investigated.

In laboratory analysis, total ash, % N, crude protein, crude fiber and pH were examined as nutritional value. Useful minerals (Ca, Cu, Fe, K, Mg, Mn, Na, P, S and Zn) and some heavy metals (Cd, Co, Cr and Pb) that are hazardous elements for livings were also determined. The total ash, total nitrogen and crude protein, pH and crude fiber content of the plants were identified as 7.00%, 1.31%, 8.03%, 6.53% and 38.40%, and respectively. Mineral analysis showed that the wild plants samples contained considerably high amounts of potassium (17.46g/kg), phosphorus (4.70g/kg), calcium (17.25g/kg), magnesium (2.47g/kg), iron (241.37mg/kg), manganese (22.95mg/kg) and zinc (18.56mg/kg). This work contributed to the nutritional properties of some wild plants, and the results may be useful for the evaluation of dietary information.

Keywords: Nutrient content, Wild plant, *Stachys lavandulifolia*, Eastern Anatolia

Received: 22 May 2018 Accepted: 23 November 2018 Revised: 21 December 2018 Published: 10 January 2019

Introduction

The genus *Stachys* is one of the largest genera in the flowering plant family of Lamiaceae with about 300 species distributed in Europe, Asia, Africa, Australasia, and North America (Evans, 1989). This genus is mainly distributed in subtropical and tropical regions of both hemispheres. *Stachys* species have many pharmacological activities and they are known as “Deli adaçayı, dağ çayı or Tüylü çay” in Anatolia. *Stachys* species are widely used in folk medicine against skin infections, peptic ulcers, respiration and kidney disorders for their antibacterial, anticancer, anti-inflammatory, antipyretic, anti-anxiety, antioxidant and cytotoxic effects. Several studies have been reported that common secondary metabolites of the *Stachys* L. are iridoids, flavonoids, diterpenes and essential oils —(İşcan et al., 2015). Decoctions or infusions of *Stachys* are applied as tonics to treat skin or taken internally for stomach disorders. Many *Stachys* species are used in the preparation of food such as yoghurt or jelly to improve the taste and as flavours (Ferhat et al., 2017). *Stachys lavandulifolia* Vahl (Wood

betony) is one of *stachys* genus members. Fresh and dried aerial parts of the plant, such as leaves and flowers are used as traditional medicine for humans (Moghanlou et al., 2018). *Stachys lavandulifolia* Vahl is an herbaceous wild plant native to Turkey which is traditionally used in Turkey folk medicine as tea for reducing anxiety and for treatment of stomach disease, against tumor, ulcer and anorexia (Sajjadi et al., 2017).

Various studies have been undertaken on the effects of micro and macronutrients in treatment human diseases. Some micronutrients, although required in minor quantities are essential for health of human. Zn, Fe, Cu, Cr, Mo, Se, Pb, Cd and Co are harmful only at high concentrations over than acceptable levels in the human body (Zeiner et al., 2015).

Until today, there are no reports about chemical composition of the *Stachys lavandulifolia* Vahl. var. *lavandulifolia* species. Therefore, the aim of this study was to determine the nutritional values and mineral compositions of *S. lavandulifolia* Vahl. var. *lavandulifolia* species which

Cite this article as:

Tuncturk, M., Tuncturk, R., Eryigit, T. (2019). Determination of nutritive value and analysis of mineral elements for wild edible *stachys lavandulifolia* vahl. var. *lavandulifolia* growing in eastern anatolia. Int. J. Agric. Environ. Food Sci., 3(1), 5-8. DOI: <https://dx.doi.org/10.31015/jaefs.2019.1.2>

Year: 2019 Volume: 3 Issue: 1 (March) Pages: 5-8

Available online at : <http://www.jaefs.com> - <http://dergipark.gov.tr/jaefs>

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grew as wild plants in the Van region of Eastern Anatolia, Turkey.

Material and Methods

Some chemical compositions of *Stachys lavandulifolia* Vahl. var. *lavandulifolia* which located in natural flora at around Van Lake in Eastern Anatolia Region, were determined. The plants were collected from natural flora in 2013 and botanical identifications were made by the Department of Biology, Science Faculty, Van Yuzuncu Yil University according to 'Flora of Turkey (Davis et al., 1988). Some information for *S. lavandulifolia* Vahl. var. *lavandulifolia* species are given in Table 1.

Plants were cleaned from foreign materials, separated to parts used and washed with deionized water, dried in room temperature, ground, packaged in plastic bags and kept in desiccators until analysis. Electric Muffle Furnace set at 550 °C was used for determination of total ash content (inorganic matter). Kjeldahl apparatus and method were used to find the nitrogen content of the samples.

After total nitrogen content determination, crude protein contents were calculated by formulas

$$\% \text{Nitrogen} = \frac{(V1 - V2) \times N \times 0.014}{m} \times 100 \rightarrow \% \text{Protein} = \% \text{Nitrogen} \times F$$

pH values were determined by pH-meter in the plant samples. Crude fiber analyses were accomplished by AOAC (Association of Analytical Chemists) method (AOAC, 2000). Mineral compositions of the samples were determined as follows; dried plant samples were ashed in a furnace by nitric (AR) and hydrochloric acid (AOAC). Afterwards, distilled water (50 ml) was added to samples in a volumetric flask. All the analyses were repeated three times and standard materials were used for chemical analyses. Atomic Absorption Spectrometry was used for determination of mineral contents. Phosphorus (P) was determined by molybdate-vanadate and sulphur (S) was observed according to the Mitchell (1992) method in conjugation with a UV-Visible spectrophotometer (Shimadzu UV-1201 V; Shimadzu, Kyoto, Japan). The average data obtained from chemical analyses have been shown in Table 2 with their standard deviations.

Table 1. Some introductory information of *Stachys lavandulifolia* Vahl. var. *lavandulifolia* species

Plants' Scientific Name	Family	Local Name	Used Parts	Locality	Collection No
<i>Stachys lavandulifolia</i> Vahl. var. <i>lavandulifolia</i>	Lamiaceae	Hairy tea, mountain tea, crazy tea	Aerial parts (especially, leaves and flowers)	B9	F 12555

L: B9; Bitlis, Tatvan, the west slopes of Alacabük Mountain, Dağdibi village, 2004, 2250m

Results and Discussion

In this study, nutrient content of *Stachys lavandulifolia* Vahl. var. *lavandulifolia* species that are important for human health for the prevention and control of diseases, were investigated and some properties such as the values of total ash, total nitrogen, crude protein, pH and crude fiber contents are given in Table 2 and mineral compositions in Table 3. The values are given as mean ± SD.

The total ash, total nitrogen, crude protein, pH and crude fiber contents of *S. lavandulifolia* Vahl. var. *lavandulifolia* situated in Van flora were determined as 7.0%, 1.31%, 8.03%, 6.53 and 38.40%, respectively. In previous studies, total ash, total nitrogen, crude protein, pH and crude fiber content of some medicinal and edible plants were found in intervals of 6.43-8.54 % (Dias et al., 2013), 1.36-8.46 % (Maiti et al., 2016), 1.30-21.69 %, 5.41-7.44 % and 36.19-46.33 % (Tuncturk et al., 2017), respectively. We conclude from this study that obtained values are compatible with the previous scientific reports on medicinal and aromatic plants.

According to the results of the study; mineral elements such as Sodium (Na), magnesium (Mg), Potassium (K),

Calcium (Ca), phosphorous (P) and sulphur (S) contents were determined as 0.34, 2.47, 17.46, 17.25, 4.70 and 0.45 g/kg from *S. lavandulifolia* Vahl. var. *lavandulifolia* species, respectively. Nutrition element concentration values of some medicinal plants obtained from previous studies were summarized for above minerals here: Na concentrations varied from 0.21 to 36.66 g/kg (Canbay and Zerrin, 2015); Mg values of medicinal and edible plants were found between 0.17 and 33.33 g/kg (Canbay and Zerrin, 2015; Maiti et al., 2016). K content changed between 5.47-163.35 g/kg (Maiti et al., 2016) in wild vegetables. Ca concentrations were found in a wide range from 3.37 to 21.89 g/kg (Canbay and Zerrin, 2015); P contents varied from 0.53 -5.79 g/kg (Maiti et al., 2016). Our findings are agreeing with the results of these researches. Mineral element rate of the plants is affected from a number of factors such as plant genetic structure, growing conditions, soil characteristics, water availability, growing seasons etc. Therefore, serious variability in mineral compositions of the plants and their different parts is expected. This status has been supported by scientific reports (Yildirim et al., 2001).

Table 2. The average chemical composition values of *Stachys lavandulifolia* Vahl. var. *lavandulifolia*.

Parameters	<i>Stachys lavandulifolia</i> Vahl. var. <i>lavandulifolia</i> .
Total ash (%)	7.00 ± 1.000
N (%)	1.31 ± 0.015
Crude protein (%)	8.03 ± 0.231
pH	6.53 ± 0.153
Crude Fiber (%)	38.40 ± 1.440

Table 3. Mean values of mineral compositions of *Stachys lavandulifolia* Vahl. var. *lavandulifolia*.

Minerals	<i>Stachys lavandulifolia</i> Vahl. var. <i>lavandulifolia</i> .
Na (g/kg)	0.34 ± 0.016
Mg (g/kg)	2.47 ± 0.369
K (g/kg)	17.46 ± 0.437
Ca (g/kg)	17.25 ± 0.990
P (g/kg)	4.70 ± 0.920
S (g/kg)	0.45 ± 0.080
Mn (mg/kg)	22.95 ± 2.190
Fe (mg/kg)	241.37 ± 2.720
Cu (mg/kg)	21.49 ± 0.840
Zn (mg/kg)	18.56 ± 0.240
Cr (mg/kg)	1.06 ± 0.072
Cd (mg/kg)	0.34 ± 0.040
Co (mg/kg)	0.73 ± 0.060

In the present study, we also determined some micronutrients and heavy metal contents. As seen in Table 3, the concentrations of Mn, Fe, Cu and Zn in studied samples were determined as 22.95, 241.37, 21.49 and 18.56 mg/kg, respectively. Different micronutrients, although required in minor quantities are essential for good health of mankind and animals. The deficiency of these elements causes abnormalities leading to infection of diseases (Maiti et al., 2016). Maiti et al. (2016) reported that Fe, Cu and Zn concentrations are between 98.28-3973.55 mg/kg, 4.17-33.88 mg/kg and 9.49-216.31 mg/kg, respectively in the result of analysis of micronutrients of 44 medicinal plants species utilized traditionally.

Analyzed plant samples had limited and trace levels of chromium (Cr), cadmium (Cd) and cobalt (Co) as 1.06, 0.34 and 0.73 mg/kg, respectively. These metals known as heavy metals and their hazardous effects on living organisms in certain quantities were reported. Cr, Cd and Co contents of medicinal plants and wild vegetables were determined between 0.10-425.0 mg/kg (Esetlili et al., 2014; Canbay and Zerrin, 2015), 0.007-0.47 mg/kg (Zeiner et al., 2015) and 0.05-1.35 mg/kg (Esetlili et al., 2014), respectively.

Conclusion

The genus *Stachys* is one of the largest genera in the flowering plant of *Lamiaceae* family. *Stachys* species are have many pharmacological activities. *S. lavandulifolia* Vahl that we were working on is an herbaceous wild plant native to Turkey which is used in Turkey folk medicine many of the plants used for medical purposes are collected from nature and marketed. It is concluded that it is important to analyze the chemical compositions of medicinal and aromatic in terms of safe consumption. In the current study, it was identified to be rich of minerals concentration of *S. lavandulifolia* Vahl. var. *Lavandulifolia* species. The accumulation of toxic elements in the human body will cause to adverse health effects. This study showed that are not pose any risk to human health of heavy metal concentrations of investigated plant.

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