

Analysis of Sodium and Potassium Levels in *Taraxacum officinale* by Flame Emission Photometry

Taraxacum officinale'deki Sodyum ve Potasyum Düzeylerinin Alev Emisyon Fotometresi ile Tayini

Özlem Sögüt Ertaş^{1*}, Hasan Fatih Aktaş¹ and M. Zeki Haznedaroğlu²

Ege University, Faculty of Pharmacy,¹ Department of Analytical Chemistry, ² Department of Pharmaceutical Botany, 35100 Bornova, İzmir, TURKEY

Abstract

Taraxacum species have been used in traditional medicine in the treatment of hepatobiliary problems, inflammatory conditions of the efferent urinary tract, dyspepsia etc. Traditionally it is used as laxative and, diuretics in Turkey. There are some studies on the diuretic effect of sodium and potassium but their diuretic effect are still under investigation.

In this study sodium and potassium are determined in high levels in *Taraxacum officinale*. The results could support the diuretic effect of the plant. It is observed that there is in not any statistical difference between extraction methods for diuretic effect.

Key words: *Taraxacum officinale*; diuretic; sodium, potassium, flame emission photometry

Introduction

Taraxacum is a small perennial herb from Asteraceae family, native throughout the Northern Hemisphere with many varieties and micro species, found growing wild in temperate zones (Blumenthal *et.al.*, 2000).

In Turkish Flora 43 species of the plant are wildly distributed. *Taraxacum officinale* G. H. Weber ex Wiggers is not native to flora however are distributed and identified in different areas (Butcher, 1961; Davis, 1975).

Taraxacum officinale G. H. Weber ex Wiggers has rosette of long, narrow, serrated, shiny dark green or brownish, glabrous or villous leaves. Flower grows directly from the root with a single, golden yellow color. The composite head has a diameter of 3 to 5 cm. All the florets are lingual and androgynous. The epicalyxes are oblong – campanulate. The tepals are arranged in three imbricate rows, two of which are turned back. The inner one is long acuminate with a white margin and erect. The receptacle has no bracts. The fruit is small, long-beaked, light gray-brown, ribbed and has a parachute-like tuft or hair. (Davis, 1975).

The genus name *Taraxacum* is derived from the Greek *taraxos* (disorder), and *akos* (remedy) (Blumenthal *et.al.*, 2000). The plant has a long history of traditional use in many systems of medicine in the treatment of hepatobiliary problems, inflammatory conditions of the efferent urinary tract, dyspepsia and also; liver and gallbladder disorders, hemorrhoids, congestion in the

* Corresponding author: e-mail: soguto@pharm.ege.edu.tr

portal system, gout, rheumatic disorders, eczema and other skin disorders (Blumenthal *et.al.*, 2000; *British Herbal Pharmacopoeia*, 1996; ESCOP., 1997; Gruenwald *et.al.*, 2000). Traditionally it is used as laxative and diuretic in Turkey (Baytop, 1999). The internal use of *Taraxaci radix cum herba* is approved by The Commission E, ESCOP, The British Herbal Compendium, for disturbances in bile flow, stimulation of diuresis, loss of appetite and dyspepsia. The material for commerce forms comes from both wild and cultivated plants (Blumenthal *et.al.*, 2000; *British Herbal Pharmacopoeia*, 1996; ESCOP. 1997).

Root of the plant contains sesquiterpene lactones (eudesmanolides and germacranolides); triterpenes (β -amyirin, taraxol, and taraxerol); carbohydrates (inulin 2% in spring and up to 40% in autumn); carotenoids (lutein); fatty acids (myristic); flavonoids (apigenin and luteolin); minerals (potassium 1.8–4.5%); phenolic acids (caffeic acid and chlorogenic acid); phytosterols (sitosterol, stigmasterol, and taraxasterol); sugars (fructose approx. 18% in spring); vitamins (vitamin A up to 14,000 iu/100g); choline; mucilage (approx. 1.1%); and pectin (Blumenthal *et.al.*, 2000; Williams *et.al.*, 1996).

Potassium, sodium and chloride are electrolytes-mineral salts that can conduct electricity when dissolved in water. Consumption of sodium and potassium in the proper balance is as important as the total potassium content of food. Too much sodium in the diet can lead to disruption of the balance. Numerous studies have demonstrated that a low-potassium, high-sodium diet plays a major role in the development of cancer and cardiovascular disease (heart disease, high blood pressure, strokes, etc). Conversely, a diet high in potassium and low in sodium is protective against these diseases, and in case of high blood pressure it can be therapeutic. There are some studies about the uretic effect of sodium and potassium but still diuretic effect of sodium and potassium are under consideration.

In this study, the aim was to determine the sodium and potassium levels of *Taraxacum officinale* consumed as a traditional diuretic medicinal plant; and to find the relationship between the usage, and sodium, potassium level of it.

Materials and Methods

Materials

Taraxacum officinale G. H. Weber ex Wiggers [Fam. Asteraceae], gathered in the flowering period from the Campus of Ege University. The plant was identified at Ege herbarium, Ege University, Izmir, and voucher specimen is kept at IZEF Herbarium (5599).

Reagent : 1000 mg L⁻¹ stock solutions of sodium and potassium were prepared from NaNO₃ and KNO₃ analytical grade reagents purchased from Merck, Germany. Standard solutions in the concentration range 20 – 100 mg L⁻¹ were prepared from stock solutions by dilution.

Apparatus The analyses were performed on Jenway PFP7 flame emission photometry.

General procedure

Taraxacum officinale samples were cleaned and dried at room temperature. The parts of radix and herba of the plant were powdered. 20 samples were weighed from this powder and extracted by infusion and decoction. 3–4 g powdered root and herb were boiled in 150 mL distilled water, after waiting 15 min, filtrated for infusion procedure. For decoction 150 mL of boiled water was poured on 2.4 g of cut and powdered root and herb waited for 5 min on low heat. The filtration was done after the decoction getting cooler (Baytop, 1999 and, Blumenthal *et.al.*, 2000). Then sodium and potassium analyses were made with flame emission photometer after appreciate dilutions.

Results

Calibration curves were obtained using working solutions of NaNO₃ and KNO₃ between 20 to 100 mg L⁻¹. Five calibration curves for each method were plotted on the same day. The intra-day precision, known as repeatability was found by regression analysis. Intra-day precision of each method was tested by analyzing 5 replicate samples containing 50 mg L⁻¹ (n=5) standard NaNO₃ and KNO₃. The values of RSD (relative standard deviation) were less than 1% indicating reasonable intra-day precision of the both substances. The inter-day precision (reproducibility) RSD value were found 1.6% and 1.2% for 50 mg L⁻¹ (n=5) for sodium and potassium, respectively. Detailed results are given in Table 1.

Table 1: The intra-day and inter-day precision analysis results of 50 mgL⁻¹ standards solutions of sodium and potassium.

n	Na		K	
	1st day	2nd day	1st day	2nd day
1	55,78	56,77	51,42	52,42
2	55,78	55,78	51,41	52,42
3	55,78	55,78	50,40	51,41
4	54,78	55,78	51,41	51,41
5	54,78	54,78	51,41	52,42
Mean	55,38	55,58	51,21	52,02
SD	0,55	0,83	0,40	0,49
RSD%	0,99	1,50	0,79	0,95

The calibration line equations for sodium and potassium are $y = 0.01X + 0.036$, $r^2 = 0.9923$ and $y = 0.0099 X + 0.0288$ and $r^2 = 0.9957$, respectively.

Sodium and potassium contents of plant extracts are shown in Table 2. The results are the mean, standard deviation and RSD% of separate 10 experiments for each extraction method. Comparison of the extraction methods is shown in Figure 1.

Table 2: Result of the analysis of potassium and sodium with flame emission photometry (n= 10 for each extraction method)

Extraction method	Mean ± SD K mg/g	RSD%	Mean ± SD Na mg/g	RSD%
Infusion	340,90 ± 10,90	3,20	1059,61 ± 11,14	1,05
Decoction	310,22 ± 4,51	1,46	962,94 ± 16,52	1,72

Discussion

In this study it was determined that Na and K were in high levels in *Taraxacum officinale*. The results could support the diuretic effect of the plant. When it was compared the extraction methods by t-test, it was determined that there was not any statistical difference between extraction methods ($p > 0,05$).

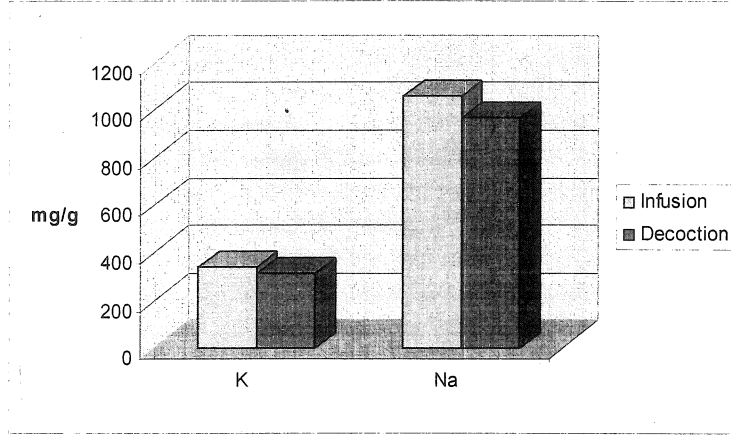


Figure 1: Comparison of extraction methods in *Taraxacum officinale*

Özet

Taraxacum türleri uzun yıllardan beri geleneksel tedavide sindirim sistemi ve idrar yolları hastalıklarında kullanılmaktadır. Türkiye’de halk arasında laksatif ve diüretik olarak kullanılmaktadır. Sodyum ve potasyumun diüretik etkisi hakkında çeşitli çalışmalar olmasına rağmen bu konu hala araştırılmaktadır. Bu çalışmada *Taraxacum officinale*’de yüksek sodyum ve potasyum düzeyleri gözlenmiştir. Bu sonuçlar bitkinin diüretik etkisini destekleyebilir. Ekstraksiyon metotları arasında istatistiksel bir fark olmadığı gözlenmiştir ($p>0,05$).

References

- Baytop, T. (1999). Türkiye’de Bitkilerle Tedavi, Nobel Tıp Kitapları, pp. 97; 227-228.
- Blumenthal, M., Goldberg A. and Brinckmann J. (2000). Herbal Medicine; Expanded Commission E Monograph, Integrative Medicine Communications, pp. 96-97.
- British Herbal Pharmacopoeia (BHP) (1996). Exeter, U.K.: British Herbal Medicine Association, pp. 68-70.
- Butcher, R.W. (1961). British Flora; A New Illustrated Part II, Leonard Hill Books, pp. 574.
- Davis, P.H. (1975). Flora of Turkey and the east Aegean Islands, Edinburgh Pres. Vol. 5, p. 812.
- ESCOP (1997). Taraxaci herba and Taraxaci radix. Monographs on the Medicinal Uses of Plant Drugs, Exeter, U.K.: European Scientific Cooperative on Phytotherapy.
- Gruenwald J. Brendler T., Jaenicke C. (2000). PDR for Herbal Medicines, Medical Economics Company, pp. 245-246.
- Williams, C.A., Goldstone, F. and Greenham, J.(1996). Flavonoids, cinnamic acids and coumarins from the different tissues and medicinal preparations of *Taraxacum officinale*. *Phytochemistry*, 42, 1:121-127.

Received: 30.04.2004

Accepted: 01.07.2004