Evaluation of the minerals content and fatty acids profiles in Descurainia Sophia and Sisymbrium Irio

Article *in* Bulgarian Chemical Communications · January 2015

CITATIONS
0

READS
79

5 authors, including:

Seyed mostafa Kazemeini
Pars Sitak Ava Company
6 PUBLICATIONS **9** CITATIONS

SEE PROFILE

Bulgarian Chemical Communications, Volume 47, Special Issue D (pp. 112 – 118) 2015

Evaluation of the minerals content and fatty acids profiles in *Descurainia Sophia* and *Sisymbrium Irio*

Seyed Mostafa Kazemeini[1*], Babak Ghiassi Tarzi[1], Hossein Bakhoda[2], Kambiz Larijani[3], Parasto Damanafshan[4]

[1]*Department of Food Science and Technology, Faculty of Agriculture, Science and Research Branch, Islamic Azad University, Tehran, Iran*

[2]*Department of Agricultural Mechanization, Faculty of Agriculture, Science and Research Branch, Islamic Azad University, Tehran, Iran*

[3]*Department of Chemistry, Islamic Azad University, Science and Research Branch, Tehran, Iran*

[4]*Department of Food Science and Technology, Shahr-e-Qods Branch, Islamic Azad University, Tehran, Iran*

Abstract

The flixweed grain as a known medicinal herb is consumed more in Iran due to its beneficial properties. There are two known species of *Descurainina Sophia* and *Sisymbrium Irio*. The *Descurainina Sophia* is highly used in Iran and this species has significant health benefits. The aim of this research is to examine some of the minerals and also fatty acids profiles in the *Descurainina Sophia* and Sisymbrium Irio and also compare them with other food products. In this study, the moisture, calcium, iron, sodium and potassium contents were measured in both species. The results revealed that the *Descurainina Sophia* is superior to *Sisymbrium Irio* in all parameters significantly. Measuring minerals content showed that the *Descurainina Sophia* had high moisture, calcium, iron and potassium content and *Sisymbrium Irio* had high sodium content which was considered as the main property of the *Descurainina Sophia*. The results of measuring fatty acids of both species depict high amount of essential fatty acids particularly in *Descurainia Sophia*.

Keywords: *Descurainina Sophia*, *Sisymbrium Irio*, minerals, fatty acids

1.INTRODUCTION

Medicinal herbs have been considered since old times and most of the medicinal effective substances have been extracted from these herbs [1]. Medicinal herbs have played a determinant role in traditional treatment methods for thousands of years [2]. These herbs are used I n traditional medicine for control and remedy of most diseases. Humans have had a close relationship with medicinal herbs and traditional medicine. According to the WHO report, nowadays more than eighty percent of the world people consume medicinal herbs for remedial purposes [1]. This organization estimated that annul consumption of medicinal herbs will increase from 14 billion dollars to 5 trillion dollars in 2050 [2]. Medicinal herbs can produce a broad scope of chemicals which are very important physiologically. These herbs include active medicinal compounds used for production of drugs [1]. The producers produce these herbs in the forms of pill, capsule, syrup or cream and herbal tea as a new form [3]. Low side effects compared to synthetic herbs, lack of drug resistance, health and environmental hygiene are advantages of medicinal herbs. Due to climatic diversity, Iran has a broad and unique biodiversity. This diversity is seen in the herbs particularly in the medicinal herbs. Among the medicinal herbs, flixweed has been considered by numerous therapeutic properties. Flixweed is an annual and biennial herb from Mustard family grows in non-agricultural and relatively humid areas as wilding herb. The seed of this herb is small and yellow or light brown. In Iran traditional medicine, the flixweed grain is used as laxative, stomach tonic and also as an appetizer. The grain is bitter and consumed for remedy of chest pain and reducing fever in case of bronchitis [4].

In this research two species of *Descurainia Sophia* (Flixweed) and *Sisymbrium Irio* (London rocket seed) were evaluated. *Descurainia Sophia* is popular species in Iran characterized by specific feature of being healthy which has caused to be considered as a traditional medicinal herb. It is a very popular beverage. In botany, *Descurainia Sophia* has a lot of leaves and the fruits growing on the short branch bent inside and the herb is white and grows in the ruins and low water areas in spring. *Sisymbrium irio* is consumed less than *Descurainia Sophia* species and it is used only in some parts of Iran. *Sisymbrium irio* has large leaves, seen along streams in the spring and it is an annual or biennial herb [5].

In 1980 and 1992, *Descurainia Sophia* was examined as a good source for medicinal herb. In

*To whom all correspondence should be sent.
mskazemeini@gmail.com

these research, their presence or absence was determined, in many combinations due to the available facilities cf. Baghi [5] and Dehdar [6]. In 2005, the microbial effect of *Descurainia Sophia* on inhibiting the standard *Escherichia coli* and *Staphylococcus aurous* strains growth were evaluated [7]. In 2007, the effect of consumption of *Descurainia Sophia* in late pregnancy on spontaneous onset of delivery in women with first pregnancy was examined. The results showed that this herb influences delivery process by opening the uterus cervical and increase possibility of vaginal delivery. Therefore, it is recommended to use it as facilitator of delivery [8]. In 2009, a study was conducted on the chemical constitutes of *Descurainia Sophia* and its biological activity. In this study, whole herb was examined. The herbs were collected from northern part of Egypt. Proteins, amino acids, fatty acids compounds and carbohydrates were determined [9].

Research on the *Sisymbrium irio* and *Descurainia Sophia* nutrition value was very limited so that the latest research on the medicinal use of this herb dates back 20 years ago. However, need for transparency and more information about some micronutrients seems necessary. For this reason, this study aimed to examine some basic components involved in feeding as oral administration.

2. MATERIALS AND METHODS

2.1. Primary materials

Two varieties of *Sisymbrium Irio* and *Descurainia Sophia* were collected randomly from the west of Tehran. Then their grains were approved by the Department of Herbarium at Tehran University.

2.2. Methods

The moisture of the species was determined using the oven according to the Iran National Standard No.6330. For determination of ash percentage, samples of both species were measured using an electric furnace [10]. Using Atomic Absorption Spectrometry some minerals such as calcium and iron were measured [11] and the amount of sodium and potassium in *Descurainia Sophia* and *Sisymbrium Irio* were measured using a flame photometer device [12]. Their oil was extracted from the seeds of two species by cold method using petroleum ether [9] and then the fatty acids became volatile derivatives by converting to methyl ester and prepared for GC analyses [10].

2.3. Statistical analysis

The results of comparison of the chemical compounds (nutritional value) of *Descurainia Sophia* and *Sisymbrium Irio* were analyzed through simple random using SPSS software Version 19. In comparison of treatments means the T-student test were used for statistical analysis.

3. RESULTS AND DISCUSSION

3.1. Determination of moisture percentage

The content of moisture of *Descurainia Sophia* and *Sisymbrium Irio* is shown in Fig. 1. As it is seen there is a significant difference in 1% in both species moisture percentage ($P<0.05$) so that the *Descurainia Sophia* has high moisture percentage compared with *Sisymbrium Irio*. It is likely physiologic conditions of these herbs are effective in significance of their moisture percentage.

The main point on *Descurainia Sophia* is that this medicinal herb is not considered among nutrients as source of water but since it is consumed as a drink with significant amount of water, it plays an important role in meeting body need for water particularly in hot seasons due to tendency toward consumption of this herb.

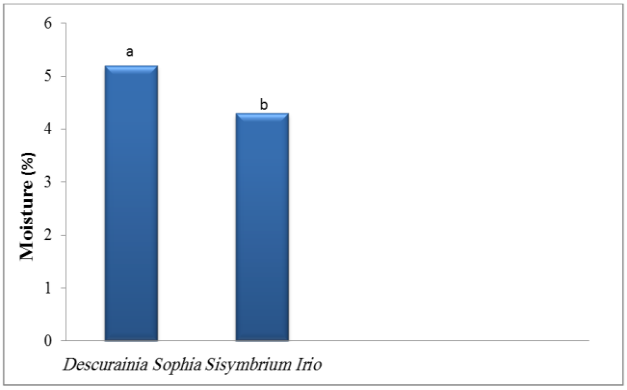

Fig 1: *Descurainia Sophia* and *Sisymbrium Irio* moisture content. Different letters depict significance of the treatments, mean in 1%.

3.3. Determination of calcium and iron in both flixweed species with atomic absorption system and comparison with other resources

The calcium content was measured in both species using atomic absorption system. The reuslts showed that there is a significant amount of calcium in both species and compared to other resources, milk is the common resource of calcium which has low content of calcium compared to flixweed [15]. It is necessary to point that when the food products including calcium are examined, calcium content is less important; however, since most of the food resources have not been described accurately in research so biological availability has not

considered as a factor for determining daily needs for calcium [13].

Calcium constitutes 1% to 2% of the body weight of an adult. The highest need for daily calcium in men is in age range 14-18 years (1094 mg or 22.2 mol/day) while for women this range is 9-13 years (889 mg or 22.2 mol/day) [13]. Approximately 236 ml fatless milk includes 300 mg calcium so drinking one glass of milk provides a part of the body required calcium [3]. Therefore, consuming diaries particularly milk plays an important role in meeting daily calcium need. However, some people suffer from digestive disorder by drinking milk [14] which reduces drinking milk. It should be pointed that the calcium content in the prepared grains is about 36763.2 mg/kg which includes highest content of calcium in highly consumed food products [15]. Although this amount is more than *Sisymbrium irio* calcium content, but it is less than *Descurainia Sophia* calcium content significantly.

It is necessary to point that a glass of drink including 4 grams *Descurainia Sophia* meets 20% of calcium dietary reference intake (DRI) (approximately 900 mg).

Shamsa et al. [16] measured the *Descurainia Sophia* calcium content 24270 mg/kg which this content is very lower than amount measured in this research. One of the reasons can be considered as the weather that the herb grows in it. The diagram in Fig. 2 depicts the *Descurainia Sophia* and *Sisymbrium Irio* calcium content measured by atomic absorption system compared to other resources.

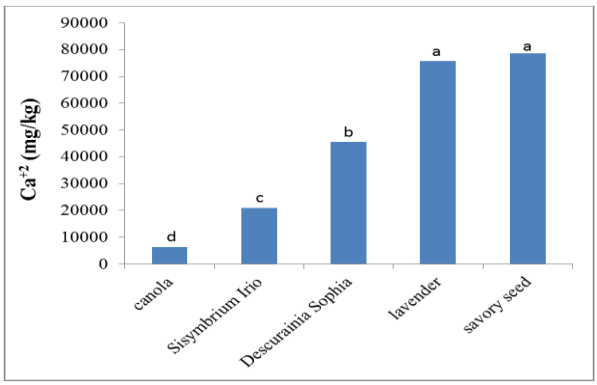

Fig. 2. Calcium content in both flixweed species compared to other resources. Different letters depict significance of the treatments mean in 1%.

Osteoporosis is one of the common diseases in this century. Calcium deficit is the main cause of this disease. Reduction of dairy products and enhancement of eating fast foods are the main reasons for calcium deficit. In addition some people cannot drink milk as the enriched source of calcium due to intolerance of lactose. Thus, according to the results of this research flixweed is recommended as a resource enriched with calcium in the people suffering from osteoporosis and of lactose intolerance.

2.3. Iron. Iron has been known as an essential nutrient for more than one century [17]. The daily reference intake of iron is 12-16 mg/day which it reaches to 18 mg/day in women older than 50 years. Anemia is one of the main problems in developed and developing countries. The major resource of iron is liver and then marine foods including oyster and fish, kidney, heart and red meat [18]. The results of this research revealed that flixweed particularly *Descurainia Sophia* is a good resource for iron so that the iron content in this species has no significant difference with other resources particularly red meat ($P>0.05$). According to the results, *Descurainia Sophia* has significant iron compared with *Sisymbrium Irio* ($P<0.05$).

In a research conducted in 2009 the content of iron was measured in ten medicinal herbs. The results showed that iron content in *Descurainia Sophia* is higher than other medicinal herbs [19]. However, due to outbreak of anemia resultant from iron deficit on one hand and unavailability of red meat resources due to economic problems flixweed is considered as an enriched and effective resource of iron besides other food products.

Also, anemia is one of the main problems in hot areas so flixweed drink can be effective in these areas. It should be pointed that high amount of iron cannot be considered as a reason for appropriateness of this resource as providing body iron. The aim is to use this product besides other products for meeting iron and other essential minerals reference intake [19].

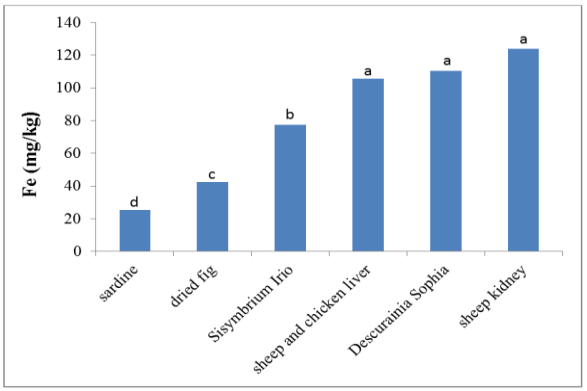

Fig. 3. Iron content in *Descurainia Sophia* and *Sisymbrium Irio* and other foods containing iron Different letters depict significance of the treatments mean in 1%.

Fig. 3 depicts iron content in *Descurainia Sophia* and *Sisymbrium Irio* and other foods containing iron.

3.4. Determining sodium and potassium content using flame photometer

3.4.1. Sodium. Sodium is the main cation of the extracellular fluids. Measuring sodium content in both species showed that sodium content is higher in *Sisymbrium Irio* than *Descurainia Sophia* although there is no significant difference in sodium content in both species ($p>0.05$).

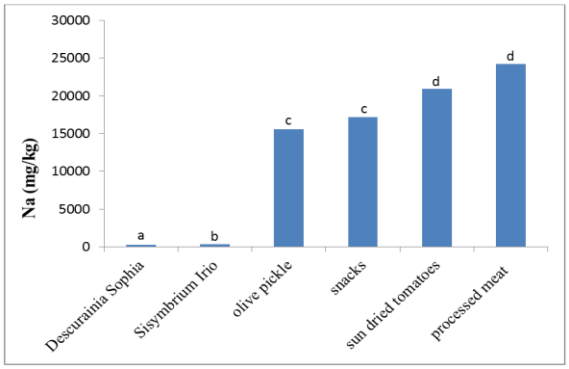

Fig. 4. Sodium content in both flixweed species compared to other resources. Different letters depict significance of the treatments mean in 1%.

Salt is the main resource of sodium in the body. More than 40% of the salt body is sodium. Sodium amount is high in salt about 380000 mg/kg. Totally, the lowest DRI of sodium is 0.2 gram equal 0.5 gram of chloride sodium. Also, the results of a research conducted in Harvard University showed the effect of consuming more sodium on blood pressure and its direct association with cardiovascular diseases. According to the reports of this research of ten morbidities related to cardiovascular diseases one is related to consumption of more than 2000 mg/kg/day sodium. The result of measuring sodium compounds content is shown in Fig. 4 which depicts among different products, flixweed has less sodium. Since sodium content is low in flixweed, so this drink can be considered as a drink with very low sodium. When the sodium content of a drink is low it can be drunk with proteins without concern [3]. In addition since the sodium content is very low in flixweed so drinking flixweed is useful for patients with blood pressure and kidney disorder.

3.4.2. Potassium. Potassium content in *Descurainia Sophia* and *Sisymbrium Irio* was measured by photometry and the results are shown in Fig. 5. The results showed significant increase of potassium in *Descurainia Sophia* compared to *Sisymbrium Irio* ($P<0.05$).

Potassium is the main intracellular cation that balances the cells osmosis pressure and acidity and base of the body. Sodium and potassium are two main ions controlled in the patients with kidney disorder [1]. These compounds have similar functions in the body but their functional ways are completely different. The individuals who consume low sodium and in contrary high potassium, their blood pressure and diseases resultant from blood pressure are reduced Potassium plays adjusting role in blood pressure. The studies showed that if potassium content reaches 400 mg/day the morbidity resultant from stroke is reduced by 40% [14]. It should be pointed that potassium has a direct

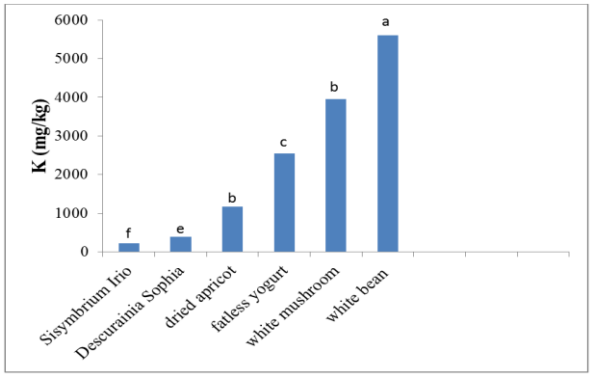

Fig. 5. Potassium content in both species of flixweed compared to other resources. Different letters depict significance of the treatments mean in 1%.

association with sweating. The daily reference intake of potassium in adults is 4.7 g or 120 Mmol/day. High sweating as a result of physical activities and hot weather causes to reduction of potassium. Potassium concentration in sweating is 4-5 mmol/day or 0.2 gram in a day. However, this content reaches 14 mmol or 0.5 gram in a day in hot weather. Sweating in hot weather can reach 11 litters which loss potassium content is about 60 mmol/day or 2.3 gram in a day that complete loss can be 116 mmol/day or 4.5 gram/day more than the body dietary reference intake. For this reason, need to potassium is high [13]. Thus it is likely that one of the reasons for heat exhaustion is losing much more potassium which in such cases consumption of the compounds with high amount of potassium is useful. Flixweed (as a drink) is one of the resources enriched in potassium and since it is considered as a good resource for providing potassium so these compounds are effective in the case of heat exhaustion for meeting needs for lost potassium and water.

3.5. Fatty acids profiles in *Descurainia Sophia* and *Sisymbrium Irio*

Fatty acids in *Descurainia Sophia* and *Sisymbrium Irio* were measured by gas chromatography. The results showed that *Descurainia Sophia* has higher fatty acids than *Sisymbrium Irio*, cf. Table 1.

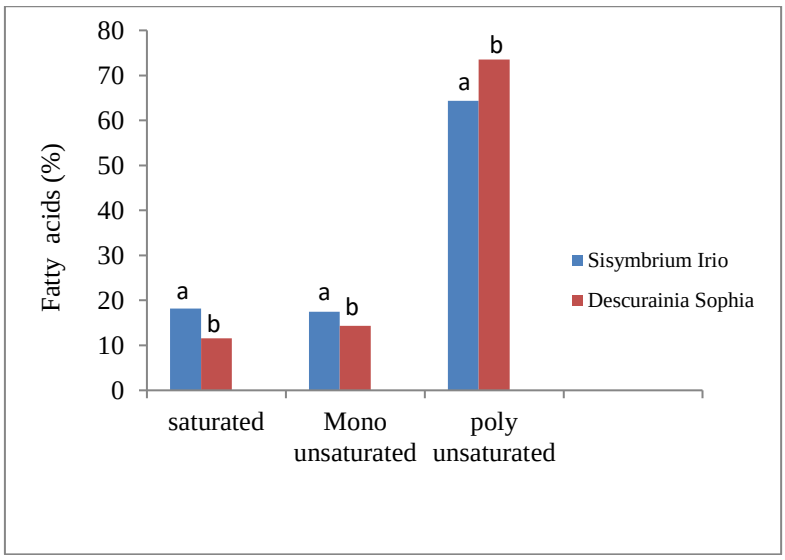

Fig. 6. Type and content of fatty acids in both flixweed species. Different letters depict significance of the treatments mean in 1%.

Table 1. Fatty acid content.

Flixweed	Mean %
Descurainia Sophia	29.21 ± 0.108
Sisymbrium Irio	25.05 ± 0.350

Some research has introduced *Descurainia Sophia* as a good resource for meeting edible oil in the body (Peng et al. [20]; Peng et al. [21]; Zhang et al. [22]; Shie [23]).

In a research it was tried to use canola oil production [24]. Canola oil is produced from *Brassica napus* and *Brassica rapa* which are genetically modified and contain low erusic acid [25]. Accordingly, it was tried to produce a hybrid of *Descurainia Sophia* and *Brassica napus* which its erusic acid is less than 0.5%. In this research the produced hybrid was recommended for edible oil industrial production [24].

Both of the flixweed species were the same in fatty acids type but they were different in levels of them. Fig. 6 depicts types and content of fatty acids in both flixweed species.

Amount and mean of saturated and unsaturated fatty acids are shown in Fig. 6. According to the results, unsaturated fatty acid in *Descurainia Sophia* is 88.41% and in *Sisymbrium Irio* is 81.80%.

Among varieties of fatty acids both linoleic acid and linolenic acid are essential fatty acids. Essential fatty acids are one of the constituents of oils and the major fatty acids are omega 3 and omega 6. Generally, fatty acids in human regimes are more important than total consumed oils [26]. Also, fatty acids ratio is very important in nutritional and economic value [27]. Among fatty acids, omega 3 (essential and unsaturated fatty acid) is considered essential fatty acid that body cannot produce and synthesis it and it is provided by food. The body should receive balanced amount of omega 3 and omega 6 existed in foods in order to convert them to required derivatives. Nowadays, due to benefits of omega 3 fatty acids they have been considered in daily foods. WHO recommends that the ratio of omega 6 to omega 3 unsaturated fatty acids should be minimum 5 to 1 and maximum 10 to 1. In other words, in daily nutrition the content of omega 6 is minimum 5 and maximum 10 times of omega 3. The role of omega 3 fatty acids has been proved in prevention of cardiovascular diseases [28]. According to the results of this research, flixweed compared to other resources is considered as a good resource of essential fatty acids Table 2 depicts the level and type of fatty acids measured in this research.

The results of measuring types and levels of fatty acids in both flixweed species showed that linolenic acid is the common fatty acid in both *Descurainia Sophia* and *Sisymbrium Irio*, by this difference that this fatty acid amount was higher in *Descurainia Sophia* than *Sisymbrium Irio*. After linolenic acid, linoleic acid was in the second rank of the fatty acids in both species which its content was high in *Descurainia Sophia*. Hence, *Descurainia Sophia* is very important in omega 3 and omega 6 content and it can be used as a proper resource of essential fatty acids. Also, by comparison of essential fatty acids in the two flixweed samples it was specified that essential fatty acids in the sample flixweed was high compared with cottonseed oil, soybean oil, sunflower oil and Turkish olive oil and on the other hand, unsaturated fatty acids in the *Descurainia Sophia* was higher in amount of all mentioned oils.

Table 2. Fatty acid content in both flixweed species.

Fatty acid	Carbon No.	RT (min)		Ratio (%)	
		Descurainia sophia	*Sisymbrio irio*	*Descurainia sophia*	*Sisymbrio irio*
Luric Acid	12:0	13.74	13.71	0.008	0.013
Miristic Acid	14:0	14.99	14.96	0.066	0.089
Pentadecanoic acid	15:0	15.88	15.83	0.050	0.051
Palmitic Acid	16:0	17.02	16.98	7.418	13.013
Palmitoleic Acid	16:1	-	18.18	-	0.465
Stearic Acid	17:0	18.23	-	0.435	-
Stearic Acid	18:0	20.21	20.15	2.356	4.240
Oleic Acid	18:1	21.98	21.87	13.551	15.713
Linoleic Acid	18:2	24.83	24.65	20.204	19.471
Linolenic Acid	18:3	29.10	28.80	53.855	44.854
Arachidic Acid	20:0	31.97	31.87	1.256	0.789
Erusic Acid	22:1	33.40	33.31	0.801	1.301

4. CONCLUSION

Medicinal herbs have played a very important role for thousands years in traditional treatment of diseases. These compounds are known as a valuable, ready to use and reliable source for individuals. One of the varieties of medicinal herbs is *Descurainia Sophia* as the oldest drinks consumed among Iranians. There are *Descurainia Sophia* and *Sisymbrium Irio* grains known as medicinal herbs in Iran with high usage because of its beneficial properties. *Descurainia Sophia* is consumed more in Iran and it has a lot of health benefits. On the other hand, *Sisymbrium Irio* is consumed in some parts of the country and it used less due to its bitterness. The results obtained in this study showed that *Descurainia Sophia* elements superiority is connected perfectly with its great popularity. So that in most of the factors measured, *Descurainia Sophia* elements were superior and only the amount of sodium was high in *Sisymbrium Irio* and since low intake of sodium is considered as favorable property, so sodium deficit is considered as advantage of *Descurainia Sophia*. In addition, the moisture, calcium, iron and potassium contents were high in *Descurainia Sophia*. Measuring the amount and types of fatty acids in two species of *Descurainia Sophia* showed that it is an excellent source of essential fatty acids. The essential fatty acids content is higher in *Descurainia Sophia* than other resources enriched with essential fatty acids. However, according to the obtained results using this herbal drink is recommended for supplying some required minerals in the body.

REFERENCES

1. M. Millikan, A. Kolasani, H. Xu, *Food Chem.*, **127**, 465 (2011).
2. A. Saha, V. Tripathy, B.B. Basak, T.S. Varghese, *Phytochem. Lett.*, **14**, 67 (2015).
3. A.C. Marshall, R.N. Gallaher, K. Gallaher, A.J. Marshall, *J. Food Composition Analysis*, **19**, S53 (2006).
4. H. Mirheydar, Plant introduction: the use of herbs in the prevention and treatment of diseases with the latest scientific scholars and scientists research (In Persian). Tehran's Islamic culture, pp. 121-123, 2010.
5. A. Baghi, Chemical evaluation of *Sisymbrium sophia* traditional plant. PhD dissertation on Pharmacology (In Persian). Department of Pharmacology and Pharmaceutical Sciences. Isfahan University of Medical Sciences, 1980, pp. 10-16.
6. F. Dehdar, Evaluation of quantity and quality of ingredients of Turkish, Artemisia, Fumaria and Stochys inflala benth. PhD dissertation on Pharmacology (In Persian), Department of Pharmacology and Pharmaceutical Sciences. Isfahan University of Medical Sciences, 1992.
7. Z. Shahande, Molana, T. Farinosh (In Persian), *J. Babol Univ. Medical Sci.*, **8**, (5) (2005).
8. N. Mohammadi Niya, M. Reazaei, Loripoor, R. Vazirinejad. *Tabib Sharq Journal* (In Persian) **10**, issue 3 (2007)
9. N.H. Mohamed, A.E. Mahrous., Chemical constituents of *Descurainia sophia L*. and its biological activity, Egypt (2009).
10. C.S. James, Analytical Chemistry of Foods, Springer-Science+ Business Media.B.V., 1995.
11. S.S. Nielson, Food Analysis, Springer- Science+ Business Media LLC, fourth edition (2010).
12. K.V. Shah, P.K. Kapupara, T.R. Desai, Determination of sodium. Potassium, calcium and lithium in a wheat grass by flame photometry, Pharma Science Monitor, India, 2010.
13. Dietary reference intakes (for calcium, phosphorus, magnesium, vitamin D, and fluoride), Standing Committee on the Scientific, Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine, 1997.
14. N. Rajabzadeh, Healthy eating: food miracle from medical point of view (In Persian). Publication of Science and Literature. Tehran, pp. 170-185 (2006).
15. F. Greer, N. Krebs, *Pediatrics*, **117,** 578 (2006).

16. F. Shamsa, S. Reza zadeh, H. Shamsa, K. Abdi, A quantitative investigation on some toxic and non-toxic metals in popular medicinal herbs in Iranian market, Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran (2009).
17. F. Gaucheron, *Trends Food Sci. Technol.*, **11**, 403 (2000).
18. K.L. Mahan, S. Escott-Stump, J.L. Raymond, , Krause's Food and the Nutrition Care Process, by Saunders. An imprint of Elsevier Inc., 2012.
19. C. Chhabra, J. Ouma, C. Sumeh, G. Nyagah, *J. Ethnopharmacol.*,. **58**, 97 (1997).
20. G. Peng, F. Hongbo, C. Zhaolin, Z. Songdong, Y. Jiaming, *Descurainia sophia*, an oil plant species with special uses, Institue of Botany, Sichuan Union University, China (1998).
21. G. Peng, Y. Yi, G. Fu-li, L. Ze-qu, A preliminary study on the introduction of *Descurainia sophia*, an oil plant species for industrial uses, Botanical Institute, Sichuan Union University, China (1996).
22. Zhang.Z.C, Li.X.F, Luo.P, *J. Agric. Sci*., **3**, 19 (1990).
23. Shie.S.Y., Wild oil crops, *Sichuan agriculture*: **2,** 64 (1958).
24. Xin.R, Zhou.C, Chen.J, Jiang.S, Zhang.L, Guan.R, New canola germplasm of high oil content created by somatic hybrids between Brassica napus and *Descurainia Sophia*, China (2010).
25. F.D. Gunstone, Vegetable oils in food technology: composition, properties and uses, Blackwell Publishing Ltd,
26. G.P. Savage, D.L. McNeil, P.C. Dutta, *Acta Hort*., **544,** 557 (2001).
27. M. Venkatachalam, S.K. Sathe, J. Agric. Food Chem., **13**, 4705 (2006).
28. J.M. Bourre, *J. Nutrition, Health Aging*, **1**, 31 (2005