

Some Chemical Characteristics of Edible Wild Rhubarb Species (*Rheum Ribes L.*)

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Abstract: Edible wild rhubarb samples used in this study were collected from six cities (Ağrı, Bitlis, Erzurum, Hakkari, Muş and Van) located in Eastern Anatolia Region. In this research some chemical characteristics (solid content, ash, nitrogen, protein, crude fiber, soluble solid content, total sugar, inverted sugar, saccharose, acidity, pH, vitamin C content) and some mineral (Fe, Zn, Pb, Cu, Mn) contents of edible wild rhubarb (*Rheum ribes L.*) were determined. Chemical contents as mean value of all samples were found as follows: Average total solids 5.589%, ash 0.636%, nitrogen 0.206%, crude protein 1.292%, crude fiber 1.798%, soluble solid content 3.897%, total sugar 1.760%, inverted sugar 1.643%, saccharose 0.112%, acidity 0.967%, pH 3.566, vitamin C 5.196 mg/100g, Fe 3.752 µg/g, Zn 1.132 µg/g, P 411.2, Pb 0.016 µg/g, Cu 0.501 µg/g and Mn 0.423 µg/g.

Key words: *Rheum ribes*, Chemical Characteristics, Mineral contents

INTRODUCTION

Rheum ribes L. is one of the wild rhubarb species belonging to *Polygonaceae*. Rhubarb is a perennial vegetable species spread from North and Central Asia to the other continents. It has also wild forms in Iran and Anatolia [16]. *Rheum ribes L.* is the only rhubarb species grown between 1800 and 2800 altitude rocky countryside of Turkey. The upper parts of *Rheum ribes L.* plants can reach up to 150 cm and its flowers bloom between June and July. Its seeds mature from July to August. This wild rhubarb species whose plants can grow in rocky soils at high altitudes of arid climate have hermaphrodite flowers pollinated by wind. Moreover, it is cross compatible with other *Rheum* species. It has also been observed that *Rheum ribes L.* prefers well drained medium or heavy structured soils and can also be grow in very clayish acidic or basic (alkaline) soils. It can resist against very cold weather and stays alive up to 20°C below freezing point. It can also grow in regions with extreme conditions such as deficiency in illumination, arid or wet soils [24]. *R. ribes* is locally known as "ışhkın, ushgun" or "uchgun" grown mostly in Eastern parts of Turkey, Lebanon and Iran. The edible part of the plant is the stem, which is eaten raw or cooked by the local people [4].

Rheum species are pharmaceutically important plants due to the presence of anthracene derivatives occurring in the subterranean parts of the plant. *Rheum ribes L.* (*Polygonaceae*) is the source of one of the most important crude drugs in the Middle East [11]. Rhubarb roots are used as oriental laxative medicine

and an antipsoriatic drug in Iran [21]. Young shoots and petioles of *R. ribes* are used against diarrhea as well as stomachic and antiemetic while juice of some parts of the plant is used against hemorrhoids, measles, smallpox and cholagogue [6]. Its fresh stems and petioles are consumed as vegetable. Stems are also eaten fresh, which are used as digestive and appetizer in Bitlis, Eastern Anatolia Region, Turkey. The roots are used to treat diabetes [1,22], hypertension and obesity [1], ulcer, diarrhea and as antihelmintic and expectorant [22]. The decoction extract of *Rheum ribes* roots possess significant blood sugar lowering activity in alloxan-induced diabetic mice, although this extract did not show hypoglycemic action in healthy mice [14].

There are a few studies on *Rheum ribes* in Turkey [16,19,13,2]. The aim of this study was to determine the chemical properties and mineral contents of *Rheum ribes L.* stems used for several purposes in Turkey.

MATERIALS AND METHODS

Materials: *Rheum ribes* samples were collected from six cities (Ağrı, Bitlis, Erzurum, Hakkari, Muş and Van) in Eastern Anatolia Region. Three *Rheum ribes* samples were supplied from different regions of each city. The edible parts of the plants were cleaned by hand to remove all foreign matter. The peels of samples were removed and then ground in a blender. The samples were then packed in glass cups and stored at 4°C until analysis. Each analysis of samples was done in duplicate.

Method:

Chemical analysis: In this research some chemical characteristics (solid content, ash, nitrogen, protein, cellulose, water soluble solid content, total sugar, inverted sugar, saccharose, acidity, pH and vitamin C content) of edible wild rhubarb were determined.

Solid content was determined by convection drying in an oven at 105°C [5]. The nitrogen content was established by the Kjeldahl method and was converted to the amount of protein by using the conversion factor 6.25 [5]. The water-soluble extracts, pH, ash, and crude fiber (cellulose) were determined according to AOAC [5] and Cemeroglu [7]. Total acidity was determined by blending a 50 g fresh sample with 300 mL distilled water to produce homogeneous slurry. A sample of 10 mL of the filtered slurry was titrated with 0.1N sodium hydroxide. The total acidity was calculated as percent citric acid [5]. Ascorbic acid (vitamin C) content of the edible wild rhubarb samples was determined by using 2,6-dichloroindophenol dye [5]. Total sugar, inverted sugar and saccharose content of the samples were carried out according to the method described by Cemeroglu [7].

Determination of Mineral Contents: Mineral contents (Fe, Zn, Pb, Cu, Mn) of samples were determined by atomic absorption spectrometer (Varian Tectron Model AAS 1000, Varian Associates, Palo Alto, CA) and phosphorus content of *Rheum ribes* samples was determined by UV/VIS Spectrometer (T80, PG Instruments Ltd. UK) [5].

RESULTS AND DISCUSSION

Chemical Contents: Chemical analysis results of the *Rheum ribes* samples were given in Table 1. The highest average total solids content was determined in samples collected from Erzurum as 6.24 %, and this followed by samples collected from Hakkari (6.18 %) and samples from Muş (5.91 %). The lowest values were belonging to the samples collected from Bitlis and Ağrı. Ash contents of samples were variable and values obtained from this parameter changed between 0.51 % (Bitlis) and 0.74 % (Ağrı). Mean ash content of the samples was calculated as 0.636 %. Nitrogen, crude protein and crude fiber values of *Rheum ribes* samples showed similar trends depending on the region where the samples were collected. Crude protein and crude fiber contents of samples varied from 1.07 % to 1.59 % and from 1.15 % to 2.31 %, respectively.

Soluble solid values most of which consisted of sugar had almost same tendency with total sugar and inverted sugar values, while saccharose values did not harmonize with them. Acidity and pH values showed opposite trends as expected. The highest acidity (1.21 %) and lowest pH value (3.38) were determined in

samples from Bitlis which also had the lowest total solids. Vitamin C content of samples varied between 3.73 mg/100 g (Ağrı) and 7.30 mg/100 g (Van).

Mineral contents: The results of some mineral contents of *Rheum ribes* were shown in Table 2. Iron contents of the samples were found different statistically. The highest Fe values were obtained from samples collected from Erzurum and Hakkari while the lowest values were determined in the ones collected from Ağrı and Bitlis. The zinc concentration of samples collected from Hakkari was significantly higher than that of others. The lowest values were belonging to samples collected from Van. Phosphorus content of samples collected from Ağrı, Erzurum, Hakkari and Muş was similar and these values were also higher than those of other samples collected from two cities. Phosphorus content of samples collected from Van was clearly lower. There was no difference among the samples in terms of lead contents which were found to be very low concentrations. Samples collected from Hakkari possessed the highest copper content and this followed by samples collected from Van. Manganese contents of samples collected from Muş, Erzurum and Hakkari were found higher than that of the others.

Discussion: There are a few published data in the literature on the chemical composition of *Rheum ribes*. L. Özcan *et al* [6] reported that the moisture, crude protein, crude ash, crude fiber, pH and acidity of *Prangos ferulacea* and *Rheum ribes* stems collected from samples collected in Ağrı and Elazığ in June were, respectively, 83.61%, 90.97 %, 91.69; 4.18%, 6.31 %, 5.45 %; 14.44 %, 7.74 %, 9.69 %; 37.03 %, 21.56 %, 20.53 %; pH 4.61, 4.01, 4.0; 0.97 %, 1.06 %, 1.08 %. The dry matter, crude ash, crude fiber and acidity values of *Prangos ferulacea* were higher than the values obtained in our study. Crude protein, crude ash, crude fiber values of *Rheum ribes* samples were lower than in our study. Özcan *et al.* [17] reported that the moisture, crude protein, crude fiber and crude ash contents of some edible wild plants consumed in Mersin province in Turkey were established between 83 and 87%, 1.2 and 2.6%, 4.2 and 9.5% and 8.2 and 15.6%, respectively. The dry matter value was higher while crude protein, crude fiber and crude ash contents were lower than our results.

Coşkun *et al.* [8] reported the dry matter, ash, protein and crude fiber of *P. ferulacea* grown in Şırnak, Turkey as 90.48%, 5.05%, 6.10% and 27.18% respectively. Results of ash, protein and crude fiber in our study were higher than values in this literature when the results based on equal dry matter ratio. As a result; these differences could be the result of different species, environmental factors and growth conditions.

Table 1: Chemical contents of *Rheum ribes* L. obtained from different region of Turkey (values are means \pm SD n=three replicate trials).

Parameters	Region of sample obtained						n	mean
	Agri	Bitlis	Erzurum	Hakkari	Mus	Van		
Total solids (%)	5.05 \pm 0.95 ^d	4.87 \pm 0.63 ^d	6.24 \pm 0.39 ^a	6.18 \pm 0.38 ^a	5.91 \pm 0.52 ^b	5.28 \pm 0.24 ^c	18	5.59 \pm 0.76
Ash (%)	0.74 \pm 0.08 ^a	0.51 \pm 0.04 ^c	0.60 \pm 0.06 ^{bc}	0.73 \pm 0.06 ^a	0.63 \pm 0.04 ^{ab}	0.61 \pm 0.05 ^{bc}	18	0.64 \pm 0.09
Total Nitrogen (%)	0.17 \pm 0.01 ^c	0.18 \pm 0.02 ^c	0.26 \pm 0.02 ^a	0.23 \pm 0.02 ^b	0.23 \pm 0.02 ^b	0.17 \pm 0.02 ^c	18	0.21 \pm 0.03
Crude protein (%)	1.08 \pm 0.09 ^c	1.14 \pm 0.11 ^c	1.59 \pm 0.12 ^a	1.46 \pm 0.12 ^{ab}	1.41 \pm 0.10 ^b	1.07 \pm 0.11 ^c	18	1.29 \pm 0.23
Crude fiber (%)	1.63 \pm 0.83 ^c	1.15 \pm 0.49 ^d	2.31 \pm 0.26 ^a	2.02 \pm 0.64 ^b	2.10 \pm 0.05 ^b	1.58 \pm 0.10 ^c	18	1.80 \pm 0.59
Soluble solids (%)	3.72 \pm 0.12 ^c	3.93 \pm 0.25 ^b	3.83 \pm 0.12 ^{bc}	3.98 \pm 0.15 ^b	3.68 \pm 0.15 ^c	4.23 \pm 0.14 ^a	18	3.90 \pm 0.24
Total sugar (%)	1.57 \pm 0.07 ^d	1.99 \pm 0.09 ^a	1.64 \pm 0.21 ^c	1.71 \pm 0.11 ^b	1.70 \pm 0.43 ^b	1.95 \pm 0.10 ^a	18	1.76 \pm 0.25
Inverted sugar (%)	1.50 \pm 0.10 ^c	1.87 \pm 0.08 ^a	1.56 \pm 0.18 ^d	1.62 \pm 0.04 ^c	1.51 \pm 0.34 ^{dc}	1.81 \pm 0.14 ^b	18	1.64 \pm 0.21
Saccharose (%)	0.07 \pm 0.05 ^b	0.11 \pm 0.04 ^{ab}	0.08 \pm 0.04 ^b	0.09 \pm 0.08 ^b	0.18 \pm 0.09 ^b	0.14 \pm 0.05 ^{ab}	18	0.11 \pm 0.06
Acidity (%)	0.84 \pm 0.05 ^d	1.21 \pm 0.20 ^a	0.92 \pm 0.16 ^c	0.90 \pm 0.02 ^c	0.84 \pm 0.08 ^d	1.09 \pm 0.17 ^b	18	0.97 \pm 0.18
pH	3.64 \pm 0.09 ^{ab}	3.38 \pm 0.05 ^c	3.69 \pm 0.05 ^a	3.55 \pm 0.13 ^{cd}	3.61 \pm 0.09 ^{bc}	3.52 \pm 0.08 ^d	18	3.57 \pm 0.13
Vitamin C (mg/100 g)	3.73 \pm 0.39 ^c	6.48 \pm 0.65 ^a	3.97 \pm 0.67 ^{bc}	4.89 \pm 0.50 ^b	4.82 \pm 0.67 ^b	7.30 \pm 1.21 ^a	18	5.21 \pm 1.47

^{a,b,c,d}Values in the same row having a different letters differ significantly (P<0.05)

Table 2: Mineral contents of *Rheum ribes* L. obtained from different region of Turkey (values are means \pm SD n=three replicate trials).

Parameters	Region of sample obtained						n	mean
	Agri	Bitlis	Erzurum	Hakkari	Mus	Van		
Fe (μ g/g)	3.073 \pm 0.45 ^c	3.146 \pm 0.37 ^c	4.413 \pm 0.61 ^a	4.363 \pm 0.41 ^a	3.591 \pm 0.43 ^{bc}	3.923 \pm 0.78 ^{ab}	18	3.752 \pm 0.73
Zn (μ g/g)	1.057 \pm 0.17 ^{bc}	1.035 \pm 0.13 ^{bc}	1.197 \pm 0.13 ^b	1.401 \pm 0.25 ^a	1.111 \pm 0.13 ^{bc}	0.990 \pm 0.12 ^c	18	1.132 \pm 0.21
P (μ g/g)	466.4 \pm 58.0 ^a	323.4 \pm 70.2 ^b	470.6 \pm 57.9 ^a	460.9 \pm 85.5 ^a	453.8 \pm 62.6 ^a	292.2 \pm 29.2 ^b	18	411.2 \pm 94.9
Pb (μ g/g)	0.006 \pm 0.01 ^a	0.016 \pm 0.02 ^a	0.022 \pm 0.02 ^a	0.016 \pm 0.03 ^a	0.024 \pm 0.02 ^a	0.012 \pm 0.01 ^a	18	0.016 \pm 0.02
Cu (μ g/g)	0.335 \pm 0.13 ^{cd}	0.229 \pm 0.03 ^d	0.360 \pm 0.13 ^{cd}	1.051 \pm 0.15 ^a	0.417 \pm 0.11 ^c	0.608 \pm 0.08 ^b	18	0.501 \pm 0.29
Mn (μ g/g)	0.353 \pm 0.07 ^b	0.301 \pm 0.08 ^b	0.541 \pm 0.09 ^a	0.461 \pm 0.04 ^a	0.546 \pm 0.15 ^a	0.337 \pm 0.06 ^b	18	0.423 \pm 0.13

^{a,b,c,d} Values in the same row having a different letters differ significantly (P<0.05)

Vitamin C contents of *Rheum ribes* L. were lower than values given by Munzuroğlu *et al.* [13]. This variation can arise from different analysis method and sample form used. Vitamin C contents of the wild herbs used for herby cheese production were reported in the range of 136.11 mg/100 g (*Ziziphora capitata* L.) and 15.84 mg/100 g (*Allium vineale* L.) [23]. These values were higher than our results even though they have used dried forms of these samples.

Iron, zinc, phosphorus and copper contents of *Rheum ribes* samples were reported by Özcan *et al.* [16]. It can be seen that our results were in accordance with their findings. On the contrary to these, in the present study manganese concentration was determined slightly higher than their result. Iron, zinc, phosphorus and manganese contents of *Prangos ferulacea* samples in the same research were higher than results found in our study.

Özcan and Akbulut [16], determined some minerals of medicinal and aromatic plants used as spices, condiments and herbal tea samples. Iron, zinc, phosphorus, lead, copper and manganese contents of fennel samples (*Foeniculum vulgare*) were reported as 316.00 ppm, 20.76 ppm, 8772.25 ppm, 0.35 ppm, 8.28 ppm and 33.39 ppm, respectively. The mineral element values of wild plants in the study were different than the present study.

Mineral elements in the present study were found to vary widely depending on the region where the samples were obtained from. These differences might be due to the growth conditions, genetic factors, geographical variations and analytical procedures [9,17,15].

Conclusion: *Rheum ribes* has been used as a traditional Turkish therapeutic agent for Diabetes mellitus and hemorrhoids in Eastern Anatolia Region.

There is a great demand for consumption of *Rheum ribes* in last two decades and it is marketed in every region of Turkey during harvesting period. This study has shown that there are significant variations in terms of chemical composition between *Rheum ribes* samples collected from six different cities in Eastern Anatolia. Besides in this study wild rhubarb was recognized as a good source of vitamin C, iron, zinc and crude fiber. Crude fiber is not a nutrient but it still plays a very important role in maintaining good health^[3,10,12,25]. Diet-rich dietary fiber has been associated with beneficial effects on human health^[25]. Lead contents of the samples were very low and these levels can be neglected in terms of health.

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