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The Nutritional Value of Wild Fruits from the North Eastern Anatolia Region of Turkey

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This study was carried out to investigate the nutrient composition of some wild fruit species such as English hawthorn (*Crateagus oxyacantha*), common barberry (*Berberis vulgaris*), sea backthorn (*Hippophae rhamnoides*), rowanberry (*Sorbus aucuparia*), wild strawberry (*Fragaria vesca*), cornelian cherry (*Cornus mas*), Japanese persimmon (*Diospyros lotus*), medlar (*Mespilus germanica*) and strawberry tree (*Arbutus unedo*) grown naturally in Northeastern Anatolia. Some properties of these species, including % moisture, protein, ash, total dry matter, total soluble solids, total sugar, reducing sugar, ascorbic acid, total acidity, pH and some minerals (P, K, Ca, Mg, Fe, Cu, Zn, Mn) were determined. Results of this study showed that the nutritional values of the wild fruit species investigated were considerably high, therefore, it can be suggested that these species should be cultured to have more benefit.

Key Words: Wild fruit species, Proximate composition, Turkey.

INTRODUCTION

Man has developed their foods from different types of plants are useful to him. Since the beginning of civilization, the people have never used plant more than 150 while about 80,000 edible plants are exist. Today, less than about 30 species provide 90 per cent of the world food requirements[1]. Increase in the world population and decrease in natural resources lead people to search for new food sources. One way of improving the per capita consumption of plant foods is to increase their production. This approach is limited, however, by resources, like land and water. Another feasible option is to explore additional sources of plant foods. From these perspectives the use of locally available wild flora has not been fully explored to help to increase the production of conventional food plants. Many of the under utilized plants are far superior sources of nutrients, texture and have

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medicinal properties as well as having high yield potential[2]. All over the world, especially in developing countries, it has been well known that wild plants make an important contribution to the life of local communities. They play a significant role in a wide range of agricultural systems as a source of wild foods and fuelwood and they also have an important socio-economic role through their use in medicines, dyes, poisons, shelter, fibres and religious and cultural ceremonies[1]. Therefore, recently, especially in European countries, the production of wild fruit species has been increased. This is probably because their influence on health has been realized. Further, owing to their tasty fruits and natural resistance against a number of pathogens, wild fruit species have gained considerable interest up to date[3]. These fruits having high nutritional values are also an appropriate material for a processing industry. Another advantage of these species might be that they can grow in relatively unfertile soils and in extreme ecological conditions[1,4-9]. Wild fruit species have been ignored by scientists and growers, although they might play a significant role in local production and processing systems. They are found naturally in almost every part of Turkey and some of them have local significances. Recently, significant interest on the production of this species has widely increased in Turkey[10]. These fruits have been an important food resource for the native people following traditional lifestyles in Turkey. The ecosystem in Turkey contains a great variety of plants which are locally consumed for their nutritional and medicinal properties; medicinal properties center on treating certain vascular and rural disorders. Studies on nutritional values of these species are not enough. In countries other than Turkey, there have been many studies on the nutritional composition of these wild fruit species[6,7,11-19]. The investigation of their components and nutritional values and defining deterministic properties of these species, commonly found in Turkey is important[10]. The nutritional value of wild food plants is of interest to ethnobotanists, clinicians, chemists, nutritionists and anthropologists. There is no definitive resource available containing this information for Turkey wild fruit species. The object of this work was to detect existing wild fruit species in some areas of Northeastern Anatolia of Turkey and to determine their nutritional attributes.

EXPERIMENTAL

This study was carried out using the English hawthorn (*Crateagus oxyacantha*), common barberry (*Berberis vulgaris*), sea buckthorn (*Hippophae rhamnoides* L.), rowanberry (*Sorbus aucuparia* L.), wild strawberry (*Fragaria vesca* L.), cornelian cherry (*Cornus mas* L.), Japanese persimmon (*Diospyros lotus*), medlar (*Mespilus germanica*) and strawberry tree (*Arbutus unedo*) naturally grown in Northeastern Anatolia.

All the fruits were identified whether they were ripe and ready for harvest and preparation and then, they were picked from at least 10 different trees to have a minimum 500 g each sample. They were then frozen in plastic bags in a household freezer (-20ºC) within 24 h of harvest and kept until analysis. Equal weights of fruit tissues (*ca.* 100 g fruits) were homogenized in a blender using distilled and deionized water. Standard techniques of the AOAC[20] were followed for total dry matter, ash and crude protein. The total soluble solids (TSS) contents of fruits were determined by a hand refractometer. Titrable acidity was determined as percentage by titration method. Dehydroascorbic acid (vitamin C) analysis was performed according to the method of Pelletier and Brassard[21]. Total and reducing sugars were determined by dinitrophenol method[22]. Minerals were analysed on nitric-perchloric acid digest method with atomic emission spectroscopy[23]. The analyses were all carried out in 3 replicates in each treatment. It has been noticed that the variations in repeated assays were routinely less than or equal to 10 %.

RESULTS AND DISCUSSION

Nutritional values of wild fruits could be contributed substantially by moisture, ash, total dry matter, TSS, total and reducing sugar, vitamin C, total acidity and pH. The results of the analysis are presented in Table-1. Data indicates that these wild fruits are good source of sugar and vitamin C. The moisture contents of the wild fruit species varied from 62.6 to 84.2 % with higher contents in cornelian cherry, sea buckthorn and wild strawberry. In a previous study[13], it is reported that moisture content of sea buckthorn ranged from 85.2 to 88.9 %, on wild fruit species in Italy. Kuhnlein[6] reported a measurement of 85 % moisture in wild strawberry from British Columbia. In present work, the moisture contents were generally lower in the wild fruits than in the cultivated fruit species. It was well-known that the moisture content of fruits is about 80-85 % depending on species, cultivar, ecology and growing techniques[24]. The decreased moisture content in wild fruit species in this study may be explained as a result of the dry and unfavourable growing conditions.

Protein contents variation depends on the wild fruit species. The highest protein content among the fruit species was observed in wild strawberry (3.55 %), followed by common barberry (2.67 %) and the lowest protein content was in medlar (0.96 %). Fruits are foods that are considered a non-protein source[24]. Hulme[24] reported that protein contents range from 0.2 to 2.2 % in the 36 cultivated fruit species. In comparison to the results given by Hulme[24], the present results show higher protein contents for the wild fruit species than for the cultivated fruit species. The present findings are in good agreement with the reported values.

TABLE-1
PROXIMATE COMPOSITIONS OF WILD FRUIT SPECIES (mg/100 g)

Component	English Hawthorn	Common Barberry	Sea Buckthorn	Rowanberry	Wild Strawberry	Cornelian Cherry	Japanese Persimmon	Medlar	Strawberry Tree
Moisture (%)	75.10	80.30	83.20	76.90	80.50	84.20	74.20	71.90	62.60
Protein (%)	2.21	2.67	1.88	2.53	3.55	2.27	1.44	0.96	1.89
Ash (%)	1.64	0.95	0.76	2.27	0.79	0.77	1.99	1.19	5.00
TSS (%)	17.50	18.10	10.80	19.40	10.80	13.70	24.30	24.70	21.70
Total sugar (%)	15.50	13.88	9.73	3.64	10.39	11.93	24.22	9.37	14.06
Reducing sugar (%)	6.15	7.35	7.58	2.15	7.66	10.05	9.83	3.93	4.30
Ascorbic acid (mg)	4.65	10.31	37.21	44.12	46.74	50.83	20.62	4.23	119.10
Total acidity	0.63	3.79	3.74	2.89	2.23	2.07	0.24	1.30	6.65
pH	4.15	3.54	2.73	3.50	3.69	2.80	5.87	4.79	3.78

TABLE-2
MINERAL COMPOSITIONS OF WILD FRUIT SPECIES (mg/100 g)

Minerals	English Hawthorn	Common Barberry	Sea Buckthorn	Rowanberry	Wild Strawberry	Cornelian Cherry	Japanese Persimmon	Medlar	Strawberry Tree
K	160.000	199.000	215.000	154.000	163.000	187.000	208.000	183.000	119.000
P	55.500	19.900	38.300	12.300	31.100	25.100	10.300	8.500	12.600
Ca	6.430	2.510	27.370	29.900	57.030	17.630	12.600	11.100	12.000
Mg	10.750	16.940	20.880	27.840	32.500	18.970	11.100	8.300	9.100
Fe	2.910	3.170	1.370	2.420	0.440	1.880	0.500	0.380	1.250
Cu	0.175	0.181	0.714	0.294	0.681	0.541	0.183	0.120	0.088
Zn	0.192	0.284	0.791	0.861	0.259	0.452	0.605	0.485	2.602
Mn	0.153	0.250	0.912	0.503	0.733	0.604	0.202	0.286	0.197

The ash content of these wild fruit species ranges from 0.76 % (sea buckthorn) to 5.00 % (strawberry tree) (Table-1). This is in agreement with the data of Artik and Eksi[25] and Kuhnlein[6]. They found that ash content was 1.03 and 0.63 % for common barberry and wild strawberry, respectively. Karaçali[26] reported an ash content of 0.3-0.8 % for fresh fruit. Ash contents determined for the wild fruits in present trial were generally higher than in Karaçali[26] report.

The total soluble solids (TSS) content is highest for medlar (24.7 %) and lowest for wild strawberry (10.8%). Previous works reported on cornelian cherry shows that TSS content was 13.2-20.6 %[27-30]. Sugiyma *et al.*[14] determined that the TSS in Japanese persimmon varies from 16.29 and 19.07 %.

Total sugar contents varied between 3.64 % (rowanberry) and 24.22 % (Japanese persimmon) (Table-1). Oblak[11] reported that the total sugar content was 2.92 % for rowanberry and 7.42% for cornelian cherry. Krgovic[28] also reported that the total sugar content in cornelian cherry was between 9.0 and 13.8 %. The present results fall between the extremes a results obtained and presented in other studies.

Reducing sugar contents varied between 2.15 % (rowanberry) and 10.05 % (cornelian cherry). Krgovic[28] reported reducing sugar content for cornelian cherry between 7.56 and 10.20 % in Yugoslavia. Total and reducing sugar contents obtained were similar with another study[25].

Fruits are important vitamin sources. While varying between species and cultivars, vitamin C is one of the most wide-spread vitamins in fruits[24,26]. The results of present study have also indicated that some of these fruits are rich in vitamin C with levels as high as 119.1, 50.8, 46.7 and 44.1 mg/100g in strawberry tree, cornelian cherry, wild strawberry and rowanberry, respectively. For comparison, orange[24] have 50 mg/100 g vitamin C. According to Karaçali[26], sea buckthorn, rowanberry, cornelian cherry and wild strawberry are rich, although English hawthorn and common barberry are poor in vitamin C. In a study carried out in Macedonia, vitamin C contents of cornelian cherry was found[27] to be 77.8 mg/100 g and another study in Slovakia and Croatia[11] found 42.94 mg/100 g. In general, wild fruits are rich in vitamin C and their contents vary due to differences in species and environmental factors.

It is also observed that the total acidity is different for different wild fruit species, ranging from 0.24 % (Japanese persimmon) to 6.65 % (strawberry tree). In previous studies concerning total acidity, it has been reported to be 3.3 % in common barberry[25], 3.38 % in rowanberry[11] and 1.17-2.68 % in cornelian cherry[30].

The pH variation has been found between 2.73 (sea buckthorn) and 5.87 (Japanese persimmon). Karadeniz[31] also have determined that pH is between 2.0-2.6 in cornelian cherry.

The mineral contents of examined wild fruit species are given in Table-2. Potassium is the most abundant element in most fruit species and this was the same in this wild fruit species. Potassium content of wild fruit species per 100 g was between 119 mg (strawberry tree) and 215 mg (sea buckthorn). On the other hand, it was shown that the wild fruit species also important source of phosphorus. Phosphorus content ranged from 8.5 mg (medlar) to 55.5 mg (English hawthorn). Additionally, among these fruit species calcium and magnesium content of wild strawberry, iron and zinc content of common barberry and copper and manganese content of sea buckthorn were higher than those of other fruit species. The present results are similar to those of Kuhnlein[6], who reported that the wild strawberry (per 100 gfw) from British Columbia contains calcium, 64 mg; phosphorus, 35 mg; magnesium, 54 mg, iron, 0.4 mg; zinc, 0.2 mg; copper, 0.8 mg; manganese, 0.8 mg. Comparison of the mineral quantities of wild fruit species to those of cultivated fruit species in literature, it could be concluded that wild fruit species are as rich as cultured fruit species, or even richer in same minerals than many cultivated fruit species[13,15].

In present data on the mineral element composition of these wild fruit species, the high mineral content found in sea buckthorn and rowanberry should be emphasized.

From the results, it is concluded that the wild fruits tested are comparatively high in sugars, vitamin C and minerals which have a very positive effect on human health. Due to the increasing popularity of the natural life style the consumption of these species is rising around the world and in some countries the traditional uses are still alive. At this point, it can be concluded that nutritional values of wild fruit species grow naturally in almost every region of Turkey and they have been vastly used. Taking in to the culture of this wild fruit species in Turkey is little unlikely other countries. This process had a special importance to increase variability of production and open relatively unfertile areas in to fruit culture.

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