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Physical, Chemical and Antioxidant Properties of Tarhana with Cornelian Cherry

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In this study, physical, chemical and antioxidant properties of tarhana with cornelian cherry were determined. The lowest and highest values of investigated parameters were as follows: Hunter L from 41.14 to 62.12, a from +5.93 to +24.67, b +7.99 to +14.05, water activity from 0.292 to 0.695, moisture content from 6.20 to 15.74, pH from 3.42 to 3.96, titratable acidity from 0.17 to 1.26 %, protein from 11.08 to 22.33 % (on dry basis), ash from 1.59 to 4.10 % (on dry basis), salt from 0.27 to 2.89 % (on dry basis), total anthocyanin value from 12.03 to 41.81 mg kg^{-1}, total phenolics from 357.40 to 762.81 mg kg^{-1}, total antioxidant activity from 2.79 to 12.47 mM.

Key Words: Antioxidant activity, Anthocyanin, Cornelian cherry, Tarhana.

INTRODUCTION

Cornelian cherry (*Cornus mas* L.) is a wild grown in Asia and Europe, as well as being recently cultivated in Turkey and its mature scarlet fruit has sour taste[1]. The fruit contains significant amounts of anthocyanins and phenolics[2]. The anthocyanins impart bright colours to several fruits and vegetables and possess antioxidant, antiinflammatory, anticancer and anti-diabetic activities[3-5]. Therefore, food industry is interested in fruits and vegetables with high content of bioactive anthocyanins to manufacture supplements with preventative and therapeutic uses. Cornellian cherry has been used for the medical treatment of gastrointestinal disorder and diarrhea among people in Turkey[1]. The fruits are not only consumed fresh but also used to produce jam, marmalade, pekmez, pestil (a locally dried fruit pulp product), syrup and several types of soft drinks[6]. They are also used to produce tarhana.

Tarhana is one of the most widely consumed fermented foods in the Middle East and Turkey. Tarhana is prepared at homes by ways that have been learned from mother and grand mother since old times[7]. It is fixed

with flour or granule raw wheat, adding only yoghurt or tomato, onion, pepper and flavouring plants (mint, black pepper, *etc.*). Production method and recipe of tarhana may have some differences from region to region[8].

Tarhana with cornelian cherry is widely manufactured in the province of Bolu, Turkey. It is different from other tarhana and prepared by mixing wheat flour, broken barley, cornelian cherry and salt. The mixture is usually sun dried at domestic level and then ground.

There are several publications about tarhana[7-13]. However, no information available about antioxidant properties of tarhana with cornelian cherry. Therefore, the purpose of this study was to determine physical, chemical and antioxidant properties of tarhana with cornelian cherry.

EXPERIMENTAL

30 Samples in 500 g glass jars were collected and transferred to laboratory and analyzed for various properties. Tarhana samples were supplied from local producers in the province of Bolu, Turkey.

Determination of physical and chemical properties: Colour of samples was evaluated by measuring Hunter L (brightness, 100 = white, 0 = black), a (+, red; -, green) and b (+, yellow; -, blue) parameters by means of a reflectance colorimeter (CR 300, Chromometer, Minolta, Japan). A white tile (No: 21733001) was used to standardize the instrument.

Water activity was measured using a Testo 400 (Germany) water activity measurement device. Moisture, pH, titratable acidity, ash, crude protein and salt contents of tarhana samples were measured according to official methods[14]. The moisture content was determined by drying at 105 °C to reach a constant weight. pH was measured with a digital pH meter (Nel-890, Turkey). Titratable acidity was determined by titration up to pH 8.1 with 0.1 N NaOH solution and results were expressed as grams of malic acid per 100 g of sample. Nitrogen content was determined using by Kjeldahl method and multiplied by a factor of 6.25 to determine the crude protein. Ash content was determined by incineration in a muffle furnace at 550 °C; salt content was determined according to Mohr method[14].

Determination of natural antioxidants and total antioxidant activity: Total anthocyanin content was determined with the pH differential method[15] and results are expressed as milligrams of cyanidin 3-glucoside equivalents per kilogram of the tarhana, on the basis of the molar absorptivity (29,600) and molecular mass (445.2 g/mol) of cyanidin 3-glucoside. Absorbance was measured at 500 nm. Spectrophotometric measured were carried out using a Jasco UV-VIS 530 (Japan) spectrophotometer.

For the determination of total antioxidant activity and total phenolics, aqueous tarhana extracts were prepared. Samples were homogenized and centrifuged at 15000 x g at 10 °C for 10 min in a centrifuge (Sigma 3K30,

Germany) to remove the tarhana residue. Total phenolic content was measured using the Folin-Ciocalteau method[16]. Results are expressed as milligrams of gallic acid equivalents per kilogram of tarhana samples.

The antioxidant activity of the tarhana determined using the FRAP assay. Aqueous samples were mixed with 0.95 mL of ferric-TPTZ reagent (prepared by mixing 300 mM acetate buffer, pH 3.6, 10 mM 2,4,6-tripyridil-s-triazine in 40 mM HCl and 20 mM $FeCl_3$ in the ratio 10:1:1) and measured at 593 nm. $FeSO_4$ was used as a standard and antioxidant activity expressed as mM FRAP[17,18].

RESULTS AND DISCUSSION

Some physical and chemical compositions of the tarhana samples are given in Table-1.

TABLE-1
PHYSICAL AND CHEMICAL PROPERTIES OF
TARHANA WITH CORNELIAN CHERRY

Parameters	Minimum	Maximum	Means ± Standard deviation
Hunter values			
L	41.140	62.120	54.260 ± 5.310
+a	5.930	24.670	15.150 ± 4.300
+b	7.990	14.050	10.400 ± 1.120
Water activity	0.292	0.695	0.506 ± 0.099
Water (%)	6.200	15.740	9.690 ± 2.030
pH	3.420	3.900	3.690 ± 0.140
Titratable acidity (%)	0.170	1.260	0.560 ± 0.300
Protein (%)*	11.080	22.330	14.960 ± 3.000
Ash (%)*	1.590	4.100	2.720 ± 0.690
Salt (%)*	0.270	2.890	1.220 ± 0.580

*On the dry basis.

There are wide variations in colour of tarhana with cornelian cherry. Hunter L, a, b values of the samples ranged between 41.14-62.12, 5.93-24.67 and 7.99-14.05, respectively. L values of tarhana reported by Köse and Çagindi[19] and Erkan *et al.*[20] are generally higher than the value determined in our study. a values are generally higher than the values reported for tarhana by Köse and Çagindi[19] and Erkan *et al.*[20], while b values are lower. This result is expected because anthocyanins in cornelian cherry pulp contribute the red colour.

Water activity content varied from 0.292 to 0.695. Water activity is the relative availability of water in a substance. The water activity of a food is critical in determining its shelf life. As seen, tarhana samples have low water activity values; therefore, tarhana is a product with high storage stability.

Water content varied from 6.20 to 15.74 %. These values were closer to the range of 5.51-13.90 % reported for tarhana[7,9,19-23].

Titratable acidity of the samples ranged from 0.17 and 1.26 %. Titratable acidity values were lower than the values reported by Öner *et al.*[9] and Tarakçi *et al.*[8]. It is expected that tarhana with cornelian cherry has lower level of acidity compared to the literature because of the fermantation step eleminated. Acidity may arise from the cornelian cherry and the reactions taking place during drying.

The range of pH was betweeen 3.42 and 3.90. pH values were higher than the values reported by Öner *et al.*[9] and lower than the values reported by Hafez and Hamada[21] and Ibanoglu *et al.*[22].

Protein content varied from 11.08 to 22.33 % on the dry basis. The protein values were within the range of 10.10- 33.56 % reported by several researchers[7-9,19-23].

Ash and salt values of the samples ranged between 1.59-4.10 and 0.27-2.89 % on dry weight, respectively. The salt values were within the range of 0.59-10.4 % reported for tarhana[7,22]. Also, the ash values were within the range of 1.10-14.2 % reported by several researchers[7-9,19,20,22].

Antioxidant properties: Results of antioxidant activity, total phenolics and anthocyanin are given in Table-2.

TABLE-2
ANTIOXIDANT ACTIVITY, TOTAL ANTHOCYANIN AND PHENOLIC CONTENTS OF TARHANA SAMPLES

Parameters	Minimum	Maximum	Means ± Standard deviation
Total anthocyanin (mg kg^{-1})	12.03	41.81	26.68 ± 8.91
Total phenolics (mg kg^{-1})	357.40	762.81	572.76 ± 100.25
Total antioxidant activity (mM)	2.79	12.47	7.03 ± 2.11

As seen Table-2, the range of total anthocyanin was 12.03-41.81 mg kg^{-1}. The anthocyanin levels in the samples stem from cornelian cherry. Normally, cornelian cherry fruits are in rich anthocyanins. Ju and Hsieh[24] and Pantelides *et al.*[25] reported that total anthocyanins were in a range of 340-2230 mg/kg for cornelian cherry.

Anthocyanins is a member of flavonoids group of substances, contributing to the antioxidant power of fruits and vegetables. There is considerable current interest in the possible health effects of anthocyanins in humans owing to their potential antioxidant effects. More intensive utilization of anthocyanins as antioxidants is an interesting prospect for the food scientists[26].

Total phenolics ranged from 357.40 to 762.81 mg kg^{-1}. Sakac *et al.*[27] found that total content of phenolics in various wheat products ranged from 19.45 and 403.37 mg/kg. Furthermore, Ju and Hsieh[24] and Marinova *et al.*[28] reported that total phenolic contents were in a range of 2090-4320 mg/kg for cornelian cherry. As seen, total phenolics in cornelian cherry pulp contribute total phenolic contents of the tarhana. Karakaya *et al.*[29] reported the total phenolic content of traditional tarhana as 3717 mg kg^{-1}. The low level determined in present study may be due to differences in process and ingredients between tarhanas.

Phenolics inhibit lipid oxidation by scavenging free radicals resulting in the formation of a low energy phenolic radical whose energy is insufficient to promote lipid oxidation at biologically significant rates[30]. Numerous studies have evaluated the antioxidant activity of phenolics from fruits, vegetables, soybeans, herbs, teas, wines and medicinal plants. Much less attention has been focused on the antioxidant potential of phenolics from whole grains. Grains contain significant concentrations of antioxidative compounds[30].

Total antioxidant activity values varied from 2.79 to 12.47 mM FW, with a mean of 7.03 mM. Karakaya *et al.*[29] reported total antioxidant activity of traditional tarhana as 6.60 mM.

A general concensus has been reached during the last few years that diet has a major role in development of chronic diseases, such as cancer, coronary heart, obesity, diabetes type 2, hypertension and cataract. This consensus suggest that a predominantly plant-based diet rich in fruits and vegetables, pulses and minimally processed starchy staple foods reduces the risk for development of these diseases significantly[31]. Fruits and vegetables contain many different antioxidant components. The antioxidant activity is most significantly correlated with the contents of total phenolics and anthocyanins[32].

Conclusion

Tarhana produced from cornelian cherry is different from traditional tarhana in terms of content and properties. This product may be important variety in food industry due to product variety and natural antioxidants. Tarhana with cornelian cherry is possible that they could contribute to dietary antioxidant intake.

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