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Physicochemical Properties of Cornelian Cherry Fruit (*Cornus mas* L.) Grown in Qazvin province, Iran

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ABSTRACT

Cornelian cherry (Cornus mas L.) has high biological and antioxidant activities. It has known for its tonic, analgesic and diuretic activities. In the present study physicochemical properties of cornelian cherry fruit collected from different areas of Qazvin province, Iran including total soluble sugar (TSS), total sugar (TS), pH, total acidity (TA), TSS/TA, dry matter, ash, flesh/seed, length (L), width (W), L/W, fruit mass and fruit weight have been investigated. Total sugar (8.83 g.Kg-1), TSS/TA ratio (14.47), dry matter (%20.71), fruit/seed ratio (5.02), fruit mass (2.16) and fruit weight (2.59) measurements of the examined cornelian cherry in the present study were lower than those reported by other researchers for cornelian cherry in the other countries. However, total soluble solid (%17.61) and ash (%0.71) content of the examined cornelian cherry were higher than those reported by other researchers. Among measured physicochemical properties evaluated for cornelian cherry, TA (%1.24), pH (3.1), length (20.9 mm) and width (13.85 mm) measurements were similar to those reported for cornelian cherry in the other studies. Cornelian cherry fruit samples collected from different areas of Qazvin province showed different properties. The variations between physicochemical properties measured for cornelian cherry fruit samples were may attributed to different genotypes of the fruit and its cultivation and growth conditions.

Key words: Physical properties, Cornus mas, Cornelian cherry fruit, Chemical characteristics.

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1. INTRODUCTION

Consumption of fruits and vegetables have been strongly associated with reduced risk of cardiovascular disease, cancer, diabetes, Alzheimer disease, cataracts, and age-related functional decline (1). Vegetables and fruits are rich in vitamins, trace minerals, dietary fiber, biologically active and antioxidant components (2). Antioxidants protect cells against oxidative damage, thus declining cancer and cardiovascular disease risk in human (3). High fiber diet including vegetables and fruits results in lower risk heart attacks and improvements in several chronic diseases including cardiovascular ones and consequently plays an important role in human health (4). Fruits and vegetables are important source of micronutrients such as vitamin C and folic acid that are necessary for health (5). Phenolic compounds and bioactive components such as anthocyanins, phenolic acids, stilbens and tannins are found in fruits (6). Cornelian cherry (*Cornus mas* L.) is a wild plant growing in Asia and Europe and being

cultivated in different areas of Iran (7). Cornelian cherry has sour taste as mature scarlet fruit with high biological and antioxidant activity (8). The presence of flavonoids and anthocyanin (natural color of fruit), the cornelian cherry is considered as a medicinal with high level of antioxidative property. Furthermore, cornelian cherry is an important source of raw materials for phytomedicine with high health benefits (9). There are several reports about its application in traditional medicine and, as food preservative. For example, cornelian cherry has been used in Chinese herbal medicine for its tonic, analgesic and diuretic activities with high advantages for liver and kidney functions (7). Anti-bacterial, anti-histamine, anti-allergic and anti-malarial activities have also been reported for cornelian cherry by the other researchers (7, 9, 10). In Iran, Cornelian cherry fruit is widely grown in East-Azerbaijan and Qazvin provinces. In these regions, 99% of cornelian cherry crop is harvested from open pollinated seedlings of wild genotypes. This fruit is very useful when is being consumed freshly. It can be processed for producing syrups, juices, jam, paste, spirits, and other traditional products (11). Recently, a number of studies were carried out on physicochemical properties of cornelian cherry fruits cultivated in Turkey, Iran (Azerbaijan province) and Serbia (7, 9, 10, 12, 13). But there are no information on physicochemical properties of cornelian cherry fruit cultivated in Qazvin Province, Iran. The aim of this research was to broaden current knowledge of physical and chemical characteristics of cornelian cherry fruit cultivated in Qazvin, Iran.

2. MATERIALS AND METHODS

2.1. Materials

Nine cornelian cherry fruit samples were investigated in this study. Fruit samples were collected from different areas of Alamout, in Qazvin province, in November 2012, and stored at -18°C until their physicochemical properties were analyzed. At least three determinations were implemented for each analysis, and the mean values were reported.

2.2. Chemical analysis of cornelian cherry fruit samples

The TSS contents were determined by extracting one drop of juice from each fruit using a digital Refractometer (Kyoto Electronics Manufacturing Ltd., Japan, Model RA-250HE). The measurement was done at 22 °C. The unit was washed with distilled water before measuring TSS of each sample (14). The measuring range of refractometer was between 0 and 60%. Reducing sugar was determined with the Merck RQflex refractometer (Merck, Darmstadt, Germany) (13). The pH value was measured using digital pH-meter (WTW Inolab pH-L1, Germany). The TTA was assessed by titration with sodium hydroxide (0.1 N) and expressed as percent of malic acid (14). Dry matter was determined by heating an amount of sample (about 2 grams) in a vacuum oven at 70 °C until a constant weight to be obtained (14). Finally, ash content was measured according to Vursavus et al. (15) by igniting a weighed sample in a muffle furnace at 550 °C to reach a constant weight.

2.3. Physical analyses of cornelian cherry fruit samples

The Flesh/Seed ratio was calculated using (fruit weight – seed weight/seed weight) formula described by Demir and Hakki-Kalyoncu (16). The length and width of the fruits were measured by vernier caliper with a sensitivity of 0.01 mm. Fruit mass was measured with a sensitive electronic balance of 0.001 g sensitivity (Scaltec Company, Gottingen, Germany; model SPB31). Fruit weight was determined using a digital balance with a sensitivity of 0.001 g (13).

2.4. Statistical analysis

Mean value obtained from three replications of each experiment was reported as mean±SD. Pearson correlation coefficients between chemical and physical characteristics of 9 cornelian cherry fruit samples were determined by Pearson correlation matrix method using SPSS software (v. 17, Chicago IL, USA).

3. RESULTS AND DISCUSSION

3.1. Chemical analysis of cornelian cherry fruit

The results of chemical properties of cornelian cherry fruit samples and correlation between them are presented in Table 1 and Table 3, respectively.

Table 1. Chemical properties of cornelian cherry fruit samples collected from Qazvin, Iran

	Mean	SD[a]	Minimum	Maximum
%TSS[b]	17.61	3.22	12.5	21.4
Total Sugar (g/kg)	8.83	0.40	8.21	9.44
pH	3.10	0.08	2.97	3.29
%TA[c]	1.24	0.20	0.98	1.53
TSS/TA	14.47	3.06	8.16	18.57
%Dry Matter	20.71	2.21	17.89	25.37
% Ash	0.71	0.08	0.56	0.82

[a] SD, Standard Deviation

[b] TSS, Total Soluble Solid

[c] TA, Titrable Acidity (%malic acid)

There are wide variations between chemical properties of the examined fruits. The range of TSS was 12.5 – 21.4% that was higher than TSS of cornelian cherry reported in the previous studies (12, 16, 17) however was similar with

the results reported by Tural and Kuca (7). This could probably because of different environmental conditions and genotype types since TSS is influenced by those factors (16). Total sugar values were in therange of 8.21 – 9.44% for samples that were lower than total sugar values reported for cornelian cherry in the other studies (7, 17, 18). The TA in the examined fruits varied from 0.98 to 1.53% while in the similar studies TA was between 1.10 to 4.69% In the present study pH value of cornelian cherry fruits were between 2.97 – 3.29 which was in agreement with the other reports ranged 2.5–3.53 (7, 12, 16, 17). A significant negative correlation (p<0.05) was found between total acidity and pH value of the fruit samples. TSS/TA ratio, indicating maturity level, (19) was in the range of 8.16-18.57 that was lower than results reported by the other researchers (15). Dry matter contents ranged between 17.89–25.37%. Tural and Kuca (7) reported the dry matter content of cornelian cherry fruit cultivated in Turkey higher than that we observed in the present investigation. Ash content of cornelian cherry fruit samples was in the range of 0.56–0.82 that were higher than that reported by Vursavus *et al.* (15) for cornelian cherry fruits grown in Turkey. All of these differences may be attributed to varied genotype types, environmental and cultivation conditions (20).

3.2. Physical properties of examined cornelian cherry fruit

Physical properties of fruit samples and correlation between them have shown in Table 2 and Table 3, respectively.

Table 2. Physical characteristics of cornelian cherry samples collected from Qazvin, Iran

	Mean	SD[a]	Minimum	Maximum
Flesh/Seed	5.02	0.83	3.94	6.78
Length (mm)	20.9	2.67	14.8	24
Width (mm)	13.85	1.48	10.8	15.7
L/W[b]	1.50	0.13	1.37	1.83
Fruit Mass (g)	2.16	0.49	1.26	2.95
Fruit Weight (g)[c]	2.59	0.55	1.57	3.52

[a] SD, Standard Deviation

[b] L/W=Length/Width

[c] Weight of wet fruit

Table 3. Pearson correlation coefficients between physic-chemical properties of cornelian cherry fruit samples collected from Qazvin, Iran

	TSS	TS	pH	TA	DM	Ash	F/S	L	W	FM	FW
TSS[a]	-	-	-	-	-	-	-	-	-	-	-
TS[b]	-0.087	-	-	-	-	-	-	-	-	-	-
pH	-0.206	-0.018	-	-	-	-	-	-	-	-	-
TA[c]	0.098	0.303	-0.833*	-	-	-	-	-	-	-	-
DM[d]	-0.085	-0.091	0.077	-0.292	-	-	-	-	-	-	-
Ash	0.481	-0.099	0.289	-0.122	0.190	-	-	-	-	-	-
F/S[e]	0.216	0.518	-0.307	0.416	-0.440	0.255	-	-	-	-	-
L[f]	-0.060	0.045	-0.101	0.356	-0.574	0.268	0.599	-	-	-	-
W[g]	0.366	0.463	-0.054	0.080	-0.519	0.350	0.619	0.751*	-	-	-
FM[h]	-0.026	0.644	0.030	0.077	-0.563	0.183	0.705*	0.871*	0.892*	-	-
FW[i]	-0.019	0.616	0.052	0.042	-0.543	0.184	0.656	0.864*	0.904*	0.997*	-

* p < 0.05, [a] %Total Soluble Solid, [b] Total Sugar (g/kg), [c] Titrable Acidity (%malic acid), [d] %Dry Matter, [e] Flesh/Seed, [f] Length (mm), [g] Width (mm), [h] Fruit Mass (g), [i] Fruit Weight.

Flesh/Seed ratio of samples ranging from 3.94 to 6.78 was lower than that reported in the other studies (12, 16, 17) Fruit length was from 14.8 to 24 mm, while fruit width was between 10.8 and 15.7 mm. The fruit length and width results was in agreement with those reported by Didin *et al.* (2000) (17) and, Demir and Kalyoncu (2003) (16). It was interesting that a significant positive correlation (p<0.05) was found between length and width measurements of cornelian cherry fruit samples. L/W ratio ranged between 1.37 and 0.83 in fruit samples (Table 2). Fruit mass measurements were lower than those reported by Vursavus et al. (15) for cornelian cherry fruit samples cultivated in Turkey. A significant positive correlation was found between fruit mass, length, width and flesh/seed ratio of cornelian cherry fruit samples (p< 0.05). Average fruit weight values of cornelian cherry samples examined in the present study ranged between 1.57 and 3.52 g, which were lower than those reported by the other researchers reported (16, 20-22). Correlation between fruit weight and, length, width and fruit mass measurements of cornelian cherry fruit samples were positive significantly (p<0.05). Finally, it can concluded that physical properties of cornelian cherry fruit samples collected from Qazvin may be related to their different genotypes and cultivation conditions (20) .

4. CONCLUSION

As a conclusion, this investigation clearly shows that physicochemical properties of cornelian cherry fruits collected from Qazvin were differed significantly from

cornelian cherry fruits grown in the other countries such as Turkey and Serbia. Total sugar, TSS/TA ratio, dry matter, fruit/seed ratio, fruit mass and fruit weight measurements were lower than those fruits investigated in the other countries while the total soluble solid and ash content were higher than those from other countries. TA, pH, length and width measurements of the fruits examined in the present study were similar to those reported by the other researchers for cornelian cherry fruits. Variabilities in the physicochemical properties of among nine fruit samples collected from different areas of Qazvin were also observed. Variations between physicochemical properties observed between cornelian cherry fruit samples collected from Qazvin, may be attributed to different genotypes and cultivation conditions.

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AUTHORS CONTRIBUTION

This work was carried out in collaboration among all authors.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interests with respect to the authorship and/or publication of this paper.

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