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Original research

Some chemical characteristics of major varieties of sour cherry grown in Iran

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A B S T R A C T

In this study some selected chemical properties such as total soluble solids, pH, total acidity, formalin index, reduced sugar content and ascorbic acid of major sour cherry cultivated grown in different provinces of Iran corresponding were investigated. Minerals K^+, Na^+, Ca^{2+}, Mg^{2+}, Cu^{2+}, Fe^{2+} and Zn^{2+} were determined by graphite furnace atomic absorption spectrophotometer. The result showed that some chemical properties of Sour cherry such as total soluble solids, pH, total acidity, formalin index content, reduced sugar content and ascorbic acid, were within the range of 12.4–17.4 g/100ml, 3.05–3.78, 0.5–1.1g/100ml, 4.09-6.01 g/100g, 3.80–5.49 g/100g, 3.59–5.06 g/100g, respectively. Fe^{2+} and Ca^{2+} were significantly higher than other minerals (K^+, Na^+, Mg^{2+}, Cu^{2+} and Zn^{2+}) in major varieties of sour cherry. In addition, the average concentration of Ascorbic acid, TA, total soluble solids, pH, reduced sugar and formalin index were respectively 3.36 g/100g, 0.76 g/100ml, 14.77 g/100ml, 3.36, 4.70 g/100g and 4.44 g/100g.

Keywords: Sour cherry, Formalin, Atomic absorption spectrophotometer

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1. Introduction

Different varieties of sour cherries *(Prunus Cerasus/Avium*) are cultivated in most world countries, including Iran (Wojdyło et al., 2014), with the production estimated to approximately 1.2 million tons per year (FAOSTAT, 2014). The main producers are Turkey, Poland, Russia and USA, respectively (Damar & Ekşi, 2012). The fruit is among the first fresh fruits which are harvested in the spring and is appreciated for their nutritional and therapeutic values (Filimon et al., 2011). A very small portion of sour cherries are consumed in a fresh state with an exception for the hybrid varieties between cherry and sour cherry and the rest is processed in food industry into many products such as juice, candies, bakery products and frozen fruits (Górnaś et al., 2016). Dried fruit has a long shelf life and can be a good alternative to fresh fruit (Gazor et al., 2014; Horuz et al., 2017).

Due to significant levels of anthocyanins that possess strong antioxidant and anti-inflammatory activities, sour cherry and its products have had an increased utilization in the food market in the past 10 years (Khoo et al., 2011). The fruit juices, prepared from red fruits, are the most available and rich sources of anthocyanins (Fanali et al., 2011). Anthocyanins are one of the major groups of water soluble pigments belonging to the family of flavonoids and responsible for most of the red, blue, and purple colors of fruits, vegetables, flowers, and other plant tissues or products (Mazza, 2007). On the basis of clinical studies, it has been suggested that anthocyanins have an anticarcinogenic action, they prevent cardiovascular diseases, and they may control obesity and diminish the action of diabetes (Ataie-Jafari et al., 2008; Nowicka & Wojdylo, 2016). All these actions are associated more or less to their antioxidizing capacity (He & Giusti, 2010).

In addition to the variety, agro-climatic conditions also may affect the biochemical composition of plant material. Iran's rich biological diversity as a result of variations in climate and presence of numerous mountains, lakes, rivers, and natural springs has made the country unique, capable of producing all types of fruits, vegetables, flowers, and agronomic crops (STATISTICS, 2005). In search for alternative crops for farmers, Sour cherry appears as a potential crop of high market value. Limited number of investigations has been done on Iranian sour cherries characteristics such as ascorbic acid, pH, total acidity, total soluble solids, total phenolic content etc., cultivated in Iran. Therefore, in the present study an attempt has been made to know the variability in chemical properties of Iran - cultivated sour cherries.

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2. Material and Methods

2.1. Sample preparation

Samples were collected from Khorasan and Tehran provinces. The cultivars (Champa, Sika and butermo) were selected according to their higher yield capacity in these two provinces. The fruits were harvested at commercial maturity stage in May 2011. The fruits were selected according to uniformity of shape and color and then transported to laboratory for analysis. Five samples of each cultivar (totally 15 samples) were immediately brought to laboratory after sampling. All fruits were cleaned to remove damaged parts and immature fruits and then the stones were separated. Fruits were squeezed and the juices were extracted. The juices were kept frozen at -20 °C. Fresh samples were used for measurement of titratable acidity, pH, total soluble solids, formaline index, reduced sugars, and freezed samples were used for mineral detection.

2.2. Physicochemical characterization

All chemicals and reagents used for analysis were of analytical grade Merck Company (Darmstadt, Germany). After defrosting and centrifuging frozen juices, total acidity (TA) in terms of malic acid (%w/w), formalin index, reduced sugar and ascorbic acid were determined according to the standard method of AOAC (AOAC, 2000). Total soluble solid contents (TSS) were determined by extracting and mixing one drop of juice from each fruit into a digital refractometer (Model A.kruss) at 20 °C (ISIRI, 2011). The pH measurements were made using a digital pH meter (Metrohm, Swiss) calibrated in pH 4 and **7** buffer solutions (ISIRI, 2008).

2.3. Determination of minerals

Seven minerals in samples were analyzed by graphite furnace atomic absorption spectroscopy using a SpectrAA 10 Plus (Varian Australia Pty Ltd., Mulgrave, Victoria, Aus- tralia)**.** A calibration curve was established for each mineral, using 4 standard solutions (Ahmadi et al., 2011).

2.4. Statistical analyses

SPSS software was used for the statistical analysis, one-way analysis of variance (ANOVA). The results were presented as means ± standard deviation of triplicate analyses. Duncan's multiple range post-hoc test was used to compare the treatment means. The test of statistical significance was based on the total error criteria with a confidence level of 95.0%.

3. Results and Discussion

3.1. Acidity

Acidity of the varieties, expressed as tartaric acid, varied from 0.7g/l to 1.3g/l. As it can be seen in Fig. 1, *Champa Ghazvin, Champa Karaj*, *Sika Mashad*, *Sika Tehran* and *Butermo mashad* varieties had higher Acidity. In reviewing the physicochemical characteristics of the four commonly used sour cherry species in China, the highest titratable acidity was reported in terms of malic acid between 0.49 (% per 100 g fruit weight) in the Santina cherries (*p. avium*) and 1.11 (% per 100 g fruit weight) in the Aode (*p. cerasus*) variety (Cao et al., 2015).

3.2. pH

The fruit of ten sour cherry species varied in pH (Fig. 2), with a range from 3.05 ± 0.06 (*Champa Chenaran*) to 3.78 ± 0.30 (*Sika* Tehran). These results are consistent with research that has found pH value of four sour cherry varieties of Khorasan between 3.48 ± 0.02 (*Early Jibilium*) and 3.77 ± 0.05 (*Butermo*) (Einafshar, 2015).

3.3. Total Soluble Solids

In many fruit product standards, minimum values of TSS and formalin index are required as quality characteristics. It is clear that using *Champa* variety from Ghazvin province as raw material has more commercial justification for the food processors than other varieties (Fig. 3). The amount of total soluble solids, titratable acidity, flavor and flavoring compounds (the proportion of the TSS/TA) are important indexes for determination the appropriate time for harvesting and ultimately the acceptance of the consumer. Karadeniz et al. (2002) and Pirlak et al. (2003) reported the amount of sour cherry pH between 2.87 and 3.23, the titratable acidity of 2 to 2.65% and the soluble solids of 11.5 to 16.8. While all the cultivars used in this study had pH higher than 3.05 up to 3.78 and almost higher soluble solids and lower titrability of acidity.

3.4. Formaline index

The average value of formalin index content (as the sum of the individual sugars) was 5.22 mg/100. The highest formalin index was found in the *Champa* variety in Ghazvin province (6.01 ± 0.31) and the lowest one in *Sika Tehran* variety (5.01 ± 0.29), which can represent more nitrogen compounds (Fig. 4).

3.5. Ascorbic Acid

Although our results showed that the highest value of ascorbic acid belonged to the variety of *Sika Tehran* (Fig. 5), other researchers had reported higher values (Ferretti et al., 2010).

3.6. Reduced Sugars

Sweetness and acidity, which are important indexes determining the taste quality of fruits varied with the variety and were determined by the concentrations of reduced sugars, Ascorbic acid and also acidity (Fig. 6).

Sour cherries also contained some important minerals which complied with national standard limits for sour cherry juice (ISIRI, 2011). The variation in minerals in agricultural products could be originated from the varieties and agro-climatic as well as the environmental conditions. Table 1 Shows that magnesium content of the samples was very low while the Calcium values were very high (50.03 ± 0.62 mg/100g) in all the varieties.

Table 2. Mineral values of Sour cherry (mg/100 g edible portion).

Mineral	Mean	SD (±)
Na^{+}	3.06	0.57
Ca^{2+}	50.03	0.62
K^{+}	2.98	0.2
Cu^{2+}	0.07	0.01
Fe^{2+}	1.02	0.06
Zn^{2+}	0.11	0.03
Mg^{2+}	0.02	---

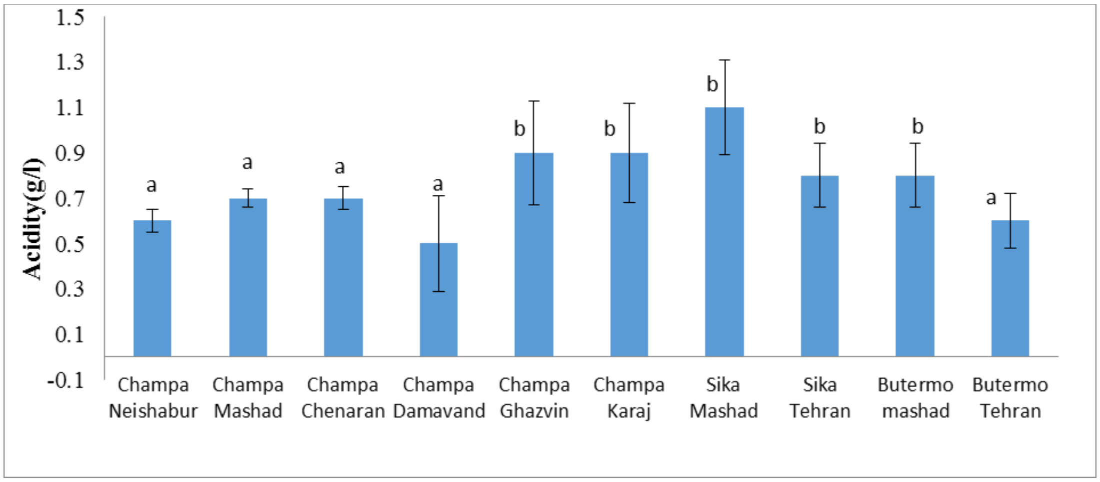

Fig. 1. Acidity of major varieties of sour cherry (values with different letters are significantly different ($p < 0.05$)).

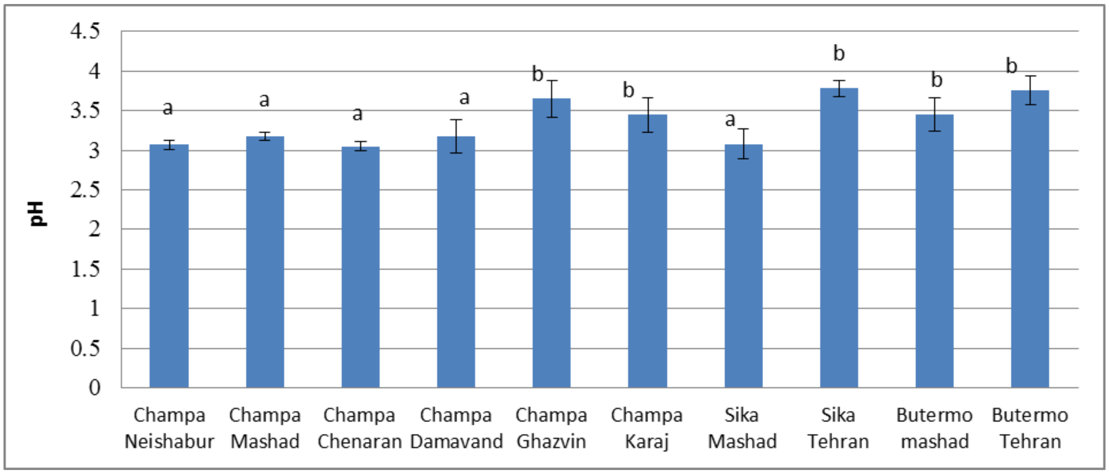

Fig. 2. pH of major varieties of sour cherry (values with different letters are significantly different ($p < 0.05$)).

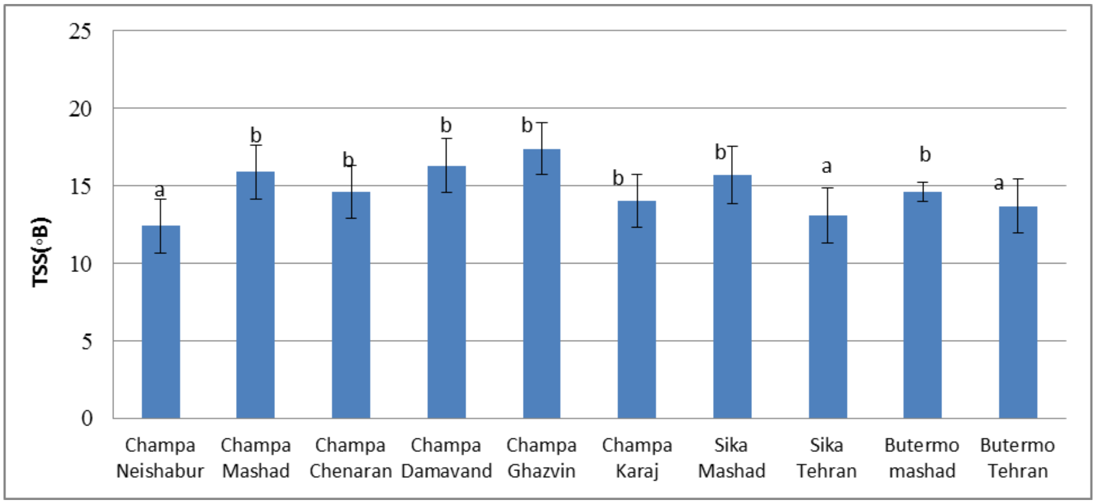

Fig. 3. Total Soluble Solids of major varieties of sour cherry (values with different letters are significantly different ($p < 0.05$)).

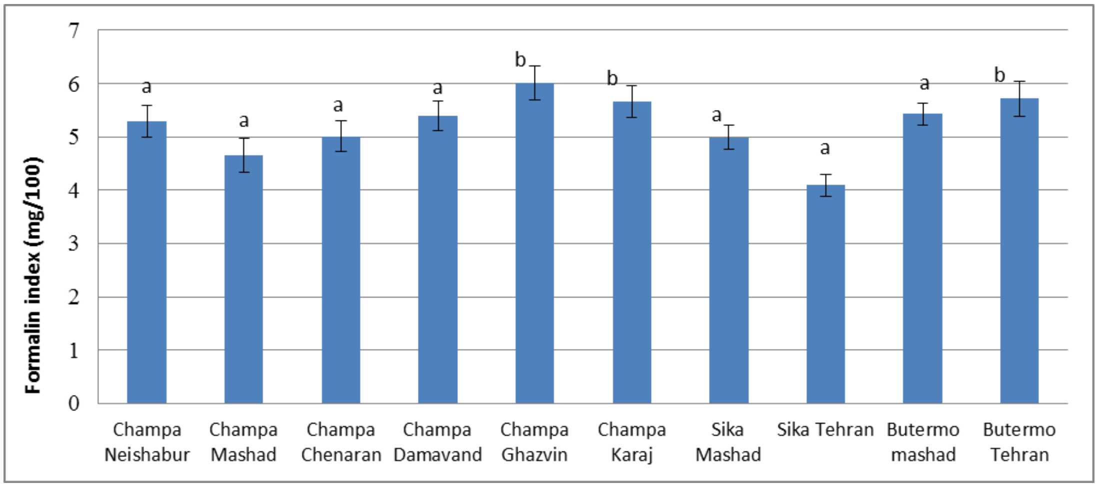

Fig. 4. Formalin index of major varieties of sour cherry (values with different letters are significantly different ($p < 0.05$)).

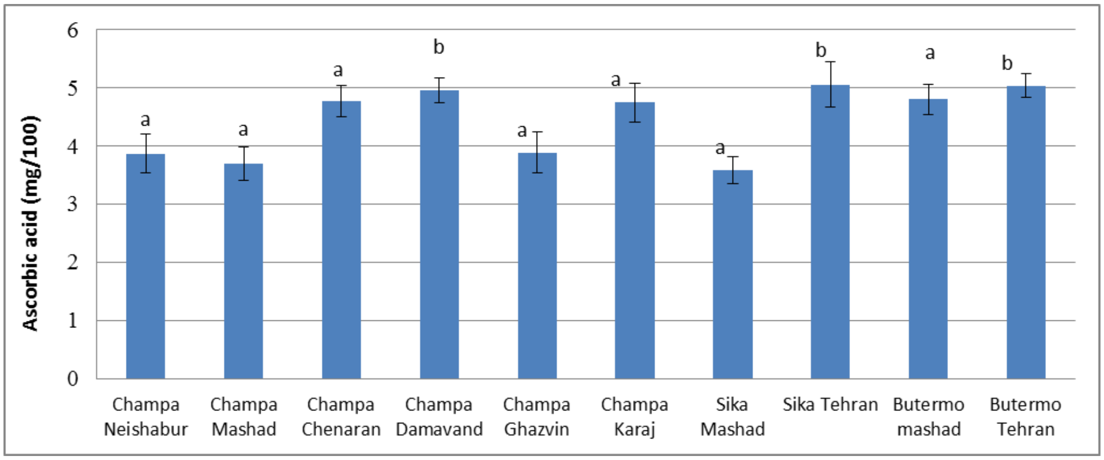

Fig. 5. Ascorbic acid content of major varieties of sour cherry (values with different letters are significantly different ($p < 0.05$)).

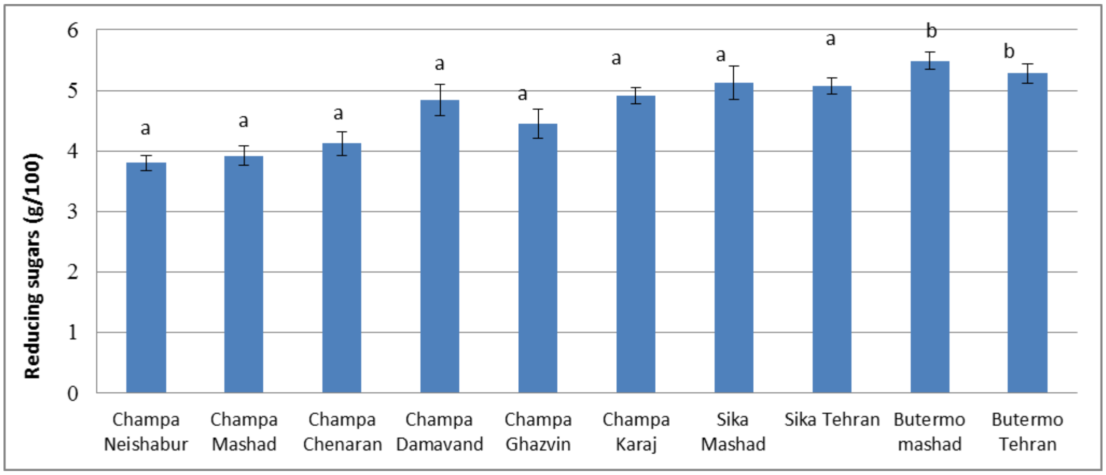

Fig. 6. Reducing sugar content of the major varieties of sour cherry (values with different letters are significantly different ($p < 0.05$)).

4. Conclusion

In this study the chemical properties of extracted juices of ten Iranian sour cherry varieties were analyzed. Signification differences in some minerals were found among the sour cherries. The study emphasizes that sour cherry fruits can be a good source of nutrients. Iran is considered as one of the main genetic reservoirs of sour cherries Furthermore, due to suitable climate, Iranian sour cherries are of high quality in international trade. More studies of this product are needed to be done on different cultivars and genotypes to support necessary information for a legal framework of standardization.

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