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Antioxidant properties of traditional sour cherry juice in light and dark conditions at ambient temperature

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ABSTRACT

Sour cherry is a delicious horticultural product, which has been widely developed due to the richness of valuable antioxidant and phenolic nutritional properties in the world. This research was conducted to investigate the quantitative properties of phenolic compounds and antioxidant activity of cherry fruit and compare it in 8 days with light and dark conditions. In this experimental study, cherries were purchased from Tehran fruit market randomly, and they were transferred to the food analysis laboratory. Subsequently, the cherry extract was taken via juicer.Total antioxidant capacity (TAC))and total flavonoid content (TFC) Cherry juice were measured with a UV-vis spectrophotometer every 24 h during 8 days. Data analysis was carried out using SPSS software. The results of the current study showed that the amount of antioxidant compounds of cherry extract in brightness and darkness was 1.96 mg/kg and 2.13 mg/kg, respectively, and the flavonoid composition of light and dark condition was 0.15 mg/kg and 0.16 mg/kg, respectively. Light can reduce the antioxidant and flavonoid properties of sour cherry juice. The antioxidant and flavonoid properties of traditional sour cherry juice extracts are sensitive to light conditions.

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1. Introduction

The Sour cherry fruit (*Prunus cerasus L, Rosaceae*) is grown mainly in the southwest of Asia and Europe (1,2). According to FAO in 2014, Russia and Ukraine are the largest cherry producer in the world, and Iran is the sixth largest producer in the world at 111, 993 per million tons. It has been suggested that main features of sour cherry is the taste, color and texture of the product (3). The amount of sugar in the sour cherry varies from about 8 to 18 percent, and the acidity of the fruit is 2.5 to 2.8 percent in terms of malic acid. It has been indicated that the pH of the cherry fruit is 3.5-3 and the degree of brix or the concentration of soluble solids varies from 24 to 19.5 depending on the type of cherry. Several studies have been shown that more than half sour cherry fruit is processed and is used in the juicing industry, wine marmalade (4).

It is necessary to note that fruits like sour cherries, strawberries, red grapes, and many red fruits rich in anthocyanins and vitamins, the dominant anthocyanin named cyanidine-3-glucoside. Anthocyanins are water-soluble pigments responsible for the redness of these fruits. Over the past decade, it is now well established that anthocyanin compounds have high nutritional value and prevent the release of free radicals. There is increasing concern that radicals are harmful energetic chemical compounds that are produced by food or internal metabolic processes or foreign chemicals and attacking vital cells of the body.

Ultimately, they lead to cell death and tissue damage (5). It has conclusively been shown that the antioxidant compounds present in these fruits attack free radicals and do not allow them to damage the cells and tissues of the body. For this purpose, these fruits prevent many

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diseases, such as cancer, cardiovascular disorders, and Nervous diseases such as Alzheimer's disease (AD), Parkinson's disease (PD), and diabetes II and obesity. In the treatment of patients with chronic pain and illness, inflammatory drugs such as arthritis, gout, and fibromyalgia are useful. Cherry can reduce the symptoms of post-exercise muscle pain in patients with fibromyalgia and prevent the production of uric acid (6,7). A number of studies have been reported that the sour cherry fruit core may have a high value for human nutrition such as protein, fiber, fat, and polyphenol (8). Polyphenols also increase the quality of food in a food system. As a result, cherry phenol can be used as edible films and reduce the negative effects of preservatives used in foods (9). The difference in the amount and composition of polyphenols in sour cherries depends on many factors, including product diversity, geographic location, the degree of harvest, environmental factors, especially storage conditions and methods the most commonly used polyphenol is in the anthocyanin red fruits. Which is the cause of the red color of the sour cherry.
The aim of this study is the effect of light and dark condition on antioxidant, flavonoids, and carotenoid compounds of traditional sour cherry juice at ambient temperature.

2. Materials and methods

2.1. Sample collection

The Sour cherries were collected in the market of Tehran city, Iran. After that they were transferred to the lab and washed thoroughly, the core removed and extracted using a juicer. The extract was filtered and transferred to vials and kept at 24 h in the refrigerator at 4°C.

2.2. Chemical Materials

Neocuproine (Sigma Company, USA), $FeCl_3$, KSCN, and $AlCl_3$ .6 H_2O (Merck Company, Germany) were used in the current study.

2.3. Determination of Cupric Ion Reducing Assay (CUPRAC)

CUPRAC method was used to measure the amount of total antioxidants using the approved method (Apak *et al.* 2008). In this method, the obtained extract was combined with 10^{-2} M $CuCl_2$ + 7.5 ×10^{-3} neocuproine + 1 M NH_4Ac and the adsorption of the final solution was measured at 450 nm (3).

2.4. Estimation of total flavonoid compound

A solution of $AlCl_3$, 6 H_2O 2% in methanol was prepared and mixed with the samples. The flavonoids are combined with trivalent aluminum ions. Samples were incubated for 10 min at room temperature. Then the absorbance of the final solution at 430 nm was measured by spectrophotometer (HACH-DR5000).

2.5. Statistical Analysis

The evaluation of statistical differences between groups was analyzed using the student's T-test by SPSS software version 16. According to the statistical facts, the difference of more than 95% ($p \leq 0.05$) was considered significant. The data values are presented as mean ± SD and significance values related to two groups.

3. Results

Total flavonoid content of sour cherry extract with diluted extracts method based on standard curve line equation (y = 749.1x + 0.1968) was calculated and measured using aluminum chloride. Samples were read in the environmental conditions by a spectrophotometer with a wavelength of 430 nm after 10 min. Total flavonoid content in brightness and darkness is given in Table 1 and 2. The results showed that light and brightness had no significant effect on flavonoid properties and there was no significant difference between treatments ($p<0.05$). Antioxidant content was tested using the CUPPAC method. Antioxidant content in brightness and darkness is given in Table 1 and 2. The results of this study showed that light and brightness had an effect on antioxidant properties and there was a significant difference between treatments ($p<0.05$).

Table 1. Antioxidant and flavonoid activity in cherry fruit treated with Light during storage at 4 °C for 8 days.

Time(day)	Treatment	Antioxidant Activity (mg/kg)	Flavonoid (mg/kg)
1	Light	1.35±0.04	1.65 ± 0.12
2	Light	2.55 ± 0.34*	1.69 ± 0.16
3	Light	2.60 ± 0.59*	1.66 ± 0.13
4	Light	2.26 ± 0.19	1.76 ± 0.16
5	Light	2.07 ± 0.22	1.77 ± 0.29
6	Light	1.42 ± 0.63	1.74 ± 0.19
7	Light	1.97 ± 0.31	1.79 ± 0.18
8	Light	1.48 ± 0.05	1.72 ± 0.04

* Different letters in the same column indicate a significant difference among storage days ($p<0.05$).

Table 2.Antioxidant and flavonoid activity in cherry fruit treated with dark during storage at 4°C for 8 days.

Time(day)	Treatment	Antioxidant Activity (mg/kg)	Flavonoid (mg/kg)
1	Dark	1.40±0.04	1.70 ± 0.12
2	Dark	2.20 ± 0.10	0.16 ± 0.007
3	Dark	2.77 ± 0.53*	0.17 ± 0.007
4	Dark	2.38 ± 0.20	0.16 ± 0.22
5	Dark	2.59 ± 0.59*	0.18 ± 0.02
6	Dark	1.67 ± 0.07	0.17 ± 0.02
7	Dark	1.66 ± 0.09	0.16 ± 0.017

*Different letters in the same column indicate a significant difference among storage days ($p<0.05$)

4. Discussion

In this study storage reduces the amount of carotenoids. Due to the sensitivity of carotenoids during storage, the amount of these compounds in the presence of light has decreased more than darkness (3). In recent years, there has been an increasing amount of literature on beneficial effects of sour cherry fruit consumption on human health have been proven. Sour cherry fruit is the natural source of polyphenolic compounds. Polyphenols include flavonoids (anthocyanins including quercetin, kaemferol, rutin, catechin, epicatechin, and phenolic acids such as (neochlorogenic acid and chlorogenic acid, and 3 - coumaroylquinic acid), flavon-3-ol and flavonols), hydroxy-cinnamic acid, and hydroxy benzoic acid. The phenolic colorant compounds depend on the culture medium and on the conditions of the harvest. The main disadvantage of anthocyanin is that the color of sour cherries, as well as their compounds that are rich in antioxidants and anti-inflammatory compounds, which are antimicrobial. These polyphenols are secondary metabolites in fruits, including sour cherries, that are effective in preventing many diseases, such as cancer and cardiovascular disease (10). This paper has been demonstrated that, traditional sour cherry juice extract had high antioxidant activity and flavonoids. In evaluating the antioxidant content of cherry juice has significantly decreased. Therefore, it can be concluded that antioxidant activity has been sensitive to light and light. The results have revealed that the range of mean level of antioxidant compounds of Cherry extract in brightness and darkness was 1.96 mg/kg and 2.13 mg/kg, respectively, and the flavonoid composition of light and darkness was 0.15 mg/kg and 0.16 mg/kg, respectively. So far, however, there has been little discussion about of antioxidant properties of cherry juice in light and dark conditions at ambient temperature. The range of mean level of antioxidant compounds in under taken study was 20.0 – 37.9 m mol/L and The highest range of mean level of total phenolic content was 2550-1510 mg/L in the sour cherry extract which was comparable to the study conducted by Damar and Ekşi from Turkey (11). Nowicka, & Wojdyło (2015) investigated total phenolic content with UPLC-PDA-FL and reported their results in order, 1179.6 mg / 100 g dm (12). The highest mean level of antioxidant compounds was found in sour cherry sampels, 1145 – 2592 mol / TE / 100 g FW, followed by Blando, & Gerardi (2004) (13). In another study from India, Nilgu¨n, & Budak (2016) have observed the levels of total phenolic content (300.1–854.79 mg GAE/L) in sour cherries (14). However,

there have been increasing numbers of studies for the presence of total antioxidant capacity and total phenolic content in the sour cherry (11).

5. Conclusion

Considering the potent antioxidant activity and the high levels of phenolic compounds, especially flavonoids and antioxidants in sour cherry fruit, the results of this study indicate that brightness and darkness do not affect the flavonoids, but the brightness and darkness in the antioxidant properties are effective and lead to these properties to decrease.

Conflict of interest

The authors have no conflict of interest.

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