MINERAL COMPOSITION OF SUMMER HALVA

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Abstract

Summer halva is a traditional Turkish sweet, the main components of which are semolina, sugar and sesame paste (tahini). This type of halva is mainly consumed during the summer period and that is why it is called "summer halva". Besides the main ingredients, cocoa powder and some nuts might be used during the preparation of summer halva. Since sweets comprise an important part of Turkish cuisine, it is of significance to evaluate the mineral content of these kinds of products. In the present study, the mineral composition of industrially produced plain summer halva samples was investigated.

Key words: *mineral composition, summer halva*

1. INTRODUCTION

Halva (also known as halawa, halava, halaweh, halvah, halwa and helva in different languages) is a traditional dessert that is widely consumed in the Balkans, Middle East and Northern Africa (Ogutcu, Arifoglu & Yilmaz 2017). The term halva comes from the word *hulv* meaning sweet in Arabic. In Turkey, with the increase in population, halva production quantities increased from 30 000 – 40 000 tons in 1985 to 60 000 – 80 000 tons in 2010 (Batu & Elyildirim 2010). Depending on the ingredients used during processing there are a number of halva types, such as tahini halva, peanut halva, met halva, koz halva, etc. (Aktas & Cebirbay 2010, Artik & Poyrazoglu 2010, Batu & Elyilidrim 2009). But the main types mostly produced are tahini halva and summer halva. The term 'halva' is mainly used for a product prepared with sesame seed paste (called tahini) and sugar syrup mixed with some other ingredients such as flour, semolina, nuts and / or cocoa powder (Kahraman et al. 2010, Ogutcu, Arifoglu & Yilmaz 2017). Tahini halva containing approximately 50% tahini is mainly consumed during winter, while summer halva which is prepared with less tahini (15-20%) is mainly preferred during summer.

According to the Turkish Standard (TS 10913) of this product, summer halva should contain at least 15% sesame oil, total sugar not exceeding 50%, moisture not exceeding 5% and ash not exceeding 0.7% (Anonymous 2001). The main ingredients of this confectionery product comprise sugar, semolina, tahini, hydrogenated vegetable oil, citric acid and soapwort extract. The processing diagram of summer halva is given in Figure 1. Traditionally, the preparation process is as follows: The sesame seeds are dehulled, roasted and ground until a homogeneous paste (tahini) is obtained. Sugar syrup is prepared and subsequently citric acid and soapwort extract are added. Then, semolina, tahini and sugar syrup are mixed. Besides, the conventional ingredients, ground nuts, vanilla and cocoa may be also added (Batu & Elyildirim 2009, 2010, Kahraman et al. 2010). Summer halva, is mostly preferred for its traditional taste, and because of its high energy value.

With the increase in tahini halva production and the continuously rising market demand for these kinds of product, a considerable research on the chemical, microbiological, nutritional and sensory quality of tahini halva has been accomplished (Acar 2011, Aloui et al. 2016, Kahraman et al. 2010, Ogutcu, Arifoglu & Yilmaz 2017, Sengun, Hancioglu & Karapinar 2005). Furthermore, optimzaiton of the formulations in view of improving the characteristics of tahini halva to obtain more stable products during storage as well as addition of various fruits and additives to obtain new tahini halva types were done (Aloui et al. 2016, Ogutcu, Arifoglu & Yilmaz 2017, Soydinc, Basyigit & Hayoglu 2016).

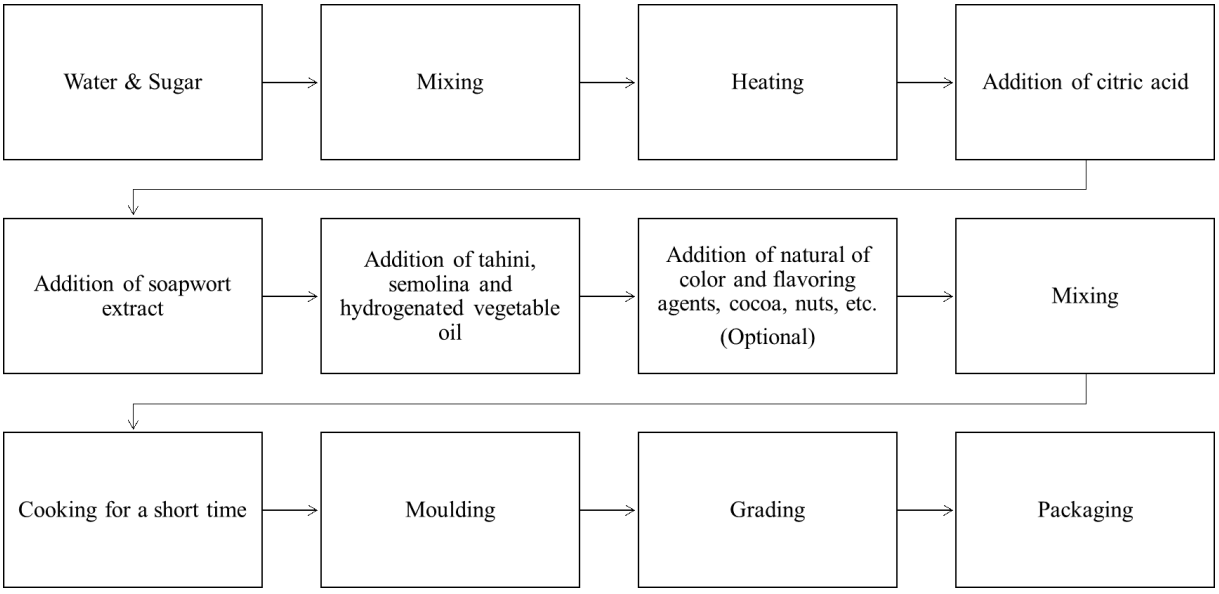


Figure 1. Flow chart of summer halva

On the other hand, research on summer halva which is the main halva type consumed during the summer season is rather scarce. Batu & Elyildirim (2010) evaluated the microbiological and sensory characteristics of summer halva during a storage period of 120 days. To the best of our knowledge, no study on the mineral composition of plain summer halva was previously done. Thus, in the present study, plain summer halva samples from 5 different producers were analyzed for their macro and micro-mineral composition.

2. MATERIALS AND METHODS

2.1. Materials

Standards of Ca, P, K, Na, Mg, Cu, Fe, Zn, Mn, Co, Cd, Ni and Cr (Merck, Darmstadt, Germany) were used for the determination of the mineral contents of the summer halva samples. All other reagents used during the analyses were of analytical grade and obtained from Merck (Darmstadt, Germany). Summer halva samples from 5 different producers were collected from supermarkets in Canakkale, Turkey.

2.2. Mineral analysis

The summer halva samples were first digested with HNO_3 / HCl (2:1) (Aydin 2008) within a microwave oven. Then, the mineral contents of the digested samples were determined via an inductively coupled plasma - optical emission spectrometer (ICP-OES) (Perkin Elmer Optima 8000). The operating parameters of the equipment were presented in Table 1. The mineral content of all samples was measured in triplicate. Given the fact that usually halva is served in portions of 100 grams, the mineral contents of the summer halva samples were expressed as mg mineral per 100 g halva sample. All results were presented as mean ± standard deviation.

Table 1. Operating parameters for ICP-OES

Parameter	Description
Rf power	1400 watts
Plasma gas flow rate	10 L/min
Auxiliary gas flow rate	0.2 L/min
Nebulizer gas flow rate	0.80 L/min
Sample uptake rate	1.5 mL/min
Argon gas (high purity)	99.99%
Torch type High solids	Axial /Radial Optima 8X00 DV Quartz Torch
Nebulizer type	Concentric glass; cyclonic spray chamber
Nebulizer pressure	200 kPa
Pump rate	1.5 mL/min
Replicates	3
Sample uptake delay	30 s

2.3. Statistical analysis

All mineral results were statistically analyzed using Minitab 16.1.0 statistical software. Significant differences among the means of the summer halva samples were determined by the Tukey's test. The findings were considered to be significantly different at $p<0.05$.

3. RESULTS AND DISCUSSION

Mineral content of human diets comes both from foods of plant and animal origin. The mineral content of any food is mostly affected by the type of ingredients used in the formulations as well as processing conditions. Thus, in order to elaborate the extent to which any food contributes to meeting the nutrient requirements of humans, the mineral contents of consumed food products should be determined. Minerals are known to play vital roles in human body, such as structuring and maintenance of bones, activating hormones and enzymes in metabolic reactions, etc. Thus, any mineral deficiency may lead to serious health problems (Grosvenor & Smolin 2002).

Traditional products are often not well investigated for their nutritional compositions, although they are widely consumed at local level. Albuquerque et al. (2013) stressed on the fact that the mineral composition of traditional products should be investigated in order to better understand the mineral intake of the people living in a given region or country and also to build up a proper food composition databases for the specific regions. On the other hand, Grembecka and Szefer (2012) pointed out that sweets are widely consumed by humans and they may be also regarded as mineral, vitamin and even functional nutrient sources.

Within the present study, the mineral compositions of summer halva samples were determined and the results were given in Table 2.

Table 2. The mineral composition of the summer halva samples*,**

	Firm A	Firm B	Firm C	Firm D	Firm E
Ca	64.43±0.15c	294.83±3.62b	72.33±0.76c	520.50±10.50a	37.90±0.52d
P	256.87±6.84b	244.77±1.79c	274.27±1.89a	168.60±1.30e	197.70±3.24d
K	178.63±2.46b	210.13±3.67a	205.17±6.47a	166.33±8.35b	170.83±3.94b
Na	58.27±1.11b	41.63±0.64c	87.53±1.23a	15.73±0.51e	20.20±0.75d
Mg	90.77±0.50b	91.13±1.02b	112.80±1.91a	58.40±2.07d	70.83±1.85c
Cu	0.48±0.01b	0.47±0.04b	0.56±0.03a	0.24±0.02c	0.45±0.02b
Fe	2.70±0.04b	2.23±0.03c	2.63±0.03b	1.98±0.04d	2.87±0.05a
Zn	1.68±0.02b	1.38±0.01c	1.89±0.07a	1.34±0.12c	1.24±0.02c
Mn	1.22±0.01a	1.17±0.01b	1.25±0.01a	0.99±0.02d	1.10±0.02c
Co	0.005±0.000a	0.005±0.001	0.006±0.004	0.004±0.002	0.004±0.003
Cd	nd***	nd	nd	nd	nd
Ni	nd	nd	nd	nd	nd
Cr	nd	nd	nd	nd	nd

* The results are presented as mean ± standard deviation with three replicates (mg / 100 g halva).

** Different letters in one row show a significant difference among the values ($p<0.05$).

*** nd: not detected

3.1. Calcium

Calcium (Ca) is regarded as an important macromineral in human nutrition, since it is essential for bones and teeth maintenance. Furthermore, calcium is involved in enzyme activity regulation, secretion of certain hormones and is vital for blood clotting. Calcium is also significant for blood pressure regulation and muscle contraction. Calcium also plays a role in the neuro-transmittance of chemical and electrical signals (Gropper, Smith & Groff 2005, Grosvenor & Smolin 2002).Thus, to prevent calcium deficiency in the body, the dietary reference intake of calcium as recommended by Otten, Hellwig and Meyers (2006) for adults at age of 19-50 years is 1000 mg per day.

In the present study, the Ca content of the analyzed summer halva samples varied between 37.90 and 520.50 mg Ca / 100 g halva. All summer halva samples, except samples of Firm A and C were found to contain significantly different Ca contents ($p<0.05$). The great variation in the Ca concentrations of the samples may be most possibly due to the ingredients used in the product formulations.

3.2. Phosphorus

Phosphorus (P) together with calcium is responsible for the healthy structure of the bones. It is also essential for energy metabolism. Phosphorus is also found in molecules of vital importance such as deoxyribonucleic acid, ribonucleic acid and phospholipids. Phosphorus is also involved in regulating pH, thus leading to proper enzyme activity regulation (Grosvenor & Smolin 2002).

The results presented in Table 2 revealed that the P contents of all investigated summer halva samples were significantly different among each other. The lowest P content was found in the sample of Firm D (168.60 mg P / 100 g halva), while the highest P content was recorded for the sample of Firm C (274.27 mg P / 100 g halva). According to the advices of Otten, Hellwig and Meyers (2006), for men and women at age of 19-50 years, the required daily intake of phosphorus is 700 mg. Given the fact

that usually 100 g of halva is served as a single portion, one portion of summer halva may contribute to 28 – 39 % of the daily P requirements.

3.3. Potassium

Potassium (K) is mainly found within cells and together with sodium is known to be responsible for the acid-base regulation, and is known to be the major intracellular cation. Furthermore, potassium is regarded to play a significant role especially in fluid balance, maintaining blood pressure, muscle contraction as well as conduction of nerve impulses. Usually, diets rich in potassium and low in sodium are considered to decrease blood pressure (Gropper, Smith & Groff 2005, Grosvenor & Smolin 2002). In general, K is mainly found in abundance in food products of plant origin, especially in oil seeds (Albuquerque et al. 2013). Thus, in this study, the K content of summer halva was evaluated, since one of the ingredients of halva is tahini prepared from sesame seeds. The halva samples of Firm B and C had significantly higher potassium content that the other samples ($p<0.05$), and the K content varied between 166.33 and 210.13 mg K / 100 g halva (Table 2). While the National Research Council suggested a dietary intake of 3500 mg per day in 1989 (NRC, 1989), more recently Otten, Hellwig and Meyers (2006) prescribed daily dietary intake of 4.7 g potassium for adults at age of 19-50 years.

3.4. Sodium

Sodium (Na) is considered as a macromineral that together with potassium, plays essential roles in maintaining the fluid balance in the body, and subsequently affecting blood pressure, nerve transmission and impulse conduction, and muscle contraction. In general, high dietary sodium intake in terms of sodium chloride, as table salt, is associated with high blood pressure (Grosvenor & Smolin 2002). Given the fact that processed food products have elevated Na contents, the National Research Council (1989) recommended a daily minimum intake of 500 mg Na.

Since halva is a kind of sweet dessert, the Na contents were found to be quite low (Table 2). The Na contents of summer halva were found to vary in the range of 15.73 – 87.53 mg Na / 100 g halva. All samples were found to be significantly different in terms of Na contents ($p<0.05$).

3.5. Magnesium

Approximately 60% the magnesium (Mg) content of the human body is found to be associated with bones. Besides, bone functioning, Mg is significant in activating enzymes related with nucleic acid and protein metabolism (Grosvenor & Smolin 2002). Thus, a daily average Mg requirement of males and females at age of 19-30 years is stated to be 330 and 255 mg, respectively (Otten, Hellwig & Meyers 2006).

The Mg contents of the analyzed summer halva samples ranged from 58.40 to 112.80 mg Mg / 100 g halva. The highest Mg level was detected in the halva sample of Firm C, while the lowest Mg content was in the sample of Firm D. No significant differences were detected between the Mg levels of the samples of Firm A and B.

3.6. Copper

The copper (Cu) content of an adult body is found in the range of 50 – 150 mg. In human nutrition, copper (Cu) is known to be a micromineral that is essential in metabolic reactions. Cu is found to act as a cofactor of enzymes involved in protein metabolism (Gropper, Smith & Groff 2005). According to NRC (1989), the dietary reference intake for adults at age of 19-50 years is 700 mg Cu per day.

The results presented in Table 2 revealed that the Cu contents of summer halva samples were lowest in the sample of Firm D (0.24 mg Cu / 100 g halva) and highest in the sample of Firm C (0.56 mg Cu/ 100 g halva). The summer halva samples of Firm A, B and E were found to be similar among each other in terms of Cu contents. The best Cu sources are products of animal origin and seafood. Cattle liver and oysters were found to contain Cu about 4.4 mg / 100g (Grosvenor & Smolin 2002). When compared with the Cu level of liver and seafood, the summer halva samples were found to contain quite low Cu concentrations.

3.7. Iron

Iron (Fe) is an essential mineral, mainly found as a constituent of hemoglobin. Thus, Fe deficiency is often related with anemia (Grosvenor & Smolin 2002).

In the present study, the Fe contents of the analyzed summer halva samples were found to be from 1.98 (Firm D) to 2.87 mg Fe / 100 g halva (Firm E).

3.8. Zinc

Zinc (Zn) content of human body is found to be approximately 1.5 – 2.5 g. Zinc acts as a cofactor of many enzymes involved in metabolism, thus Zn deficiency may lead to serious chronic disorders. Furthermore, Zn is essential for cell replication and development (Grosvenor & Smolin 2002, Otten, Hellwig & Meyers 2006). The daily estimated average Zn requirement is 9.4 and 6.8 mg for males and females at age of 19-50 years, respectively (Otten, Hellwig & Meyers 2006).

Within the present study, the Zn contents of summer halva samples were estimated and the results were given in Table 2. From the data, it can be concluded that the Zn level of summer halva varied between 1.24 and 1.89 mg Zn / 100 g halva. Thus, a portion of 100 g halva may serve to meet the Zn requirements of male and female adults at levels about 17 % and 23 %, respectively.

3.9. Manganese

Similar to zinc, in human body, manganese (Mn) functions as a cofactor of a number of enzymes (Grosvenor & Smolin 2002). The adequate daily Mn intake is recommended to be 1.8 and 2.3 mg for female and male adults, while the tolerable upper daily intake level is considered to be 11 mg (Otten, Hellwig & Meyers 2006).

The Mn content of summer halva samples was determined and the results were given in Table 2. The maximum Mn content was recorded for the halva sample of Firm C (1.25 mg Mn/ 100 g halva), whereas the minimum Mn level was found in the sample of Firm D (0.99 mg Mn / 100 g halva). No significant difference was detected for the samples of firm A and C in terms of Mn level.

3.10. Cobalt

Cobalt (Co) is found in the structure of cobalamin (Vitamin B_{12}) and there is insufficient data about any function of Co in human body (Gropper, Smith & Groff 2005). In this study, no differences were detected for the analyzed summer halva samples in terms of Co levels and these levels were found to be quite low (Table 2).

3.11. Cadmium, Nickel and Chromium

No cadmium (Cd), nickel (Ni) and chromium (Cr) were detected in the analyzed summer halva samples (Table 2).

4. CONCLUSION

In the present study, the mineral composition of summer halva, a preferred traditional Turkish dessert was investigated. Samples from 5 different producers were investigated and it was found that the sample of Firm C had highest P, K, Na, Mg, Cu, Zn and Mn contents. To the best of our knowledge, for the first time the mineral contents of summer halva were evaluated. Considering the importance of building up nutritional food databases, these results will be significant in elaborating the mineral intakes of at local levels.

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