



Determination of Chemical and Microbiological Quality in Commercial Tahini Halva Samples[#]

Zeynep Kilci^{1,a,*}, Ramazan Ulku Cetin^{1,b}

¹Department of Food Processing, Vocational School of Susurluk, Bandirma Onyedil Eylul University, Balikesir, Turkiye,

*Corresponding author

ARTICLE INFO	ABSTRACT
<p>[#]This study was presented at the 6th International Anatolian Agriculture, Food, Environment and Biology Congress (Kütahya, TARGID 2022)</p> <p>Research Article</p> <p>Received : 28.10.2022 Accepted : 08.12.2022</p> <p>Keywords: Tahini Halva Plain Hazelnut Carob Vanilla</p>	<p>40 samples of tahini halva from 5 different firms, in 4 distinct varieties—plain, hazelnut, carob, and vanilla—were gathered for this study from producers in the provinces of Balikesir and Bursa as well as from commercial markets. Samples were taken from two different lot numbers for each company. As a result of the analyzes made on the tahini halva samples, it was determined that the total amount of sesame oil varied between 24.67-38.87%, the total amount of tahini ranged between 59.34-69.7%, the total moisture amount was between 0.1-0.9%, the total ash amount was 0.089-3.16%, and the total salt amount was between 0.001-0.024%; as a result of microbiological cultivations in which the presence of yeast and mold were analyzed, an average of 10 cfu/g in plain tahini halva samples, an average of 90 cfu/g in hazelnut tahini halva samples, an average of 45 cfu/g in carob tahini halva samples, and an average of 25 cfu/g in vanilla tahini halva samples were determined. All samples of tahini halva were found to be free of contamination with <i>Salmonella spp.</i>, <i>Staphylococcus aureus</i> or <i>Escherichia coli</i>. When all of these findings were taken into consideration, it was found that one of the sampled firms did not produce in accordance with the Turkish Food Codex Communiqué on Tahini Halva (2015/28) in terms of total sesame oil (%) and ash content (%) of two companies. Combined, the findings of the chemical and microbiological analyses indicate that 85% of the samples were prepared in line with the TFC.</p>

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Piyasada Satılan Tahin Helvası Örneklerinde Kimyasal Ve Mikrobiyolojik Kalitenin Belirlenmesi

MAKALE BİLGİSİ	ÖZ
<p>Araştırma Makalesi</p> <p>Geliş : 28.10.2022 Kabul : 08.12.2022</p> <p>Anahtar Kelimeler: Tahin Helva Sade Fındıklı Keçiboynuzlu Vanilyalı</p>	<p>Bu çalışma kapsamında Balikesir ve Bursa illerindeki üreticilerden ve ticari olarak satış yapılan marketlerden; sade, fındıklı, keçiboynuzlu ve vanilyalı olmak üzere 4 farklı çeşitte, 5 farklı firmaya ait toplam 40 tahin helva numunesi toplanmıştır. Numuneler her bir firma için iki farklı parti numarasından olacak şekilde alınmıştır. Tahin helvası numunelerine yapılan analizler neticesinde toplam susam yağı miktarının %24,67-38,87, toplam tahin miktarının %59,34-69,7, toplam nem miktarının %0,1-0,9, toplam kül miktarının %0,089-3,16, toplam tuz miktarının %0,001-0,024 aralığında değiştiği; maya ve küf varlığının analiz edildiği mikrobiyolojik ekimler sonucunda sade tahin helvası numunelerinde ortalama 10 kob/g, fındıklı tahin helvası numunelerinde ortalama 90 kob/g, keçiboynuzlu tahin helvası numunelerinde ortalama 45 kob/g, vanilyalı tahin helvası numunelerinde ortalama 25 kob/g canlılık belirlenirken tüm tahin helvası numuneleri içerisinde <i>Escherichia coli</i>, <i>Staphylococcus aureus</i>, <i>Salmonella spp</i> kontamine olmuş örnek bulunmadığı tespit edilmiştir. Tüm bu sonuçlar değerlendirildiğinde tahin helvası numuneleri içerisinde yer alan bir markaya ait sade tahin helvalarının susam yağı miktarı (%) değeri açısından, farklı iki firmaya ait keçiboynuzlu tahin helvası numunelerinin ise kül miktarı (%) değeri açısından Türk Gıda Kodeksi Tahin Helvası Tebliği (2015/28)'ne uygun üretim yapmadığı belirlenmiştir. Kimyasal ve mikrobiyolojik analiz ölçümleri bir arada değerlendirildiğinde toplanan numunelerin %85'inin TGK'ya uygun kalitede üretildiği sonucuna ulaşılmaktadır.</p>

^a znale@bandirma.edu.tr

^{ib} <https://orcid.org/0000-0003-1700-8597>

^b rcetin@bandirma.edu.tr

^{ib} <https://orcid.org/0000-0002-9968-4988>



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Introduction

Tahini halva, known as Turkish honey or Turkish dessert in western countries, is obtained by boiling sugar at approximately 150°C and adding sage root (*Saponaria officinalis*) water and whisking, then adding white tahini to the white sugar paste and kneading until it reaches the desired consistency. It is an old-fashioned item. Tahini halva has all the characteristic features of tahini as it is produced from tahini. The qualities that tahini halva ought to possess are listed in the Turkish Food Codex (TFC) Tahini Halva Communiqué (2015/28) that was published in the Official Gazette No. 29385. There are various studies on the production and composition of tahini halva. The chemical composition of tahini halva according to the Turkish Food Codex Communiqué on Tahini Halva (2015/27) is summarized in Table-1. (TFC, 2015b).

Table 1. Chemical Properties of Tahini Halva (TFC, 2015b)

Components	Mass %
Sesame Oil (least, %)	26
Tahini Amount (least, %)	52
Protein (least, %)	10
Total Sugar (as sucrose) (most, %)	47
Moisture Amount (most, %)	3
Ash Amount (most, %)	2
Peroxide Value (in extracted oil) (most, meq/kg)	10
Acidity (as oleic acid in the extracted oil) (most, %)	2
Saponin (most, %)	0.1

One of our traditional products, tahini halva, is industrially produced all across our nation; the method of preparation and the ingredients used can vary from one location to the next. The Turkish Food Codex Communiqué on Tahini Halva (2015/28) states that there are two varieties of tahini halva available on the market: flavored and plain. To briefly summarize the production of tahini halva can be specified as;

- Production of tahini from sesame,
- Boiling water and sugar,
- Bleaching and sugar waxing,
- Mixing sugar wax and tahini,
- Transfer to molds and cooling,
- Packaging (Benlikurt, 2019).

If the nutritional value of halva is investigated, it can be found that 100 grams of halva has a high content of fat, protein, and minerals and delivers an average of 540 kilocalories (kcal) of energy when consumed (Osaili et al., 2017). It is highlighted that due to its rich nutritional content, it should be a regular part of the diets of young children during their formative years, adults with high energy requirements, expectant and lactating women and athletes. Halva provides this high nutritional value with 30-35% fat, 10-12% protein and 40-47% sugar (Var et al., 2004).

In light of this information, 40 samples of tahini halva in 4 different varieties (plain, hazelnut, carob and vanilla) from 5 different companies were acquired for this study from manufacturers in the provinces of Balikesir and Bursa as well as from commercial marketplaces. For each manufacturer, samples were gathered from two different lot numbers. The reasons for choosing the provinces of

Balikesir and Bursa for the research can be summarized as; the high geographical importance of cities in terms of their locations, representing a transition corridor between Europe and Asia, diversity in terms of both corporate businesses and small family businesses, sales points.

Materials and Methods

Material

Tahini halva samples consist of 4 different varieties as plain, with hazelnut, carob and vanilla, totally 40 samples belonging to 5 different companies and two different lot numbers of each company. All samples were collected in their original packaging, delivered to the laboratory at 4-6°C and were kept at 4-6°C until the analyzes were completed. All analyzes were conducted in triplicate and in two replications.

Methods

Chemical Analysis

Determination of Oil Amount

After using the soxhalet method to extract the oil, the oil content of the tahini halva samples was calculated gravimetrically. 10 g of halva sample was weighed 10 g was put into a Soxhalet cartridge for analysis. Sand was also added to the cartridge and mixed with the sample to make it homogenous, which would help the extraction process work more efficiently. After the extraction procedure, which took about 6 hours, the petroleum ether that was still in the Soxhalet balloon was removed, and the cartridge was held at 100°C until it reached a constant weight (Cemeroglu, 2007).

Determination of Tahini Amount

In determining the amount of tahini in tahini halva samples; The method of multiplying the amount of oil in the samples by 1.9 was applied (Anonymous, 1998).

Determination of Moisture Amount

Moisture analysis in halva samples was determined gravimetrically by vacuum oven method applied in sugary solid food products and the results were calculated as percent (%) (AOAC, 2000).

Determination of Ash Amount

The total amount of ash in the food was obtained by dividing the mass of the remaining part after the test sample was burned at a temperature of 550 (±25)°C by the mass of the test sample, and the results were calculated as percent (%) (Anonymous, 1988).

Determination of Salt Amount

The Mohr technique was used to calculate the total salt content of the samples of tahini halva. In the analysis, 10 g of tahini halva sample was titrated with the Silver Nitrate solution, the normality of which was predetermined, using the Potassium Chromate indicator. (Chen et al., 2005).

Microbiological Analysis

Enumeration Results of Coagulase Positive Staphylococci (Staphylococcus aureus and Other Staphylococci Types)

In the analysis performed according to Shimamura et al., (2006), Mannitol Salt Agar medium was used and the petri dishes were incubated for 2 days at 37°C.

Enumeration Results of Escherichia coli

In the analysis made according to Kornacki (2001), Violet Red Bile Agar medium was used and the petri dishes were incubated for 1 day at 44°C.

Enumeration Results of Salmonella spp.

In the analysis performed according to US-FDA BAM (2008), Salmonella-Shigella Agar medium was used and the petri dishes were incubated for 1 day at 37°C.

Enumeration Results of Mold and Yeast

Potato Dextrose Agar medium was used in the analysis according to Beuchat and Cousin (2001) and the petri dishes were incubated for 5 days at 25°C.

Results and Discussion

Chemical Analysis Results of Tahini Halva Samples

The results of 40 samples of tahini halva that included four different varieties (plain, hazelnut, carob, and vanilla) and two separate batch samples from the companies are listed in Table-4, Table-5, Table-6 and Table-7 as well. The plain tahini halva samples from *one* brand included in the tahini halva samples are in the Turkish Food Codex in terms of the amount of sesame oil, and the carob tahini halva samples from *two* different companies are in the Turkish Food Codex in terms of the amount of ash. When compared with the limit values of the relevant analyses in the Turkish Food Codex, these samples were found to be inappropriate.

According to the tables; the lowest amount of sesame oil for plain tahini halva is 24.67% and the highest is

38.47%; for the tahini halva samples with hazelnut the lowest was 28%, the highest was 31%; for the tahini halva samples with carob the lowest was 32.1%, the highest 36.6%; for the tahini halva samples with vanilla the lowest was 26.34%, the highest was 29.32%. According to the Turkish Food Codex Communiqué on Tahini Halva (2015/28) the minimum percentage of sesame oil that should be present in halva is 47%.

It was found that the samples of plain tahini halva belonging to one company contained less sesame oil than the limit value indicated in the Codex. As a result, it is considered that the abovementioned sample's final product should not have been released onto the market. In the study by Ünsal and Nas from 1995, it was noted that the percentage oil content values of the tahini halva samples were in the range of 27.76-38.48, and it was observed that the results were consistent with the products examined within the scope of this study (Unsal and Nas, 1995). Similarly, it is seen that similar results were obtained in the study conducted by Guler (2003) (Guler, 2003).

The results of the Turkish Food Codex Communiqué on Tahini Halva (in terms of% tahini content,% moisture content,% salt content of 4 different types (total of 40) tahini halva samples belonging to 5 different companies and 2 different batch samples of these companies) are consistent with the limit values that should be present in halva. When the literature on the related analyzes is reviewed, it is seen that the results compatible with the analyzes made within the scope of the study are stated (Benlikurt et al., 2020; Meydani,2008; Ozcan & Akgul, 1993).

Table 2. Chemical Analysis Results of Plain Tahini Halva Samples

Parameter	Least	Most	Average	Turkish Food Codex Criteria
Sesame Oil Content (%)	24.67	38.87	34.7	≥ 26
Tahini Content (%)	59.34	69.7	65.9	≥57
Moisture Content (%)	0.004	0.34	0.1	≤ 3
Ash Content (%)	0.7	0.89	0.8	≤ 2
Salt Content (%)	0.002	0.018	0.004	≤ 0.04

Table 3. Chemical Analysis Results of Tahini Halva Samples with Hazelnut

Parameter	Least	Most	Average	Turkish Food Codex Criteria
Sesame Oil Content (%)	28	31	29	≥ 26
Tahini Content (%)	59.78	62.1	60.8	≥57
Moisture Content (%)	0.1	0.9	0.6	≤ 3
Ash Content (%)	0.089	0.5	0.2	≤ 2
Salt Content (%)	0.004	0.023	0.007	≤ 0.04

Table 4. Chemical Analysis Results of Tahini Halva Samples with Carob

Parameter	Least	Most	Average	Turkish Food Codex Criteria
Sesame Oil Content (%)	32.1	36.6	33.4	≥ 26
Tahini Content (%)	60.23	66.6	63.5	≥57
Moisture Content (%)	0.34	0.73	0.4	≤ 3
Ash Content (%)	0.2	3.16	1.3	≤ 2
Salt Content (%)	0.005	0.024	0.009	≤ 0.04

Table 5. Chemical Analysis Results of Tahini Halva Samples with Vanilla

Parameter	Least	Most	Average	Turkish Food Codex Criteria
Sesame Oil Content (%)	26.34	29.32	28	≥ 26
Tahini Content (%)	59.76	63.20	61.5	≥57
Moisture Content (%)	0.1	0.5	0.2	≤ 3
Ash Content (%)	0.09	1.34	0.1	≤ 2
Salt Content (%)	0.001	0.006	0.002	≤ 0.04

It was determined that the % ash content of the samples of tahini halva samples with carob belonging to two companies did not have results compatible with the limit values that should be found in halvans in the TFC Tahini Halva Communique (2015/28). Comments that the amount of ash may be high due to the shells involved in the process as a result of the production of tahini to be used in the production of tahini halva is supported by our research result (Ozcan and Akgul, 1993). Moisture, ash content, oil, and peroxide were measured in a total of 20 samples from 10 different companies for Benlikurt's (2019) research aimed at assessing the chemical quality characteristics of plain tahini halva sold in the province of Tokat and to investigate the compliance of the relevant samples with the Turkish Food Codex Tahini Halva Communique. The

report stated that some analyzes performed to determine the amount of tahini, protein, total sugar (as sucrose) and the results within the scope of that research partially complied with the criteria specified in the Turkish Food Codex Communique on Tahini Halva (Benlikurt, 2019).

Microbiological Analysis Results of Tahini Halva Samples

Microbiological analysis results of a total of 40 tahini halva samples are summarized in Table-6, Table-7, Table-8 and Table-9. When a comparison is made between the standard values and the analysis results, it can be interpreted that the tahini halva samples have results that do not exceed the limit values and that their microbiological quality is at a good level.

Table 6. Microbiological Analysis Results of Plain Tahini Halva Samples

Analysis	Result (cfu/g)	Turkish Food Codex Criteria (cfu/g)
<i>E. coli</i> Count	0.00	0.00
<i>Staphylococcus aureus</i> Count	0.00	0.00
<i>Salmonella spp</i> Count	0.00	0.00
Mold and Yeast Count	10	≤ 100 kob/g

Table 7. Microbiological Analysis Results of Tahini Halva Samples with Hazelnut

Analysis	Result (cfu/g)	Turkish Food Codex Criteria (cfu/g)
<i>E. coli</i> Count	0.00	0.00
<i>Staphylococcus aureus</i> Count	0.00	0.00
<i>Salmonella spp</i> Count	0.00	0.00
Mold and Yeast Count	90	≤ 100 kob/g

Table 8. Microbiological Analysis Results of Tahini Halva Samples with Carob

Analysis	Result (cfu/g)	Turkish Food Codex Criteria (cfu/g)
<i>E. coli</i> Count	0.00	0.00
<i>Staphylococcus aureus</i> Count	0.00	0.00
<i>Salmonella spp</i> Count	0.00	0.00
Mold and Yeast Count	45	≤ 100 kob/g

Table 9. Microbiological Analysis Results of Tahini Halva Samples with Vanilla

Analysis	Result (cfu/g)	Turkish Food Codex Criteria (cfu/g)
<i>E. coli</i> Count	0.00	0.00
<i>Staphylococcus aureus</i> Count	0.00	0.00
<i>Salmonella spp</i> Count	0.00	0.00
Mold and Yeast Count	25	≤ 100 kob/g

The presence of *Escherichia coli* and the extended family of Coliform bacteria indicates fecal contamination. One of the most significant microorganisms that demonstrates fecal-based contamination of food at any step, from the supply of raw materials to the transportation of the final product, is *E. coli*. The absence of *E. coli* in the tahini halva samples gathered for our investigation is evidence that no fecal contamination occurred during manufacturing or presentation of the samples for sale, proving that they were made and transported in facilities with sufficient sanitary conditions.

Many healthy people have *Staphylococcus aureus* as part of their nasal, throat, or skin-associated microflora, and it can lead to frequent outbreaks of foodborne disease (Bremer et al., 2004). As stated by the US Food and Drug Administration (FDA, 1992), *S. aureus* populations reach 10⁵ cells per gram once effective levels of staphylococcal enterotoxins that cause foodborne disease occur. While it was noted that *S. aureus* was not isolated from samples of tahini halva in an Egyptian investigation (Eissa and Zohair, 2006), Kotzekidou (1998) and Engun et al. (2005) reported that *S. aureus* was found at 80 cfu/g and 40 cfu/g,

respectively. The reasons for obtaining different results in various studies; it can be expressed as post-production contamination, unfavorable storage conditions, production conditions with insufficient hygiene. *Staphylococcus aureus* was not detected in the tahini halva samples collected within the scope of our study.

Salmonella spp., one of the most significant pathogenic strains involved in outbreaks of foodborne bacteria, has been connected to cases of poisoning in the past and has been detected in halva. In an epidemic of 27 cases in Sweden in 2001, a *Salmonella typhimurium* phage contaminated with tahini halva was shown to cause an epidemic (Andersson et al., 2001). There are also studies in Germany and Austria indicating that *S. typhimurium* was isolated from tahini halva (Fisher et al., 2001). In the tahini halva samples collected within the scope of our study do not contain *Salmonella spp.* It supports the negative result in terms of health (Collins et al., 1995; Al-Tahiri, 2005). The samples did not contain both *E.coli* and *Salmonella spp.*; it is also supported by the negative result in terms of (Collins et al., 1995; Al-Tahiri, 2005).

Mold and yeast are simple food contaminants that can be carried on by environmental toxins found in the air, water, soil, and dust. The reason for the detection of yeast and/or mold in food samples can be stated as the contamination of the raw material and insufficient hygienic conditions in the production and storage areas (Jarvis et al., 1983). In the samples analyzed within the scope of the study, the value of 100 cfu per gram of samples was below for each variety. When similar studies in the literature on tahini halva samples were examined, it was stated that 1.5×10^2 cfu/g in the research by Sengun et al. (2005) and 4.9×10^3 cfu/g in a research conducted in Greece by Kotzekidou (1998).

In order to determine the microbiological and chemical quality characteristics of tahini halva, 120 different halva samples were collected from the Marmara Region between March 2007 and February 2008. As a way to evaluate the chemical quality of the collected samples analyzes were carried out to determine the amount of sesame oil, protein, moisture, ash, tahini and total sugar, acidity determination and peroxide values. In order to determine the microbiological quality, analyzes were carried out to search for Mesophilic Aerobic Bacteria, *Staphylococcus aureus*, Coliform Bacteria, *Escherichia coli*, Mold/Yeast, *Salmonella spp.*, Staphylococcal enterotoxin. As a result of the analyzes, it was stated that 36.44% of the halva samples did not comply with the microbiological and chemical quality criteria recommended by the Turkish Food Codex, while *Salmonella spp* and enterotoxins were not found in the samples (Kahraman et al., 2010).

Conclusion

In this study, some chemical and microbiological quality criteria of a total of 40 tahini halva samples of 4 different varieties (plain, hazelnut, carob, vanilla) belonging to 5 different companies and 2 different batch samples of these companies were tried to be determined. The percentage of sesame oil, amount of tahini, salt, ash and moisture values of the mentioned tahini halva samples were determined. Chemical analyses revealed that tahini halva samples with carob from two different companies

had an excessive amount of ash and also that plain tahini halva samples from one company did not meet the requirements of the Turkish Food Codex for sesame oil content. Furthermore the samples were analyzed for yeast, mold, *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella spp* in order to assess the microbiological quality. *E. coli*, *Staphylococcus aureus* and *Salmonella spp* were not found in the samples after microbiological evaluation. However, as a result of microbiological analyzes to control yeast and mold contamination an average of 10 cfu/g in plain tahini halva, an average of 90 cfu/g in tahini halva with hazelnut, an average of 45 cfu/g in tahini halva with carob and an average of 25 cfu/g in tahini halva with vanilla was detected. A conclusion that can be drawn from the findings of previous studies is that we were capable of proving that the tahini halva samples we collected for our investigation seem to have higher microbiological quality

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