SİDAS MEDYA
Akademik Gıda®
ISSN Online: 2148-015X
http://www.academicfoodjournal.com

Akademik Gıda 16(1) (2018) 42-50, DOI: 10.24323/akademik-gida.415677

Research Paper / Araştırma Makalesi

Microbiological Risks Related with Raw Materials in Halva Production and Detection of Microbiological Critical Control Points

Ferid Aydın[1], Burhan Başaran[2]

[1] Department of Food Engineering, Agricultural Faculty, Atatürk University, Erzurum, Turkey
[2] Ardeşen Vocational School, Recep Tayyip Erdoğan University, Rize, Turkey

Received (Geliş Tarihi): 28.01.2017, Accepted (Kabul Tarihi): 24.04.2017
Corresponding author (Yazışmalardan Sorumlu Yazar): feray@atauni.edu.tr (F. Aydın)
0 442 231 24 79 0 442 231 58 78

ABSTRACT

A few studies in the literature reported that infections were developed due to the consumption of some halva products exported from Turkey. In this respect, this research aims to monitor and evaluate the microbiological risks originating from raw material in tahini halva production unit of a food company implementing ISO 22000. For this purpose, 12 different samples were taken from different sampling points in halva production processes and analyses have been performed. Results evaluated according to the decision tree method indicated that *Salmonella* spp. was present in sesame, and pistachio was unsuitable in terms of mould and yeast load. Sesame Roasting and Viscous Cooking steps were defined as critical control points as the temperature-time based treatments in these steps eliminate the microbiological risks arising from raw-materials. Furthermore, cocoa powder and pistachio raw-materials input validation operations were also defined as critical control points.

Keywords: *E. coli*, Halva, ISO 22000, Sesame, *Salmonella*

Helva Üretiminde Hammadde Kaynaklı Mikrobiyolojik Riskler ve Mikrobiyolojik Kritik Kontrol Noktalarının Tespiti

ÖZ

Literatür taramasında Türkiye'den ihraç edilen bazı helvalarının tüketimine bağlı enfeksiyonlar görüldüğü bildirilmiştir. Bu araştırmanın amacı; ISO 22000 standardının uygulandığı bir gıda işletmesinin tahin helvası üretim biriminde hammadde kaynaklı mikrobiyolojik riskleri belirlemek ve tespit etmektir. Bu amaçla helva üretiminin farklı proses basamaklarından 12 farklı numune alınmış ve analizler gerçekleştirilmiştir. Elde edilen analiz sonuçları karar ağacı yöntemiyle değerlendirilmiştir. Analiz sonuçlarına göre, susam *Salmonella* spp., antep fıstığı ise maya ve küf varlığı açısından uygunsuz olarak tespit edilmiştir. Susam Döner Kavurma ve Ağda Pişirme proses basamaklarında uygulanan sıcaklık-süre işlemleri hammadde kaynaklı mikrobiyolojik riskleri elimine ettiği için kritik kontrol noktası olarak tanımlanmıştır. Ayrıca kakao tozu ve Antep fıstığı hammaddelerinin girdi kabul kontrol işlemleri de kritik kontrol noktası olarak tanımlanmıştır.

Anahtar Kelimeler: *E. coli*, Helva, ISO 22000, Susam, *Salmonella*

INTRODUCTION

Tahini Halva is defined as a solid and homogenous product with a thin fibrous structure prepared according to a specified technique by means of making the sugar syrup, which is produced through cooking sugar, potable water, and citric acid/tartaric acid, or edible glucose syrup is also added to the combination when necessary,

viscous and then is whitened with soapwort extract *(Radix saponariae Albae sive* L.) and/or with modified proteins. The mixture is then combined with tahini and condiments also (nuts, pistachio etc. each of which is added by 8% at least) can be added [1].

Microbiological quality in halva is closely related with the raw material and the production technique. Watering the raw materials used in the production of halva with contaminated water containing faecal sourced microorganisms, inconvenient environmental conditions during various process steps such as moulding, cooling, mellowing, packing or storage, and other factors like personnel and machinery all directly influence the microbiological quality of halva [2-5]. The sesame in the product is primarily held responsible for *Salmonella* contaminations not only in Halva, but in all sesame-based products [5, 6]. The most important risk in pistachio is aflatoxin [7].

It is reported that *Salmonella* typhimurium DT 104 infection was identified among consumers in Sweden, England, and Australia after the consumption of tahini and halva that were imported from Turkey [2, 8, 9]. Brockmann et al. [3] identified *Salmonella* in 11 of the 117 food samples (among which Halva was also present) with sesame content. Şengün et al. [10], reported that mould value in pistachio halva is higher than that of the other halva types. Gök and Var [4] examined 102 pieces of originally packed Turkish product halva. Out of 34 pistachio halvas, 21 pieces were inconvenient in mould quantity, and 33 in Coliform Bacteria; out of 34 cocoa halvas, 9 pieces were inconvenient in *E.coli*; and finally, out of 34 plain halvas, 4 pieces were inconvenient in yeast quantity [4]. Torlak and Özfidan [11], detected *Salmonella* in 1of 33 plain halva samples that were obtained from various sales points around Konya region. Kaya and Ergönül [12], reported that the halva sold in open air in Manisa are microbiologically reliable yet potential health risks should still be taken into consideration.

Food faces a variety of risks throughout its production process. It is therefore essential to ensure, monitor, and evaluate adequate and effective controls in all phases of food chain. A lot of countries and companies convene and develop standards for safe food supply in this respect. One of these developed standards is ISO 22000. The basic approach in this standard is to efficiently inspect the stages of production process and to eliminate the potential risks that might occur against consumer health or at least reduce them to acceptable levels. ISO 22000:2005 covers all individuals and corporations throughout the food chain, from the primary producer to the end customer.

The purpose of this research is to monitor and evaluate the raw material-sourced microbiological risks at tahini production unit of a food establishment in which ISO 22000 standard is applied by also taking the control measures in the current HACCP plan into consideration, and to determine whether there are any microbiologically critical control points in the production steps through which these microbiological risks are eliminated or reduced to the acceptable level.

MATERIALS and METHODS

Materials

The data was collected in a private halva production premise in the Central Anatolia Region of Turkey. The establishment, which surrounds 5400 sqm closed area and employs 40 personnel, reports its halva production capacity as 2200 tons/year, its domestic sales as 1500 tons/year, and foreign sales as 600 tons/year. The plant was certified with ISO 22000 in 2006 by Sistemer Uluslararası Belgelendirme ve Dış Ticaret San. Tic. Ltd. Şti. (Sistemer International Certification and Foreign Trade Ltd.), and this was followed by follow-up inspections, the most recent of which was made in 2013. In accordance with the research purpose, the ISO 22000 documentation system of the establishment and the raw material used in halva production were adopted as the research materials.

Halva Production Process

The basic halva raw materials are sesame, tahini, sugar, and soapwort. Cocoa powder and pistachio are the raw materials that are added in accordance with the product type. The production process of halva is made up of three main processes, the third of which is the actual combination of the outputs of the previous two. The very first step of the production is obtaining tahini out of sesame. The last process involves mixing of halva and the viscous in 1 to 1 proportion. Figure 1 displays the halva production process diagram of the firm.

ISO 22000 Documentation System of the Establishment

According to the hazard and risks analyses performed by the food safety team of the firm founded on the basis of ISO 22000 practices, no microbiological critical control points have been determined in halva production process.

Raw Materials Used in Halva Production

Table 1 shows the information regarding raw materials used in halva production that was carried on under controlled conditions.

Methods

Microbiological Sampling Points (SP) and Sampling

In order to determine the process steps in which raw-material-sourced microbiological risks are eliminated or decreased to an acceptable level, three different processes in the production of the end product are considered separate and 12 different microbiological sampling points are ascertained. While ascertaining the critical control points, the practices realized within the scope of ISO 22000 and the related literature were considered. Sampling points are explained in Figure 1 and the reasons are given in Table 2.

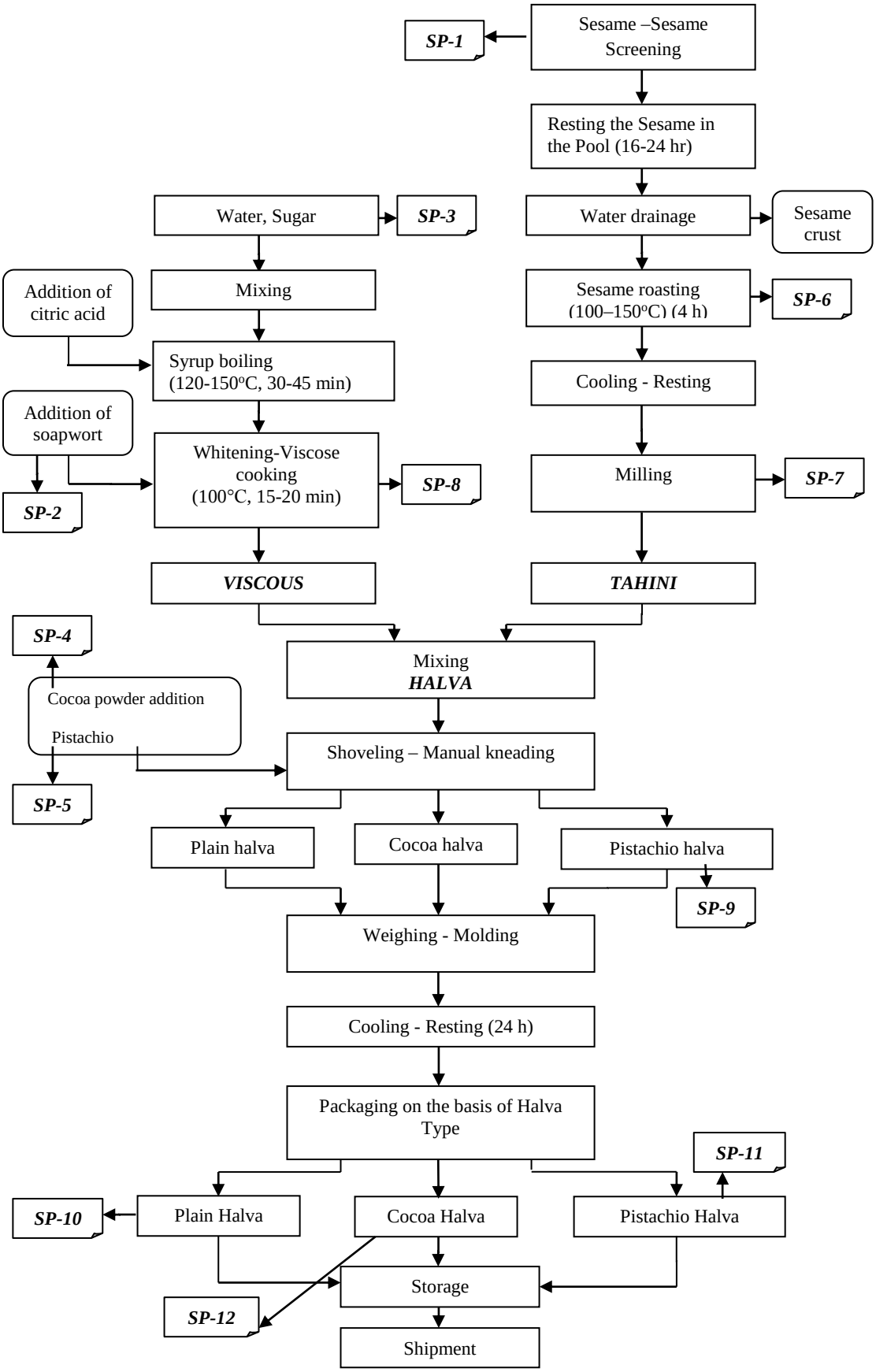

Figure 1. Tahini, viscous, halva production flow-process diagram

Table 1. Raw materials used in halva production

Raw material	Production date	Date of expiry	Batch number	Origin	Date of arrival in the plant
Sesame	09/2013	09/2014	-	Kanu/Nigeria	18/12/2013
Pistachio	12/11/2013	12/05/2015	12122013	Kahramanmaraş/ Turkey	23/12/2013
Cocoa powder	05/03/2013	04/0372014	BEM0254	Malaysia	28/08/2013
Soapwort extract	04/10/2013	04710/2015	2409	Tekirdağ/Turkey	07/10/2013
Sugar	2013	2014	2013K	Yozgat/Turkey	19/12/2013

All raw material samples were taken from their natural packages from their actual storage environments. In the production steps, samples were obtained separately under aseptic conditions and placed into sterile glass jars with two parallels (jars are filled almost 1/2).

Microbiological Criteria

Three types of Halva are produced in the halva process of this establishment: Plain Halva, Cocoa Halva, and Pistachio Halva. Since the main purpose of this research is to identify the microbiologically critical control points in the halva production process, the parameters set by the legal authorities regarding the halva product constitute the main basis to be referred to.

The microorganisms that should be sought and counted in halva according to the Turkish Food Codex Microbiological Criteria Communique are shown in Table 3. Also Table 4 shows the microorganisms that should be specifically sought and counted with regards to the addition of cocoa and pistachio as condiments.

Analyses

Salmonella spp. analyses and inventory in raw materials, production steps and end-product samples were performed according to ISO 6579:2002 [16]. Mould-yeast analyses and inventory were made in conformity with ISO 21527-2: 2008 [17] and *E.coli* analysis and inventory were based on ISO 16649-2:2001 [18] and aflatoxin analysis was done according to the AOAC Official Method 991.31 [19].

Decision tree

In order to determine the critical control points, the study benefited from the results of the analyses and the decision tree method [20].

RESULTS and DISCUSSION

Microbiological analysis results of the samples are shown in Table 5 displayed in Table 6 and the results of the decision tree are. The results are discussed under 4 headings. Tahini Production Stage analysis results are explained and discussed in the 1st section while Viscous Production Stage analysis results in the 2nd and Halva Production Stage analysis results in the 3rd section and results of end product in the 4th section. The results of the decision tree are explained and discussed in the 5th section.

Section 1

In sesame raw material (which is also defined as SP-1), *E.coli*, mould, yeast, and *Salmonella* analyses were made. Findings were compared with the microbiological limits that are shown on Table 3. *E.coli* was below the critical limit. However, *Salmonella* presence has been detected in the sesame and the mould and yeast analyses results were found to be 7.8×10^4kob/g, which exceeds the critical limit. Consequently, the sesame used in the analyses was not proper.

Salmonella, *E.coli*, mould and yeast analyses were made in sesame roasting (SP-6) and milling (SP-7) process steps. The *E.coli* counting results in SP-6 and SP-7 are found to be<10 kob/g. As this result is compared with the initial *E.coli* in sesame, it can be said that there is no actual difference present. The yeast and mould counting corresponds to<10 kob/g. The analysis regarding *Salmonella* presence shows no signs of *Salmonella.*

Section 2:

E.coli, mould and yeast analyses were made on granulated sugar samples (SP-3) and on the soaproot extract (SP-2) and the analyses results suggested that the values were below the critical limits.

Analysis results of the samples taken from Viscous Cooking (SP-8) are <10 kob/g for *E.coli* and <10 kob/g for mould and yeast. It can therefore be claimed that Viscous Cooking (SP-8) does eliminate the mould and yeast values (especially the soaproot extract-sourced mould and yeast values) or reduce those to acceptable levels.

Section 3:

E.coli, mould and yeast analyses were performed on cocoa powder. The results showed that the values were below the critical limits as it suggested in Table 3.

Table 2. Sampling points and the reasons they were selected

1.Raw material	Sampling point (SP)	Reason
1.1 Sesame 1.2 Soapwort extract 1.3 Granulated sugar 1.4 Cocoa powder 1.5 Pistachio	SP-1 SP-2 SP-3 SP-4 SP-5	In order to monitor the microbiological risks that source from the raw materials in the halva process and to detect the CCP M, it is first essential to take samples from the raw materials which are shown on Table 1 and which are to be used in production.
2. Production stages		
2.1 Sesame roasting	SP-6	A series of treatments were applied to the sample sesame. The sample was pneumatically brought to the production area and taken to the rotary roasting line. The duration through which the sesame was processed at the rotary roasting was around 3.5 hours. The heat temperature may increase up to 150°C during this process. As the inhibiting effect of heat and duration on the living creatures that pose the microbiological risks is known, the roasting process as a specific stage of heat practice on the sesame was chosen as a sampling point as it would enable the researcher to compare the microbiological load of the sesame before and after the roasting. On et al. [5] reported that no particular study regarding the influence of sesame roasting process on *Salmonella* potential in sesame seeds, it is unclear whether this might result from inadequate processing, or normal processing being insufficient. Brockmann et al. [3] reported that they detected *Salmonella* in roasted sesame samples. They explained that this is either caused by inadequate heat and/or duration practice during roasting or by post-roasting contamination. Torlak et al. [13] found that after injecting the Salmonella to the sesame seeds, the roasting process of sesame seeds which was realized under different temperatures (110, 130 and 150°C) and different time durations (30, 50 and 60 minutes) was effective to inactivate the Salmonella.
2.2 Milling	SP-7	During the milling of the cooled sesame, the friction between the mill notches causes a release of a specific amount of heat. It was predicted that this heat could reduce the microbiological load when the primary heat & duration practice with rotary roasting remained inadequate to reduce the same. In addition, transfer for exhibition following the stage of rotary roasting included contamination potential due to the work environment conditions, contact with the personnel, and similar factors.
2.3 Viscous cooking	SP-8	Since the syrup boiling process included the application of high temperature (100°C) and duration (15-20 minutes), it was thought that this stage would eliminate the microbiological risks resulting from water and sugar or reduce those risks to acceptable levels.
2.4 Manual kneading (Pistachio Halva)	SP-9	The viscous and tahini were mixed in accordance with the specified technique. Right before the kneading stage commenced, the condiments that specified the type of the product (cocoa powder and pistachio) were added in. The products manufactured by use of the same raw materials followed the same process and were processed in separate tanks in the kneading process. It was at this stage that 3 different products appeared: Plain Halva, Cocoa Halva and Pistachio Halva. The dough of each product was taken to a separate and disinfected kneading tank yet all of the three were kneaded by the same personnel. The hands and arms of this employee were cleaned and disinfected before the kneading. The good hygiene practices that were used throughout the entire production were followed at this stage, too so the employee also used a bonnet and a mask. The manual kneading stage is a critical stage in terms of microbiological risk since it can only be carried out with manpower. After this stage, there is no heat and duration practice by which a possible remaining microbiological risk can be eliminated. Therefore, the samples of the dough obtained after manual kneading were taken to figure out if there had occurred any personnel-sourced contamination. Since the raw material, the entire production process, and the kneading stage were all identical, it was decided that no sample would be taken from plain tahini halva or the cocoa halva, and sample would only be taken from the pistachio halva.
2.5 Plain halva	SP-10	After the manual kneading, the product was and then spilled onto the machine belt. The product passed through the cooling tunnel to then be cut into convenient sizes by pre-arranged knives for packing. By the eventual process of defining the actual date and batch information onto the package where the product was placed in, the end products of plain halva, cocoa halva, and pistachio halva were obtained. The product obtaining order was plain halva, pistachio halva, and cocoa halva. Cocoa halva was obtained last in case its flavour might spread onto the next product (pistachio halva) if it would be followed by another type. Between the manual kneading and the eventual composition of the end product, there exist microbiological risk sources such as machinery, work environment, personnel, and packaging. Moreover, the end products must be examined in terms of their conformity with the legal criteria.
2.6 Pistachio	SP-11	
2.7. Cocoa halva	SP-12	

Table 3. Microbiological criteria in halva products [14]

Food/Microorganism		Sampling plan		Limits	
		n	c	m	M
Tahini halva	Yeast and mould	5	2	10^2kob/g	10^3kob/g
	E. coli	5	0	<10^1kob/g	
Cocoa and cocoa products	*Salmonella*	5	0	0/25 g-mL	

n: number of samples chosen randomly and independently from the party; c: maximum number of samples between m and M (maximum number of samples which can be identified as m value); m: maximum microbiological value that can be found in (n-c); M: number of microorganisms which indicate the unsuitable and unacceptable values in case c number of samples exceeds this value.

Table 4. Aflatoxin limits for pistachio [15]

Aflatoxin	Maximum Limit (µg/kg)		
	B_1	$B_1+B_2+G_1+G_2$	M_1
Pistachio (which should be sorted out or taken into other physical processes prior to its release to human consumption or prior to usage as a food ingredient)	12.0	15.0	—

Table 5. Microbiological analysis results of the samples

Sampling points	*E. coli* (kob/g)	*Mould and Yeast (kob/g)	*Salmonella* spp. (/25 g)	*Total Aflatoxin (B1+B2+G1+G2) (µg/kg)
SP-1 Sesame	< 10	7.8×10^4	Detected	NAM
SP-2 Soaproot extract	< 10	1.0×10^3	NAM	NAM
SP-3 Granulated Sugar	< 10	< 10	NAM	NAM
SP-4 Cocoa powder	< 10	< 10	Not found	NAM
SP-5 Pistachio	< 10	2.0×10^3	NAM	0,34
SP-6 Sesame Roasting	< 10	< 10	Not found	NAM
SP-7 Milling	< 10	< 10	Not found	NAM
SP-8 Viscous Cooking	< 10	< 10	NAM	NAM
SP-9 Manual Kneading	< 10	1.0×10^3	Not found	NAM
SP-10 Plain Halva	< 10	< 10	Not found	NAM
SP-11 Pistachio Halva	< 10	8.0×10^3	Not found	Not detected
SP-12 Cocoa Halva	< 10	1.0×10^2	Not found	NAM

NAM :No Analysis Made *Analyses are accredited.

The analysis on pistachio revealed the aflatoxin and *E. coli* results were below the critical limits. However, mould and yeast results ($2.0x10^3$ kob/g) exceeded the critical limit ($1.0x10^3$ kob/g). When the results were compared to the criteria in Table 3, the comparison suggested that all the values were within the critical limits. While in the tahini and viscous cooking processes, mould and yeast values were <10 kob/g, in the manual kneading process the values increased to $1.0x10^3$ kob/g. This result can be explained with the pistachio added in this process.

Results for manual kneading (SP9) was <10 kob/g for *E.coli*, $1.0x10^3$ kob/g for mould and yeast, and no *Salmonella* was detected. When the results are compared to Table 3, it is clear that all the values are within the limits. Although mould and yeast values were <10 kob/g in tahini and viscous processes, the values increased to $1.0x10^3$ kob/g in manual kneading. This change is considered interrelated to pistachio addition in this process.

Section 4:

When the plain halva analysis results (SP-10) are compared to the legal limits, all the values were either below the limits or at acceptable levels rendering the end product appropriate for consumption. Results showed that no microbiological contamination was taken place in the processes of mixing viscous and tahini, kneading and packaging.

In pistachio halva (SP-11), *E.coli*, *Salmonella*, and total aflatoxin values are below legal or acceptable limits. On the other hand, the result for mould and yeast was quite higher than legal limits ($8.0x10^3$ kob/g). Until pistachio was added into the mixture, the mould and yeast values were at acceptable levels (in the tahini and viscous processes). The mould and yeast values were founded inappropriate in the initial analysis results for pistachio. These analyses showed that the inappropriate values in the end-product in terms of mould and yeast were because of pistachio. Another point supporting this statement is that the mould and yeast values for plain halva were appropriate considering legal limits. Because all the steps and processes were performed same in plain and pistachio halva productions, except for adding pistachio as a condiment.

Table 6. Data obtained through the decision tree method for halva processing

Process Step	*Are the control measures that are considered against the hazard convenient and adequate?*	*Can this process eliminate the hazard or reduce it to an acceptable level?*	*Can smearing occur at unacceptable level(s) or can it rise to unacceptable level(s)?*	*Can the next process step eliminate the identified hazard or reduce it to an acceptable level?*	*CCP*
Sesame (SP-1)	Y	N	Y	Y	-
Soapwort extract (SP-2)	Y	N	Y	Y	-
Granulated sugar (SP-3)	Y	N	Y	Y	-
Cocoa powder (SP-4)	Y	N	Y	N	CCP-M^1
Pistachio (SP-5)	Y	N	Y	N	CCP-M^2
Sesame roasting (SP-6)	Y	Y	-	-	CCP-M^3
Milling (SP-7)	Y	N	N	-	-
Viscous cooking (SP-8)	Y	Y		-	CCP-M^4
Manual kneading (SP-9)	Y	N	Y	N	CCP-M^5
Plain halva (SP-10)	Y	N	Y	N	CCP-M^6
Pistachio halva (SP-11)	Y	N	Y	N	CCP-M^7
Cocoa halva (SP-12)	Y	N	Y	N	CCP-M^8

Y:Yes N:No

The analysis results of cocoa halva (SP-12) show that all values of this product type are below the legal critical limits. In the light of these data, it can be said that cocoa halva is an appropriate end product for consumption. The mould and yeast value of the cocoa halva being $1.0x10^2$ kob/g was yet found meaningful. All details that are explained above for pistachio halva regarding mould and yeast are true for cocoa halva, too. It is therefore apparent that the mould and yeast load in the cocoa halva originated from the pistachio halva which passed through the same line right before the cocoa halva.

Section 5: Decision Tree

Taking the analysis results of sesame (SP-1), soapwort extract (SP-2), and granulated sugar (SP-3) into consideration, it can be said that the microbial risks they bear are eliminated at latter production stages (Sesame Roasting, Viscous Cooking). Therefore, it cannot be considered as a CCP-M.

According to decision tree, there are not any process steps that can eliminate or minimize the raw-material-sourced microbiological risks after cocoa powder and pistachio are included in halva production process. Therefore cocoa powder (SP-4) should be defined as CCP-M^1 and the pistachio (SP-5) as CCP-M^2.

Sesame roasting (SP-6) and viscous cooking (SP-8) processes reduce the raw material sourced microbial risks to acceptable levels. No other production step follows these in the process flow that can achieve that effect. Therefore, sesame roasting should be defined as CCP-M^3 and Viscous Cooking as CCP-M^4.

In tahini milling process (SP-7) heating happens as a result of the friction of the millstones. However, the heating occurring here cannot be considered as a systematic temperature-time treatment. This temperature cannot be measured and interfered when necessary. It cannot be considered as a systematic technique and consequently as a CCP-M.

Manual kneading phase (SP-9) is the process in which the materials are mixed and no other treatment is practiced in this step that can eliminate or minimize the possible microorganisms that can arise from cocoa powder, pistachio or tahini and viscous processes. Mix is carried out by personnel. According to the decision tree, there is no other eliminating step by which personnel-induced microbiological risks in the process. Thus, Manual kneading phase should be described as CCP-M^5.

The last phase of halva production processes are Plain (SP-10), pistachio (SP-11) and cocoa halvas (SP-11). There is no other eliminating step by which personnel-induced and business-driven microbiological risks in the process of final product. Thus, plain halva, pistachio halva and cocoa halva must be described as CCP-M^6, CCP-M^7 and CCP-M^8, respectively.

CONCLUSION

Halva is a traditional Turkish food and mostly consumed at breakfast in Turkey as well as in many Middle Eastern and Asian countries. In the literature, halva studies are mostly aimed to determine microbiological load of the halva products put on the market. Halva production process has not been investigated in details as well as there are few studies on food safety risk analysis in the literature. On the other hand, Salmonella spp. infection has been reported to occur due to the consumption of products exported to Europe.

This study is conducted at one of the halva production company in order to determine the critical microbiological control points in the process of halva production. Result from the study is as follows:

Input control operations of Sesame, soapwort extract and granulated sugar that are bought for company is not CCP-M. Still, the input control operations of these materials should define. Within the scope of plan, every batch should be inspected, their microbiological analysis certificates should be requested, and the suppliers of these materials should be periodically audited.

The fact that cocoa powder is an export product and pistachio is an agricultural product is the potential source of microbiological hazard. These two materials are directly used in halva production without going through an initial process beforehand. Moreover, It is clear from Figure 1 and decision tree that cocoa powder (SP-4) should be defined as CCP-M[1] and the pistachio (SP-5) as CCP-M[2].

Tahini Milling Process (SP-7) cannot be considered as a CCP-M. On the other hand, it is an important process step as it shows whether there happens any contamination in the related processes.

Manual kneading, plain halva, pistachio halva and cocoa halva are indicated as CCP-M[6], CCP-M[7] ve CCP-M[8] respectively in the decision tree. Operation in these process steps do not include any operation that can eliminate microbial load or reduce to acceptable level. At this stage, operations for microbial load determination are conducted. Personnel-induced microbiological risks during the manual kneading process exist and it is almost impossible to track it with CCP. Determining the end product analysis as CCP is a contradiction with the system approach for safe food production using effective periodic maintenance. Thus, determining these steps as CCP is not a realistic approach. Effective control point should be determined for these process steps and systematic operations including release systems must be conducted. The efficiency of the system should be increased by periodic maintenance and sanitation of all the machinery, effective implementation of swap analyses, personnel training and check-ups.

The establishment has been practicing ISO 22000 Food Safety Management System since 2006. However, it is clearly seen that the system established and applied in the establishment is inaccurate. Therefore, the company was recommended to revise its system and then to contract with another certification authority.

ACKNOWLEDGMENTS

This study was accepted as a master's thesis at Ataturk University by the Institute of Science. Additionally, a part of this study was presented at Turkey Natural Diet and Lifelong Health Summit as a poster presentation.

REFERENCES

[1] TGK (Türk Gıda Kodeksi), 2008. Türk Gıda Kodeksi Tahin Helvası Tebliği. Tebliğ no: 2008/6. 26807 sayılı Resmi Gazete.

[2] Andersson, Y., De Yong, B., Hellström, L., Stamer, U., Wollin, R., Giesecke, J., 2001. *Salmonella* Typhimurium outbreak in Sweden from contaminated jars of helva (Halva). Eurosurveillance Weekly, *5*, 29. Avaliable at: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=1715. Access: 15.11.2016.

[3] Brockmann, S.O., Piechotowski, I., Kimming, P., 2004. *Salmonella* in sesame seed products. *Journal of Food Microbiology* 67(1):178-180.

[4] Gök, F., Var, I., 2005. Piyasadan sağlanan tahin helvalarının mikrobiyolojik kalitesinin belirlenmesi ve *Salmonella* spp. izolasyonu. Yüksek Lisans Tezi. Çukurova Üniversitesi, Fen Bilimleri Enstitüsü Adana.

[5] On, S., Lake, R., King, N., Cressey, P., Gilbert, S., 2010. *Salmonella* (Non Typhoidal) in high lipids foods made from sesame seeds, peanuts or cocoa beans. Available at: http://www.foodsafety.govt.nz/elibrary/industry/salmonella-in-high-lipid-foods.pdf. Access: 01.11.2016.

[6] Willis, C., Little, C.L., Sagoo, S., de Pinna, E., Threlfall, J., 2009. Assessment of the microbiological safety of edible dried seeds from retail premises in the United Kingdom with of focus *Salmonella* spp. *Food Microbiology* 26: 847-852.

[7] Çeliktaş, M., Dağlıoğlu, F., 2008. Kuru meyvelerde aflatoksin riski. *Türkiye 10. Gıda Kongresi*, May 21-23, 2008, Erzurum, Turkey, Book of Proceedings, 237-240p.

[8] Little, C., 2001. International outbreak of *Salmonella typhimurium* DT 104 – update from The United Kingdom. Eurosurveillance Weekly, Available at: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=1700. Access: 15.11.2016.

[9] O'Grady, K.A., 2001. *Salmonella* Typhimurium DT 104-Australia, Sweden: ProMED mail. Available at: http://www.promedmail.org/?p_filename=20010730.1494&p_year=2001&p_month=07. Access: 15.11.2016.

[10] Şengün, I.Y., Hancıoğlu, O., Karapınar, M., 2005. Microbiological profile of helva sold at retail markets in İzmir city and the survival of *Staphlococcus aureus* in this product. *Food Control* 16(10): 840-844.

[11] Torlak, E., Özfidan, C., 2012. Tahin helvalarında *Salmonella* kontaminasyonu. *3. Geleneksel Gıdalar*

Sempozyumu, May 10-12, 2012, Konya, Turkey, Book of Proceedings, 54-55p.

[12] Kaya, B., Ergönül, B., 2012. Manisa'da açıkta satışa sunulan tahin helvaların mikrobiyolojik özellikleri. *3. Geleneksel Gıdalar Sempozyumu,* May 10-12, 2012, Konya, Turkey, Book of Proceedings 299-300p.

[13] Torlak, E., Sert, D., Serin, P., 2013. Fate of *Salmonella* during sesame seeds roasting and storage of tahini. *International Journal of Food Microbiology* 163(2): 214-217.

[14] TGK, 2011a. Türk Gıda Kodeksi Mikrobiyolojik Kriterler Tebliği. Tebliğ no: 2011/12. 28157 sayılı Resmi Gazete, Ankara.

[15] TGK, 2011b. Türk Gıda Kodeksi Bulaşanlar Yönetmeliği. Tebliğ no: 2011/12. 28157 sayılı Resmi Gazete, Ankara.

[16] ISO (International Organization for Standardization), 2002. *ISO 6579:2002.* Microbiology of food and animal feeding stuffs - Horizontal method for the detection of *Salmonella* spp.

[17] ISO, 2008. *ISO 21527-2:2008.* Microbiology of food and animal feeding stuffs -- Horizontal method for the enumeration of yeasts and moulds -- Part 2: Colony count technique in products with water activity less than or equal to 0.95.

[18] ISO, 2001. *ISO 16649-2:2001.* Microbiology of Food and Animal Feeding Stuffs- Horizontal Method for Enumeration of *β*-glucuronidase Positive *Escherichia coli* - Part 2: Colony - Count Technique at 44°C using 5-bromo-4-chloro-3-indolyl *β*-D-glucuronide.

[19] AOAC, 1995. Official Method 991.31. Aflatoxins in Corn, Raw Peanuts and Peanut Butter Immunoaffinity (Aflatest) Method First Action 1991. Final Action 1994, *AOAC Official Methods of Analysis Supplement* March 1995, chapter 49 p: 20-21.

[20] FAO (Food and Agriculture Organization), 1997. Hazard analysis and critical control point (HACCP) system guidelines for its application. CAC/RCP 1e1969, Rev.3.