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A Study of the Chemical and Microbiological Quality of Baloryeh, Burma and Baklawa, Traditional Arabic Sweets Produced In Jordan

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Abstract

Arabic traditional sweets (baloryeh, burma and baklawa), are a paste dessert made of very thin layers of dough filled with pistachio, baked with ghee or oil, sweetened and held together with sugar syrup. The microbial qualities, peroxide values and acidity value of baloryeh, burma and baklawa samples of the most five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants and the market, were investigated. The results showed that Aerobic plate count (APC) of baloryeh, burma and baklawa were lower than 10^5CFU/g and ranged between not detected to 8.2 ×10 ^{4}CFU/g. The coliforms most probable number ranged between not detected to 550 MPN/g, while fecal coliforms were detected in some samples and ranged between 4.7-550 MPN/g. Yeast and mold, staphylococcus aureus and salmonella were not detected in any sample. Post processing recontamination with food borne pathogen a hazard can take place, this calls for high hygiene practices, especially personal hygiene, during all steps during packaging, display and sale. The results also showed that peroxide values (PV) in baloryeh, burma and baklawa were ranged between 0.79- 6.69 meqO_2/kg, while Free fatty acids (FFA%) were ranged between 0.5-2.05%.

Keywords: Arabic sweets; Baloryeh; Burma; Baklawa; Chemical, microbiological quality.

1. Introduction

" Arabic sweets can be defined as light and flaky , aromatic and spices, sweet and savoury, runchy, crumbly, smooth and creamy, rich and buttery, melt- in-the-mouth, spongy and soft. Deep fried or baked, or simply prepared and left to cool. Arab sweets are made with pastry or kataifi (shredded filo pastry), with semolina or flour and sweetened with honey, aromatic syrups or sugar. There are also puddings and candies Most include nuts, a type of sweet cheese or dates, apricots or other fruits for their filling or for their garnish" (Salloum, et al., 2013). Baklawa is a type of popular Arabic traditional sweet, it is a paste dessert made of very thin layers of dough filled with dried pistachio nut such as hazelnut or walnut, sweetened and held together with sugar syrup. There are many types of baklawa depending on the design scheme, dry nuts used and to cut shape**.**

Although baklawa is generally recognized as an Arabic sweet, some non Arabic countries such as Turkey, Greece and Netherland consider Baklawa as own traditional sweet. The name of Baklawa is used in many languages with minor phonetic and spelling variations. Baklawa is made in different shape and size according to the country of production (Akkaya and Koc, 2017). Baklawa is usually prepared by adding baklawa paste in the form of layers then filled with pistachios and then covered with another layers of dough. Baklawa is baked with ghee or oil until the dough is browned and sugar syrup is finally added to the baked baklawa. Burma, is Arabic dessert that is prepared in different ways, related to baklawa. Its components are similar to the components of Kunafa, where nuts are used as fillings, Arabic ghee, and syrup. Burma composed of Kunafa dough, ghee or oil, thick sugar syrup and pistachio. Burma is usually prepared by adding dough in a straight line shape and place the nuts evenly in the center of the dough, then fried until browned and well drained from the oil or fat, finally sugar syrup is added on burma and then the fried Burma is cut into circles.

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Baloryeh, is another popular Arabic sweet which is white in color filled with pistachios and take this brilliant white color characteristic of the light baking that leaves the dough semi-raw. Then the added sugar syrup gives baloryeh its bright color. It is the only piece of the coordinated baklawa that is semi-raw as it bakes for a short time. The thick and rich pistachio filling makes it the favorite piece of pistachio. Baloryeh is mainly composed of Kunafa dough, ghee or oil, starch, thick sugar syrup and pistachio.

Outbreaks of foodborne disease are caused by foods that are contaminated intrinsically or that become contaminated during harvesting, processing, preparation and storage of ready to eat food (Olsonel, et al., 1997). Food handlers may transmit pathogen to food from infected personnel, improper hand washing practices, insufficient cleaning of processing equipment and cross contamination (Guzewich and Ross, 1999). So the practices of food service staff and their knowledge regarding food hygiene are necessary for the prevention of food borne outbreaks (Little, et al., 2002, Abdul-Mutalib, et al., 2012). Food safety describe the proper handling, preparation, and storage of food to prevent foodborne illness outbreaks. This includes a number of steps and ways that should be followed to avoid any potential health hazards. Hygienic requirement have to be applied in food plants in order to ensure the safety of food, these requirements are described by the Codex Alimentarius Commission (CAC/RCP 1-1969, Rev 4-2003), and the Jordanian Standard 493:2003 (Hygiene requirement – general principals of food hygiene).

Baklawa, Burma and Baloryeh are ready to eat food which is directly consumed after purchase without any further treatment, so the risk of foodborne illness could not be excluded, especially high if it is improperly handled. In this type of food the method of handling, processing, storage, and display can also affect the level of microorganism. Several studies and researches in many countries conducted on the microbiological quality of ready to eat food products have demonstrated the presence of potential foodborne bacteria including Salmonella spp, Listeria monocytogenes, Escherichia coli, Yersinia enterocolitica , Staphylococcus aureus and others (Angelidis, et al., 2006). Free fatty acids (FFA) are produced by the hydrolysis of oils and fats. The level of FFA depends on many factors that may affect their value such as time, temperature and moisture content. FFA are less stable than neutral oil, they are more prone to oxidation and to turning rancid**.** Rancidity is one of the most important quality parameters for food containing fat. The term rancidity refers to 'off' odours and flavours resulting from lipid oxidation or lipolysis.

The Jordanian quality mark of Arabic traditional sweet (baklawa, burma and baloryeh) as described by Jordan Institution for Standards and Metrology (JISM) did not require accepted values for FFA or PV. While in Jordanian Standards, FFA and peroxide values are allowed to go as high as 1 % and 10 meqO_2/kg respectively, for biscuits and similar products, while in Turkey, the Turkish Standards, FFA and peroxide values are allowed to go as high as I .5% and 10 meqO_2/kg respectively, for biscuits and similar products (Anonymous,1991). Peroxide value (PV) is also used as quality indicators in food industry (Dobarganes and Velasco, 2002). PV should not be above 10–20 meqO_2/kg fat to void rancidity flavor (Connell, 1975). The water activity is also responsible for maintaining chemical stability of food and optimizing the physical properties of products (Sandulachi, 2012). Food product manufacturers are interested in water activity, an important property that can be used to predict stability and safety of food (Gabriel, 2008). The objectives of this study were to evaluate the chemical and microbiological quality of baklawa, burma and baloryeh by testing collected samples from the most five prominent Arabic sweet bands in Amman, Jordan collected from the sweet plants and the market.

2. Methodology

2.1 Sampling of baloryeh , burma and baklawa samples

60 samples of baloryeh, burma and baklawa of the most five prominent Arabic sweet brands in Amman, Jordan. Samples were selected and purchased dierctly after prodution in the plants and from sweet shops in the market.

2.2 Chemical analysis

Fat extraction and testing for the free fatty acids (FFA%) as oleic acid and peroxide values as described in Association of Official Agricultural Chemists (AOAC) were as followed in testing of the samples of Arabic sweets.

2.3 Water activity (a_w)

Water activity of all samples was measured by hygrometers (Prior, 1979).

2.4 Microbiological analysis

Samples were tested for aerobic plate count (APC), coliforms most propable number, yeast and mold count(YMC) as well as for presence of Salomonella and enumeration of Staphylococcus aureus. Methods described in FDA's Bacteriological Analytical Manual (BAM) were followed

2.5 Statistical analysis

Log10-transformed data of each product were subjected to a one-way ANOVA, followed by a Least Significant Differences test at 95 % confidence level (SAS Institute, 2014) to compare bacteria count among the studied factories for each product. Also, t-test used to do comparisons between plant and market for each product in each factory.

3. Result and discussion

3.1 Chemical analysis

3.1.1 Free fatty acids (FFA %)

Free fatty acids (FFA) are produced by the hydrolysis of oils and fats. The level of FFA depends on many factors that may affect their value such as time, temperature and moisture content. FFA are less stable than neutral oil, they are more prone to oxidation and to turning rancid**.** Rancidity is one of the most important quality parameters for food containing fat. The term rancidity refers to 'off' odours and flavours resulting from lipid oxidation or lipolysis (Pike, 1998).

Table 1 shows averages of free fatty acids values in baloryeh, burma and baklawa samples of five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants and the market. In baloryeh FFA ranged between 0.5 and 0.8 % without any significant differences ($p > 0.05$) in FFA value between the plants of five brands, while the FFA in baloryeh samples collected from market ranged between 0.55 and 0.9% with significant differences ($p < 0.05$) in FFA value between the markets samples of five brands.

Table1. Averages of free fatty acids (FFA%) and peroxide value (PV) in baloryeh, burma and baklawa samples of five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants and the market.

*Each value in each column followed by the same letter is not significantly different ($p > 0.05$).

Brand	Baloryeh				Burma				Baklawa			
	FFA(%)*		PV ($meqO_2/kg$)*		FFA(%)*		PV ($meqO_2/kg$)*		FFA(%)*		PV ($meqO_2/kg$)*	
	Plant	Market	Plant	Market	Plant	Market	Plant	Market	Plant	Market	Plant	Market
A	0.8^{a}	0.55^{c}	0.99^{a}	0.89^{a}	0.75^{a}	0.75^{c}	1.24^{b}	1.68^{bc}	0.6^{a}	0.65^{a}	1.33^{a}	1.29^{a}
B	0.65^{a}	0.75^{ba}	1.08^{a}	1.58^{a}	0.66^{a}	0.7^{c}	1.36^{b}	1.23^{c}	0.55^{a}	0.55^{a}	0.79^{a}	1.49^{a}
C	0.75^{a}	1^{a}	4.68^{a}	3.17^{a}	1.25^{a}	1.3^{b}	5.83^{a}	5.79^{a}	0.8^{a}	0.9^{a}	4.63^{a}	2.09^{a}
D	0.8^{a}	0.9^{ba}	1.09^{a}	1.2^{a}	0.95^{a}	0.9^{cb}	0.79^{b}	1.35^{c}	0.5^{a}	0.6^{a}	4.85^{a}	6.69^{a}
E	0.5^{a}	0.65^{bc}	1.17^{a}	1.3^{a}	0.9^{a}	2.05^{a}	0.87^{b}	3.91^{ba}	0.55^{a}	0.6^{a}	0.98^{a}	4.53^{a}

The averages of free fatty acids values in burma samples ranged between 0.66 and 1.25 % without any significant differences ($p > 0.05$) in FFA value between the plants of five brands, while the FFA in burma samples collected from market ranged between 0.7 and 2.05% with significant differences ($p < 0.05$) in FFA value between the markets samples of five brands while, the averages of free fatty acids values in baklawa samples ranged between 0.5 and 0.8 % without any significant differences ($p > 0.05$) in FFA value between the plants of five brands, while the FFA in baklawa samples collected from market ranged between 0.55 and 0.9% without any significant differences ($p > 0.05$) in FFA value between the markets samples of five brands. There were no significant differences ($p > 0.05$) of each value of FFA of baloryeh, burma and baklawa between plant and market of each brand. In this study the FFA and peroxide value were determined in baloryeh, burma and baklawa. However, burma had the highest FFA both in plants and market samples ranged from (0.66 -1.25%) and (0.7 – 2.05%) respectively. The free fatty acids of baloryeh and baklawa samples were less than 1%. The quality mark of Arabic traditional sweet (baloryeh, burma and baklawa) as described by Jordan Institution for Standards and Metrology (JISM) did not require accepted values for FFA or PV.

While in Jordanian Standards, FFA and peroxide values are allowed to go as high as 1 % and 10 $meqO_2/kg$ respectively, for biscuits and similar products, while in Turkey, the Turkish Standards, FFA and peroxide values are allowed to go as high as I .5% and 10 $meqO_2/kg$ respectively, for biscuits and similar products (Anonymous,1991). Compared to our result a survey in West of Iran was conducted to evaluate the level of 120 samples of Persian doughnuts.

The survey showed that 56.92 and 43.07 % of the samples were out of standard limit and not suitable for consumption due to high levels of acidity. The minimum and maximum acidity of the samples were 0.7 and 2.9 wt%, respectively (Birjandi, et al., 2016).

3.1.2 Peroxide value (PV)

Peroxide value (PV) is used as quality indicators in food industry (Dobarganes and Velasco, 2002). PV should not be above 10–20 meqO_2/kg fat to void rancidity flavor (Connell, 1975). Some products had a PV above 10 meqO_2/kg such as a result shown in a study on the fat quality of retails cakes of Dhaka city, was found that the peroxide values were higher than the acceptable range (20.27-49.4 meqO_2/kg) indicated that all fats were in rancid condition. Table 1 shows averages of peroxide values (PV) in baloryeh, burma and baklawa samples of five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants and the market. In baloryeh PV ranged between 0.99 and 4.68 meqO_2/kg without any significant differences ($p > 0.05$) in PV value between the plants of five brands, while the PV in baloryeh samples collected from market ranged between 0.89 and 3.17 meqO_2/kg without any significant differences ($p > 0.05$) in PV value between the markets samples of five brands.

In burma PV ranged between 0.79 and 5.83 meqO_2/kg with significant differences ($p < 0.05$) in PV value between the plants of five brands, while the PV in burma samples collected from market ranged between 1.23 and 5.79 meqO_2/kg with significant differences ($p < 0.05$) in PV value between the markets samples of five brands. In baklawa PV ranged between 0.79 and 4.85 meqO_2/kg without any significant differences ($p > 0.05$) in PV value between the plants of five brands, while the PV in baklawa samples collected from market ranged between 1.29 and 6.69 meqO_2/kg without any significant differences ($p > 0.05$) in PV value between the markets samples of five brands.

* There were no significant differences ($p > 0.05$) of each value of PV of baloryeh, burma and baklawa between plant and market of each brand.

In this study the highest FFA and peroxide value were determined in baloryeh, burma and baklawa. However, burma had the highest PV in plants samples ranged from (0.79 -5.83) meqO_2/kg and baklawa had the highest PV in market samples ranged from (1.29 – 6.63) meqO_2/kg. PV of baloryeh, burma and baklawa samples were less than 10 meqO_2/kg and not considered rancid.

The quality mark of Arabic traditional sweet (baklawa, burma and baloryeh) as described by Jordan Institution for Standards and Metrology (JISM) did not require accepted values for FFA or PV. While in Jordanian Standards, FFA and peroxide values are allowed to go as high as 1 % and 10 meqO_2/kg respectively, for biscuits and similar products, while in Turkey, the Turkish Standards, FFA and peroxide values are allowed to go as high as I .5% and 10 meqO_2/kg respectively, for biscuits and similar products (Anonymous,1991).

Compared this study with a survey in West of Iran was conducted to evaluate the peroxide content and of 120 samples of Persian doughnuts. The survey showed that 56.92 and 43.07 % of the samples were out of standard limit and not suitable for consumption due to high levels of peroxides. The lowest and highest peroxide value were 1.1 and 2.9 meqO_2/kg, respectively (Birjandi, et al., 2016).

In a study done by Begum, et al., (2016) on the fat quality of retails cakes of Dhaka city, was found that the peroxide values were higher than the acceptable range (20.27-49.4 meqO_2/kg) in all thirteen cake samples analyzed, indicated that all fats were in rancid condition.

Min, et al., (1985) studied the effects of storage conditions on the rancidity of Yackwa (a Korean fried cake made from wheat flour, honey and 20% oil) This study was carried out to evaluate the storage stability of Yackwa under different storage temperature for 20 weeks period. In 5 deg. C storage, acid and peroxide values increased slowly, showing the peroxide value of 20 meqO_2/kg after 13 weeks. In 40 deg. C storage, acid and peroxide values increased remarkably.

3.1.3 Water activity (a_w)

The water activity is responsible for maintaining chemical stability of food and optimizing the physical properties of products (Sandulachi, 2012). Food product manufacturers are interested in water activity, an important property that can be used to predict stability and safety of food (Gabriel, 2008). In this study the averages of water activity (a_w) in baloryeh samples of five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants and the market.

In baloryeh a_w ranged between0.37and 0.42 without any significant differences ($p > 0.05$) in a_w value between the plants of five brands, while the a_w in baloryeh samples collected from market ranged between 0. 0.37 and 0.4 without any significant differences ($p > 0.05$) in a_w value between the markets samples of five brands.

The averages of water activity (a_w) in burma ranged between 0. 0.33 and 0.43 with significant differences ($p < 0.05$) in a_w value between the plants of five brands, while the a_w in burma samples collected from market ranged between 0. 0.35 and 0.44 without any significant differences ($p > 0.05$) in a_w value between the markets samples of five brands while, the averages of water activity (a_w) in baklawa samples ranged between 0. 0.33 and 0.43 without any significant differences ($p > 0.05$) in a_w value between the plants of five brands, while the a_w in baklawa samples collected from market ranged between 0. 0.35 and 0.44 without any significant differences ($p > 0.05$) in a_w value between the markets samples of five brands. There were no significant differences ($p > 0.05$) of each value of a_w of baloryeh, burma and baklawa between plant and market of each brand.

The water activity is responsible for maintaining chemical stability of food and optimizing the physical properties of products (Sandulachi, 2012). Food product manufacturers are interested in water activity, an important property that can be used to predict stability and safety of food (Gabriel, 2008). In research conducted to study the Influence of water activity on growth and survival of yeasts and molds, found that fungal spoilage of foods occurs more often than bacterial spoilage at a_w 0.61–0.85. The study also found that mold and yeast are also grow faster at reduced a_w due to the absence of bacterial growth and their competitive effects at low a_w (Larry, 1983).

All samples in this study had a water activity ranged from 0.33 – 0.44 and clssified as low moisure food ($a_w < 0.6$). Water activity is more important for food stability than total water content. Water activity can determine a food's shelf stability. It can predict which microorganisms will be potential sources of spoilage and infection.

3.2 Microbiological analysis

3.2.1 Aerobic plate count (APC)

Table 2 shows averages of aerobic plate count (APC) in baloryeh, burma and baklawa samples of the most five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants and the market. In baloryeh APC ranged between 0.0 and 3.9 (Log_{10} CFU/g) without any significant differences ($p > 0.05$) in APC value between the plants of five brands, while the APC in baloryeh samples collected from market ranged between 0. 0 and 4.23 (Log_{10} CFU/g) without any significant differences ($p > 0.05$) in APC value between the markets samples of five brands**.**

Table 2. Averages of aerobic plate counts (APC) and the count of coliforms in baloryeh, burma and baklawa samples of five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants and the market

Brand	Baloryeh				Burma				Baklawa			
	*APC (CFU/g)		*Coliforms (MPN/g)		*APC (CFU/g)		* Coliforms (MPN/g)		*APC (CFU/g)		* Coliforms (MPN/g)	
	Plant	Market	Plant	Market	Plant	Market	Plant	Market	Plant	Market	Plant	Market
A	ND	ND	<3	<3	1.8×10^3	ND	<3	160	<3	160	<3	160
B	7.6×10^3	ND	<3	7.4	ND	1.1×10^4	4	<3	4	<3	4	<3
C	6.5×10^2	1.8×10^4	23	15	2.8×10^3	6.2×10^2	13	240	13	240	13	240
D	2.9×10^2	1×10^3	11	43	1.3×10^4	ND	23	<3	23	<3	23	<3
E	ND	ND	19.8	<3	ND	ND	3.6	<3	3.6	<3	3.6	<3

ND : not detected

*No significant differences ($p > 0.05$) were noticed in the APC and coliforms

The averages of aerobic plate count (APC) in burma samples ranged between 0.0 and 4.1 (Log_{10} CFU/g) without any significant differences ($p > 0.05$) in APC value between the plants of five brands, while the APC in burma samples collected from market ranged between 0. 0 and 4.0 (Log_{10} CFU/g) without any significant differences ($p > 0.05$) in APC value between the markets samples of five brands while, the averages of aerobic plate count (APC) in baklawa samples ranged between 0.0 and 2.6 (Log_{10} CFU/g) without any significant differences ($p > 0.05$) in APC value between the plants of five brands, while the APC in baklawa samples collected from market ranged between 0. 0 and 4.9 (Log_{10} CFU/g) without any significant differences ($p > 0.05$) in APC value between the markets samples of five brands.

* There were no significant differences ($p > 0.05$) of each value of APC of baloryeh,burma and baklawa between plant and market of each brand.

The Aerobic Plate Count (APC) is used as an indicator of bacterial populations in a product (BAM). The levels of aerobic bacteria counts recovered from baloryeh, burma and baklawa, in this study are comparable to findings of previous studies on different food from certain geographic areas. In Ghana a study was carried out to determine the microbiological load of the foods sold by the food businesses. Microbial counts of all food samples were generally high ranging from 1.2×10^5 CFU/g to 1.1×10^8 CFU/g (Baiden, 2011).

In Nigeria the microbial qualities of candied-pineapple and cherry cakes were investigated. Both cake samples were also analyzed for microbial load before, during and after 56 days storage at room temperature. The microbial loads of the candied pineapple cake were lower than the cherry cake throughout the duration of the 56 days storage at room temperature. The highest bacterial load was recorded after the 28th day (148.0×10^5 CFU/g) and (194.30×10^5 CFU/g) for candied pineapple and cherry cakes respectively (Olua and Edide, 2013).

In china special surveillance was conducted on bulk ready-to-eat meat products. Aerobic plate count (APC) was detected. APC was detected. 29.68% (1017/3427) of the samples had APC above 10^5 CFU/g (Yang, et al., 2016). In a study conducted in China by Yam – fung, el al., (2013) to evaluate the microbiological quality of ready to eat meat in licensed Siu Mei and Lo Mei shops in Hong Kong. A total of 115 samples were collected from supermarkets or wet markets in the 18 districts. They were tested for aerobic plate counts (APC). Results showed APC ranging from 1.97 to 6.84 log CFU/g, with a mean of 5.05 log CFU/g. The mean APC counts of samples from supermarkets were found to be significantly lower than those from wet markets ($p < 0.05$) indicating that supermarkets had better microbiological quality than wet markets. In this study the brand "E" is the only brand that did not show any microbial growth on APC media, while APC of all other samples from plants and market were below 10^5 CFU/g and not exceed the maximum allowed APC (10^6 CFU/g) as described in the quality mark of Arabic traditional sweet by JISM.

3.2.2 Coliforms

Detection of coliforms is used as an indicator of sanitary quality or as a general indicator of sanitary condition in the food-processing environment. E. coli is used to indicate recent fecal contamination or unsanitary processing, MPN method is particularly useful for low concentrations of organisms (<100/g) (BAM). Table 2 shows averages of coliforms in baloryeh, burma and baklawa samples of the most five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants and the market. In baloryeh coliforms ranged between 0. 0 and 19.8 MPN/g without any significant differences ($p > 0.05$) in coliforms value between the plants of five brands, while the coliforms in baloryeh samples collected from market ranged between 0. 0 and 43 MPN/g without any significant differences ($p > 0.05$) in coliforms number between the markets samples of five brands.

The averages of coliforms in burma ranged between 0. 0 and 23 MPN/g without any significant differences ($p > 0.05$) in coliforms number between the plants of five brands, while the coliforms in burma samples collected from market ranged between 0. 0 and 160 MPN/g without any significant differences ($p > 0.05$) in coliforms value between the markets samples of five brands.

The averages of coliforms in baklawa samples ranged between 0. 0 and 33 MPN/g without any significant differences ($p > 0.05$) in coliforms numbers between the plants of five brands, while the Coliforms in baklawa samples collected from market ranged between 0. 0 and 550 MPN/g without any significant differences ($p > 0.05$) in coliforms numbers between the markets samples of five brands.

There were no significant differences ($p > 0.05$) of each number of coliforms of baklawa between plant and market of each brand. Table 3 shows averages of fecal coliform count in baloryeh, burma and baklawa samples of five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants. In baloryeh the fecal coliform numbers ranged between 0. 0 and 18 MPN/g without any significant differences ($p > 0.05$) in fecal coliform number between the plants of five brands, while the fecal coliform was not detected in baloryeh samples collected from market. The averages of fecal coliform count in burma samples of five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants. In plants samples fecal coliform was only detected in one brand with 13.3 MPN/g, while the fecal coliforms in market was also detected in one brand (120 MPN/g).

Table 3. Averages of fecal coliforms most probable number in baloryeh, burma and baklawa samples of five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants and the market.

Brand	Fecal coliforms (MPN/g) *					
	Baloryeh		Burma		Baklawa	
	Plant	Market	Plant	Market	Plant	Market
A	ND	ND	ND	ND	ND	230
B	ND	ND	ND	ND	ND	4.7
C	11.5	ND	13.3	ND	33	550
D	5.5	ND	ND	ND	ND	ND
E	18	ND	ND	ND	ND	ND

ND: not detected; *No significant differences were noticed in the fecal coliforms.

The averages of fecal coliform in baklawa samples of five prominent Arabic sweet brands in Amman, Jordan collected from the sweet plants. Fecal coliforms was only detected in one brand froem plants samples with 33 MPN/g, while the fecal coliform numbers in baklawa samples collected from market ranged between 0. 0 and 550 (MPN/g) without any significant differences ($p > 0.05$) in fecal coliforms numbers between the markets samples of five brands.

* There were no significant differences ($p > 0.05$) of each fecal coliforms number of baloryeh, burma and baklawa between plant and market of each brand.

In this study only 4 samples had shown coliforms count ranged between (160-550) MPN/g and not exceed the maximum allowed CC (10^2 CFU/g) as described in the quality mark of Arabic traditional sweet by JISM. Only 3 samples had a fecal coliforms ranged between (120 -550) MPN/g and were not in conformity with Jordanian mark quality, which is requires the samples to be free from any fecal coliforms.

The levels of coliforms recovered from baloryeh, burma and baklawa, in this study are comparable to findings of previous studies on different food from certain geographic areas. In a study conducted in China by Yam – fung, el al., (2013) to evaluate the microbiological quality of ready to eat meat in licensed Siu Mei and Lo Mei shops in Hong Kong. A total of 115 samples were collected from supermarkets or wet markets in the 18 districts. They were tested for Escherichia coli. Results showed E. coli counts ranging from none detected to 3.10 log CFU/g, with a mean of 1.78 log CFU/. The mean E. coli counts of samples from supermarkets were found to be significantly lower than those from wet markets ($p < 0.05$) indicating that supermarkets had better microbiological quality than wet markets. In Ghana a study was carried to determine the microbiological load of the foods sold by the food businesses. The total coliforms counts of foods ranged from 1.0×10^4CFU/g to 5.0×10^6 CFU/g (Baiden, 2011).

Yeast and mold, Salmonella and Staphylococcus aureus were not deteced from any of the samples. The baloryeh, burma and baklawa are classifided as low moisture foods and had a low water activity, which are less expoure to microbial and fugal growth.

4. Conclusion

This study showed that most of the samples of baloryeh, burma and baklawa were chemically stable and not showed rancidity, FFA and Peroxide values were within the acceptable limit exept a few samples that show some higher values of FFA. The baloryeh, burma and baklawa showed that some samples were not accepted microbially due to their contamination with fecal coliform which had to be zero as required in Jordanian quality mark of Arabic traditional sweets as described by JISM Low water activity , high fat content , frying or baking under high tempreature during the production of burma, baloryeh and baklawa is responsible for the absence of most of the foodborne pathogen, while the presence of fecal coliforms was a strong indicator of poor hygiene practices espically personal hygiene during all steps after production, during packaging, display and sale.

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