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Assessment of Various Hazards Found In Halewet El-Moulid And Cream Cake Handled In The Local Egyptian Market.

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Abstract

The current work was performed to investigate the safety of Halewet El-Moulid and cream cake handled in the local Egyptian market. Four kinds of Halewet El-Moulid samples were collected from 5 governorates. The potential chemical and microbiological hazards of collected samples were assessed. The obtained results reveal that all Halewet El-Moulid samples did not contain aflatoxins; however, their lead and copper content were varied between 0.02 – 0.71 and 0.62 – 3.8 ppm, respectively. Moreover, 50% of the extracted oil from samples containing oily seeds had peroxide values greater than the maximum acceptable limit. In spite of salmonella and fungal counts, all other measured microbiological cream cake sample hazards were unacceptable. These results indicate the necessity of imposing safety programs during processing, storage, and retail of food products.

Key words: Halewet El-Moulid, Chemical hazards, Microbiological hazards, Aflatoxins, Cream cake.

Introduction

Increase awareness about food safety directed food specialists to find out the factors (threats) that affect food safety and implement food safety assurance systems to ensure the safety and wholesome of food. The threats (hazards) that affect food safety can be classified into chemical, physical and biological hazards. The hazard analysis and risk management have received considerable critical attention since there was and still happen a lot of food borne illness outbreaks around the world (Mead *et al*., 1999**).** Annually, millions of people are influenced by diseases related to consuming contaminated food which are known as foodborne diseases (Rooney *et al.*, 2004). The identified diseases that are transmitted via food comprise more than 200 diseases. The signs of foodborne disease range from mild gastroenteritis to neurological, hepatic, and renal syndromes that are life-threatening (Mead *et al*., 1999**).** Therefore, a considerable literature has grown up around the theme of the quality of food and their content of essential and toxic trace elements in different foodstuffs (Milačič and Kralj, 2003**).**

In recent years, there has been growing recognition of the vital links between food contamination with aflatoxin and food types in several countries. The most contamination occurred in cereals and nuts and was tested by high-performance liquid chromatography (HPLC) (Chen *et al*., 2013). Aflatoxins are a group of naturally occurring toxins produced mainly by molds (Gürbay *et al.*, 2006). Aflatoxins were first discovered as a result of the deaths of thousands of turkeys in the UK in 1960 (O' Riordan and Wilkinson, 2008). The four major aflatoxins are known as aflatoxin B1, aflatoxin B2, aflatoxin G1, and aflatoxin G2 (Al-Zoreky and Saleh, 2019). Aflatoxin B1 is the most toxic and has been classified as a Group I carcinogen by the International Agency for Research on Cancer (IARC) (Al-Zoreky and Saleh, 2019**).** The maximum allowable level of total aflatoxins for unprocessed peanuts and ready-to-eat tree nuts were 15 and 10 ng g^{-1}, respectively, as adopted by the Codex Alimentarius Commission (2011)

Heavy metals are not only considered as the main contaminants of food supply but also, they adversely affect the ecosystem (Arigbede and Dawodu, 2019; Cevik *et al*., 2009). The problem of contamination with heavy metals takes place all over the world; however, in developing countries such as Egypt, North and South Africa, Yemen, Turkey, Nigeria, Zimbabwe, and Tanzania, this problem is more serious (Brhane and Shiferaw, 2014) .

Halawet Elmoled are oriental sugar confectionery products that comprise several product types. According to (EOS 464-1, 2005), it is defined as the product of cooking a mixture of sucrose and commercial glucose with certain ratios at a suitable temperature in a certain type of utensils. Some emulsifiers, flavoring agents (approved) and seeds (sesame, peanut, etc.) can be added. All these seeds should be peeled and roasted except sesame seed that can be used unroasted. The final product takes a lot of shapes such as discs, slides, and fingers. Moreover, another type of these products (Turkish delight including domia) is defined as the product of cooking a mixture of sucrose and commercial glucose in addition to starch and fat (permitted), citric and tartaric acid as well as permitted flavoring and coloring agents at a certain temperature in open utensils (EOS 464-1, 2005).

Cream cake is rich with nutrients, its moisture content and water activity are high a_w> 85%. In addition, it has neutral pH and contains various ingredients such as milk, butter cream, and fruit which make it a good growth medium for many microorganisms kinds (Can *et al*., 2014; Siriken, *et al.*, 2009). In addition, many fillings of pastry

products can support the growth of food-borne pathogens, especially if they contain egg or dairy products. Custard products are a potential health hazard, as they are prepared from milk and eggs, which are possible sources of pathogens due to contamination. *Bacillus cereus* and *Staphylococcus aureus* from custard cake have been implicated in food poisoning outbreaks (Ashenafi, 2015)**.**

In the light of previous information, the current study aimed to analyze and determine various hazards that affect the safety of two different types of confectionery products handled in the local Egyptian markets. To achieve this aim, different confectionery samples were collected from various locations in Egypt and analyzed to detect the potential hazards.

Materials and Methods

Material

a) **Analyzed samples**

Due to their potential hazards two different confectionary product types were selected. Hard confectionery products that are characterized by low moisture content and high sugar content. This group of samples involves 20 samples of four different Halewet El-Moulid types (Semsemia (S), Foulia (F), Humusia(H) and Domia (D)) which were purchased from five different governorates [(Cairo (C), Al-Fayoum (F), Damietta (D), Kafr Elsheikh (K), and Tanta (Gharbia governorate) (T)], Egypt. The second type comprises soft confectionery products that involves three different cream cake samples which were purchased from different three distinct territories (Faysal, Downtown, Embaba), Cairo, Egypt. Halewet El-Moulid samples were identified using two uppercase letters. The first letter represents sample type while the second one represents the governorate from which sample was collected.

b) **Chemicals**

Hexane (60-80°C), glacial acetic acid, chloroform, potassium iodide, sodium thiosulfate, ethanol, and potassium hydroxide were purchased from ElGomhoria Co. for Chemicals., Egypt.

Methods

I. Evaluation of chemical hazards found in Halewet El-Moulid samples

Halewet El-Moulid involves several ingredients. Among these ingredients, high lipid content ingredients such as nuts, and sesame seeds that represent a considerable percentage of the final product. These types of confectionery products are usually manufactured using traditional and local techniques that might transfer certain heavy metals to final products. Thus, the following determinations were performed to assess the chemical hazards that are potentially found in these products.

a) **Determination of Aflatoxins**

Aflatoxins content of various Halewet El-Moulid samples were determined according to AOAC (1994) and expressed as nanogram (ng) total aflatoxins/ g sample. Fifty grams of each examined sample were fine grounded and extracted using 100 ml of acetonitrile/water solution (9:1 v/v), and then purified by immunoaffinity column. Aflatoxins levels were determined using high performance liquid chromatography (HPLC) at the Regional Center for Food and Feed (RCFF), Agricultural Research Center, Ministry of Agriculture.

b) **Determination of copper and lead**

Copper and lead content of various Halewet El-Moulid samples were determined in RCFF using ICP-MS according to AOAC (1988) and expressed as ppm (µg/ g sample).

c) **Determination of peroxide and acid values of isolated lipids**

1) **Extraction of oil from various samples**

The oil fraction of ground Halewet El-Moulid samples was extracted using hexane at a ratio of 1:10 (w/v) for 10 h at room temperature followed by filtration through filter paper (Whatman No. 1). The solvent was evaporated under vacuum at 40 °C using a rotary evaporator. The extracted oil was stored at 5 °C till analysis.

2) **Peroxide value**

The peroxide value (PV) represents the quantity of peroxide expressed in milliequivalents of active oxygen contained in 1000 g of the sample. The peroxide value (PV) of the oils was determined using a titration method according to AOAC (1969).

3) **Acid value**

The acid value (AV) of the samples was determined according to AOAC (1999). The results were expressed as the average of three measurements in mg KOH/g oil.

II. Microbiological examination:

Cream cake samples were immediately brought to the food safety laboratory in the Regional Center of Food and Feed in the Center of Agriculture Research for microbiological analysis. Cream cake samples were microbiologically analyzed to determine their biological hazards. Total bacterial count (cfu/g) (NMKL, 2013), total coliform count (cfu/g) and fecal coliform count (cfu/g) (NMKL, 2005b) *Staphlyococcus* detected (cfu/g) (NMKL, 2009), presence of *Salmonella* detected (NMKL, 1999) ,*Bacillus cereus* detected (cfu/g) (NMKL, 2010), total molds and yeast count(cfu/g) (NMKL, 2005a) were determined.

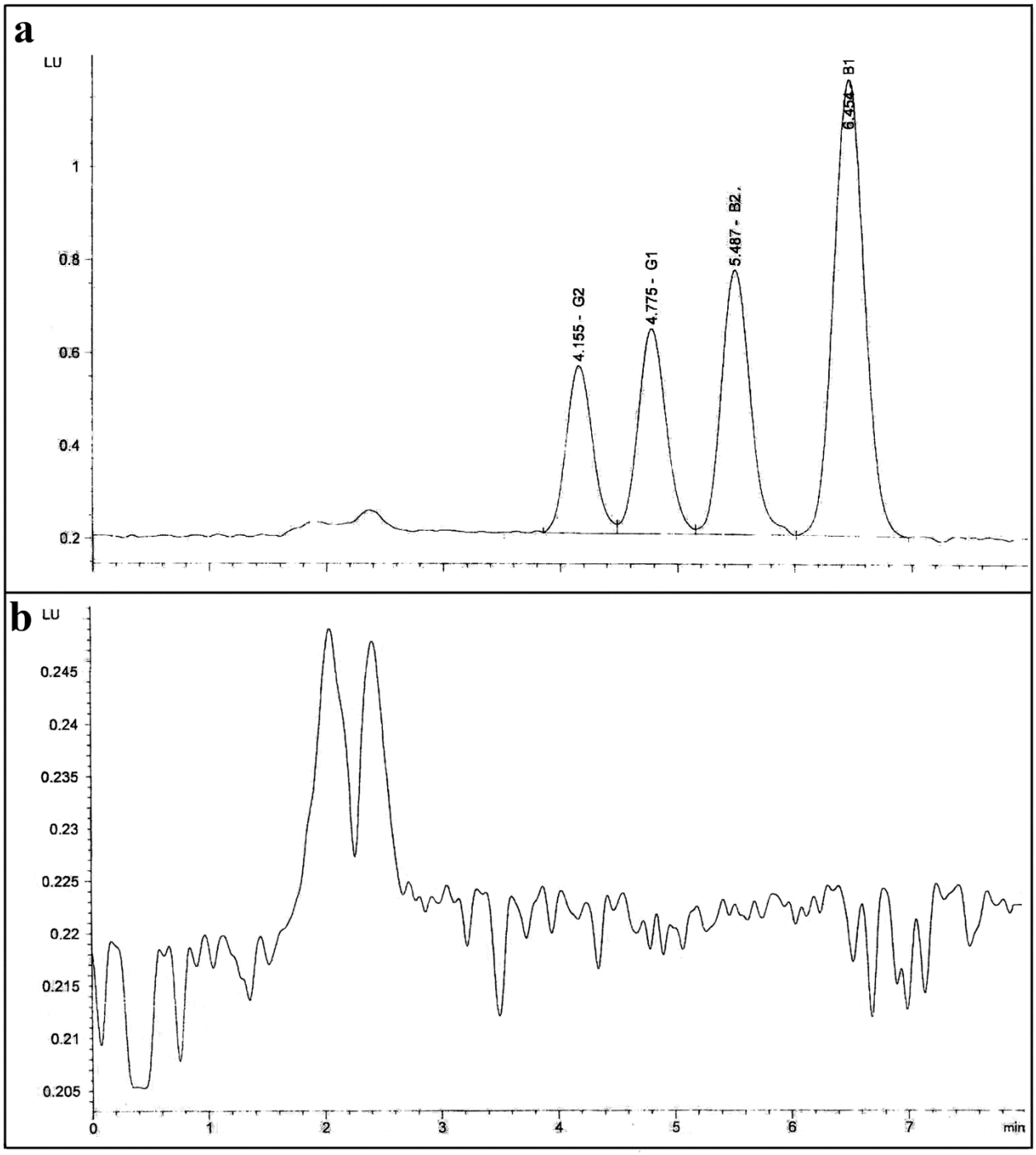

Fig. (1) HPLC chromatogram of aflatoxin standards (a) and their profile in analyzed sample (b)

Results and Discussion

Aflatoxins content

Due to their harmful effect, the maximum acceptable limit of aflatoxins in several food items was specified. According to EOS 1875-1 (2007) the highest acceptable limit of total aflatoxins in peanut is 15µg/kg which is the highest acceptable limit among other food items. In addition, Codex states the maximum levels for aflatoxins in various nuts, grains, dried figs, and milk are in the range of 0.5 to 15µg/kg.

Table 1: The concentration of aflatoxins in various collected samples

Governorate	Sample**	Aflatoxins concentration (ppb)			
		B1	B2	G1	G2
Cairo	Humusia (HC)	ND*	ND*	ND*	ND*
	Semsemia (SC)	ND*	ND*	ND*	ND*
	Foulia (FC)	ND*	ND*	ND*	ND*
	Domia (DC)	ND*	ND*	ND*	ND*
Fayoum	Humusia (HF)	ND*	ND*	ND*	ND*
	Semsemia (SF)	ND*	ND*	ND*	ND*
	Foulia (FF)	ND*	ND*	ND*	ND*
	Domia (DF)	ND*	ND*	ND*	ND*
Tanta	Humusia (HT)	ND*	ND*	ND*	ND*
	Semsemia (ST)	ND*	ND*	ND*	ND*
	Foulia (FT)	ND*	ND*	ND*	ND*
	Domia (DT)	ND*	ND*	ND*	ND*
Kafr Elsheikh	Humusia (HK)	ND*	ND*	ND*	ND*
	Semsemia (SK)	ND*	ND*	ND*	ND*
	Foulia (FK)	ND*	ND*	ND*	ND*
	Domia (DK)	ND*	ND*	ND*	ND*
Damietta	Humusia (HD)	ND*	ND*	ND*	ND*
	Semsemia (SD)	ND*	ND*	ND*	ND*
	Foulia (FD)	ND*	ND*	ND*	ND*
	Domia (DD)	ND*	ND*	ND*	ND*

*ND: not detected

** Every sample was identified using two uppercase letters. The first letter represents sample type (Semsemia (S), Foulia (F), Humusia (H) and Domia (D)) while the second one represents the governorate from which sample was purchased [(Cairo (C), Al-Fayoum (F), Damietta (D), Kafr Elsheikh (K), Tanta (Gharbia governorate) (T)], Egypt.

The results listed in Table 1 and Figure 1 indicated that Aflatoxins content of all evaluated samples was surprisingly under the detection limit of HPLC apparatus. These results indicate the safety and wholesomeness of evaluated samples. These results match with those observed by Scott and Kennedy (1973)**,** where they did not detect any aflatoxins in 24 samples of ground black or white pepper. Also, the findings of this study further support the idea of the presence of aflatoxins below the acceptable limit. Moreover, Gürbay *et al.* (2006) found that 59.3% of all investigated milk samples were positive to contamination with aflatoxin M1 which regarded as low contamination percentage. They also recorded only one sample that had contamination level higher than the permissible level (50 ng/L) in most European countries.

Contrarily, Lewis *et al.* (2005) found that 55% of 350 collected market maize samples had aflatoxin levels greater than the regulatory limit of 20 ppb. Moreover, they found that 35% of tested maize samples had aflatoxin levels equal to and greater than 100 ppb. O' Riordan and Wilkinson (2008) attributed the low levels of aflatoxins to implementing of good manufacturing practice (GMP) during processing which include: Implementing drying process in controlled zone that prevent the contact with several contaminants, applying preventative measures that limit the growth of molds throughout processing steps and storage, preventing moisture contamination through packing dried spices in hermetic clean packs. Gürbay *et al.* (2006) pointed out that at very low level of contamination, aflatoxins are not representing a serious problem on the public health at the moment; however, their risk on human health could be serious if the daily intake of mycotoxins in the presence of aflatoxins is taken into account.

Concentration of lead and copper

The concentration of analyzed metals revealed significant variability across the geographic spread of the sample points in the study area. Data in Table 2 reveal that the concentration of lead ranged between 0.02 to 0.71 ppm. The highest lead concentration (0.71 ppm) was detected in a HK sample which is higher than the maximum acceptable concentration of lead in children's candy which is stated to be 0.1 ppm as specified by Codex Alimentarius Commission (2011). Moreover**,** Codex Alimentarius Commission (2011) stated the maximum approved limit of lead is 0.2 mg/kg in cereal grains, except buckwheat, canihua and quinoa , canned chestnuts and canned chestnuts puree. However, the lowest lead concentration (0.02 ppm.) was detected in Domia Damietta sample which is in accordance with specified limit (Codex Alimentarius Commission, 2011)**.** Approximately, 25% of the tested samples are exceeding the maximum lead level (0.2 mg/kg) as specified by EOS-7136 (2010).

Table 2. The concentrations of copper and lead in various collected samples.

Governorate	Sample**	Lead (ppm)*	Copper (ppm)*
Cairo	Humusia (HC)	0.15±0.014	3.70± 0.282
	Semsemia (SC)	0.21±0.028	3.80±0.141
	Foulia (FC)	0.17±0.042	3.80±0.212
	Domia (DC)	0.13±0.028	0.62± 0.000
Fayoum	Humusia (HF)	0.19± 0.000	2.30±0.071
	Semsemia (SF)	0.16± 0.000	2.50±0.141
	Foulia (FF)	0.09± 0.014	2.30±0.028
	Domia (DF)	0.08± 0.000	1.37±0.014
Tanta	Humusia(HT)	0.17± 0.849	2.00± 0.000
	Semsemia (ST)	0.32± 0.014	2.80±0.339
	Foulia (FT)	0.50± 0.000	2.30±0.057
	Domia (DT)	0.18± 0.014	1.68± 0.000
Kafr Elsheikh	Humusia (HK)	0.71± 0.000	2.70 ±0.184
	Semsemia (SK)	0.06± 0.000	2.30 ±0.283
	Foulia (FK)	0.40± 0.057	2.54±0.212
	Domia (DK)	0.07± 0.001	1.20 ± 0.000
Damietta	Humusia (HD)	0.05± 0.000	2.20 ±0.169
	Semsemia (SD)	0.50± 0.042	2.80 ±0.141
	Foulia (FD)	0.13± 0.014	1.60 ±0.197
	Domia (DD)	0.02± 0.000	1.35±0.071

***The values are given as mean of two replicates. ± SD.**

** **Every sample was identified using two uppercase letters. The first letter represents sample type (Semsemia (S), Foulia (F), Humusia (H) and Domia (D)) while the second one represents the governorate from which sample was purchased [(Cairo (C), Al-Fayoum (F), Damietta (D), Kafr Elsheikh (K), Tanta (Gharbia governorate) (T)], Egypt.**

Lead is a dangerous element that moves from food to the body of the consumer through the food chain. The accumulation of lead in the body causes physiological damage such as mental retardation and lack of vital functions. lead is found in most factories waste, car residues (oils and gasoline), generators using heavy fuel, frequent operating hours and movement of vehicles in the area, and the frequent use of pesticides, which often dump their residues randomly in most areas of the region as well as the dumping of waste cars, batteries and tires indiscriminately in these agricultural lands (Abu-Almaaly, 2019; Su *et al*., 2014)**.**

Copper content of various samples was analyzed as these types of oriental confectionery products (Halewet El-Moulid) are prepared and produced in equipment made of copper. Data in Table 2 reveal that the concentration of copper ranged from 0.62 to 3.8 ppm. ATSDR (2004) limited the recommended dietary allowance (RDA) of copper for adults to be 0.9 mg/day. Moreover, the Food and Nutrition Board of the Institute of Medicine in Washington DC established the recommended dietary allowances (RDAs) of copper for children according to their ages to be 340, 440, 700 and 890 µg/day for children aged 1–3 years, 4–8 years, 9–13 years and 14–18 years, respectively (de Romaña *et al*., 2011 and Russell *et al*., 2011). The copper content of investigated samples is high, and some samples exceed the maximum permissible limits. According to ATSDR (2004) consuming excessive amounts of copper induce several adverse health effects such as anemia, liver and kidney damage, developmental toxicity and immunotoxicity (Russell *et al.*, 2001)

The obtained results showed that the highest concentration of copper (3.8 ppm) was detected in Semsemia and Foulia samples purchased from Cairo governorate whereas the lowest concentration of copper (0.62 ppm) was found in Domia purchased from Cairo governorate. Our findings are in agreement with that reported by Cevik *et al*. (2009)**.** They were working on Hazelnut in Turkey and they found that the concentration of Cu ranged from 56 to 320 ppm in the kernel and from 18 to 157 ppm in the peel of the samples**.** Cherfi *et al.* (2014) investigated the Cu content of fruits and vegetables sold in Algeria, and they recorded that Cu concentration in potatoes ranged from 4-29.49 mg/kg dry wt.**;** However, Arigbede and Dawodu (2019) didn't detect copper in any of the biscuit samples.

Peroxide value (PV) and acid value (AV) of isolated oils from hard confectionery samples (Halwa El-Moulid)

The oils of semsemia and foulia samples were extracted using hexane and their PV and AV are listed in Table 3. Peroxides are the initial reaction products of lipid oxidation and responsible for primary oxidation. The peroxide value is a good indicator of lipid oxidation under normal conditions. Peroxides are high active intermediate compounds that can be speedily transformed to free radicals. The presence of peroxides stimulates oxidation reactions which lead to deterioration of foods. In addition, consuming the food containing these peroxides has adverse effect on body tissues of the consumer which usually appear as chronic signs. Several studies reported that consuming of rancid oils induce carcinogenicity, teratogenicity, cytotoxicity, inflammatory diseases, liver disease, cardiovascular disease, abdominal pain, nausea and vomiting, aging and diarrhea, headache and weakness and lethargy, etc.

Table 3. Peroxide value (PV) and acid value (AV) of isolated oils from Hard Confectionary samples (Halawet El-moulid)

Governorate	Sample**	peroxide value (meq./kg)	Acid value (mg KOH/g)
Fayoum	Semsemia (SF)	4.75 ± 0.28	2.34 ± 0.32
	Foulia (FF)	29.15 ± 0.49	5.94 ± 0.44
Tanta	Semsemia (ST)	2.67 ± 0.31	4.00 ± 0.28
	Foulia (FT)	22.97 ± 4.06	1.60 ± 0.08
Cairo	Semsemia (SC)	14.53 ± 0.98	19.06 ± 0.27
	Foulia (FC)	36.87 ± 1.76	5.87 ± 0.54
Damietta	Semsemia (SD)	ND*	5.57 ± 0.54
	Foulia (FD)	4.98 ± 0.39	7.16 ± 0.98
Kafr Elsheikh	Semsemia (SK)	3.07 ± 0.26	7.65 ± 0.80
	Foulia (FK)	7.21 ± 0.45	10.12 ± 0.19

*ND: not detected

** Every sample was identified using two uppercase letters. The first letter represents sample type (Semsemia (S), Foulia (F)) while the second one represents the governorate from which sample was purchased [(Cairo (C), Al-Fayoum (F), Damietta (D), Kafr Elsheikh (K), Tanta (Gharbia governorate) (T)], Egypt.

In Table 3 the obtained results show that peroxide values of 5 (50 %) tested extracted oils samples were higher than the acceptable limit. Peroxide value of refined or cold pressed and virgin oils is up to 10 and 15 milliequivalents of active oxygen/kg oil, respectively (EOS 7985, 2015; CODEX STAN 210-1999). Similarly, the same data show that AV in 7 (70%) of the extracted oil samples was higher than the standard limit which is 4.0 mg KOH/g fat or oil**,** (EOS 7985, 2015; CODEX STAN 210-1999)**.**

High PV and AV in the extracted oil samples in the present study regardless of the oil type indicate the onset of oxidation in oils and progress of oil deterioration.

Microbiological risk assessment of cream cake

The microbiological analyses of all samples are shown in Table 4. According to the analysis none of the tested samples were positive for *Salmonella*. Which is compatible with the EOS-1599, (2005). Also, these findings are in agreement with those reported by Johannessen *et al.* (2002), Lindblad *et al.* (2006) and Siriken *et al.* (2009)**.** They did not record any of *Salmonella* in their studies of various products such as meatball, cream cake, Turkish delight, fresh produce and broiler chickens. Also, the obtained results show that there was no detection of fungal growth that matches what is stated in EOS-4037(2005). On the contrary, total bacterial count, total coliform count, fecal coliform count, *staphylococcus*, *Bacillus cereus*, and total yeast count for all samples were unsatisfactory as specified by ICMSF (1996), and the related Egyptian standards (EOS 1599, 2005)

Table 4. Overview of unsatisfactory/unacceptable rates by tested samples for individual microbial parameter

Microbial hazard	SS1	SS2	SS3
Total bacterial count (Cfu/g)	$32\pm2\times10^6$	$28\pm 2\times10^5$	$35\pm5\times10^4$
Total Coliform Count(Cfu/g)	2×10	$7\pm 1\times10$	$30\pm12\times10^2$
Fecal Coliform Count (Cfu/g)	2×10	$3\pm 1\times10$	$20\pm2\times10^2$
***Salmonella* detected**	ND*	ND*	ND*
Staphylococcus detected **(Cfu/g)**	$21\pm3\times10^6$	$12\pm 2\times10^5$	$55\pm5\times10^3$
Bacillus cereus detected **(Cfu/g)**	$>10^3$	$>10^3$	$30\pm2\times10^2$
Total Fungal (Cfu/g)	ND*	ND*	ND*
Total Molds and Yeast Count(Cfu/g)	$17\pm3\times10^4$	$13\pm 1\times10^4$	$16\pm1\times10^4$

*ND: not detected

Coliform bacteria in investigated samples are traditionally correlated to fecal contamination. Johannessen *et al*. (2002) stated that Toxicogenic *S. aureus* is a major cause of food intoxications. Staphylococci are usually found on human skin and nasal membranes which might contaminate the products during handling and distribution when the conditions are suitable for bacterial growth and toxin production. *Staphylococcus* detected in the tested cake samples were detected at the unsatisfactory level (ICMSF, 1996)**.** Food contamination of *Staph.* spp. is mainly a result of contact with skin, so it indicates very poor good hygienic practices (GHP). *Bacillus cereus* detected in the three tested cream cake samples were found in high level $>10^3$ cfu/g as specified by ICMSF (1996)**.** In addition, increasing these bacterial counts to levels $\geq10^4$ is considered as potentially hazardous as consumption of food with this level of contamination may cause food borne illness. The results of *S. aureus* and *B. cereus* match those recorded by Meldrum *et al.* (2006) who also found them in unsatisfactory levels.

It can be observed from the results of the total yeast count exceeded the limits stated in EOS-1599 (2005) which is not exceeding 100 cell/g for the total molds and yeast count. Yeasts encountered at this study can be problems mainly in intermediate and high moisture bakery products. However, due to the short holding period of cakes, these groups of microorganisms may have no ecological role other than indicating gross contamination of the cakes. However, the high counts of microbial load indicated very unhygienic practices in the preparation and handling of the cakes.

Conclusion

The current study showed that aflatoxin contamination in tested samples (Halewet El-Moulid) was not detected; however, their copper and lead contents were exceeded the maximum specified limits by Local organizations such as Egyptian organization for standardization (EOS) as well as International ones such as (FAO, WHO and ATSDR,…etc.) . In addition, the peroxide value of 50% of isolated oils from samples containing high oily seeds was higher than the acceptable limit. Moreover, despite salmonella and fungal counts, all the microbiological indicators of investigated cream cake samples were unacceptable. These results indicate the lack of applying safety programs and the necessity of imposing safety programs during processing, storage, and retail of food products to insure their wholeness and safety.

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تقييم المخاطر المختلفة الموجودة في حلوى المولد والجاتوه التي يتم تداولها في السوق المصري المحلي

تقوم الدراسة الحالية على التحقق من سلامة حلوى المولد و الجاتوه التي يتم تداولها في السوق المصري المحلى . لذا تم تجميع أربعة أنواع من عينات حلوى المولد من خمس محافظات بالإضافة الى ثلاثة أنواع من حلوى الجاتوه ، وتم تقييم المخاطر الكيميائية والميكروبيولوجية المحتملة للعينات التي تم جمعها. و قد أظهرت النتائج عدم إحتواء جميع عينات حلوى المولد على الأفلاتوكسين (السموم الفطرية). وتفاوت محتواها من الرصاص والنحاس بين 0.02 – 0.71 و 0.62 – 3.8 جزء في المليون على التوالي. علاوة على ذلك ، فإن 50٪ من الزيت المستخرج من العينات المحتوية على بذور زيتية (مثل السمسمية و الفولية) كان يحتوي على رقم بيروكسيد أعلى من الحد الأقصى المقبول . على الرغم من خلو عينات الجاتوه من السالمونيلا والفطريات ، فإن جميع الإختبارات الميكروبيولوجية الاخرى التى تم الكشف عنها كانت نتائجها غير مقبولة. تشير هذه النتائج إلى ضرورة فرض تطبيق برامج السلامة على المنتجات الغذائية أثناء تصنيعها وتخزينها وبيعها بالتجزئة.

الكلمات المفتاحية: حلوى المولد ، المخاطر الكيميائية ، المخاطر الميكروبيولوجية ، الأفلاتوكسين ،الجاتوه