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MICROBIOLOGICAL AND CHEMICAL EVALUATION OF LUNCHEON MEAT SOLD IN GIZA AREA (EGYPT)

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ABSTRACT

A total of 72 samples of luncheon meat were randomly collected from different retail outlets in Giza city, Egypt. The samples were examined chemically for moisture content, total ash content and thiobarbituric acid (TBA); and microbiologically for the count of total aerobes, total mould and yeast, psychrophilic bacteria, *Staphylococcus aureus*, *Bacillus cereus* and *Salmonella* and *Shigella*. As well, most probable number (MPN) count was performed for *coliform* and *E. coli*. The mean values of moisture content, total ash content and thiobarbituric acid (TBA) for the examined samples were 59.84%, 3.43% and 0.64 mg/kg, respectively. For total aerobes, total mould and yeast, Psychrophilic bacteria, *Staphylococcus aureus*, *Bacillus cereus* and *Salmonella* and *Shigella* the mean values were 5.48, 3.91, 4.07, 2.34, 3.87 and 0 log cfu/g sample, respectively. The MPN count of coliforms varied greatly in positive samples from 6.20 to 460 and from 3 to 43 MPN/g sample respectively. According to the Egyptian standards, most of the examined samples (100%) had *Salmonella* and *Shigella* values complied with limits of the standard. As for total aerobic, *Staphylococcus aureus* total mould and yeast counts 79.19, 90.27 and 19.4% of the examined samples were not complied with the standards. The results declared that the hygienic quality of luncheon meat available in Giza retail markets is not satisfactory and not comply with the standards.

Keywords: Microbiological, luncheon meat, chemical evaluation

Introduction

Meat is highly valued food product for human consumption because it is a good source of all essential amino acids and a major source of B-complex vitamins, minerals. The intrinsic properties of fresh meat including relatively high water activity, slightly acidic pH and the availability of carbohydrates (glycogen) and protein make it a good substrate for microbial growth and consequently it is a highly perishable commodity. Therefore, the shelf life of meat products is limited by enzymatic and microbiological spoilage (Islam *et al.,* 2010).

The Ready-to eat meats, beef burger, sausage and luncheon are a high risk food group, since they are often consumed without a cooking step. Luncheon is traditionally produced as industrially vacuum-packaged loaves, and afterwards is sliced and repackaged at retail stores; therefore the product may be exposed to the contamination hazard at any time (Mottin *et al.,* 2011).

Luncheon is emulsion type product containing minced meat forming emulsion with oil and fat by help of salt and filling material (Leygonie *et al*., 2012). Also, meat luncheon generally containing finely chopped meat and fat with or without some added grains treated with spices, salt, nitrite and heat processed. Luncheon has a high spread in the world due to their high nutritional value, acceptable price, agreeable taste and easy during eating (Kdous *et al*., 2016).

In recent years, foodborne infections and intoxications have assumed significance as a health hazard. The presence of pathogenic and spoilage microorganisms in meat products remains a significant concern for suppliers, consumers and public health officials worldwide. Bacterial contamination of these foods depends on the bacterial level of the meat used as the raw product, the hygienic practices during manipulation and on the time and temperature of storage (El-Leithy and Rashad, 1989). *Mesophiles, psychrotrophs, coliforms, Escherichia coli* and *Staphylococcus aureus* have been tested in meat products to assess microbiological safety and sanitation conditions during processing and keeping quality of product (Bean and Griffin, 1990).Therefore, it is important to prevent the hazards and to provide a safe and wholesome product for human consumption (Singh *et al*., 1984).

Thus, the aim of this study was to evaluate microbiological contamination occurring in luncheon meat sliced and packaged at supermarkets to assess the hazard of this kind of product for consumers.

Materials and Methods

Collection of Samples

A total of 72 samples of luncheon meat were randomly collected from different supermarkets at different production dates in Giza city, Egypt. The samples were taken and transferred directly to the laboratory under complete aseptic conditions without undue delay and subjected to the following examinations.

Chemical Analyses

Moisture content (%) and total ash content (%) were determined according to AOAC (2005). Lipid oxidation was evaluated on the basis of changes in Thiobarbituric acid-reactive substances (TBARS). Thiobarbituric acid values (TBA) were performed in triplicate. The procedure for measurement of TBARS was based on methods used by Delgado Pando *et al*. (2011).

Microbiological Examination

For each sample, 10 g were aseptically weighed in a sterile stomacher bag (Seward, London, UK), then homogenized in stomacher (Laboratory Blender, London, UK) with 90 ml of sterile peptone water 0.1 % (w/v) (Merck, Germany) for 2 min. Further decimal dilutions were prepared in 9 ml volumes of 0.1 % (w/v) peptone water and microbiological analyses were made using pour plate method (ICMSF, 1996). Total aerobic bacterial count (TABC) on Plate Count Agar (PCA) (Merck, Germany), incubated at 30 °C for 48 h; Coliforms and *E. coli* most probable number "MPN" counts were done following the procedures described in AOAC (1995). Staphylococci on Baird Parker Agar (BPA) (Merck, Germany) supplemented with Egg Yolk Tellurite Emulsion (Merck, Germany) incubated at 37°C for 2 d; yeast and mold on Rose Bengal Chloramphenicol agar (Merck, Germany) supplemented with Chloramphenicol Supplement (Merck, Germany) incubated at 25°C for 5 d; Psychrophilic bacterial count on Plate Count Agar (PCA) (Merck, Germany), incubated at 7 °C for 10 d and Salmonella on Salmonella Shigella agar (SSA) (Merck, Germany), *Bacillus cereus* was counted on selective agar base (Atlas, 2010) at 37°C for 72 h. *Bacillus cereus* grow as moderate-sized (5mm) colonies, which was turquoise, surrounded by a precipitate of egg yolk and turquoise (Ronald, 2010).

Results and Discussion

Chemical examination for deterioration criteria of examined luncheon samples

The seventy two samples of beef luncheon were chemically analyzed to determine the moisture content, total ash and thiobarbituric acid (TBA). The obtained results are shown in Table 1.

Table 1: Moisture content, total ash and thiobarbituric acid (TBA) for the examined luncheon samples (n*=72)

Item	Minimum	Maximum	Mean	E.O.S*
Moisture content %	54.96	66.45	59.84	Up to 60 %
Total ash %	3.15	4.22	3.43	Up to 3.5 %
TBA (mg malonaldehyde/kg)	0.46	0.71	0.64	0.9

*E.O.S (Egyptian Organization Standardization, 2005)

The results in Table (1) indicated that, the moisture content of luncheon samples ranged between 54.96 % and 66.45% with a mean value of 59.84 %. These results are in agreement with those recorded by Egyptian Organization Standardization (2005).

Ragab *et al.* (2019) mentioned that the moisture contents of luncheon samples from different companies ranged between 65.61 and 68.29 %.

Ash content of beef luncheon samples ranged between 3.15 and 4.22 % with a mean value of 3.43 %. The obtained ash content in the current study seems to be nearly similar to that specified by E.O.S, as well as with those detected by Ragab *et al.* (2019) since they observed that ash content ranged from 3 to 5.49% with mean value 3.8%.

TBA values may be considered as a useful quality index for the assessment of rancidity during storage of meat products (Edris *et al.*, 2012). TBA values of beef luncheon samples ranged between 0.46 and 0.71 mg/kg sample. These results are in agreement with those obtained by Kdous *et al.* (2016). They observed that TBA values ranged from 0.26 to 0.35 mg malonaldehyde/kg sample. The values of TBA were in the permissible level stated by Egyptian Organization Standardization (2005) which limited the content of TBA values in some meat products must be not over than 0.9 mg malonaldehyde/kg sample.

Microbial examination of beef luncheon samples

Contamination of meat products by bacteria can be due to the poor sanitation applied in the factories, the poor technology adopted more manual handling of the product and manual filling and absence of the tunnel freezing of the product which may reduce the propagation of bacteria during the phase of preparation (Cohen *et al.*, 2007). Table 2 shows the total plat count, total mould and yeast, psychrophilic bacteria and coliform group (log cfu/g) of the examined luncheon samples.

Table 2: Values of total aerobic bacterial count, total mould and yeast, psychrophilic bacteria and coliform group (log cfu/g) of the examined luncheon samples (n*=72)

Microorganism	Positive Samples		Minimum	Maximum	Mean
	No.	%			
Total aerobic bacterial count	72	100	4.70	6.46	5.48
Total Mold and Yeast	67	93	2.32	5.30	3.91
Total Psychrotrophic bacterial count	72	100	3.69	5.28	4.07
Coliform Group	64	88	0.79	2.66	1.96

The total aerobic bacterial count is tended to indicate the level of microorganisms in products (FDA, 2001). The obtained results are shown in Table 2 which indicated that the total aerobic bacterial count (log cfu/g) in the examined beef luncheon samples ranged from 4.70 to 6.46 with a mean value of 5.48 log cfu/g, also all of the examined samples were positive for total aerobic bacterial count. The result achieved in Table (5) illustrated that 79.1 % of the examined

beef luncheon samples exceeded the permissible limit recommended by EOS, 1651 (2005) which stated that the permissible limit of total plate count was 10^4 cfu/g. This high value of the total bacterial count of some meat products such as luncheon because of luncheon is a good medium for bacterial growth (Nowak and Krysiak, 2005).

Mold and yeast count is used as an index of the proper sanitation and high quality products (Samaha *et al.*, 2016). Data presented in Table (2) showed that mold and yeast count of luncheon samples ranged between 2.32 and 5.30 with a mean value of 3.91 log cfu/g. By contrast, mold and yeast count was higher than that recorded by Mousa *et al.* (2014), who found that mold and yeast count of luncheon samples ranged from 1.60 and 4.23 with a mean value of 2.08 log cfu/g. The result achieved in Table (5) illustrated that 19.44 % of the examined beef luncheon samples exceeded the permissible limit recommended by EOS, 1651 (2005) which stated that the permissible limit of mold and yeast count was 10^2 cfu/g.

Psychrotrophic bacteria are the main cause of spoilage of meat products which are kept under refrigeration temperature due to their ability to grow at low temperature. Total Psychrotrophic bacterial count can provide useful information about the keeping quality of some meat products (Mousa *et al.,* 2014). Table (2) revealed the total Psychrotrophic bacterial count of the examined luncheon samples ranged between 3.69 and 5.28 log cfu/g with a mean value of 4.07 log cfu/g. These results are higher than that found by Mousa *et al.* (2014).

Table 3: Values of *Staphylococcus aureus*, *E. coli*, *Bacillus cereus* and *Salmonella & Shigella* (log cfu/g) of the examined luncheon samples (n*=72)

Microorganism	Positive Samples		Minimum	Maximum	Mean
	No.	%			
Staphylococcus aureus	64	88	1.95	3.06	2.34
E. coli	8	11	2.25	3.64	1.39
Bacillus cereus	72	100	2.54	4.18	3.87
Salmonella and Shigella	0	0	0	0	0

The tabulated data in Table (3) showed that the *Staphylococcus aureus* count (log cfu/g) in luncheon samples ranged between 1.95 and 3.06 log cfu/g with a mean value of 2.34 log cfu/g. The incidence of Staphylococci in meat product may be attributed to contamination of the raw meat from surrounding environment especially meat handlers as Staphylococci are a human nasal flora and suppurated wounds. Also, it is risky to allow workers with infected hands to handle the processed meat as mentioned that the workers risk confined to the possibility that they can get pathogen on their hands from contaminated products then transferring these organisms back into the processing environment (ICMSF, 1980).

The result achieved in Table (5) illustrated that 90.27 % of luncheon samples were exceeded the permissible limit (sample should be free) according to safe permissible limits stipulated by EOS 1651 (2005).

B. cereus, a Gram-positive, rod shaped endospore-forming bacteria is an important cause of food-borne illness in humans and is frequently involved in food-borne outbreaks (Hall *et al.*, 2001). Also, *B. cereus* can pose a serious hazard to the meat industry, since a mild heat treatment cannot guarantee its complete inactivation. Table (3) revealed that the *B. cereus* count (log cfu/g) of examined luncheon samples ranged between 2.54 and 4.18 log cfu/g with a mean value of 3.87 log cfu/g.

The obtained results are lower than that obtained by Abostate *et al.* (2006) who counted total bacilli in meat luncheon, chicken luncheon in Cairo and Giza, Egypt being 1.66 x10^5 cfu/g (5.22 log cfu/g) and 7.53 x 10^4 cfu/g (4.87 log cfu/g), respectively.

Salmonella and *Shigella* spp. (Table 3) was not detected in all samples. The results are in the permissible limit of E.O.S. (2005) of luncheon meat "sample should be free" (Table 5). So that, these samples are accepted according to the E.O.S. (2005). The obtained results are similar to that obtained by Hassanien (2004) who did not found *Salmonella* and *Shigella* in luncheon samples. On the other hand, the obtained results are in disagreement with that obtained by Karmi (2013) who isolated *Salmonella sp*. from luncheon Aswan, Egypt.

Table 4: Values of total coliform and *E. coli* (MPN/g) of the examined luncheon meat samples (n=72).

Microorganism	Positive Samples		Minimum	Maximum	Mean
	No.	%			
Coliform	64	88	6.20	460.00	38
E. coli	8	11	3.00	43.00	7.4

As recorded in Table 4, out of the 50 examined samples 64 (88%) and 8 (11%) were positive for coliforms and *E. coli* MPN counts, respectively. The MPN counts for the previously mentioned microorganisms in the positive examined samples were ranged from 6.2 to 460 and 3 to 43 MPN/g; with mean values of 38 and 7.4 MPN/g sample for coliforms and *E. coli*, respectively.

The presence of coliforms in meat products (luncheon) indicates non-sanitary conditions during production (Tawfeek *et al.,* 1989). The present coliforms and *E. coli* MPN counts were >3 in 88 and 11% of the examined samples, respectively. Higher incidences were detected by Abd-ElShahid and Ibrahim (2010); and Abd-Allah *et al.* (2012) for coliforms, which were 68 and 100%, respectively.

Escherichia coli were detected at higher rates by El-Safey and abdul-Raouf (2003). Nearly similar rates for *E. coli* were recorded by Saleh *et al.* (2010) and Abd-Allah *et al.* (2012).

Table 5: Egyptian Organization Standardization limits for luncheon meat (E.O.S., 2005).

Item	The standard limit	Samples within the standard limit		Samples above the standard limit		Total number
		No.	%	No.	%	
Total aerobic bacterial count	10^4	15	20.83	57	79.16	72
Mold and yeast	10^2	58	80.55	14	19.44	72
Coliform Group	10^2	8	11	64	88	72
E. coli	Free	64	88	8	11	72
Staphylococcus aureus	Free	7	9.72	65	90.27	72
Salmonella & Shigella	Free	72	100	0	0	72

Conclusion

Based on the study, it could be concluded that all of the luncheon meat samples gathered from some of the markets, generally could not meet one or some of the strictly requirements of the bacteriological properties in the Egyptian standard. There were no present Salmonella and Shigella bacteria in all of the luncheon meat samples.

Conflict of Interest

The authors declared that present study was performed in absence of any conflict of interest.

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Author Contributions

Khalaf-Allah A. M., Galal M. Khalafalla and Mohamed E. Abdel-Aziz contributed in the research idea and designed the experiments and reviewed the manuscript. Ibrahim, M. Abdellatif processed the experiments also wrote the manuscript. All authors read and approved the final version.

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