

MICROBIOLOGICAL AND CHEMICAL ANALYSES OF SAUSAGE AND LUNCHEON SAMPLES COLLECTED FROM SOME SUPERMARKETS IN MANSOURA CITY.



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ABSTRACT

The present work was carried out to be ensured that the microbiological and chemical analyses of the collected samples of sausage and luncheon are safe for human consumption and in high quality for human nutrition or not, Microbiological analysis revealed that total bacterial count in luncheon sample ranged from 3.6×10^4 to 222.0×10^4 cfu/g. Most samples showed exceeding for the maximum limit (10^5). The total fungal count ranged from 0.31×10^2 to 240×10^2 cfu/g. *lipolytic* and *proteolytic* bacteria ranged from 0.0 to 55.7×10 and from 0.21 to 91.3×10^4 cfu/g respectively. Counts of *Enterobacteriaceae* members ranged from 0×10^2 to 157.7×10^2 cfu/g. The count of coliform organisms ranged from 0.05×10^4 to 40×10^4 cfu/g, *Salmonella* & *Shigella* were detected in 37.5% of the samples and *Clostridium* was detected in 50% of the samples. Furthermore, *Listeria* and *Staphylococcus* were detected in 68.75 and 87.5% of the samples, respectively. Counts of coliform ranged from 2.37×10^3 to 251.3×10^3 cfu/g. Microbiological results of sausage samples revealed that the values of total bacterial count ranged from 0.13×10^5 to 221.0×10^5 cfu/g. Fungal count ranged from 0.0 to 40.7×10^2 cfu/g. Lipolytic bacteria counts ranged from 0.0 to 234.3×10 cfu/g. Proteolytic bacteria counts ranged from 0.55×10^4 to 261.33×10^4 cfu/g. *Enterobacteriaceae* members count ranged from 0.35×10^3 to 225.0×10^3 cfu/g, *Salmonella* & *Shigella* were negative in all samples except two samples. About 53% of the examined samples were contaminated by *Clostridium* while only three samples (23%) were free from *Listeria monocytogenes*, all samples were contaminated with *Staphylococcus* except two sample. For chemical composition, all luncheon samples had moisture content up to 58.0%. The highest ash content was 6.72% in luncheon sample B₄ while the lowest value represented in sample B₁ being 5.11%. pH values of the collected luncheon samples are around 5.9 to 6.4. (Rabie, 2010). The values of TVN were ranged from 11.63 and 13.06 mg/100gm sample. (NPN) were varied from 0.18 to 0.39 and SPN did not exceed 0.5%, while TSN ranged also from 0.44 to 0.69%. All obtained value for the content of malondhyde of fat for some collected luncheon products did not exceed 3.0 mg malondhyde kg/oit. Chemical analysis of sausage samples showed that the moisture values ranged from 53.62 to 56.75%, Samples of A scored the highest value of fat being 46.07% . Protein ranged from 20.69 to 33.19%, TBA values also in the same level. pH values of the samples are around 6.15 and 6.61. Finally, samples of luncheon and sausage were chemically in accordance with the Egyptian Standard Specification (2005_b) but from microbiological view most of the samples were not safe.

Keywords: Luncheon, Sausage, Pathogenic bacteria.

INTRODUCTION

Meat and meat products present an ideal substrate supporting the growth of several spoilage and pathogenic bacteria. Intrinsic factors of meat

such as pH and water activity are not inhibitory to growth of such organisms owing to their neutral and high initial values respectively (Matorogas *et al.*, 2008), The growth of microbes such as bacteria yeasts and molds deteriorate the safety and quality of food products and cause significant economic loss (Asefa *et al.*, 2010), Pathogenic bacteria could be found in fresh meat as well as other foods and can be transmitted to consumers and occupationally exposed persons. Meat products have been implicated in the human pathogens such as *Staphylococcus aureas*, *salmonella spp.*, *Listeria monocytogenes*, *E. coli* and *Clostridium perfringens* (Alboronz *et al.*, 1995), The sample which have high numbers of spoilage microorganisms become spoiled and infect for human consumption ,Ouf (2004) evaluated the load in sample of burger, kofta, minced meat and sausages. He reported that, the incidence rate of *E.coli* , *Salmonella spp.* and *Staphylococcus aureas* in the examined minced meat samples were 20%, 0%, 20% and 10% of total count in all examined sample, Many products of meat are sold in the supermarkets in Mansoura city, 13 samples of sausage and 16 samples of luncheon from three different supermarkets were collect during four months, The aim of research is to:

- (1) Determining the occurrence of pathogenic and non-pathogenic microorganisms in luncheon and sausage products.
- (2) Evaluating the chemical analysis of the two products.
- (3) Deciding whether the two products are safe for human consumption and in high quality for human nutrition or not.

MATERIALS AND METHODS

Materials:

Sausage and Luncheon samples were collected from three supermarkets in Mansoura city. The samples represented three famous companies for meat products Chemicals and media used for chemical and microbiological examinations were obtained from oxoid,

Samples preparation for microbial examination:

Samples were maintained into ice box to the laboratory. Twenty five gram of each sample were homogenized for 21 min in 225 ml sterile physiological saline supplemented by 0.1% peptone. From these homogenates decimal dilutions were made and microbiological analyses were done (Andrews and June, 1998).

Microbiological Evaluation:

- Total bacterial counts were performed using Wehr & Frank medium (2004).
- Total coliform counts were done using brilliant green bile agar medium according to (Downes and Ito, 2001).
- *Enterobacteriaceae* counts were performed using violet red bile glucose agar according to Mossel *et al.* 1995.
- *Salmonella and Shigella* counts were done using X.L.D. agar medium according to McCarthy, (1966).

- *Listeria* was counted on *Listeria* Oxford Base medium and Oxford *Listeria* supplement according to Van Netten *et al.* (1991), after cultivation on *Listeria* enrichment broth (Van Netten *et al.*, 1991).

Chemical Analyses:

- Moisture, crude protein, crude fat were determined using AOAC (2000) methods.
- Carbohydrates were calculated by difference (Turhan *et al.*, 2005) as follows:
% carbohydrate = 100 – (% moisture + % protein %ash + % fat).
- Thiobarbituric acid value was determined according to the method of Lemon (1975).
- Total volatile basic nitrogen (T.V.B.W) was determined according to the method described by Malle and Tao (1987).
- Nitrogen compounds: total nitrogen and soluble protein nitrogen were determined according to El-Gharabawi and Dugan (1965).
- Total soluble nitrogen (T.S.N) was determined according to the method of A.O.A.C (2000).
- Non protein nitrogen (N.P.N) was determined according to Bodwell and McClain (1971), it was calculated using the following equation:
N.P.N = T.S.P – S.P.N
- pH value was measured according to the method of Lima Dos Santos, (1981).

RESULTS AND DISCUSSION

Results in Table 1 revealed that the values of total bacterial counts in Luncheon samples ranged from 3.6×10^4 to 222.0×10^4 cfu/g. All samples showed exceeding for the maximum limit (10^5). Results are in agreement with those obtained by Rabie, (2010) and disagreement with El-Gazar, (1997). The total fungal count ranged from 0.31×10^2 to 240×10^2 cfu/g, As regard to lipolytic and proteolytic bacteria, the highest values were 65.7×10 and 62.3×10^2 cfu/g, respectively. Generally, the counts of proteolytic bacteria were higher than of lipolytic bacteria. On *Enterobacteriaceae*, data showed that counts ranged from 0×10^2 to 157.7×10^2 cfu/g, two samples recorded the absence of *Enterobacteriaceae* organisms, Results in Table 2 showed count of some pathogenic bacteria in luncheon samples. As can be seen in the same Table, *Salmonella* & *Shigella* were detected in 37.5% of the samples and Clostridium was detected in 50% of the samples. Furthermore, *Listeria* and *Staphylococcus* were detected in 68.75 and 87.5% of the samples, respectively. Five samples exceeded the maximum level of the Staphylococcus Count of coliform ranged from 2.37×10^3 to 251.3×10^3 cfu/g. All samples exceeded the maximum level.

Table 1: Counts of some microorganisms in Luncheon samples.

Sample No.	Code of company	Collection date	Total bacterial count 10 ⁴	Total Fungi 10 ²	Lipolytic bacteria 10 ¹	Proteolytic bacteria 10 ⁴	Enterobacteriaceae 10 ²
1	AI	15/4	3.60	0.31	1.20	1.97	7.57
2	AI	30/4	209.3	15.00	55.7	18.63	0.00
3	AI	10/5	10.73	0.27	1.23	4.83	30.3
4	AI	10/6	93.70	0.33	0.31	4.43	156.3
5	AI	2/7	222.0	1.30	0.26	8.00	11.90
6	BI	15/4	5.10	0.27	0.27	2.73	0.00
7	BI	30/4	28.00	24.00	65.7	4.67	15.30
8	BI	10/5	138.3	0.13	4.80	91.30	33.70
9	BI	25/5	30.30	2.00	1.54	16.63	157.7
10	BI	10/6	102.0	12.00	0.00	47.70	152.3
11	BI	2/7	30.30	1.30	0.59	17.70	10.10
12	CI	15/4	3.93	7.10	1.40	1.67	1.03
13	CI	30/4	180.0	30.7	20.0	16.37	0.00
14	CI	10/5	62.70	0.37	2.00	62.30	18.3
15	CI	10/6	4.40	0.70	0.00	1.26	31.3
16	CI	2/7	3.13	8.70	0.00	0.21	8.13
Standard			1.00	-	-	-	1.00

Table 2: Counts of some pathogenic bacteria in Luncheon samples.

Sample No.	Code of company	Collection date	Salmonella & Shigella	Clostridium perfringens	Listeria	Staphylococcus 10 ²	Total coliform 10 ²
1	AI	15/4	N	P	P	0.80	2.37
2	AI	30/4	P	N	P	0.87	251.3
3	AI	10/5	P	N	P	0.50	14.7
4	AI	10/6	P	P	P	1.57	11.93
5	AI	2/7	N	N	N	1.17	23.7
6	BI	15/4	N	P	P	0.77	3.47
7	BI	30/4	N	P	P	0.90	112.0
8	BI	10/5	N	N	P	0.83	246.7
9	BI	25/5	N	N	N	0.00	3.97
10	BI	10/6	P	P	P	1.27	21.93
11	BI	2/7	N	N	N	1.80	12.63
12	CI	15/4	P	P	P	0.87	11.40
13	CI	30/4	N	P	N	0.93	225.3
14	CI	10/5	P	P	P	0.40	93.3
15	CI	10/6	N	N	P	1.50	3.67
16	CI	2/7	N	N	N	0.00	3.73
Standard			N	N	N	1.00	1.00

N: negative

P: positive

Chemical composition of collected luncheon samples was presented in Table 3. Obtained results for all collected luncheon samples had moisture content up to 58.0%, these results are in accordance with the permissible limit by (EOS, 2005) which indicated the moisture content being 55%. Concerning the data of ash, it could be noticed that the highest ash content being 6.72 and the lowest value being 5.11%. Furthermore, pH values of collected luncheon samples around 5.9 to 6.4, these obtained values of pH due to the addition of curing agents within luncheon processing such as acidifiers, organic substances. The obtained results are in accordance with Rabie, (2010), The values of TVN were ranged from 11.63 and 13.06 mg/100gm sample. The obtained values did not exceed the legal limit of the EOS, (2005) which showed that the value of TVN is not more than 20 mg/100gm . In addition, (NPN) were varied from 0.18 to 0.39 and SPN did not exceed 0.5% while TSN ranged also from 0.44 to 0.69%. All obtained values for the content of malonldhyde of fat for some collected luncheon samples did not exceed 3.0 mg malonldhyde/kg oil.

Results in Table 4 revealed that the values of total bacterial count in sausage samples ranged from 0.13×10^5 to 221.0×10^5 cfu/g, Four samples exceeded the maximum level (10.0×10^3 cfu/g). Fungi were not detected in sample No. 5 and No. 10, and counts ranged from 0.0×10^2 to 20.7×10^2 cfu/g. Lipolytic bacteria were not found in samples No. 2, 8 and 13, while the highest number (234.3×10) was found in sample No.13 followed by sample No.3 (163.3×10). Proteolytic bacteria counts showed that the count ranged from 0.55×10^4 to 261.33×10^4 cfu/g. The highest value (261.33×10^4 cfu/g) recorded in sample No.3 and followed by sample No.13 (216.67×10^4 cfu/g). Data on Enterobacteriaceae counts revealed that sample No. 5. is free while counts of the other sample ranged from 0.35×10^3 to 225.0×10^3 cfu/g, Results in Table 5 showed counts of some pathogenic bacteria in the samples of sausage. Data showed that *Salmonella* & *Shigella* were negative in all samples except samples No. 9 and 10. On the other hand, 61.53% of the samples were contaminated with *Clostridium*, only three samples (23%) were free from *Listeria monocytogenes* while the others (77%) were positive.

Results of *Staphylococcus* counts revealed that, all samples were contaminated with *Staphylococcus* except samples No. 8 and 13. Data also revealed counts of coliform organisms ranged from 0.05×10^4 to 40×10^4 cfu/g. All samples except samples No 4,5 and 10 exceeded the maximum level of coliform count.

Table 4: counts of some microorganisms in Sausage samples

Sample No.	Code of company	Collection date	Total bacterial count 10 ⁵	Total Fungi 10 ²	Lipolytic bacteria 10 ¹	Proteolytic bacteria 10 ⁴	Enterobacteriaceae 10 ²
1	As	1/4	0.58	0.13	6.00	2.17	0.55
2	As	30/4	21.40	14.7	0.00	19.1	31.30
3	As	25/5	256.7	17.7	163.3	261.33	225.0
4	As	25/6	0.72	3.30	18.3	5.70	0.59
5	Bs	1/4	0.16	0.00	5.30	1.37	0.00
6	Bs	30/4	15.87	20.7	2.30	14.83	5.83
7	Bs	25/5	0.36	1.30	37.7	1.42	0.77
8	Bs	10/6	4.10	0.13	0.00	56.67	8.00
9	Bs	25/6	1.90	2.00	14.3	3.67	5.43
10	Cs	1/4	0.25	0.00	4.70	1.07	0.55
11	Cs	30/4	2.63	40.7	32.3	3.77	10.23
12	Cs	25/5	221.0	4.00	234.3	216.67	0.40
13	Cs	25/6	0.13	3.00	0.00	0.55	0.35
Standard			10.00	-	-	-	1.00

Table 5: counts of some pathogenic bacteria in Sausage samples

Sample No.	Code of company	Collection date	Salmonella & Shigella	Clostridium perfringens	Listeria	Staphylococcus 10 ²	Total coliform 10 ²
1	As	1/4	N	P	P	0.33	0.05
2	As	30/4	N	P	P	0.83	23.17
3	As	25/5	N	P	P	0.33	40.7
4	As	25/6	N	P	P	1.57	0.37
5	Bs	1/4	N	P	P	0.37	0.06
6	Bs	30/4	N	N	N	0.73	20.77
7	Bs	25/5	N	P	P	0.00	6.77
8	Bs	10/6	N	N	P	1.60	2.29
9	Bs	25/6	P	N	P	0.00	3.17
10	Cs	1/4	P	P	P	0.47	0.52
11	Cs	30/4	N	P	P	0.63	4.57
12	Cs	25/5	N	N	N	0.33	2.97
13	Cs	25/6	N	N	N	0.00	1.04
Standard			N	N	N	1.00	1.00

N: negative P: positive

Data given in Table 6 showed some chemical indices of sausage samples. Chemical analysis showed that the moisture values ranged from 53.62 to 56.75% in all samples. Results for fat content showed also that samples of A scored the highest value of fat being 46.07, the highest value of fat may be due the addition of different type of crude fat and using also fatty tissues during processing. The percentage of protein ranged from 20.96 to 33.19%, Data illustrated in Table 6 also cleared the TBA values also in the same level. Results from protein fraction and pH values indicated that these collected samples are in good quality. These obtained results were in the legal limit of those reported by EOS, (2005) for sausage.

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التحليل الميكروبيولوجية والكيميائية لعينات اللانشون والسجق التى جمعت من بعض المحلات بمدينة المنصورة

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أجري هذا البحث على ستة عشر عينة لانشون وثلاثة عشرة عينة من السجق جمعت من ثلاث محال تجارية فى مدينة المنصورة والعينات ممثلة فى ثلاث شركات تصنيع غذائى .
أجريت الفحوص الكيميائية والميكروبيولوجية على العينات وكانت النتائج كالاتى :

التحليل الميكروبيولوجي:

- العدد لكل جم فى عينات اللانشون
- العدد الكلى للبكتيرى تراوح بين 3.6×10^4 الى 222×10^4 ومعظم العينات تخطت الأعداد القياسية ، الفطريات بين 31×10^2 الى 240×10^2 ، البكتريا المحلله للدهون من صفر الى 55.7×10 و البكتريا المحلله للبروتين من 21×10^4 الى 91.3×10^4 وأعداد *Enterobacteriaceae* بين صفر الى 157.7×10^2 .
- أما عدد الميكروبات الممرضة فأعداد الكوليفورم من 05×10^4 الى 40×10^4 وظهرت السالمونيلا والشيجيلا فى 37 % من العينات والكلوستيريديم فى 50 % والليستيريا فى 68.75 % والإستافيلوكوكس فى 87.5 % .

وفى عينات السجق :

- العدد الكلى للبكتيريا تراوح من 13×10^5 الى 221×10^5 ، الفطريات من صفر الى 40.7×10^2 والبكتريا المحلله للدهون من صفر الى 234.3×10 والبكتريا المحلله للبروتين من 55×10^4 الى 261.33×10^4 وأعداد *Enterobacteriaceae* من 35×10^3 الى 225×10^3 .
- أما عن السالمونيلا والشيجيلا فقد ظهرت فى عينتين فقط بينما 61.33 % من العينات ملوثة بالكلوستيريديم ، 23 % ملوثة بالليستيريا وكلها عدا عينتين ملوثة بالإستافيلوكوكس .

أما التحليل الكيماوى :

فأظهرت التحليلات فى جميع العينات سواء من السجق أو اللانشون نسبة الرطوبة ، Ash ، T.S.N ، S.P.N ، N.P.N ، T.V.B.N فى كل من اللانشون والسجق مطابقة مع النسب القياسية ، والخلاصة أن العينات صالحة من الناحية الكيماوية ولكن من الناحية الميكروبيولوجية فالغالبية العظمى منها غير صالحة .

Table 3: Some chemical composition of Luncheon collected from Mansoura market.

Sample No.	Code of Company	Collection Date	% (g/100g dry weight)									Mg/100g	ppm	PH
			Moisture	C.protein	T. Fats	Ash	T.carbo.	C.fiber	T.S.N	N.P.N	S.P.N			
1	A	15/4	56.07	29.88	47.21	5.20	11.41	7.95	0.49	0.31	0.18	12.80	0.504	6.01
2	A	30/4	57.38	28.98	46.13	5.56	10.95	7.32	0.64	0.35	0.29	11.98	0.485	6.44
3	A	10/5	56.70	28.16	47.66	5.12	10.79	6.42	0.54	0.21	0.33	12.05	0.486	5.94
4	A	10/6	55.04	29.31	46.21	5.89	11.81	7.93	0.45	0.39	0.06	12.98	0.525	6.07
5	A	2/7	56.15	29.75	47.21	5.40	11.17	8.15	0.50	0.36	0.14	13.02	0.535	6.10
6	B	15/4	56.32	29.60	47.59	5.11	11.65	8.18	0.51	0.27	0.24	12.94	0.512	5.96
7	B	30/4	56.94	29.61	45.41	5.79	10.38	6.88	0.72	0.28	0.44	11.68	0.464	6.50
8	B	10/5	55.88	26.98	46.12	5.49	10.81	6.55	0.53	0.18	0.35	10.59	0.427	6.62
9	B	25/5	54.82	30.98	44.09	6.72	9.63	5.73	0.62	0.19	0.43	11.19	0.447	6.25
10	B	10/6	54.98	29.43	46.16	5.96	11.97	8.04	0.45	0.34	0.11	13.09	0.532	6.02
11	B	2/7	55.83	29.56	46.82	5.33	10.98	7.96	0.46	0.29	0.17	13.12	0.526	6.12
12	C	15/4	55.80	30.27	46.85	5.29	11.29	7.67	0.45	0.34	0.11	12.66	0.496	6.06
13	C	30/4	57.12	29.27	45.82	5.68	10.71	7.09	0.69	0.33	0.33	11.84	0.473	6.46
14	C	10/5	56.98	28.47	47.03	5.51	10.93	6.49	0.55	0.20	0.35	11.63	0.477	5.98
15	C	10/6	55.16	29.17	46.13	5.84	11.73	7.81	0.44	0.39	0.05	12.62	0.507	6.12
16	C	2/7	55.94	30.05	46.98	5.37	11.09	8.10	0.49	0.33	0.16	13.06	0.531	6.14

Table 6: Some chemical composition of Sausage collected from Mansoura market.

Sample No.	Code of Company	Collection Date	% (g/100g dry weight)									Mg/100g	ppm	PH
			Moisture	C.protein	T. Fats	Ash	T. carbo.	C. fiber	T.S.N	N.P.N	S.P.N	T.V.B.N	T.B.A	
1	A	1/4	55.31	30.97	46.07	5.50	10.85	7.25	0.41	0.39	0.02	12.37	0.485	3.14
2	A	30/4	56.75	29.96	45.06	5.92	10.14	6.69	0.73	0.25	0.48	11.52	0.456	6.52
3	A	25/5	54.71	31.17	43.94	6.85	9.51	5.62	0.63	0.19	0.44	10.88	0.433	6.21
4	A	25/6	53.88	32.83	43.62	5.89	9.02	6.07	0.57	0.35	0.20	11.97	0.461	6.33
5	B	1/4	54.35	32.29	44.52	5.89	9.87	6.51	0.49	0.32	0.17	11.86	0.456	6.36
6	B	30/4	56.18	30.65	44.28	6.14	9.66	6.21	0.80	0.17	0.63	11.21	0.435	6.57
7	B	25/5	55.14	30.29	44.61	6.38	10.12	6.21	0.60	0.18	0.42	10.35	0.412	6.15
8	B	10/6	53.91	31.95	44.05	6.71	10.31	6.22	0.55	0.30	0.25	10.88	0.441	5.83
9	B	25/6	54.16	32.97	43.97	5.96	9.09	6.13	0.66	0.32	0.34	12.03	0.459	6.27
10	C	1/4	53.62	33.18	43.30	6.20	9.19	5.90	0.56	0.25	0.31	11.41	0.4365	6.51
11	C	30/4	55.93	31.02	43.95	6.25	9.43	5.98	0.83	0.12	0.71	11.09	0.426	6.61
12	C	25/5	55.07	30.41	44.28	6.51	9.97	6.05	0.61	0.18	0.43	10.51	0.420	6.18
13	C	25/6	53.97	33.19	43.88	6.12	9.21	6.25	0.60	0.37	0.23	11.91	0.451	6.31