STANDARDIZATION OF SOME LOCALLY MANUFACTURED MEAT PRODUCTS WITH EGYPTIAN LEGISLATION

By

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SUMMARY

One hundred and eighty random samples of locally manufactured sausage, beef burger, luncheon and basterma were equally collected from three different processing plants to determine their chemical and bacteriological criteria. The obtained results indicated that 6.7%, 33.3% and 73.3% of sausage samples manufactured by plants A, B and C disagreed with the Egyptian standard as a result of their lower contents of protein. Further, 80%, 46.7% and 33.3% of plant C sausage exceeded the safe permissible limits of Aerobic plate count (APC), total Staphylococci and coliform counts, respectively. Regarding beef burger samples, the mean values of APC were 1.7 x 10^5 ± 0.3 x 10^5, 4.1 x 10^5 ± 0.7 x 10^5 and 7.6 x 10^5 ± 1.5 x 10^5/g for plants A,B and C, respectively. However, 20%, 60% and 86.6% of beef burger produced by plants A, B and C disagreed with chemical and bacteriological profiles stipulated by Egyptian standard.

On the other hand, the average protein contents of luncheon samples of plants A,B and C were 11.5 ± 0.7%, 13.2 ± 0.9 % and 8.9 ± 0.6%, respectively. In general, the majority of luncheon samples of plant C were highly contaminated with different bacterial groups when compared with those of plant A or B. Also, all examined samples of basterma of plant C disagreed with Egyptian standards either chemically or bacteriologically. In contrast, 33.3 % and 73.3% of basterma samples of plants A and B were falsified, respectively. The significance of occurrence of such variations in the chemical and bacteriological criteria of examined meat products of different processing plants were discussed.

INTRODUCTION

On a global basis, meat products are highly demanded due to their high biological value, reasonable price, agreeable taste

and ease of serving. Thus, meat products are considered as excellent sources of high quality protein but they are also important potential sources of diseases if they are not properly prepared following the good hygienic practices *(Ekour, 2001)*.

In Egypt, locally manufactured meat products such as sausage, beef burger, luncheon and basterma are gaining popularity to compensate the shortage in fresh meat of high price which is not within the reach of many families with limited income.

The processing formula of each meat product is greatly differed from one processor to another. Consequently, there are wide variations in the chemical constituents either between the different types of meat products or within the same products *(Ellis , 1987)*. However, most microbial contaminants can gain access to certain meat products via raw materials, workers and equipments resulting in a public health hazard or affecting the shelf life of these products *(Hassan, 1999 and Silva et al., 2002)*.

Accordingly, chemical and bacteriological standards are being proposed for such food articles because advances in the technology of meat processing resulted in changes of the normal and historical microbial ecology of these products which may potentiate a new hazard.

Therefore, the current study was planned to match the chemical and bacteriological criteria of some locally manufactured meat products with the Egyptian standards to determine their quality

MATERIALS AND METHODS

A total of 180 random samples of locally manufactured meat products were collected from three different processing plants (60 of each). The collected samples were represented by sausage, beef burger, luncheon and basterma (15 of each plant). All collected samples were subjected to chemical and bacteriological examinations for evaluation of their quality by comparison with the Egyptian Organization for Standardization and Quality Control

A- Chemical examination:

Quantitative analysis of moisture, protein and fat in examined samples was carried out according to the technique recommended by *Pearson (1984)*.

B- Bacteriological examination:

To 25 g of meat product sample, 225 ml of sterile peptone water were added and mixed under complete aseptic conditions. Decimal serial dilutions were prepared.

The methods adopted by *ICMSF (1996)* were used to determine Aerobic Plate Count (APC) by using plate count agar plates, total Staphylococci count by using Baired Parker agar plates and total coliform count (MPN) by using three successive MacConkey broth tubes.

Furthermore, the total anaerobic count was estimated according to the technique recommended by *Hua and Ling (1994)* by using reinforced Clostridium agar plates.

RESULTS AND DISCUSSION

Chemical and bacteriological characteristics of the examined samples of sausage produced by three different processing plants were shown in table (1). In regard to chemical analysis of sausage, the average moisture, protein and fat contents were 57.5± 1.0%, 15.3 ± 0.9% & 20.6 ± 0.7% for plant A, 62.7 ± 1.3%, 10.4 ± 0.8% & 21.3 ± 1.1 % for plant B and 64.6 ± 1.2%, 9.1 ± 0.6 % & 22.0 ± 0.9 % for plant C, respectively.

The *Egyptian standard (1991)* stipulated that sausage should not be contained more than 60% moisture and 30% fat while protein content should not be less than 15%. Accordingly, 6.7%, 33.3% and 73.3 % of sausage of plants A,B and C were unaccepted according to their contents of protein. Concerning moisture content, 20% and 53.3 % of sausage of plants B and C exceeded these permissible limits.

On the other hand, APC, total Staphylocci count and total coliform count should not be more than 10^6, 10^3 and 10^3/g of sausage, respectively, as recommended by *Egyptian standard (1991)*. Thus, 80%, 46.7% and 33.3 % of sausage produced by plant C exceeded these safe standard limits, respectively (table 1).

According to chemical and bacteriological results of sausage of plants A,B and C, 6.7%, 46.7% and 80% of such samples were

falsified (unaccepted) as indicated in table (5). Totally, 44.4% of locally manufactured sausage either of plant A, B or C disagreed with the Egyptian standard.

The present results agree, to some extent, with those reported by *Soliman (1988), Abd El-Aziz et al. (1996) and Omar (2001).*

The variations in chemical and bacteriological criteria of sausage between the three different plants could be attributed to the variable amount of lean meat, fat and water as well as sodium chloride added during the manufacture of the product by each plant *(Vural et al., 1998).*

Table (2) revealed that the mean values of APC, total Staphylococci, coliform and anaerobic counts of examined samples of beef burger were $1.7 \times 10^5 \pm 0.3 \times 10^5$, $5.6 \pm 10 \pm 0.8 \times 10$, $1.9 \times 10^2 \pm 0.3 \times 10^2$ and $1.1 \times 10^2 \pm 0.2 \times 10^2$ /g for plant A, $4.1 \times 10^5 \pm 0.7 \times 10^5$, $3.2 \times 10^2 \pm 0.5 \times 10^2$, $8.9 \times 10^2 \pm 1.8 \times 10^2$ and $1.5 \times 10^2 \pm 0.2 \times 10^2$ /g for plant B and $7.6 \times 10^5 \pm 1.5 \times 10^5$, $8.3 \times 10^2 \pm 1.8 \times 10^2$, $2.4 \times 10^3 \pm 0.5 \times 10^3$, $1.9 \times 10^2 \pm 0.3 \times 10^2$/g for plant C. Consequently, the majority of beef burger samples particularly produced by plants B and C were unaccepted by matching of their bacteriological quality with that of the Egyptian Standard.

Respectively, 6.7%, 13.3% & 6.7% of plant A beef burger, 26.7%, 20% & 6.7 % of plant B beef burger and 80%, 73.3% and 20 % of plant C beef burger disagreed with Egyptian Standards recommended for moisture, protein and fat contents as demonstrated in table (2).

In general, 20%, 60% and 86.6% of beef burger of plants A, B and C were unaccepted as a results of their disagreement with chemical or bacteriological requirements stipulated by Egyptian Standard (table 5).

Many authors recommended marginal bacterial standards for beef burger. *Potter (2001)* reported that beef burger should maintain a standard less than 5×10^4 organisms per gram and coliform count of less than 10^2/g. Also, *Murugkar et al (2003)* stated that APC and total Staphylococci count should not exceed 10^4 and 10^2/g of beef burger, respectively.

Most foods are regarded as unwholesome when they have large population of microorganisms even the organisms are not known to be pathogenic and do not alter the character of the product *(Davies and Board, 1998)*. Therefore, the high bacterial count of the meat product should be looked with suspicion as it may be attributed to neglected sanitary measures during long chain of preparation, processing and handling as well as storage of such product *(Mueller et al., 2002)*.

Results achieved in table (3) declared that the majority of examined luncheon samples produced by plant A come in accordance with the requirements of the Egyptian Standard as compared with those produced by plant B or C. In this respect, the average protein contents of luncheon samples were 11.5 ± 0.7%, 13.2 ± 0.9 % and 8.9 ± 0.6% for plants A, B and C, respectively. Thus, 13.3%, 33.3% and 53.3% of these samples less than the permissible limit of protein stipulated by *Egyptian Standard (1991)* which stated that the protein content of luncheon should not be less than 15%.

However, the results of bacteriological examination of luncheon indicated that plant C luncheon samples were the most contaminated with different bacterial groups than those of plant A or B. Hence, the APC and total anaerobic count in examined luncheon samples were $2.1 \times 10^4 \pm 0.4 \times 10^4$ & $1.5 \times 10^2 \pm 0.1 \times 10^2$/g for plant A, $7.1 \times 10^4 \pm 1.3 \times 10^4$ & $1.0 \times 10^2 \pm 0.1 \times 10^2$ for plant B and $3.2 \times 10^5 \pm 0.5 \times 10^5$ & $1.2 \times 10^2 \pm 0.1 \times 10^2$ /g for plant C, respectively (table 3). Also, the total coliform and Staphylococci counts were recorded at highest values for luncheon produced by plant C rather than plant A or B.

Accurately, 26.7%, 53.3% and 60% of examined samples of luncheon of plants A, B and C were falsified on basis of their chemical and bacteriological profiles when compared with those recommended by Egyptian Standard, respectively (table 5). As total, 46.7% of locally manufactured luncheon produced by plants A, B and C were not accepted as shown in table (5).

Some previous studies carried out by *Fathi and Rashwan (1992), Nassar (1999) and Eleiwa (2003)* come in agreement with the current results.

It is interesting here to mention that the coliform bacteria have probably received more attention than most other groups of bacteria occurring in processed meat products where they are reliable indicators of inadequate processing and/or post processing contamination of such products *(ICMSF, 1996).* In addition, coliforms in processed meat may be responsible for inferior quality resulting in economic losses beside their presence in great numbers may give rise to public health hazard *(Moreno et al., 1997).*

On the other hand, improper holding of processed meat products after cooking may lead to growth of Staphylococci readily without competition with other organisms which have been killed by heat treatment *(Hua and Ling, 1994).*

Concerning the basterma samples, tables (4 & 5) proved that all examined samples of basterma of plant C disagreed with the Egyptian specification. While, 33.3% and 73.3% of basterma of plants A and B were unaccepted, respectively. In details, the percentages of basterma samples exceeded the safe permissible limits of APC, total Staphylococci, coliform and anaerobic counts were 26.7%, 13.3%, 20% & 20% for plant A, 66.7%, 40%, 60% and 33.3% for plant B and 73.3%, 53.3%, 93.3% and 46.7% for plant C, respectively. In general, the mean values of APC of examined samples of basterma of plants A, B and C were $8.2 \times 10^4 \pm 1.1 \times 10^4$, $1.3 \times 10^5 \pm 0.2 \times 10^5$ and $5.7 \times 10^5 \pm 0.8 \times 10^5$ /g, respectively (table 4).

Such high results of bacterial contamination of basterma were previously recorded by *Abd El-Aziz et al. (1996) and El-Khateib (1997)* who found the APC in basterma samples was ranged from 1×10^4 to 9×10^6/g. While, the chemical results in the present study agree, quite well, with those obtained by *Mousa et al. (1993)* who recorded that the average moisture, protein and fat contents in locally manufactured basterma samples were 58.4%, 20.5 % and 16.5%, respectively.

Regardless of type of meat product, the overall percentages of unaccepted samples of meat products produced by plants A, B and C were 21.7%, 58.3% and 81.7%, respectively, as compared with the chemical and bacteriological criteria of Egyptian Standards as shown in table (5).

Accordingly, the current results allow to conclude that there is no uniform guidelines can be used to interpret the results of chemical composition of meat products where each product must be evaluated on the basis of its own characteristics. Moreover, the guidelines must be established to prove that the raw ingredients are of good quality and satisfactory plant sanitation must be maintained to obtain a product comes in accordance with standard limits on one side and to ensure a maximum level of safety to consumers on the other side.

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C) Egyptian Standard for requirements of luncheon, Ministry of Industry No. 1114/1991.
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TABLE (1): STANDARDIZATION OF CHEMICAL AND BACTERIOLOGICAL PROFILES OF EXAMINED SAUSAGE SAMPLES WITH EGYPTIAN STANDARD (N= 15).

	Egyptian Standard	Plant A			Plant B			Plant C		
		Mean ± S.E*	Unaccepted samples		Mean ± S.E	Unaccepted samples		Mean ± S.E	Unaccepted samples	
			No.	%		No.	%		No.	%
Moisture %	Not more 60%	57.5 ± 1.0	-	-	62.7 ± 1.3	3	20.0	64.6 ± 1.2	8	53.3
Protein %	Not less 15%	15.3 ± 0.9	1	6.7	10.4 ± 0.8	5	33.3	9.1 ± 0.6	11	73.3
Fat %	Not more 30%	20.6 ± 0.7	-	-	21.3 ± 1.1	-	-	22.0 ± 0.9	-	-
Aerobic plate count	Not more 10^6/g	8.7×10^5 ± 1.0×10^5	1	6.7	3.1×10^6 ± 0.4 x 10^6	4	26.7	1.1×10^7 ± 0.2 x 10^7	12	80.0
Staphylococci count	Not more 10^3/g	3.0×10^2 ± 0.6×10^2	-	-	2.1×10^2 ± 0.3 x 10^2	-	-	2.3×10^3 ± 0.4 x 10^3	7	46.7
Coliform count	Nor more 10^3/g	7.2×10^2 ± 0.8×10^2	-	-	1.1×10^2 ± 0.1 x 10^2	2	13.3	1.5×10^3 ± 0.3 x 10^3	5	33.3
Anaerobic count	Not monitored	3.5×10^2 ± 0.4×10^2	-	-	2.0×10^2 ± 0.3 x 10^2	-	-	1.0×10^3 ± 0.2 x 10^3	-	-

* Standard Error

TABLE (2): STANDARDIZATION OF CHEMICAL AND BACTERIOLOGICAL PROFILES OF EXAMINED BEEF BURGER SAMPLES WITH EGYPTIAN STANDARD (N= 15).

	Egyptian Standard	Plant A			Plant B			Plant C		
		Mean ± S.E*	Unaccepted samples		Mean ± S.E	Unaccepted samples		Mean ± S.E	Unaccepted samples	
			No.	%		No.	%		No.	%
Moisture %	Not more 60%	59.1 ± 1.0	1	6.7	63.8 ± 1.2	4	26.7	66.1 ± 1.7	12	80.0
Protein %	Not less 15%	14.8 ± 0.7	2	13.3	12.1 ± 0.9	3	20.0	10.3 ± 0.6	11	73.3
Fat %	Not more 20%	21.6 ± 0.8	1	6.7	21.5 ± 1.0	1	6.7	22.4 ± 0.8	3	20.0
Aerobic plate count	Not more 10^5/g	$1.7 \times 10^5 \pm 0.3 \times 10^5$	3	20.0	$4.1 \times 10^5 \pm 0.7 \times 10^5$	7	46.7	$7.6 \times 10^5 \pm 1.5 \times 10^5$	10	66.7
Staphylococci count	Not more 10^2/g	$5.6 \times 10 \pm 0.8 \times 10$	-	-	$3.2 \times 10^2 \pm 0.5 \times 10^2$	8	53.3	$8.3 \times 10^2 \pm 1.8 \times 10^2$	9	60.0
Coliform count	Not more 10^3/g	$1.9 \times 10^2 \pm 0.3 \times 10^2$	-	-	$8.9 \times 10^2 \pm 1.8 \times 10^2$	2	13.3	$2.4 \times 10^3 \pm 0.5 \times 10^3$	6	40.0
Anaerobic count	Not more 10^2/g	$1.1 \times 10^2 \pm 0.2 \times 10^2$	2	13.3	$1.5 \times 10^2 \pm 0.2 \times 10^2$	4	26.7	$1.9 \times 10^2 \pm 0.3 \times 10^2$	5	33.3

* Standard Error

Table (3): Standardization of chemical and bacteriological profiles of examined luncheon samples with Egyptian Standard (n= 15).

	Egyptian Standard	Plant A			Plant B			Plant C		
		Mean ± S.E*	Unaccepted samples		Mean ± S.E	Unaccepted samples		Mean ± S.E	Unaccepted samples	
			No.	%		No.	%		No.	%
Moisture %	Not more 55%	60.1 ± 1.4	4	26.7	58.1 ± 1.2	3	20.0	61.4 ± 1.5	6	40.0
Protein %	Not less 15%	11.5 ± 0.7	2	13.3	13.2 ± 0.9	5	33.3	8.9 ± 0.6	8	53.3
Fat %	Not more 20%	21.9 ± 0.8	2	13.3	22.1 ± 1.0	2	13.3	23.0 ± 1.1	3	20.0
Aerobic plate count	Not more 10^4/g	$2.1 \times 10^4 \pm 0.4 \times 10^4$	3	20.0	$7.1 \times 10^4 \pm 1.3 \times 10^4$	8	53.3	$3.2 \times 10^5 \pm 0.5 \times 10^5$	9	60.0
Staphylococci count	Not more 10^2/g	$2.9 \times 10^2 \pm 0.5 \times 10^2$	4	26.7	$1.5 \times 10^2 \pm 0.2 \times 10^2$	3	20.0	$3.0 \times 10^2 \pm 0.4 \times 10^2$	7	46.7
Coliform count	Nor more 10^2/g	$4.0 \times 10 \pm 0.1 \times 10$	-	-	$0.5 \times 10 \pm 0.1 \times 10$	-	-	$4.0 \times 10 \pm 0.1 \times 10$	-	-
Anaerobic count	Not more 10^2/g	$1.5 \times 10^2 \pm 0.1 \times 10^2$	3	20.0	$1.0 \times 10^2 \pm 0.1 \times 10^2$	2	13.3	$1.2 \times 10^2 \pm 0.1 \times 10^2$	2	13.3

* Standard Error

Table (4): Standardization of chemical and bacteriological profiles of examined basterma samples with Egyptian Standard (n= 15).

	Egyptian Standard	Plant A			Plant B			Plant C		
		Mean ± S.E*	Unaccepted samples		Mean ± S.E	Unaccepted samples		Mean ± S.E	Unaccepted samples	
			No.	%		No.	%		No.	%
Moisture %	Not more 50%	52.1 ± 1.0	2	13.3	57.2 ± 0.0	7	46.7	60.3 ± 1.4	12	80.0
Protein %	Not mentioned	18.4 ± 0.8	-	-	15.3 ± 0.3	-	-	16.1 ± 0.5	-	-
Fat %	Not more 5%	11.2 ± 0.9	5	33.3	9.1 ± 0.7	6	40.0	8.4 ± 0.7	4	26.7
Aerobic plate count	Not more 10^4/g	$8.2 \times 10^4 \pm 1.1 \times 10^4$	4	26.7	$1.3 \times 10^5 \pm 0.2 \times 10^5$	10	66.7	$5.7 \times 10^5 \pm 0.8 \times 10^5$	11	73.3
Staphylococci count	Not more 10^2/g	$1.1 \times 10^2 \pm 0.1 \times 10^2$	2	13.3	$2.0 \times 10^2 \pm 0.3 \times 10^2$	6	40.0	$3.2 \times 10^2 \pm 0.4 \times 10^2$	8	53.3
Coliform count	Free	$9.0 \times 10^2 \pm 1.3 \times 10^2$	3	20.0	$\times 101.1 \times 0.2 \pm {}^2{}_{10}$	9	60.0	$9.4 \times 10^2 \pm 1.5 \times 10^2$	14	93.3
Anaerobic count	Free	$8.5 \times 10 \pm 0.7 \times 10$	3	20.0	$1.2 \times 10^2 \pm 0.2 \times 10^2$	5	33.3	$1.1 \times 10^2 \pm 0.1 \times 10^2$	7	46.7

* Standard Error

Table (5): Summarized table of unacceptable sampels of selected meat products manufactured by three different processing plants based on Egyptian standards

Plant \ Product	Sausage (n=15)		Beef burger (n=15)		Luncheon (n=15)		Basterma (n=15)		Over all* (n= 60)	
	No.	%	No.	%	No.	%	No.	%	No.	%
PLANT A	1	6.7	3	20.0	4	26.7	5	33.3	13	21.7
PLANT B	7	46.7	9	60.0	8	53.3	11	73.3	35	58.3
Plant C	12	80.0	13	86.6	9	60.0	15	100.0	49	81.7
Total ** (n =45)	20	44.4	25	55.6	21	46.7	31	68.9		

* Total numbers of all examined meat products of each processing plant (n = 60).
** Total number of each examined meat product of three processing plants (n = 54).

الملخص العربى

مطابقة بعض منتجات اللحوم المصنعة محليا للمواصفات القياسية المصرية

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أجريت هذه الدراسة على عدد مائة وثمانين (180) عينة متساوية من السجق، البيف برجر، اللانشون والبسطرمة والتى تم تجميعها من ثلاث مصانع مختلفة لتصنيع اللحوم (60 عينة من كل مصنع) بواقع 15 عينة من كل منتج وذلك لفحصها كيميائيا وبكتريولوجيا للتأكد من مدى مطابقتها للمواصفات القياسية المصرية

وقد دلت نتائج الدراسة على أن 6.7 %، 33.3% و 73.3 % من عينات السجق الخاصة بالشركات ا ،ب ، جـ غير مطابقة للمواصفات المصرية نظرا لاحتوائها على نسب بروتين أقل من المسموح به، على التوالى 0بينما كان 80%، 40% و 33.3% من عينات سجق الشركة جـ تتخطى الحدود المسموح بها للعدد الكلى للميكروبات الهوائية، ميكروبات العنقود الذهبى وميكروبات الكوليفورم، على الترتيب وبالنسبة لعينات البيف برجر فقد أوضحت النتائج أن متوسطات العدد الكلى للميكروبات الهوائية كانت 1.7 4.1 ،10^5 10^5و 7.6 × /10^5جم للشركات ا، ب ،جـ كما أن 20% ، 60% و 86.6% من تلك العينات كانت مخالفة للمواصفات القياسية المصرية، على التوالى

كما تبين من نتائج الدراسة أن معظم عينات اللانشون المنتجة بواسطة الشركات جـ كانت الأكثر تلوثا بالمجموعات البكتيرية المختلفة وذلك عند مقارنتها بمثيلتها المنتجة بواسطة الشركة ا، ب. فى المقابل فإن جميع عينات البسطرمة المنتجة بواسطة الشركة جـ لم تتوافق مع المواصفات القياسية المصرية سواء من الناحية الكيميائية أو البكتيريولوجية0 بينما 33.3و 73.3 %من عينات البسطرمة الخاصة بالشركتين ا، ب كانت مرفوضة كيميائيا وبكتريولوجيا على الترتيب

هذا وقد تمت مناقشة هذه الاختلافات بين العينات محل الدراسة مع بيان خطورة تداول تلك المنتجات المتجاوزة للمواصفات القياسية على صحة المستهلك

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