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Bacteriological Quality of some Meat Products in the Egyptian Retail Markets

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Abstract

This study was aimed to evaluate the bacteriological quality of some meat products produced by different companies in the Egyptian markets. 50 samples from five different sources of each of minced meat, beef burger, kofta, and sausage were subjected to bacteriological analysis. Isolation and identification of pathogenic and Public Health Hazard bacterial groups were carried out. The obtained results indicated that minced meat has the highest contamination level compared with the other products. The mean values of total bacterial count isolated from minced meat, kofta, beef burger and sausage samples were 6.6x 10^8, 4.6x 10^6, 3.1x 10^5 and 5.6x 10^4CFU/g, respectively. *Escherichia coli* were detected in 50 % of the examined minced meet samples and 30% of both kofta and beef burger but not found in sausage samples. Salmonella were isolated from 20 % of minced meat sample and 10% of Beef burger at levels of 6x 10^4 and 4x 10^2 CFU/ g, respectively. Data also showed that 20% of minced meet samples and 10% of both kofta and beef burger samples *were contaminated with Staphylococcus aureus at levels of 3x 10^3, 4x 10^2 and 2x 10^2 CFU/g,* respectively.

Keywords: *Meet products, contamination, pathogenic bacteria.*

Introduction

Meat is a very important food to human health due to its composition; Meat is rich in high quality protein, fats, vitamins, minerals and trace elements, so that a huge number of people consume meat and meat products. Generally, meats are very susceptible to quality loss due to microbiological spoilage. The bad and improper processing, handling and storage of meat products lead to spoilage which rises to economic losses and public health hazard.

Meat and meat product such as minced meat are appreciated because of its convenience. Unfortunately, their shelf- life is limited because the large exposed surface area facilitates spoilage. The rate of deteriorative change depends on meat composition, hygienic practices during cutting, grinding, and preparation, as well as storage conditions. The most important factor in controlling meat spoilage is microbial contamination and their growth, which affect safety and quality (Brooks *et al.*, 2008). Food safety experts, agree that pathogen reduction requires a farm to the table approach. Microbiological testing is designed to address improvements at the plant level, with the understanding that additional initiatives at other points in the food production chain also are needed. USDA already has began a number of projects to address these other points, including safe handling instructions for consumers, identification and trace back of animals, and the development of on-farm pathogen prevention models. FSIS established a series of baseline data collection programs to acquire

information that provides general microbiological profiles of meat and poultry for selected microorganisms that are of various degrees of public health concern (Mead, *et al.,* 1999). Baseline studies are also used to develop pathogen reduction performance standards that plans must meet earlier baseline studies (steer/heifer, cow/bull, broiler chicken, market hog, and young turkey) and surveys (raw ground beef, raw ground chicken, and raw ground turkey) included the following microbial analyses of *Escherichia coli; Clostridium perfringens; Staphylococcus aureus; Listeria monocytogenes; Campylobacter; Escherichia coli 0157:H7; and Salmonella* (Friedman *et al.,*2002). Although the total bacterial count was used in bacteriological examination to reflect the hygienic quality, however, it is evident that coliform group count is considered of much greater value in assessing its quality (Djenane *et al.,* 2011). Salmonella is now established, as one of the most important causes of food – brone illness at worldwide (Hussien, 2006). *The Staphylococcal* genus contains at least 23 species, most important being *Staphylococcus aureus*. This organism is of major concern to the meat and poultry industries **(**Hannan *et al.,* 2008).

The purpose of the study was to assess the bacteriological quality for retail packages of some meat products produced by different companies in the Egyptian market. Isolation and identification of some pathogenic and health hazard bacterial groups was carried out.

Materials and Methods

Samples of meat products:

Two hundred retail package samples of minced meat, beef burger, kofta, and sausage (50 samples of each product collected from five different sources - 10 samples of each source) were purchased from local market of Assiut City, Egypt.

Media used:

1-Media used for determination of total bacterial count:

Nutrient agar medium (American Public Health Association (A.P.H.A), 1976 and Difco manual, 1984) was used for the determination of total bacterial count.

2-Media used for isolation of *Staphylococcus aureus*:

Manitol salt agar media and Vogel Jonson media were used to isolate *Staphylococcus aureus* according to Difco manual,(1984).

3-Media used for isolation of coliform group bacteria:

Mac Conkey broth, Mac Conkey agar and Eosin methylene blue agar media were used for isolation and identification of coliform bacteria (*E. coli*) according to Difco manual, (1984).

4-Media used for isolation Salmonella:

The salmonella – shigella – agar medium was used as selective plating medium as described by (FAO, 1979).

Preparation of samples for bacteriological analysis:

Ten grams of each sample were mixed with 90 ml of sterile saline solution (9 g Na Cl/1L distilled water) under sterile conditions to give 1/10 dilution. Serial dilutions were prepared to be used for counting several types of bacteria.

Determination of total bacterial count:

The total bacterial count was determined using the plate counts technique on a nutrient agar medium according to procedures of A.P.H.A (1976) and Difco manual, (1984).

The plates were incubated at 37°C for 48 hrs.

Isolation of *Staphylococcus aureus:*

Staphylococcus aureus bacteria was determined according to the method described by (A.P.H.A., 1976 and Difco manual, 1984) using Vogel Jonson medium plus 1 ml potassium tellurite solution 1 % (w/v) to each 100 ml of sterilized medium which mixed well before pouring in the plates. The plates were incubated at 37° C for 24 hr.

Isolation of coliform bacteria:

Coliform group bacteria were determined using Mac Conkey agar medium according to the procedures described by A.P.H.A (1976) and Difco manual, (1984). The plates were incubated at 37°C for 24 hr.

Isolation of Salmonella:

The presence or absence of *Salmonella* was determined according to the method described by FAO (1979). *Salmonella* - *Shigella* agar plates were incubated at 35°C for 24 hr. *Salmonella* appeared as black colonies, some of them with metalic sheet.

Results and Discussion

Data presented in Table (1) showed the total aerobic bacterial count isolated from minced meat, kofta, beef burger and sausage samples collected from different sources. The bacteriological analysis indicated that minced meat has the highest contamination level compared with the other products. The total count of aerobic bacteria isolated from minced meat ranged from 5 x 10^6 to10 x 10^8 with an average of 6.6x 10^8 CFU/g. At the same time, the mean values of total bacterial count isolated from kofta, beef burger and sausage samples were 4.6x 10^6, 3.1x 10^5 and 5.6x 10^4CFU/g respectively.

The obtained results are in agreement with those recorded by Mousa *et al.* (1993), They investigated microbial quality of 50 samples of luncheon and minced meat (25 samples of each). They showed that the minced meat has heavier bacterial load than luncheon samples and they traced this result to miss handling, improper hygienic measures during manufacturing and transportation and keeping methods as well as methods of exposure to sale. Also, Tolba (1994) examined 80 samples of minced meat, kofta, beef burger and luncheon (20 samples each) from different areas in Cairo and Giza. They found the aerobic plate counts for these previous products were 2.2 x 10^6, 2.9 x 10^3, 2 x 10^5 and 1.3 x 10^5, respectively.

Doyle *et al*., (2007) reported that fresh minced meat tends to have a short shelf life because the quality of the raw ingredients is usually lower (i.e., has higher number of contaminating microorganisms), and is re-contaminated through the grinding /handling process. Mincing and grinding of meat at the retail location can introduce more spoilage microorganisms if proper equipment hygiene and handling measures are not followed.

Table 1. Total aerobic bacterial count (CFU/g) of meat products samples

Meat Products	No. of samples	Positive samples		Aerobic bacterial Count (CFU/g)		
		No.	%	Min.	Max.	Mean
Minced meat	50	50	100%	5×10^6	10×10^8	6.6×10^8
kofta	50	50	100%	5×10^4	5×10^6	4.6×10^6
Beef burger	50	50	100%	3×10^4	6×10^5	3.1×10^5
Sausage	50	50	100%	3×10^3	8×10^4	5.6×10^4

Data in Table (2) showed that *E. coli* was detected in 50 % of the examined minced meet samples and 30% of both kofta and beef burger samples. The average values of the contamination level with *E. coli* were6×10^4,6×10^2 and 4×10^2in the examined samples of minced meet, kofta and beef burger, respectively. On the other hand, *E.coli* couldn't detect in the examined sausage samples. Nearly similar results were found by previous investigators. Duitschaever (1977) and Fathi *et al*., (1992), they detected *E.coli* in 47.37% and 28.3% of the examined minced meat and beef burger samples.

Table 2. *Escherichia coli* count (CFU/g) in meat products samples

Meat Products	No. of samples	Positive samples		*Escherichia coli* count		
		No.	%	Min.	Max.	Mean
Minced meat	50	25	50%	3×10^2	8×10^4	6×10^4
kofta	50	15	30%	2×10^2	10×10^2	6×10^2
Sausage	50	0	0	-	-	-
Beef burger	50	15	30%	1×10^2	6×10^2	4×10^2

Fig. (1 and 2): Isolation of *E. coli* from meat products on Mac-Conkey agar and EMB agar media.

Fig. (1) : *E-coli* on Mac-Conkey agar give Pink colonies

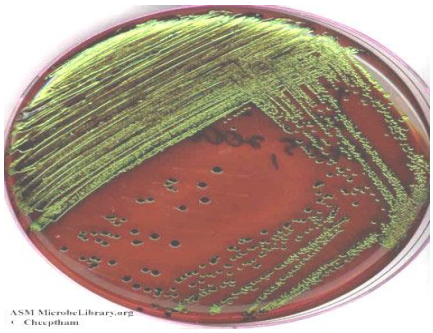

Fig. (2): *E-coli* on EMB gives green metal shine

Table (3) clears that the incidence of *salmonella* in miced meat and Beef burger samples were 20 % and 10%, respectively, but not detected in Sausage and kofta. *Salmonella* counts ranged from3×10^2 to 8×10^4 with mean value of 6×10^4 CFU/ g of minced meat, but only ranged from 1×10^2 to 6×10^2 with a mean value 4×10^2CFU/ g of Beef burger.

The obtained results were similar to some extent with that reported by El-Mossalami *et al.* (1989), they found that the incidence of Salmonella in beef burger was 6% out of 50 samples and in frozen minced meat was 6% out of 50 tested samples and in fresh minced meat the percentage was 12%. In contrary, they failed to isolate *salmonella* from any of examined luncheon samples. *Salmonella* species were detected in 5% of the examined minced meat samples, but not found in any of the examined luncheon samples. (Abdel-Aziz *et al.* 1996) or kofta samples (Kuplul and Oral, 2003).

Table 3. Salmonella counts (CFU/g) in meat products samples

Meat Products	No. of samples	Positive samples		Salmonella counts		
		No.	%	Min.	Max.	Mean
Minced meat	50	10	20%	$3x\ 10^2$	$8x\ 10^4$	$6x\ 10^4$
Raw kofta	50	0	0%	_	_	_
Sausage	50	0	0%	_	_	_
Beef burger	50	5	10%	$1x\ 10^2$	$6x\ 10^2$	$4x\ 10^2$

Fig. (3 and 4): Isolation of *Salmonella* from meat products on Mac Conkey agar and Bismus sulphate agar media.

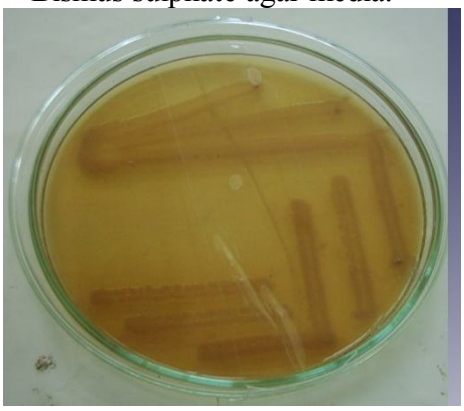

Fig.(3): pale yellow colonies of Salmonella on Mac. agar

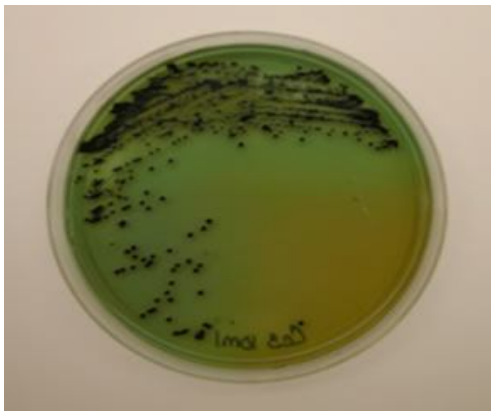

Fig.(4): black colonies of Salmonella on Bismus agar

Data presented in Table (4) indicated the incidence of Staphylococcus spp. in 10, 5, and 5 samples out of 50 analyzed samples of each of minced meat, kofta and beef burger but not in sausage samples. Minced meat showed the highest contamination level (3x 103 CFU/g) Followed by beef burger (4x 102 CFU/g) and finally kofta (2x 102 CFU/g). Nearly similar results were obtained by Scanga *et al.* (1999) and Heredia *et al.* (2001) who detected Staphylococcus in 1.5% and 11.4% of the examined ground meat samples of the examined ground beef samples. On the other hand, Staphylococcus had not been detected in beef burger or minced meat as reported by Tolba (1994), Abdel-Aziz *et al.* (1996), Duffy *et al.* (1999), Chung *et al.* (2003).

Table 4. Staphylococcus count (CFU/g) in meat product samples

Meat Products	No. of samples	Positive samples		Staphylococcus count		
		No.	%	Min.	Max.	Mean
Minced meat	50	10	20%	$1x\ 10^2$	$6x\ 10^3$	$3x\ 10^3$
kofta	50	5	10%	1x 10	$4x\ 10^2$	$2x\ 10^2$
Sausage	50	0	0%	-	-	-
Beef burger	50	5	10%	2x 10	$6x\ 10^2$	$4x\ 10^2$

Fig. (5 and 6): Isolation of Staphylococcus from minced meat samples on Mannitol salt agar and blood agar media

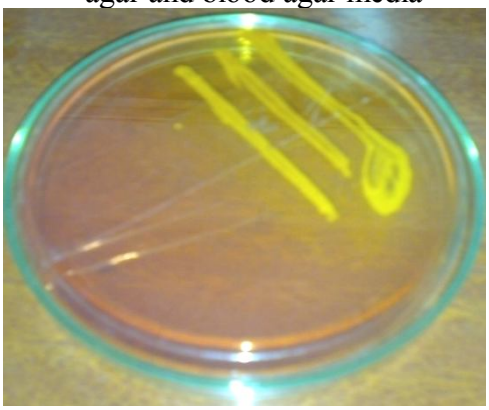

Fig.(5): yellow colonies of Staphylococcus on Mannitol salt agar pale

Fig.(6): B- haemolysis on blood agar with Clear zone around Staphylococcus colony

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الجودة البكتريولوجية لبعض منتجات اللحوم في أسواق التجزئة المصرية

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الملخص

تهدف هذه الدراسة الي تقييم الجودة البكتريولوجية لبعض منتجات اللحوم المنتجة بواسطة شركات مختلفة في الأسواق المصرية. تم اخذ ٥٠ عينة من خمسة مصادر مختلفة لكل من اللحم المفروم، البيف برجر، الكفتة والسجق واجري عليها التحليل البكتيريولوجي حيث تم عزل وتعريف بعض مجموعات البكتيريا الممرضة وذات الخطورة على الصحة العامة.

أوضحت النتائج المتحصل عليها ان اللحم المفروم يحتوي علي اعلي نسبة تلوث مقارنة بمنتجات اللحوم الأخرى وكان متوسط الأعداد الكلية للبكتيريا المعزولة من عينات اللحم المفروم، البيف برجر، الكفتة والسجق تساوي ٦,٦×١٠^{٨}، ٤,٦×١٠^{٦}، ٣,١×١٠^{٥} و٥,٦×١٠^{٤} على التوالي. ثبت تواجد بكتيريا القولون (اشيريشيا كولاي) في ٥٠% من عينات اللحم المفروم ، ٣٠% من عينات الكفتة والبيف برجر في حين لم يثبت وجودها في عينات السجق. كذلك تم عزل بكتيريا السالمونيلا من ٢٠% من عينات اللحم المفروم و١٠% من عينات البيف برجر وكانت اعدادها ٦×١٠^{٤} ، ٤×١٠^{٢} على التوالي. كما أوضحت النتائج أيضا ان ٢٠% من عينات اللحم المفروم و١٠% من عينات كلا من الكفتة والبيف برجر كانت ملوثة بالبكتيريا العنقودية (استافيلوكوكس) بأعداد تساوي ٣×١٠^{٣}، ٤×١٠^{٢} ، ٢×١٠^{٢} على التوالي.