Animal Health Research Journal Vol. 7, No. 1, March 2019 pp. 201-215

ISSN: 2356-7767

Bacteriological Evaluation of Prepared Food of Animal Origin in Butcher Area at Hotel's kitchen

***Afaf, A.M. Ahmed;** Heba, Badr; *** Shimaa, El-Nagarand ** Soad, A. Nasef**

*Food Hygiene, Reference Laboratory for Veterinary Quality Control on Poultry Production, Animal Health Research Institute, (AHRI) Ministry of Agriculture, Luxor.
**Bacteriology, Reference Laboratory for Veterinary Quality Control on Poultry Production, (RLQP), Animal Health Research Institute, Ministry of Agriculture, (AHRI).
*** Bacteriology, Reference Laboratory for Veterinary Quality Control on Poultry Production, Animal Health Research Institute, (AHRI) Ministry of Agriculture, Luxor.

Received in 9/1/2019
Accepted in 12/2/2019

Abstract

To evaluate the hygienic status during preparation of food in fixed and floating hotels from Kitchen area in Luxor, Egypt; one hundred samples were collected; 20 from each raw beef, chicken meat, surface, hand and knife swabs (10 from each, fixed and floating). The meat samples were examined for the Aerobic plate count (APC), Coliforms count (CC) and Coagulase Positive Staphylococci (CPS). As the results indicated that the count varies from satisfactory to unsatisfactory according to the parameter mentioned in Egyptian standards of frozen meat (ES 1522/2005) and (Egyptian standards of frozen poultry) ES 1090/2005, also, the meat samples were examined for the important food borne pathogens (*E.coli, Salmonella* spp. and other enteric bacteria). The results indicated higher percentage in beef than poultry for *E.coli* isolation 20% (4/20) and 15% (3/20), respectively; its serotypes are O_{26}: H_{11}, O44:H_{18}, O_{78}, O_{103}:H_4 and O_{127}:$H_{6.}$ Detected STEC by multiplex PCR for *Stx1*, *Stx2* and *eaeA* genes; showed different result for each serotype. *Salmonella* isolation was similar in both beef and poultry 10% (2/20), its serotypes were *S. Typhimurium, S. Enteritidis* and *S. Montevideo* with applied of multiplex PCR for *invA*, *hliA* and *fimH* as virulence genes. The other enteric bacteria were prevalent in 35% (7/20) of examined meat samples; one *Citrobacter freundi* and also one *Serratia liquefaciens* and *Enterobacter agglomerans* with percentage of (5%) for each, two *Enterobacter aerogenes* and also two *Proteus morabilis* with percentage of (10%) for each. While, from poultry samples enteric bacteria constituted 10% (2/20) as one *Enterobacter aerogenes* and one *Klebsiella pneumonia* with percentage of 5% for each one. This obtained data indicated that the microbiological quality of analyzed raw beef samples had high unsatisfactory result than poultry meat samples, and both could be an important cause of food borne disease. Good manufacturing practices (GMP) for Egyptian hotels should be applicable and food handler's health screening have to be made to control pathogenic microbes which potential for public health risks.

Key words: *Butcher area, Salmonella, S.aureus count, E.coli isolation, Aerobic bacterial count, Coliform count, Hotel's kitchen, enteric bacteria.*

Introduction

Meats are the main media of bacterial growth due to; it contains high moisture, rich in protein, have fermentable carbohydrate, have favorable pH and other growth factors **(Mboto *et al.,* 2012)**. Many food-borne diseases are associated with consumption of meat and poultry. Some pathogens are not previously known (new pathogens), others have newly arisen as food-borne (emerging pathogens), and others have become more potent or associated with other products (evolving pathogens). Many of

these pathogens may cause severe illness, besides gastroenteritis. Outbreaks of enterohemorrhagic *Escherichia coli* have been associated with consumption of contaminated meat **(Mor-Mur and Yste, 2010).**

Presence of microorganisms indicated that the food has been processed in unhygienic condition. Presence of Coliforms and Aerobic bacteria is a good indicator for determining the hygienic quality of meat. In food poisoning the most important bacteria is *S. aureus* count which has been compared in the standards **(İsmail and Belma, 2002).** *S. aureus* plays a great role in bacterial contamination of food, Staphylococcus can be carried on human hands, nasal passage or throats, so workers play a major role of *S. aureus* contamination in different stages of food. Most food-borne illnesses of *S. aureus* outbreaks are a result of production of heat stable enterotoxins in the food which may lead to severe food poisoning outbreaks **(Ahmed, 1991 and FSIS, 2003).**

The microbiological quality of the raw meat, personal hygiene and any contamination during the process will determines the quality of end product in terms of microbial contamination **(Elmali and Yaman, 2005).**

Food-borne illnesses are defined by the world health organization as diseases caused byconsumption of contaminated foods or water by infectious or toxic substance. Food-borne illnesses have two broad groups; intoxication and infection. Intoxication is caused by ingestion of toxin produced by pathogens, while infection is caused by ingestion of food containing viable pathogens **(Addis and Sisay, 2015).** Food borne diseases are diseases resulting from ingestion of bacteria, toxins and cells produced by microorganisms present in food. The severity of the signs and symptoms may vary with the amount of contaminated food ingested and susceptibility of the individuals to the enterotoxins **(Clarence *et al*., 2009).**
The pathogenic mechanism of *E.coli* among various serotypes differs depending on intestinal colonization by STEC produce either Shiga toxin 1 (Stx1), Shiga toxin 2 (Stx2), or a combination of both toxins. The Shiga-like toxins, or verocytotoxins, are the major virulence factor which induced death in certain individuals. But, colonization by enteropathogenic *E.coli* (EPEC) causes effacement of microvilli by adherence to the epithelial cell membrane. Presence of the EPEC detecting by the ability of adherence factor plasmid to adhere by an outer membrane protein called intimin that is encoded by the *eae* gene **(Bacon and Sofos, 2003).**

Most of these food-borne diseases are due to mishandling of foods, those ways should be avoided (e.g. improper cooling, inadequate heating/reheating, and poor personal hygiene),education of food handlers and consumers about the importance of food hygiene to improve safety and so prevent many illness **(Leon-Velarde *et al.,* 2004 and Sofos, 2008)**. Other ways such as incorrect thaws, inadequate cleaning and sanitation of utensils resulting in higher contamination with microorganisms and lower keeping quality measures, which lead to severe public health hazards **(Hassan *et al.*, 2015).** So, to ensure that the food is microbiologically safe, both the manipulators and the food need to be continually monitored **(Gilling *et al.*, 2001).**

The HACCP system identifies critical control points during food processing where contamination is likely to occur. This allows food industry personnel to focus on the critical areas and put in place controls to prevent contamination. HACCP places primary responsible for the safety of food in food processing industry. The government's role is to verify that industry is carrying out its responsibility, by examining this area and to initiate appropriate regulatory action if necessary. Meat and poultry production and processing facilities must have an HACCP plan in place **(Roberts, 2001)**.

Here in the present study, the butcher area in hotel‘s kitchen have been bacteriologically examined using APC of handler and contact surfaces of food during its preparation as indicator for hygienic status. Also, quality of food by bacteriological identification of APC, CC, CPS and isolation of food poisoning bacteria from meat samples to highlight potential problems of storage and handling since production and detect the most toxic and pathogenic genes.

Materials and Methods

Collection of Samples:

A total of one hundred (100) food samples and contact surface swabs were collected from 20 fixed and floating hotels from Kitchen area in Egypt and used for evaluation of the hygienic status during preparation of food (raw meat and chicken) and isolation of food poisoning microorganisms.

The collected samples include raw meat and raw chicken (40), food contact surfaces (20), chef's hand swab (20) and Knife swabs (20).
Each sample was kept in a separated sterile plastic bag and put in an ice box then transferred to the laboratory under complete aseptic condition without undue delay and examined as quickly as possible. The collected samples were subjected to the microbiological examination to evaluate their quality.

Preparation of samples

Preparation of sample homogenate.

To each 25 grams of the food sample, 225 ml of sterile peptone water were added and thoroughly mixed using sterile homogenizer for 1 – 1.5 minutes, from which tenfold serial dilutions were prepared according to standard methods **(ISO 6887-1 and 2: 2017).**

Swab samples: Sterile cotton screw capped plastic tubes with 10 ml diluents ready for use and a template which made of metal having an exposed inner area of 10 cm^2 (2×5 cm) was used to delineate area of sampling.
The template was wrapped in aluminum foil and sterilized in hot air oven at 180ºC for 20 minutes. Buffered peptone water was used as rinsing and diluents fluid. The solution was distributed to small heat resistant screw capped tubes, each containing 10 ml of rinsing fluid, and then sterilized in the autoclave at 121ºC for 20 minutes. For use, the sterilized template placed firmly against the surface of the food serving establishments and food handlers to limit the examined area.

The sterile cotton swab drawn from the tubes, moistened in rinsing fluid solutions (buffered peptone water), then rolled over the limited area inside the template rolled in one direction and perpendicular to this direction to represent all area. Finally, cotton swab was aseptically retained into the rinsing fluid screw capped tubes containing 10 ml buffered peptone water. **(ISO 18593: 2004).**

Bacterial isolation, counting, purification and identification

The prepared samples and swabs were subjected to the following examinations:
Aerobic Plate Count (APC) according to **(ISO 4833:2013)**
Total Coliforms count (CC) according to **(ISO 4832: 2006)**
Enumeration of Coagulase Positive *Staphylococci* (CPS) according to **(ISO 6888-1: 2003)**
Isolation and identification of Enteropathogenic *Escherichia coli* according to **(Lee and Arp, 1998).**
Isolation and identification of *Salmonellae* according to **(ISO 6579-1:2002)**
Identification of suspected enteric bacteria according to (**MacFaddin, 2000)**.

Serological identification of *E. coli*:

The isolates were serologically identified according to **Kok *et al.* (1996)** by using rapid diagnostic *E. coli* antisera sets ("Denka Seiken" Co., Japan).

Serological identification of *Salmonellae:*

Serological identification of *Salmonellae* was carried out according to **(ISO 6579-3:2014)** and reading with Kauffman – White scheme **(Grimont and Weill, 2007)** for the determination of Somatic (O) and flagellar (H) antigens using *Salmonella* antiserum **("Denka Seiken" Co., Japan and "Sifin", Germany).**

IV. Molecular characterization using multiplex PCR technique:

Demonstration of virulence factors including invasion A (*invA*), hyper-invasive locus *(hilA)* and fimbrial (*fimH*) genes of the isolated *Salmonella species.*
Identification of shiga toxins (*stx1 & stx2) and* intimin *(eaeA) genes of E.Coli* was performed essentially by using primers (Pharmacia Biotech).
DNA Extraction using QIA amp DNA Mini kit (Qiagen, Germany, GmbH).
Oligonucleotide Primer Primers used were supplied from (Pharmacia Biotech) and was

listed in **table (1 and 2).**

PCR amplification. Primers were utilized in a 25- µl reaction containing 12.5 µl of EmeraldAmp5X Taq master (Fermentas), 1 µl of each primer of 20 pmol concentrations, 4.5 µl of water, and 6 µl of DNA template. The reaction was performed in an applied biosystem 2720 thermal cycler (Master cycler, Eppendorf, Hamburg, Germany).

Analysis of the PCR Products. Finally, 5 µl of each amplicon was electrophoresed in 1.5 % agrose gel (Sigma –USA, stained with ethidium bromide and visualized as well as captured on UV transilluminator. A 100 bp DNA ladder (Qiagen, Germany, GmbH) was used as a marker for PCR products.

Table (1). primer sequence of virulence genes used in Salmonella isolates with annealing temperature 58^{O}C:

Target gene	Oligonucleotide sequence (5′ → 3′)	Product size (bp)	References
invA (F)	**5′** GTGAAATTATCGCCACGTTCGGGCA **′3**	284	**Shanmugasamy *et al.* (2011)**
invA(R)	**5′** TCATCGCACCGTCAAAGGAACC **′3**		
hilA (F)	**5′** CTGCCGCAGTGTTAAGGATA **′3**	497	**Guo *et al.* (2000)**
hilA (R)	**5′** CTGTCGCCTTAATCGCATGT **′3**		
fimH (F)	**5′** GGA TCC ATG AAA ATA TAC TC **′3**	1008	**Menghistu (2010)**
fimH (R)	**5′** AAG CTT TTA ATC ATA ATC GAC TC **′3**		

Table (2). primer sequence of genes used in *E.coli* isolates with annealing temperature 58^{O}C:

Primer	Oligonucleotide sequence (5′ → 3′)	Product size (bp)	References
stx1 (F)	**5′** ACACTGGATGATCTCAGTGG **′3**	614	**Dhanashree and Mallya(2008)**
stx1 (R)	**5′** CTGAATCCCCCTCCATTATG **′3**		
stx2 (F)	**5′** CCATGACAACGGACAGCAGTT **′3**	779	
stx2 (R)	**5′** CCTGTCAACTGAGCAGCACTTTG **′3**		
eaeA (F)	**5′** GTGGCGAATACTGGCGAGACT **′3**	890	**Mazaheri *et al.* (2014)**
eaeA (R)	**5′** CCCCATTCTTTTTCACCGTCG **′3**		

Results

The results were statically analytical to evaluate the mean values of APC (CFU/gm) of randomly taken samples of meat from 10 fixed hotels were $4.3x10^5 \pm 2.6x10^5$ for thawed beef and $1.4x10^4 \pm 4.7x10^3$ for thawed poultry, respectively; but for floating boats hotels were $7.4x10^5 \pm 3x10^5$ for thawed beef and $10^5 \pm 8.3x10^4$ for thawed poultry, respectively as shown in Table (3).

Table (3). Statistical analytical results of aerobic plate count (APC) (CFU/g) of meat and chicken samples from fixed hotels and floating boats: (n= 20 of each)

Type of Hotel	Type of Samples (Acceptable limit)	Aerobic Plate Count (APC) (CFU/g)		
		Min.	Max.	Mean ± SE
Fixed	Beef ($\leq 10^6$)	10^3	3×10^6	$4.3 \times 10^5 \pm 2.6 \times 10^5$
	Chicken ($\leq 10^5$)	10^3	5×10^4	$1.4 \times 10^4 \pm 4.7 \times 10^3$
Floating	Beef ($\leq 10^6$)	10^3	2.4×10^6	$7.4 \times 10^5 \pm 3 \times 10^5$
	Chicken ($\leq 10^5$)	10^3	9×10^5	$1 \times 10^5 \pm 8.3 \times 10^4$

SE=Standard error

Table (4) showed that the mean values of Coliforms count (CFU/gm) of randomly taken samples of meat from fixed hotels were $6.6x10^4 \pm 4.8x10^4$ for thawed beef and $7.6x10^2 \pm 4.7x10^2$ for thawed poultry, respectively; but for floating boats hotels were $1.7x10^3 \pm 8.9x10^2$ for thawed beef and $2.2x10^3 \pm 1.9x10^3$ for thawed poultry, respectively. On the other hands, the result ofall examined samples was less than $1x10^1$ CFU/g for enumeration of Coagulase Positive *Staphylococci* (CPS).

Table (4). Statistical analytical results of Coliforms count (CC) (CFU/g) of meat and chicken samples from fixed hotels and floating boats: (n= 20 of each)

Type of Hotel	Type of Samples (Acceptable limit)	Coliforms Count (CFU/g)		
		Min.	Max.	Mean $\pm$ SE
Fixed	Beef ($\leq 10^2$)	10^2	5×10^5	$6.6 \times 10^4 \pm 4.8 \times 10^4$
	Chicken ($\leq 10^2$)	10^2	5×10^3	$7.6 \times 10^2 \pm 4.7 \times 10^2$
Floating	Beef ($\leq 10^2$)	10^2	9×10^4	$1.7 \times 10^3 \pm 8.9 \times 10^2$
	Chicken ($\leq 10^2$)	10^2	2×10^4	$2.2 \times 10^3 \pm 1.9 \times 10^3$

SE= Standard error

Conclusion: unaccepted samples show higher APC than standard were (2/10) 20% and 4/10 (40%) of beef meat from fixed and floating boat hotels, respectively and (2/10) 20% of chicken meat from floating boat hotels, while all chicken meat of fixed hotels were acceptable. Others unaccepted samples show higher CC than standard were 4/10 (40%) and (3/10) 30% of beef meat from fixed and floating boat hotels, respectively and 2/10 (20%) and (1/10) 10% of chicken meat from fixed and floating boat hotels, respectively.

The food contact surfaces and food handler's swabs results were statically analyzed to evaluate the mean values of APC (CFU/cm^2); from fixed hotels were $5x10^2 \pm 2.6x10^2$ for cutting board surfaces, 8.6x10±2.9x10 for knife blade and 4.4x10±1.6x10 for chef hand. While, from floating boat hotels were $3.6x10^2 \pm 1.2x10^2$ for cutting board surface, $3.2x10^2 \pm 1.2x10^2$ for knife blade and 4.4x10±1.4x10 for chef hand, as shown in table (5).

Table (5). Statistical analytical results of aerobic plate count (APC) (CFU/cm^2) of environmental samples from fixed hotels and floating boats: (n= 10 of each).

Type of Hotel	Type of Samples (Acceptable limit)*	Aerobic Plate Count (APC) (CFU/cm^2)		
		Min.	Max.	Mean ± SE
Fixed	Cutting Board surface ($\leq 10^2$)	10	2.8 X 10^3	5 X 10^2± 2.6 X 10^2
	Knife blade ($\leq 10^2$)	10	2.9 X 10^2	8.6 X 10± 2.9 X 10
	Chef Hand ($\leq 10^2$)	10	1.5 X 10^2	4.4 X 10± 1.6 X 10
Floating	Cutting Board surface ($\leq 10^2$)	10	9 X 10^2	3.6 X 10^2± 1.2 X 10^2
	Knife blade ($\leq 10^2$)	10	9 X 10^2	3.2 X 10^2± 1.2 X 10^2
	Chef Hand ($\leq 10^2$)	10	1.4 X 10^2	4.4 X 10± 1.4 X 10

SE=Standard error
*According to **Jankowicz, (2002)**

Finally, the unaccepted count of swabs samples (cutting board surface, knife blade and chef hand) show higher APC than standard were 70%, 40% and 20% in fixed hotels and 60%, 50% and 20% in floating boat hotels, respectively.

As shown in Table (6) the incidence of *E.coli* isolated from meat samples, was (4) with percentage 20% and from poultry samples, was (3) with percentage 15%; also the incidence of *Salmonella* Spp. Isolated from meat samples, was (2) with percentage 10% and from poultry samples, was (2) with percentage 10%.

Table (6). Incidence of *E. coli* and *Salmonella* spp. isolated from the examined food samples from fixed hotels and floating boats:

Samples	No. of Samples	No. of Positive Samples			
		E. coli		*Salmonella* spp.	
		No.	%	No.	%
Beef	20	4	20	2	10
Chicken	20	3	15	2	10
Total	40	7		4	

Isolation and identification of other isolates belonged to Enterobacteriaceae, found 7/20 from meat samples and 2/20 from chicken samples, which revealed from one *Citrobacter freundi* with percentage of (5%), two *Enterobacter aerogenes* with percentage of (10%), one *Enterobacter agglomerans* with percentage (5%), Two *Proteus morabilis* with percentage (10%), one *Serratia liquefaciens* with percentage of (5%). While, from poultry samples; were one *Enterobacter aerogenes* with percentage 5% and one *Klebsiella pneumonia* with percentage 5% as shown in table (7).

Table (7). Identification of Enterobacteriaceae microorganism isolated from examined food samples:

Identified Microorganism	Meat (n=20)	%	Chicken (n=20)	%
Citrobacter freundii	1	5	0	0
Enterobacter aerogenes	2	10	1	5
Enterobacter agglomerans	1	5	0	0
Klebsiella pneumonia	0	0	1	5
Proteus mirabilis	2	10	0	0
Serratia liquefaciens	1	5	0	0

Table (8) showed the serotypes of isolated *E.coli* from examined meat samples, 7 strains isolated from samples as two isolates of *E.coli* O26:H11, one isolate of *E.coli* O44:H18, also one isolate of *E.coli* O78 and *E.coli* O103: H4, while two isolates of *E.coli* O127: H6.

Table (8). Serotypes of isolated *E. coli*:

Serotype	Meat	Chicken	Total (7)
O26:H11	1	1	2
O44:H18	0	1	1
O78	1	0	1
O103:H4	1	0	1
O127:H6	1	1	2

Fig. (1) showed the prevalence of STEC in different serotypes isolated from meat samples by agarose gel electrophoresis of multiplex PCR of *Stx1* (614 bp), *Stx2* (779 bp) and *eaeA* (890 bp) genes which detect that *E.coli* O26 from beef was positive for *stx1, stx2* and *eaeA* genes, the other *E.coli* O26 from chicken was positive for *stx2* and *eaeA* genes, while *E.coli* O78 and two isolates O127 were positive for *stx1* gene but *E.coli* O103 was positive for *stx1* and *stx2* genes. *E.coli* O44 from chicken was positive to *stx2* gene.

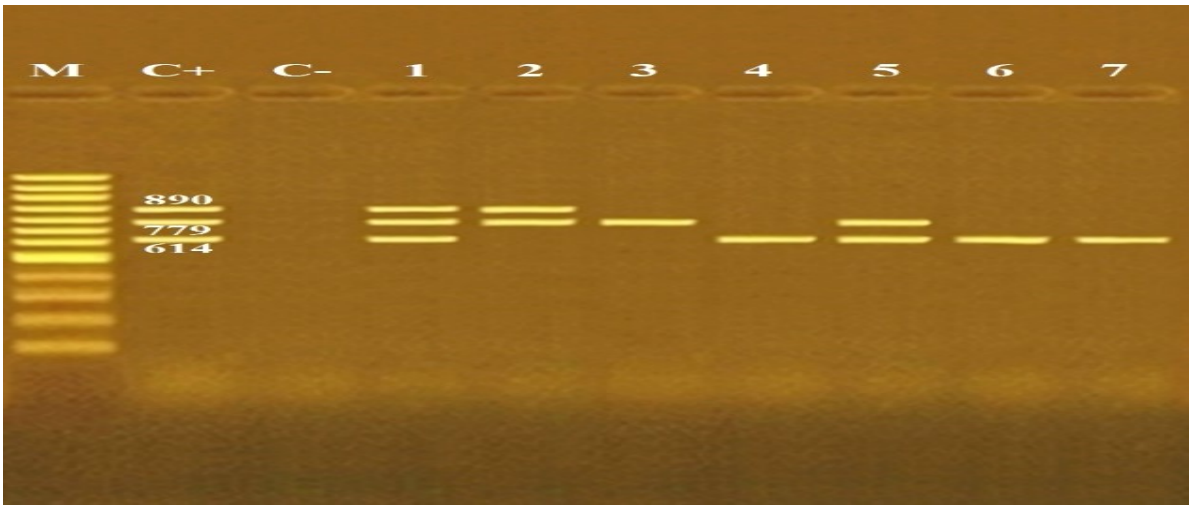

Fig. (1): Agarose gel electrophoresis of multiplex PCR of *Stx1* (614 bp), *Stx2* (779 bp) and *eaeA* (890 bp) genes for characterization of Enteropathogenic *E. coli*.

Lane M: 100 bp ladder as molecular size DNA marker, **Lane C+:** Control positive *E. coli* for *stx1, stx2*and *eaeA* genes, **Lane C-**: Control negative, **Lane 1** (O26): Positive *E. coli* for *stx1, stx2* and *eaeA* genes, **Lane 2** (O26): Positive *E. coli* for *stx2* and *eaeA* genes, **Lane 3** (O44): Positive *E. coli* strain for *stx2* gene, **Lanes 4** (O78), **6 & 7** (O127): Positive *E. coli* strains for *stx1* gene, **Lane 5** (O103): Positive *E. coli* strain for *stx1* and *stx2* genes.

Table (9) revealed that the serotyping of four *Salmonella* spp. was *S.* Typhimurium*, S.* Enteritidis and *S.* Montevideo as 2, 1 and 1 isolate, respectively. Those isolates, prevalence and characterization from meat samples by agarose gel electrophoresis of multiplex PCR for *invA* (284 bp), *hliA* (497 bp) and *fimH* (1008 bp) as virulence genes appeared *S.* Typhimurium and *S.* Enteritidis were positive for *invA, hilA* and *fimH* genes. But *S.* Montevideo was positive for *invA* and *hilA* genes only as shown in Table (10) and Fig. (2).

Table (9). *Salmonella* serovars isolated from meat and chicken samples:

Serovars	Meat	Chicken	Total (4)
***S.* Typhimurium**	1	1	2
***S.* Enteritidis**	1	0	1
***S.* Montevideo**	0	1	1

Table (10). Prevalence of virulence genes in *Salmonella* spp. isolated from food samples:

Type of Shiga toxin	*Salmonella* strains		
	***S.* Typhimurium**	***S.* Enteritidis**	***S.* Montevideo**
invA	+	+	+
hilA	+	+	+
fimH	+	+	-

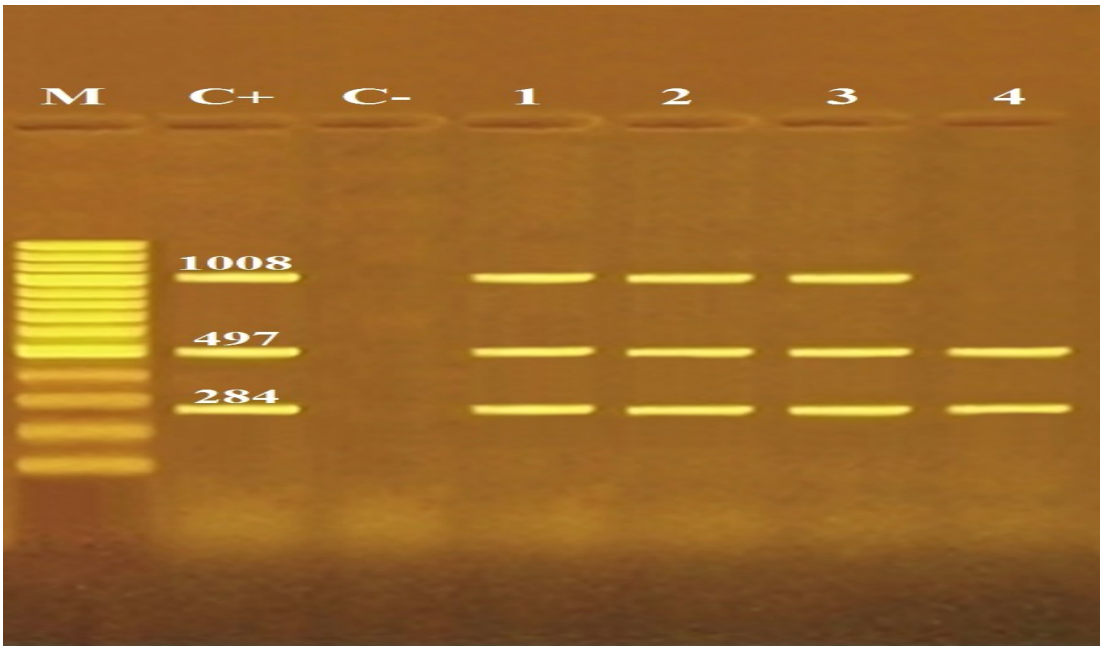

Fig. (2): Agarose gel electrophoresis of multiplex PCR of *invA* (284 bp), *hilA* (497 bp) and *fimH* (1008 bp) virulence genes for characterization of *Salmonella* strains.

Lane M: 100 bp ladder as molecular size DNA marker, **Lane C+:** Control positive *S. Typhimurium* for *invA, hilA* and *fimH* genes, **Lane C-:** Control negative, **Lanes 1, 2** (*S. Typhimurium*) **and 3** (*S. Enteritidis*)**:** Positive strains for *invA, hilA* and *fimH* genes, **Lane 4** (*S. Montevideo*): Positive strain for *invA* and *hilA* gene.

Discussion

Aerobic plate count (APC) is the most reliable index of meat quality, sanitary processing and shelf- life of meat products **(ICMSF, 1980).** Coliforms count was greatly considered to be suitable indicator for fecal contamination **(Mousa *et al.* 2001).** High count of *S. aureus* in a food indicates its contamination from food handlers and inadequately cleaned equipments **(ICMSF, 1996).** In the present study, the mean values of APC (CFU/gm) of randomly taken samples of meat from 10 fixed hotels (Table 3) were $4.3x10^5 \pm 2.6x10^5$ for thawed beef and $1.4x10^4 \pm 4.7x10^3$ for thawed poultry, but for floating boats hotels were $7.4x10^5 \pm 3x10^5$ for thawed beef and $10^5 \pm 8.3x10^4$ for thawed poultry. On the other hands, the mean values of Coliform count (CFU/gm) of randomly taken samples of meat from fixed hotels (Table 4) were $6.6x10^4 \pm 4.8x10^4$ for thawed beef and $7.6x10^2 \pm 4.7x10^2$ for thawed poultry, but for floating boats hotels were $1.7x10^3 \pm 8.9x10^2$ for thawed beef and $2.2x10^3 \pm 1.9x10^3$ for thawed poultry. The results obtained of all examined samples were less than $1x10^1$ (<10) CFU/g for enumeration of Coagulase Positive *Staphylococci* (CPS). **Thomas *et al.* (2015)** showed higher result when collect 260 raw beef samples (55 Slaughterhouse, 55 butchers shop (restaurants/ hotels), 150 from different types of markets) in analysis of microbiological quality; the mean aerobic plate count in beef was slightly higher in butchers shop (restaurants/hotels) (2.82×10^6). Similarly, the coliform count in meat samples was higher from restaurants/hotels (3.73×10^4CFU/g), and **Sharma and Chattopadhyay (2015)** found APC of meat from different parts of carcasses ranged from 10^6 to 10^7 CFU/g but chicken around 10^6 CFU/g.

The mean values of APC (CFU/cm^2) of food contact surfaces and food handler's swabs; from fixed hotels (Table 5) were $5x10^2 \pm 2.6x10^2$ for cutting board surfaces, $8.6x10 \pm 2.9x10$ for knife blade and $4.4x10 \pm 1.6x10$ for chef hand. While, from floating boat hotels were $3.6x10^2 \pm 1.2x10^2$ for cutting board surface, $3.2x10^2 \pm 1.2x10^2$ for knife blade and $4.4x10 \pm 1.4x10$ for chef hand. Similar results were obtained by **Montville and Schaffner (2004)** who found variation of log normal dis-

tribution parameters (log CFU/g) in different types of surface swabs from meat contact surfaces showed higher mean microbial levels tended to be plastic (e.g., juice dispenser tips, pastry brushes, plastic cutting boards) which suggested that most of these items were commonly encountered wet, which provided a good environment for bacterial growth and provided a higher bacterial transfer rate than dry surfaces. Also, **Abdel-Shakour *et al.* (2014)** concluded that surface swabs were satisfactory with standard when used chlorine tablets as safety material while unsatisfactory handler swabs with same place as a result of using gel hand and others with very high count (6×10^3 CFU/g) of PCA but others by using normal disinfectant are satisfactory. While, contact surfaces of ready to eat food were shown high APC (3.3×10^3 CFU/g and 9.7×10^2 CFU/g).

Food-borne illness is a major international problem and leads to great socioeconomic impact. The contamination of the food with pathogens and its persistence, growth, multiplication and/or toxin production has emerged as an important public health concern. Most of these problems could be controlled with the efforts on the part of the food handlers, whether in a processing plant, a restaurant, and others **(Mensah *et al.*, 2002).** In the current study, the incidence of *E.coli* from meat samples (Table 6), was (4 isolates) with percentage 20% and from poultry samples, was (3 isolates) with percentage 15%. Also, the incidence of *Salmonella* spp. from meat samples was (2 isolates) (10%) and from poultry samples, was (2 isolates) (10%). Isolation and identification of other isolates belonged to Enterobacteriaceae, (Table 7) were 7/20 from meat samples and 2/20 from chicken samples, which identified in meat samples as one *Citrobacter freundi* with percentage of (5%), two *Enterobacter aerogenes* with percentage of (10%), one *Enterobacter agglomerans* with percentage (5%), Two *Proteus morabilis* with percentage (10%), one *Serratia liquefaciens* with percentage of (5%). While, from poultry samples; were one *Enterobacter aerogenes* with percentage 5% and one *Klebsiella pneumonia* with percentage 5%. Higher results were reported by, **Zhao *et al.* (2001)** who reported high prevalence of *E. coli* (38.7%) and lower prevalence of *Salmonella* spp. 4.2% from 212 chicken meat samples. Also, **Milhem *et al.* (2016)** examined beef meat samples from major abattoirs and found 35 isolates (29.9%) were *Escherichia coli* and 2 isolates (1.7%) were *Citrobacter Freundii***.** Also, **Gwida *et al.* (2014)** identify 27/50 (54.0%) and 8/50 (16.0%) from raw beef and chicken meat samples, respectively, as *E. coli* and *Proteus* spp. from chicken meat (78.0%) and beef meat (58.0%) while, *Klebsiella* spp. were isolated from 3 samples of raw beef (6.0%) and 13 samples (26.0%) of raw chicken meat but *Citrobacter* spp. (13.3%).

Badr *et al.* (2016) isolated *Salmonella* with percentage 3.8% (4/104) from chicken meat but *E. coli* was 35.6% (37/104). While, **Adeyanju and Ishola (2014)** reported 47.2% (25/53) from *E.coli* isolation and **Dhaher *et al.* (2011)** reported rate of *Salmonella* of 24.76%. **Phillips *et al.* (2001)** detected *E. coli* on 10.3% of carcasses and 5.1% of boneless beef samples, In Australia. Also, **Sumner *et al.* (2003)** isolated *E. coli* with percentage 18.8% from beef carcasses. In Croatia, **Miokovic *et al.* (2004)** found *E. coli* in 6% of the beef samples. **Iroha *et al.* (2011)** reported bacterial contamination in fresh meat that is the most common bacteria were respectively *E. coli* followed by *Klebsiella pneumonia*. Other study reported by **Omorodion and Odu (2014)** about Assessment of bacteriological quality of fresh meats sold in Calabar metropolis, Nigeria, showed that *K. pneumoniae* (16.7%) was the most predominant pathogens. This was followed by *Enterobacter* spp (13.9%) and *C. freundii* (13.9%). Other studies showed different isolation and percentage as, **Sharma and Chattopadhyay (2015)** isolated pathogenic microorganisms in higher percentages; *E. coli* (98%), *Enterococcus faecalis* (90%), *Salmonella* spp. (2%), *Bordetella* spp. (1%). Other organisms that were isolated in this study were *Klebsiella pneumoniae* (98%), *Enterococcus aerogenes* (90%), *Citrobactor spp.* (52%), *Proteus spp.* (50%), *Klebsiella oxytoca* (35%) from raw meat. Also, **Tanimoto *et al.* (2005)** found that *Enterococcus faecalis* and *Enterobacter aerogenes* were present in 90% of the samples in raw chicken meat of Japan and **Kim *et al.***

(2005) showed prevalence 98% of *Klebsiella pneumoniae* in the chicken samples and **Simjee *et al.* (2002)** reported *E. faecalis* Isolation from raw chicken meat. Also, **Abdel-Shakour *et al.* (2014)** isolated *Citrobacter freundii* (meat and chicken), *Enterobacter aerogenes* (meat and chicken), *Enterobacter agglomerans* (chicken), *Klebsiella pneumonia* (meat and chicken), *Proteus mirabilis* (meat and chicken) and *Serratia liquefaciens* (chicken)

Seven *E.coli* strains from meat and chicken samples were serotyped (Table 8) as two isolates of *E.coli* O26:H11, one isolate of *E.coli* O44:H18, also one isolate of *E.coli* O78 and *E.coli* O103: H4, while two isolates of *E.coli* O127: H6. On virulence genes identification detected that *E.coli* O26 isolate was positive for *stx1*, *stx2* and *eaeA* genes, other *E.coli* O26 isolate was positive for *stx2* and *eaeA* genes, *E.coli* O78 and (no. = 2) O127 isolates were positive for *stx1* gene but E.coli O103 isolate was positive for *stx1* and *stx2* genes. **Yassin and EL-Gammal (2016)** detected *E. coli* in 12% of 50 examined samples serologically identified as O78, O103:H2, O1:H7 and O125:H21. **Abdel-Shakour *et al.* (2014)** isolated *E.coli* O111:K58, O26:K60, O55:K59 from raw beef meat. Close to the obtained data, **Younis *et al.* (2017)** reported that 11.66% (14/120) of chicken meat samples were *E. coli*, the most predominant serotypes were O78 and O128: H2 (21.5%, each), followed by O121: H7 and O44: H18 with molecular method detected that 2 strains (25%) harbored *stx1*, 3 strains (37.5%) *stx2*, and 3 strains (37.5%) both *stx1* and *stx2*, while 1 (12.5%) strain carried *eaeA* gene. Particularly, only O26 serotype had all tested virulence genes (*stx1, stx2*, and *eaeA*). In another study conducted by **Rashid *et al.*, 2013** found that *E. coli* isolates had *stx1* (10.5%), *stx2* (7%), both *stx1* and *stx2* (1.5%), and (8%) as virulence genes. Other investigators detected both *stx1* and *eaeA* genes in all strains, but no strains had *stx2* **(Park *et al.*, 2015).**

Several genes have been used to detect *Salmonella* in natural environmental samples as well as food and fecal samples. Virulence chromosomal genes including; *invA, invE, himA* and *phoP* are target genes for PCR amplification of *Salmonella* species **(Jamshidi *et al.*, 2009).**The *invA* gene has ability as specific primers sets to confirm the isolates as *Salmonella* at the genus level **Shanmugasamy *et al.* (2011).** On Serotyping of *Salmonella* spp. found *S.* Typhimurium, *S*. Enteritidis and *S*. Montevideo as 2, 1 and 1 isolate, respectively. with percentage of 50%, 25% and 25%, respectively. Those isolates, prevalence and characterization from meat samples by agarose gel electrophoresis of multiplex PCR for *invA* (284 bp), *hliA* (497 bp) and *fimH* (1008 bp) as virulence genes appeared *S.* Typhimurium and *S.* Enteritidis were positive for *invA, hilA* and *fimH* genes. But *S.* Montevideo was positive for *invA* and *hilA* genes only (Table 9). Also**, Molla and Mesfin (2003)** reported *Salmonella* in chicken meat (15.4%), mainly *S.* Typhimurium. While, in Kafr elshiekh Governorate **Yassin and EL-Gammal (2016)** detected *Salmonella spp.* with a percentage of 18% Serotypes as *S.* Typhimurium (6%), *S.* Enteritidis (4%), *S.* Kentucky (4%), *S.* Molade (2%) and *S.* Infants (2%), and **Abdel-Shakour *et al.* (2014)** isolated *Salmonella* spp. as *S.* Enteritidies in raw meat While, *S.* Munester, *S.* Enteritidies and *S.* Typhimurium in raw chicken. Also, **Saad *et al.* (2015)** detected *S.* Enteritidis, *S.* Typhimurium and *S.* Anatum 33%, 50% and 17% from raw chicken samples, respectively then applied multiplex PCR methods for detection of virulence factors *(invA, hil A, fimH* and *Stn* genes) of *S.* Typhimurium and *S.* Enteritidis. On the other hand, **Javadi and Safarmashaei (2011)** failed to isolate *Salmonellae* spp. from marketed broiler meat.

Conclusions and Recommendations:

Unsatisfactory of this sample refers to bad manufacturing or preparation practices which may be cross contamination from other contaminated foods, bad personal hygiene or improper cleaning and sanitation. So it must be used good healthy measures like, periodic cleaning for tools and surfaces contact to the meat during skinning or defeathering and slicing of the meat in order to reduce the potential contamination. Programs like good manufactories practices (GMP), good hygienic practices (GHP), HACCP and ISO 22000 systems must be applied especially in hotels to prevent and control foodborne pathogens with regular food

safetyand hygiene workshops and training for food handlers that commensurate with their roles as well as and food handler's health screening were made.

References

Abdel-Shakour, E.H.; Elouboudy, S.S.; Abdelaziz, Z.K.; Hassan, M.A. and Emara, M.B. (2014). The impact of food preparation practices on food borne diseases. *Rep Opinion*, 6(6): 22-35.

Addis, M. and Sisay, D. (2015). A Review on Major Food Borne Bacterial Illnesses. J Trop Dis., 3(4): 176-183.

Adeyanju G.T. and Ishola O. (2014). Salmonella and Escherichia coli contamination of poultry meat from a processing plant and retail markets in Ibadan, Oyo State, Nigeria. Springer Plus, 3: 139. https: doi. org/10. 1186 /2193-1801-3-139.

Ahmed, I.M.I. (1991). Hygienic quality of marketed ready to eat meat. M.V.Sc. Thesis Meat hygiene, Fac. Vet. Med.; Zagazig Univ.

Bacon and Sofos (2003). Food hazards : biological food; characteristics of biological hazards in foods. In *Food Safety Handbook*, R.H. Schmidt and G. Rodrick, Editors. pp. 157-195. Willey Interscience, New York, NY, USA.

Badr, H.; AlAtfeehy, N.M. and Nasef, S.A. (2016). Detection of food borne pathogens from retail chicken. BVMJ, 31(2): 276-282.

Clarence, S.Y.; Obinna, C.N. and Shalom, N.C. (2009). Assessment of bacteriological quality of ready to eat food (Meat pie) in Benin City metropolis, Nigeria. African Journal of Microbiology Research. 3(6): 390-395.

Dhaher, F.H.; Awni, M.N.; Mahmod, M.M. AND Jamil, H.S. (2011). Isolation and diagnosis of Salmonella in animal origin food, import feed in Baghdad local markets and localpoultry farms. Iraq Acad. Sci. J. 5, 1-19.

Dhanashree, B. and Mallya, S. (2008). Detection of shiga-toxigenic *Escherichiacoli* (STEC) indiarrhoeagenic stool and meat samples inMangalore, India.Indian J. Med. Res., 128: 271-277.

Elmali, M. and Yaman, H. (2005). "Microbiological quality of raw meat balls: produced and sold in the eastern of Turkey". Pakistan Journal of Nutrition **(4),** 197-201.

Food Safety and Inspection Service "FSIS" (2003). United States Department of Agriculture. Meat preparation: Beef from farm to table. Washington. DC. 20250-3700.

Gilling, S.; Taylor, E.A.; Kane, K. and Taylor, J.Z. (2001). Successful hazard analysis critical control point implementation in the United Kingdom: understanding the barriers through the use of a behavioral adherence model. J. Food Protect., 64, 710-715.

Grimont, P.A.D. and Weill, F.X. (2007). Antigenic formulas of the *Salmonella* Serovars, WHO Collaborating Center for reference and research on Salmonella, Paris (9th edition).

Guo, X.; Chen, J.; Beuchat, L. and Brackett, R. (2000). PCR detection of*Salmonella* enterica serotype Montevideo in and on raw tomatoes usingprimers derived from *hilA*. Appl. Environ. Microbiol., 66: 5248-5252.

Gwida, M.; Hotzel, H.; Geue, L. and Tomaso, H. (2014). Occurrence of *Enterobacteriaceae* in Raw Meat and in Human Samples from Egyptian Retail Sellers. International Scholarly Research Notices, Article ID 565671: 1- 6. http://dx. doi. org/ 10. 1155 /2014/565671

Hassan, M.A.; Amin, R.A. and El-Salhy, M.S. (2015). Bacteriological and Chemical Evaluation of Meat Meals in Some Egyptian Hotels. BVMJ, 29(2): 80-91.

International Commission and Microbiological Specification for Foods "ICMSF" (1980)." Microbial ecology of foods". Vol. 1, Academic Press, New York, Toronto.

International Commission of Microbiological Specification for Foods "ICMSF" (1996). Microorganisms in Food. 1- Their significance and methods of enumeration. (3rd Ed.) Univ. of Toronto, Canada.

International organization for standardization (ISO 18593, 2004). Microbiology of food and animal feeding stuffs — Horizontal methods for sampling techniques from surfaces using contact plates and swabs

International organization for standardization (ISO 4832, 2006). Horizontal method for the enumeration of Coliforms–colony-count technique

International organization for standardization (ISO 4833, 2013). Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of microorgan-

isms — Colony-count technique at 30°C.

International organization for standardization (ISO 6579 part 1, 2002). Microbiology of food and animal feeding stuffs – Horizontal method for the detection of *Salmonella*. International Standards Organization, Geneva.

International organization for standardization (ISO 6579 part 3, 2014). Microbiology of food and animal feeding stuffs – Horizontal method for the detection of *Salmonella*. International Standards Organization, Geneva.

International organization for standardization (ISO 6887 part 1, 2017). Microbiology of the food chain— Preparation of test samples, initial suspension and decimal dilutions for microbiological examination - Part 1: General rules for the preparation of the initial suspension and decimal dilutions**.**

International organization for standardization (ISO 6887 part 2, 2017). Microbiology of the food chain -- Preparation of test samples, initial suspension and decimal dilutions for microbiological examination -- Part 2: Specific rules for the preparation of meat and meat products.

International organization for standardization (ISO 6888 part 1, 2003). Microbiology of food and animal feeding stuffs – Horizontal method for enumeration of coagulase – positive *staphylococci* (*Staphylococcus aureus* and other species International Standards Organization, Geneva.

Iroha, I.R.; Ugbo, E.C.; Ilang, D.C.; Oji, A.E. and Ayogu, T.E. (2011). Bacterial contamination of raw meat sold in Abakaliki, Ebonyi State Nigeria. J. Public Health. Epidemiol., 3: 49-53.

İsmail, K. and Belma, D. (2002). "Microbiological investigation on some of the commercial frozen meat in Izmir". Turkish Electronic Journal of Biotechnology, 18-23.

Jamshidi, A.; Bassami, M.R. and Afshari-Nic, S. (2009). Identification of Salmonella spp. and Salmonellatyphimurium by a multiplex PCR-based assay from poultry carcasses in Mashhad- Iran Int. J. Vet. Res. 3,1: 43-48.

Jankowicz, A.D. (2002). Business research projects. 3rd edition. London: Thamson Learning.

Javadi, A. and Safarmashaei, S. (2011). Microbial profile of marketed broiler meat. Middle-East J. Sci. Res. 9(5): 652-656.

Kim, S.H.; Wei, C.I.; Tzou, Y.M. and An, H. (2005). Multidrug-resistant Klebsiella pneumoniae isolated from farm environments and retail products in Oklahoma. Journal of Food Protection, 68 (10): 2022-2029.

Kok, T.; Worswich, D. and Gowans, E. (1996). Some serological techniques for microbial and viral infections. In: Collee, J., Fraser, A., Marmion, B. and Simmons, A., editors. Practical Medical Microbiology. 14th ed. Churchill Livingstone, UK, Edinburgh.

Lee, M.D. and Arp, L.H. (1998). A laboratory manual for the isolation and identification of avian pathogen Daviv E. Swayne, Chairman, John R. Glisson, Mark W. Jackwood, James E. Pearson, Willie M. Reed. Editorial Board for the American Association of Avian Pathologists, 4th ed., Chapter 3, Colibacillosis. 14-16.

Leon-Velarde, C.; Cai, G.H.; Larkin, Y.; Bell-Rogers, C.; Stevens, P.R.W. and Odumeru, J.A. (2004). Evaluation of methods for the identification of Salmonella enterica serotype Typhimurium DT104 from poultry environmental samples. J Microbiol Methods 58, 79–86

MacFaddin, J.F. (2000). Biochemical tests for identification medical bacteria. Warery Press Inc, Baltimore, Md. 21202 USA.

Mazaheri, S.; Ahrabi, S. and Aslani, M. (2014). Shiga toxin-producing *Escherichia coli* isolated from lettucesamples in Tehran, Iran. Jundishapur J. Microbiol., 7 (11): 1-6.

Mboto, C.I.; Agbo, B.E.; Ikpoh, I.S., Agbor, R.B.; Udoh, D.I.; Ambo, E.E. and Ekim, M.A. (2012). Bacteriological study of raw meat of Calabar Abattoir with public health and veterinary importance. J. Microbiol. Biotech. Res., 2(4): 529-532.

Menghistu, H. (2010). Studies on molecular heterogeneity among *Salmonella* Gallinarum isolates of poultry origin. M.V.Sc. Thesis, Deemed Univ., IVRI, Izatnagar, Bareilly.

Mensah, P.; Yeboah-Manu, D.; Owusu-Darko, K. and Ablordey, A. (2002). Street foods in Accra, Ghana: how safe are they? Bull. World Health Org., 80, 546-554.

Milhem, H.; Azizieh, A. and younes, A.A.

(2016). Prevalence of Escherichia coli and Citrobacter freundii in Raw Beef from major Abattoirs located in Damascus and countryside, Syria. International Journal of ChemTech Research, 9 (2): 290-296.

Miokovic, B.; Kozacinski, L.; Sertic, M. and Njari, B. (2004). Microbiological quality of yearling beef carcass halves. Arch. Lebensmittelhyg., 55, 4-6.

Molla, B. and Mesfin, A. (2003). A survey of Salmonella contamination in chicken carcass and giblets in Central Ethiopia. Revue De Medecine Veterinaire 154, 267-270.

Montville, R and Schaffner, D.W. (2004). Statistical Distributions Describing Microbial Quality of Surfaces and Foods in Food Service Operations Journal of Food Protection, 67(1): 162–167.

Mor-Mur, M. and Yuste, J. (2010). Emerging bacterial pathogens in meat and poultry: an overview. Food and Bioprocess Technology 3, 24–35.

Mousa, M.M.; Bkheet, A.A. and Abdel Tawab, E. (2001). "Bacteriological aspects of pre-cooked de-boned poultry meat in Damanhour". 2nd Int. Sci. Conf., The role of veterinary, Mansoura University.

Omorodion, N.J.P.N. and Odu, N.N. (2014). Microbiological Quality of Meats Sold In Port Harcourt Metropolis, Nigeria. Natural Science,12(2):58-62. (ISSN: 1545-0740).

Park, H.J.; Yoon, J.W.; Heo, E.J.; Ko, E.K.; Kim, K.Y.; Kim, Y.J.; Yoon, H.J.; Wee, S.H.; Park, Y.H. and Moon, J.S. (2015). Antibiotic resistance and virulence potentials of Shiga toxin-producing E. coli isolates from raw meats of slaughterhouses and retail markets in Korea. J. Microbiol. Biotechnol., 25(9): 1460-1466.

Phillips, D.; Sumner, J.; Alexander, J.F. and Dutton K.M. (2001). Microbiological quality of Australian beef. J. Food Prot., 64, 692-696.

Rashid, M.; Kotwal, S.K.; Malik, M.A. and Singh, M. (2013). Prevalence, genetic profile of virulence determinants and multidrug resistance of *Escherichia coli* isolates from foods of animal origin. Vet. World, 6(3): 139 -142. 20.

Roberts, C.A. (2001). The food safety information Hand Book, 1st Ed, Oryx press ,USA.

Saad, M.S.; Samar, S.N. and Abd El Sattar, S. (2015). Incidence of Salmonella species in chicken cut-up carcasses and chicken products. BVMJ, 29(2): 29-35.

Shanmugasamy, M.; Velayutham, T. and Rajeswar, J. (2011). *Inv A* gene specific PCR for detection of Salmonella from broilers. Vet. World, 4(12): 562-564.

Sharma, K.P. and Chattopadhyay, U.K. (2015). Assessment of Microbial load of raw meat Samples sold in the Open Markets of city of Kolkata. Journal of Agriculture and Veterinary Science, 8(3) Ver.1: 24-27.

Simjee, S.; White, D.G.; Wagner, D.D.; Meng, J.; Qaiyumi, S.; Zhao, S. and McDermott, P.F. (2002). Identification of vat (E) in Enterococcus faecalis isolates from retail poultry and its transferability to Enterococcus faecium. Antimicrobial Agents and Chemotherapy, 46(12): 3823-3828.

Sofos, J.N. (2008). Challenges to meat safety in the 21st century. Meat Sci., 78(1-2):3-13.

Sumner, J.; Petrenas, E.; Dean, P.; Dowsett, P.; West, G.; Wiering, R. and Raven G. (2003). Microbial contamination on beef and sheep carcasses in South Australia. Int. J. Food Microbiol., 81, 255-260.

Tanimoto, K.; Nomura, T.; Hamatani, H.; Xiao, Y.H. and Ike, Y. (2005). A vancomycin-dependent VanA-type *Enterococcus faecalis* strain isolated in Japan from chicken imported from China. Letters in Applied Microbiology, 41(2):157-162.

Thomas, N.; Kiros, A.; Pal, M. and Aylate, A. (2015). Bacteriological Quality of Raw Beef Collected from Municipality Slaughterhouse and Local Markets in and around Wolaita Soddo Town, Southern Ethiopia. Int J Vet Health Sci Res. 3(8), 75-81.

Yassin, S.A. and El-Gammal, G.A. (2016). Detection of some pathogenic bacteria in chicken meat sold in poultry shops. Assiut Vet. Med. J. 62, 45-53.

Yassin, S.A. and El-Gammal, G.A. (2016). Detection of some pathogenic bacteria in chicken meat sold in poultry shops. Assiut Vet. Med. J. 62, 45-53.

Yassin, S.A. and El-Gammal, G.A. (2016). Detection of some pathogenic bacteria in chicken meat sold in poultry shops. Assiut Vet. Med. J. 62, 45-53.

Yassin, S.A. and El-Gammal, G.A. (2016).

Detection of some pathogenic bacteria in chicken meat sold in poultry shops. Assiut Vet. Med. J. 62, 45-53.

Yassin, S.A. and El-Gammal, G.A. (2016). Detection of some pathogenic bacteria in chicken meat sold in poultry shops. Assiut Vet. Med. J. 62,45-53.

Younis, G.A.; Elkenany, R.M.; Fouda, M.A. and Mostafa, N.F. (2017). Virulence and extended-spectrum β-lactamase encoding genes in *Escherichia coli* recovered from chicken meat intended for hospitalized human consumption, Veterinary World, 10(10): 1281-1285.

Zhao, C.; Ge, B.; Villena, J.D.; Sudler, R. and Yeh, E. (2001). Prevalence of *Campylobacter spp., Escherichia coli* and *Salmonella* serovars in retail chicken, Turkey, pork and beef from the Greater Washington D.C., Area. Applied and Environmental Microbiology, 67(12): 5431-5436.