Bacterial Quality of Some Meat Products

Saad, M. Saad[1]; Faten, S.Hassanin[1]; Amani, M.Salem[1], Nahla, A.Shawqy[2] and Walaa, M.Gomaa[2]

[1] *Food Control Department. Faculty of Veterinary Medicine, Benha University*

[2] *Animal Health Research Institute, Shebin el koom Branch, Egypt.*

A B S T R A C T

A total of one hundred random samples of different meat products of frozen beef burger, kofta, emulsion type sausage and luncheon (25 of each) Twenty five gm of each sample were collected from different super markets in Menoufia governorate to be examined bacteriologically. The mean values of aerobic plate, Staphylococcal**,** *E. coli* and *Salmonella* counts were 1.70 x 10^8 ± 1.72,5.04 x 10^4 ± 1.46, 8.49 x 10^3 ± 1.88 and 5.35 x 10 ± 1.51in beefburger,1.93 x 10^6 ± 1.31, 7.56 x 10^3 ± 1.19, 4.40 x 10^3 ± 1.42 and 1.54 x 10^2 ± 1.58 in kofta,1.37 x 10^7 ± 1.72, 5.08 x 10^5 ±1.62, 6.31 x 10^3 ± 1.80 and 5.93 x 10 ± 1.55in sausage and 5.16 x 10^4 ± 1.37, 8.53 x 10^2 ± 1.24, 1.43 x 10^3 ± 1.72 and 7.62 x 10 ± 1.47in luncheon. The incidence of *Staphylococcus aureus* in the examined meat product samples of beef burger, kofta, sausage and Luncheon were 12 (48%), 13 (52%),12 (48%) and **7** (28%), of *E. coli it was*4(16%), 4(16%), 6(24%) and 3(12%) and 2(8%), 4(16%), 5 (20%) and 2(8%) of *Salmonella* , respectively. Achieved results in the present study proved that most of the examined meat products were contaminated with *E. coli,* Salmonella *species and Staphylococcus aureus,* this considered objectionable, as they render the product of inferior quality and unfit for consumption.

Keywords: Meat products, APC, *E.coli, S.aureus, Salmonella*

(http://www.bvmj.bu.edu.eg) **(BVMJ-34(1): 344-352, 2018)**

1. INTRODUCTION

In Egypt, meat products such as minced meat, kofta, sausage, beef burger and luncheon are gaining popularity because they represent quick easily prepared meat meals and solve the problem of the shortage in fresh meat of high price which is not within the reach of large numbers of families with limited income.

The preparation and handling of meat constitute the main sources for microbiological contamination. The risk of contamination may be increased by storage of cooked meat at ambient temperature, by using insufficient high temperature for reheating of cooked meat and by adding contaminated ingredients at stages where no further heat treatment will be applied (Ehirl *et al.*, 2001).

The food borne pathogens are responsible to impose a substantial burden of infection in the developed countries, while the impact in case of developing countries is higher. It reduces markedly social and economic productivity of the countries. Amongst the food borne pathogens, *E. coli*, *Salmonella* and

Staphylococcus aureus are the most common and frequent pathogens responsible for food poisoning and food related infections (Pires et al., 2012).

In general, *E. coli* is a major component of the normal intestinal flora of human and other mammals which are usually harmless to the host and only cause diseases in immunocompromised hosts or when the gastrointestinal barriers are breached. However, some specific *E.coli* strains represent primary pathogens with enhanced potential to cause disease after acquiring specific virulence attributes (Li et al., 2005).

Salmonellosis is a worldwide health problem, and second most dominant bacterial cause of food-borne gastroenteritis. More than 2,500 serotypes of Salmonella exist. However, only some of these serotypes have been frequently associated with food-borne illnesses (Mahmoud, 2012).

Staphylococcus aureus is an important pathogen and has been indicated as the fifth causative agent of food-borne human illness throughout the world. Staphylococcal enterotoxins (SEs) are toxic compounds excreted mainly by strains of *Staphylococcus aureus* (Soriano et al., 2012).

Therefore, the present study was planned out to throw a light on Isolation, Identification and Serotyping of some food poisoning microorganisms mainly *E.coli, Salmonella* and *Staphylococcus aureus* in locally manufactured meat product samples (beef burger, kofta, sausage and luncheon).

2. MATERIALS AND METHODS

2.1. Collection of samples:

One hundred samples of different meat products of frozen beef burger, kofta, emulsion type sausage and luncheon (25 of each) Twenty five gm were collected randomly from different supermarkets in El-Menofia governorate to be examined bacteriologically for detection of some food poisoning microorganisms. Each sample was kept in a separate sterile plastic bag and preserved in an ice box, then transferred to the laboratory under possible aseptic conditions without undue delay and examined as quickly as possible.

2.2 Bacteriological analysis:

2.2.1 Preparation of sample (ICMSF, 1996):

Twenty five gm of the sample were transferred to a sterile polyethylene bag. Then 225 mls of 0.1% sterile peptone water were aseptically added to the content of the bag and then homogenized at 200 rpm for 1-2 minutes to provide a homogenate of 1/10 dilution. One ml was transferred with the pipette to another sterile tube containing 9 ml of sterile peptone water and mixed well to make the next dilution from which further decimal serial dilutions were prepared.

2.2.2Aerobic Plate Count:

It was carried out according to (ICMSF, 1996)

2.2.3Detection of Staphylococci:

It was carried out according to (ICMSF, 1996)

2.2.4Detection of Escherichia coli:

It was identified and isolated Morphologically, Biochemically and Serologically according to (ICMSF, 1996)

2.2.5 Detection of Salmonellae:

It was identified and isolated Morphologically, Biochemically and Serologically according to (ICMSF, 1996)

2.2.6Detection of Staphylococcus aureus (ICMSF, 1996)

2.3. Statistical Analysis (*Snedecor and Cochran, 1967).*

3. RESULTS

It is evident from the results recorded in Table 1, that the mean values of APC (cfu/g)of the

examined samples of meat products were 1.70 x 10^8 ± 1.72in beefburger,1.93 x 10^6 ± 1.31in Kofta,1.37 x 10^7 ± 1.72in Sausage and5.16 x 10^4 ± 1.37in Luncheon. The staphylococci counts (cfu/g) were5.04 x 10^4 ± 1.46in Burger,7.56 x 10^3 ± 1.19in Kofta,5.08 x 10^5 ±1.62 in sausage and8.53 x 10^2 ± 1.24for Luncheon. On the other hand, results in table 2indicated that the incidence *and* averages of *E. coli*, *Salmonella Staph. aureus* in beef burger, kofta, sausage and Luncheon were 4(16%), 4(16%), 6(24%) and 3(12%), 8.49 x 10^3 ± 1.88, 4.40 x 10^3 ± 1.42,6.31 x 10^3 ± 1.80and1.43 x 10^3 ± 1.72,2(8%), 4(16%), 5 (20%) and 2(8%), 5.35 x 10 ± 1.51,1.54 x 10^2 ± 1.58,5.93 x 10 ± 1.55and7.62 x 10 ± 1.47,12 (48%), 13 (52%),12 (48%) and **7**(28%), respectively.

The data recorded in table 3 indicated that the incidence of *E. coli* Serotypes in the examined samples were O26: H11 (EHEC) (4%) ,O111: H4 (EHEC) (8%) and O44: H18 (EPEC) (4%) in Burger, O86 (EPEC) (4%), O111: H4 (EHEC) (4%), O91: H21 (EHEC) (4%) and O127: H6 (ETEC) (4%) in Kofta, O26: H11 (EHEC) (4%), O111: H4 (EHEC) (4%), O119: H4 (EPEC) 4% and O127: H6 (ETEC) (8%) in Sausage,O26: H11 (EHEC) (8%) and O119: H4 (EPEC) 4% in Luncheon.

On the other hand, results in table 4 indicated that the incidence of *Salmonella* serotypes in the examined samples were *S. Enteritidis* (4%) and *S.Typhimurium* (4%) in beef Burger, *S.Typhimurium* (8%), *S. Haifa(4%) and S.Infantis* (4%)in Kofta, *S. Enteritidis* (8%) *S.Typhimurium* (4%),*S. Muenster* (4%) and *S.Infantis* (4%)in Sausage, *S.Typhimurium* (4%) and *S. Muenster* (4%) in Luncheon.

Table (5) declared that all the examined samples of beef Burger and 28% of Luncheon were unaccepted according to the ES (2005) for APC, while 16%, 16%, 24% and 12% of Burger, kofta, Sausage and Luncheon, respectively were unaccepted according to EOS (2005) of *E. coli*, on the other hand, 8%, 16%, 20% and 8% of beef Burger, kofta, Sausage and Luncheon, respectively were un accepted according to EOS (2005) of *E. coli*, also, 1%, 12% and 16% of beef Burger, kofta and Sausage, respectively were unaccepted according to EOS (2005) of *Staph. aureus*

Table (1): Statistical analytical results of Aerobic plate counts (cfu/g) (APC) and Staphylococcal count of the examined samples of meat products (n = 25).

Meat products	Aeropic plate count Mean ***	Staphyloccocci count Mean ***
Burger	1.70 x 10^8 ± 1.72A	5.04 x 10^4 ± 1.46 A
Kofta	1.93 x 10^6 ± 1.31abC	7.56 x 10^3 ± 1.19 abC
Luncheon	5.16 x 10^4 ± 1.37aB	8.53 x 10^2 ± 1.24 aB
Sausage	1.37 x 10^7 ± 1.72abc	5.08 x 10^5 ± 1.62 abc

***: highly significant difference between products at P< 0.05

Table (2): Incidence and Statistical analytical results of *E. coli*, *Salmonella* and Staphylococci count of the examined samples of meat product (n = 25).

Product	*E.coli*			*Salmonella*			*S.aureus*	
	Incidence		Mean*	Incidence		Mean*	Incidence	
	No.	%	± S.E	No.	%	± S.E	No.	%
Burger	4	16	$8.49 \times 10^3 \pm 1.88A$	2	8	$5.35 \times 10 \pm 1.51$	12	48
Kofta	4	16	$4.40 \times 10^3 \pm 1.42$	4	16	$1.54 \times 10^2 \pm 1.58$	13	52
Luncheon	3	12	$1.43 \times 10^3 \pm 1.72a$	2	٨	$7.62 \times 10 \pm 1.47$	7	28
Sausage	6	24	$6.31 \times 10^3 \pm 1.80$	5	20	$5.93 \times 10 \pm 1.55$	12	48

*: Non significant difference between products at P< 0.05

Table (3): Incidence of *E. coli* Serotypes in the examined samples of meat products (n=25).

E.coli Strains	Beef Burger		Kofta		Sausage		Luncheon	
	No.	%	No.	%	No.	%	No.	%
O26 : H11 EHEC	1	4	-	-	1	4	2	8
O86 EPEC	-	-	1	4	-	-	-	-
O111 : H4 EHEC	2	8	1	4	1	4	-	-
O44 : H18 EPEC	1	4	-	-	-	-	-	-
O119 : H4 EPEC	-	-	-	-	1	4	1	4
O91 : H21 EHEC	-	-	1	4	-	-	-	-
O124 EIEC	-	-	-	-	1	4	-	-
O127 : H6 ETEC	-	-	1	4	2	8	-	-
Total	4	16	4	16	6	24	3	12

Table (4): Incidence of Salmonella Serotypes in the examined samples of meat products (n=25).

Salmonella Strains	Beef Burger		Kofta		Sausage		Luncheon	
	No.	%	No.	%	No.	%	No.	%
S. Enteritidis	1	4	-	-	2	8	-	-
S. Typhimurium	1	4	2	8	1	4	1	4
S. Muenster	-	-	-	-	1	4	1	4
S.Haifa	-	-	1	4	-	-	-	-
s. Infantis	-	-	1	4	1	4	-	-
Total	2	8	4	16	5	20	2	8

Table (5): Acceptability of bacterial load in the examined samples of meat products according to permissible limits of E.O.S (2005)

Product	*APC*			*E.coli*			*Salmonella*			*S.aures*		
	P.L	Un accepted samples		P.L	Un accepted samples		P.L	Un accepted samples		P.L	Un accepted samples	
		No.	%		No.	%		No.	%		No.	%
Burger	$<10^5$	25	100	0	4	16	0	2	8	$< 10^2$	1	1
Kofta	$10^6<$	0	0	0	4	16	0	4	16	$< 10^2$	3	12
Sausage	$10^6<$	0	0	0	6	24	0	5	20	$< 10^2$	4	16
Luncheon	$<10^4$	7	28	0	3	12	0	2	8	$< 10^2$	0	0

4. DISCUSSION

Meat products are perishable foods and unless stored under proper conditions spoil quickly. In addition, if pathogens are present, meat products become hazardous for consumers. Therefore, assurance of meat safety and quality is the most important (Shimoni and Iabuza, 2000).

According to results achieved in table (1) Comparing the obtained values from the examined samples, Lower results were recorded by *Tolba (1994)*, who found that APC in the examined samples of kofta was $2.9\times10^5 \pm 1.9\times10^5$/g, Ibrahim *et al.* (2014), found that APC in the examined samples of kofta was $1.83\times10^4 \pm 0.39\times10^4$, El-Taher (2009),who found that APC in the examined samples of kofta was 3.53×10^5. Accordingly, Beef Burger was the most contaminated meat product followed by Sausage, Kofta and Luncheon .This could be attributed to the fact that Beef Burger and Sausage may receive more handling during preparation as well as

addition of spices which may be contaminated with larger number of microorganisms

Alsoit is evident from the results recorded in Table (1) that there is nearly similar results obtained by Abou- Hussien (2004) who found that the staphylococcal count (CFU/g) in the examined sausage samples was$5.38\times10^5 \pm 9.7 \times10^4$**.** Lower results were recorded by Abd El-Hamid (2010)who revealed that the mean value of staphylococcal count in the examined burger samples was $2.17 \times10^3 \pm 4.31 \times10^2$ while in the examined sausage samples, the mean value of staphylococcal countwas$2.2 \times10^3 \pm 4.54 \times10^2$.However, higher findings were obtained by Abou- Hussien (2004) who found that the staphylococcal count (CFU/g) in the examined burger samples was $9.6\times10^5 \pm 2.1 \times10^5$, El-Taher (2009) who found that the staphylococcal count in the examined kofta samples was5.2×10^4,and Abd El-Hamid (2010) who revealed that the mean value of staphylococcal count in the examined luncheon samples was$1.4 \times10^3 \pm 3.32 \times10^2$.

The difference between the examined samples of burger, Luncheon, kofta and Sausage was highly significant at $P< 0.05$ as shown in Table (1).

The presence of *E. coli* in contaminated food products is commonly attributed to fecal contamination when they are improperly handled and/or when inactivation treatments fail.

Results recorded in Table (2) illustrated that the incidence of *E.coli* in burger, nearly similar to the results obtained by Maarouf and Nassif (2008) 16.7%. While lower results were recorded by *El- Dosoky et al. (2013)10%*. Higher results were reported by Mansour (2013) 48.0%, for kofta, Higher results were obtained by Al-Mutairi (2011) 28% and Mansour (2013) 56%. In sausage, the results were nearly similar to those obtained by Ouf (2001) 25%.On the other hand, higher results were obtained by Maarouf and Nassif (2008) 29.2%, and Mansour (2013) 40%. Lower figure were obtained by *Al-Mutairi (2011)12%* and *El-Dosoky et al. (2013)10%*, for luncheon, Lower results were obtained by Eleiwa (2003) 4% while Ouf (2001) failed to detect *E. coli* in the examined luncheon samples. On the other hand higher results obtained by Reham (2004)40%.Results summarized in Table (2)indicate incidence of Salmonellae in the examined meat product samples in Beef Burger, Kofta, Sausage and Luncheon was 2(8%), 4(16%),5 (20%) and 2(8%) respectively. Also results in Table (2) illustrated that the incidence of *staph.aureus* in burger, nearly similar results were reported by Abd El-Hady (2015)50% lower results were obtained by Eldaly et al. (2014) 10% while higher results were reported by Abou-Hussien (2004) 68% and Mousa *et al.* (2014) 68%, for kofta, nearly similar results were obtained by El-Taher (2009) 53.3%, for sausage, Lower results were obtained by Eldaly et al. (2014) 20% and *El-Dosoky et al. (2013)20%*. On the other hand, higher results were obtained by Abou-Hussien (2004) 72% and Hassanien (2004)52% for luncheon.

Sausage is the most contaminated with *Salmonella* and *E.coli* followed by Kofta, While Kofta is the most contaminated product with *Staph. aureus* followed by Sausage. The high prevalence rates reported here might be due to a combination of low quality of beef carcass used, poor manufacturing processes during processing and storage, in adequate cleaning and disinfection of both equipment and surfaces like floors or poor personal hygiene and use of untrained personal.

Table (2) indicated that, there is no significant difference appeared between such examined samples of meat products. Presence of *E. coli* in meat products were unaccepted

and hazard on consumer health also disagreed with those reported by ES(2005) of such meat products and indicates inadequate sanitary conditions during stages of manufacturing, dirty equipment and improper handling.

Presence of pathogens like Salmonella indicates substandard hygiene during processing, storage and retailing which represent a high risk to consumer.ES No 1973 (2005)reported that the meat products must be free from microorganism which are considered as hazard for public health as Salmonella.

5. CONCLUSION

Achieved results in the present study proved that most of the examined meat products were contaminated with E. coli, Salmonella species and Staphylococcus aureus, this considered objectionable, not only as they render the product of inferior quality and unfit for consumption but also, is considered a reliable index of fecal contamination and improper handling during processing. Burger was the most contaminated meat product by APC followed by Sausage, Kofta and Luncheon .This could be attributed to the fact that Burger and Sausage may receive more handling during preparation as well as addition of spices which may be contaminated with larger number of microorganisms

Sausage is the most contaminated product with Salmonella and E.coli followed by Kofta, While Kofta is the most contaminated product with Staph. aureus followed by Sausage. The high prevalence rates reported here might be due to a combination of a low quality of beef carcass used, poor manufacturing processes

5- REFERENCES

Abd El-Hady, A.M. 2015. Bacteriological and molecular characterization of *S. aureus* from beef meat products in El Gharbia Province. M.V.SC. (Meat Hygiene) Thesis, Fac. Vet. Med.,Cairo Univ.

Abd El-Hamid, M. A. 2010. Detection of some food poisoning microorganism in some meat products. M.V.Sc.(Meat Hygiene)Thesis, Fac. Vet. Med., Alex. Univ.

Abou Hussein-Reham, A. A. 2004. "Microbial Evaluation of Some Meat Products", M. V. Sci. Thesis (Meat Hygiene), Fac. Vet. Med., Zagazig Unive. (Benha Branch).

Al-Mutairi, M. F. 2011.The Incidence of Enterobacteriaceae Causing Food Poisoning in Some meat ProductsAdv. J. Food Sci. Technol., 3(2): 116-121.

Ehirl, J.E.J.; Azubuike, M.C.; Ubbaonu, C.N.; Anyanwu, E.G.; Lbe, K.M. and Ogbonna, M.O. 2001. Critical control points of complementary food preparation and handling in eastern Nigeria. Bull World Health Organ., 79 (5):423 – 433.

Eldaly, E.A.; El Shopary,Nermeen, F. andEl Bayomi, Rasha, M. 2014. Detection of enterotoxigenic *S. aureus* genes prevalentin some meat products using Multiplex PCR. The 1st Int. Conf. On The Impact Of Environmental Hazards On Food Safety, Zagazig University J., August 20th 2014. p 162-168.

El-Dosoky, H. F. A.; Shafik, S. and Baher, M. W. 2013. Detection of spoilage and food poisoning bacteria in some ready to eat meat products in Dakahlia Governorate. Assiut Vet. Med. J., 59(138).p 71-78

Eleiwa, N. Z. H. 2003. "Effect of chemical preservatives on food poisoning bacteria in some locally manufactured

meat products". Ph. D. Thesis (Meat hygiene), Fac. Vet. Med., Zagazig University, (Benha Branch).

El-Taher-Amna, M. (2009):"Impact of temperature abuse on safety of food offered in University Student Restaurant". M.V. Sc. Thesis, Meat Hygiene, Fac. of Vet. Med., Benha Univ.

ES "Egyptian Organization for Standardization and specification" (2005):For beef Kofta No. 1973.

Hassanien, Fatin, S. 2004. Bacterial hazards associated with consumption of some meat products. Benha Vet. Med. J., 15(2): 41-54

Ibrahim-Hemmat, M., Amin-Reham, A. and Sobieh A. S 2014. Bacteriological Evaluation of Fast Foods at Restaurants Level in Cairo Governorate, Benha Vet. Med. J., 26(1):34 - 42.

ICMSF "International Commission on Microbiological Specificans for Foods" 1996. Microorganisms in food, Ill-microbial specification of food pathogens. Vol.2, Chapman and Hall, London, New York.

Levine, M.M. 1987. *Escherichia coli* that cause diarrhea: enterotoxigenci, enteropathogenic, enteroinvasive, entero- haemorrhagic enteroaldherant. J.Infect. Dis., 155:377-389.

Li, Y.; Zhuang, S.and Mustapha, A. 2005. Application of a multiplex PCR for the simultaneous detection of Escherichia coliO157:H7, Salmonella and Shigella in raw and ready-to-eat meat products. Meat Science, 71: 402–406.

Maarouf, A. A.and Nassif-Marionette, Z. 2008. "Bacteriological studies on frozen cow meat and some meat products at Benha city". Journal of the Egyptian Vet. Med. Assoc., 68 (1):129-141.

Mahmoud, B. SM. 2012. *Salmonella* - A Dangerous Food borne Pathogen. ISBN 978-953-307-782-6, 450 pages, Publisher: InTech, Chapters published January 20, 2012 under CC BY 3.0 license, DOI: 10.5772/1308.

Mansour-Amal, F. A. 2013. "Occurrence of *Escherichia coli* in some beef products at Alexandria markets". Animal Health Research J., 1**(2)**:50-54.

Ouf-Jehan, M. 2001. "Microorganisms of sanitary importance in some meat products additives". Ph. D. Thesis (Meat Hygiene), Fac. Vet. Med., Cairo Univ., Egypt.

Pires, S. M.; Vieira, A. R.; Perez, E.; Wong, D. L. F. and Hald, T. 2012. Attributing human foodborne illness to food sources and water in Latin America and the Caribbean using data from outbreak investigations. Int. J. Food Microbiol., 152(3):129-38.

Shimoni, E. and Labuza, T. P. 2000. Modeling pathogen growth in meat products: future challenges. Trends in food Science and Technology, 11(11): 394.

Snedecor,G. W. and Cochran, W.G. 1967."Statistical Methods". 6th Ed. Oxford Publishing Company, London.

Soriano, J.M.; Mañes, J.; Soler, C. and Sospedra, I. 2012. Rapid whole protein quantitation of staphylococcal enterotoxins A and B by liquid chromatography/mass spectrometry. J. Chromatography A., 1238: 54–59.

Tolba, K.S. 1994. Microflora in locally processed frozen meat. Vet. Med. J. Giza, 42 (2): 99.