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Studies on bacteriological Profile of some meat products

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ABSTRACT

A total of 100 random samples of meat products represented by luncheon, frozen minced meat, kofta, and sausage (25 of each) were collected from different supermarket's shops in Tanta city These products subjected to bacteriological examination as Aerobic Plate Count (APC), Coliform Count, *Staph. aureus* count and isolation and identification of *Salmonellae* and *E-Coli*. The result revealed that minced meat showed relatively higher mean values of Aerobic Plate Count as well as Coliform Count (6.07± 0.1) log CFU/g and (3.1±.1) log CFU/g, respectively than the other products. While, it was the lowest one in *Staph aureus* count (2.2 ± .07) log CFU/g. Regarding to *Salmonellae* and *E-Coli* could be detected in 40% & 32% &12% & 28% & 16% & 24% of minced meat, kofta and sausage, respectively On the other hand, luncheon samples were free from *Salmonella* and *E-coli*.

KEYWORDS: Minced meat, luncheon, kofta, *E-coli*, *Staphylococcus aureus*, Aerobic plate count

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1. INTRODUCTION

In recent years, there has been a steady increase in the production and consumption of processed meat products worldwide because of their high nutritive value and convenience. (Rajic´et al., 2007). Meat products are subjected to contamination with several types of microorganisms from different sources during preparation, processing and serving to consumers. These microorganisms varied according to the method of manufacture, quality of used non- meat ingredient, and contamination level during the processing chain, packaging and storage (Borch and Arinda, 2002). Raw meat may harbor many important pathogenic microbes i.e. *E. coli, Salmonellae spp.* and *Staph. aureus* making the meat a risk for human health, as without the proper handling and control of these pathogens, food borne ill-nesses may occur (Nørrung et al., 2009). Accurately, up to 4000 deaths and 5 million illnesses each year is caused by contaminated meat and meat products with food poisoning bacteria particularly, *E. coli, Salmonella, S. aureus* (APHA,1984). *Staphylococcus aureus* is an important cause of food intoxication throughout the world. This bacterium can contaminate several foods, including minimally processed meat products and produce several types of enterotoxins (Naomi and Avraham, 2000). Moreover, detection of Coliforms is used as a general indicator of sanitary condition in the food-processing environment (Feng et al., 2002).

Also, contamination of minced meat with *Salmonella* is still considered a major problem in food hygiene (Vipham et al., 2012). Humans become infected with Salmonella primarily through faecal contamination of food products or water. Another source of human infection, primarily affecting farm families, employees, and visitors is contact with ill animals (Wells et al., 2001). Salmonellosis is still one of the major global causes of gastroenteritis in humans and animals (Grimont and Weil, 2007). Insufficient cooking may result in survival of *E-coli* and subsequently causes food poisoning to consumers (Cruz et al., 2005). *E -coli* is commonly non virulent but some strains have adopted pathogenic or toxigenic virulence factors that make them serious for man and animals (Donald et al., 2001).

Therefore, the present study is planned out to detect bacteriological profile of some meat products to ensure consumer safety.

2. MATERIAL AND METHODS

2.1. Samples:

A total of 100 samples of various types of packed meat products as luncheon and frozen minced meat, kofta, and sausage (25 of each) were randomly collected from different supermarkets at different production dates in Tanta city, El-Gharbia governorate, Egypt. The samples were taken and transferred directly to the laboratory under complete aseptic conditions without undue delay and subjected to Bacteriological examinations.

2.2. Preparation of Samples:

according to ICMSF, (1978). A 10 g portion of each sample was aseptically weighted into 90 ml of 0.1% peptone water in a sterile plastic bag, and then blended in a Stomacher 400 Lab Blender (Seward Medical, London, UK) for 30 seconds. Ten-fold serial dilutions were used for bacteriological examination.

2.3. Bacteriological examination:

Aerobic Plate Count and Coliform Count were carried out according to APHA, (1992) *Staph. aureus* Counting, Isolation and identification of *E. coli* were carried out according to ICMSF, (1996). Isolation and identification of *Salmonellae* was carried out according to ISO, (2002). Serological identification of Salmonellae according to Kauffman, (1974) and *E-Coli* according to Varnam and Evans (1991)

3. RESULTS

The mean values (log CFU/g) of aerobic plate, Colifrom and *Staph. aureus* counts /g were 4.2±.1, 2.6±.1 and 2.5±.1 in luncheon, 6.1±0.1, 3.1±.1 and 2.2 ±.1 in minced meat, 5.8±0.1, 2.6±.1 and 2.5 ±.2 in kofta and 4.8±0.1, 2.9±.01 and 2.6 ±.1 in sausage, respectively. There was a significant difference at level ($P<0.05$) between the examined samples. (table 1). Moreover, as shown in Table (2) 60%,28% and 16% & 52%, - and 20%&16%,- and 8% and - , 20% and 24% of examined samples of luncheon , frozen minced meat, kofta and sausage were unacceptable for APC, Coliform and *S. aureus* Counts according to permissible limit recommended by E.O.S. (2005a-b-c-d). Furthermore, the results in table (3) revealed that *Salmonella spp* was detected in minced meat (40%), kofta (12%) and sausages (16%), while it failed to be detected in luncheon samples. Consequently, they serologically identified as *Salmonella*. *Enteritidis*, *S. Typhimurium*, S. *Newport*, S. *Antum* and *S. Typhi.* Also, the results recorded in tables (4) revealed that the highest rate of contamination with *E. coli* was recorded in minced meat (32%) followed by kofta (28%) but lowest one found in sausage (24%). While, *E-coli* was failed to be detected in luncheon samples. Moreover, *E. coli* serotypes were serologically identified as *O55: K59*, *O125:K70, O124:K72 and O119:K69*, *O111: K58*, *O128:K67and O119:K69* Finally, *O124:K72, O111:K58 and O126:K71* in minced meat, kofta and sausage samples, respectively.

Table (1) Mean values of (APC-Coliform-*Staph. aureus)* of examined meat product samples

Meat products	Microorganisms	Positive samples No	Positive samples %	Min	Max	Mean± SE*
Luncheon	APC	25	100	3.00	4.95	4.2± .1
	Coliform	7	28	2.30	2.90	2.6 ±.1
	Staph. aureus	4	16	2.30	2.78	2.5 ±.1
Minced meat	APC	25	100	5.08	6.98	6.1 ± .1
	Coliform	9	36	2.60	3.78	3.1±.1
	Staph. aureus	5	20	2.00	2.30	2.2 ±.1
Kofta	APC	25	100	5.00	6.94	5.8±.1
	Coliform	8	32	2.30	2.90	2.6±.1
	Staph. aureus	2	8	2.30	2.60	2.5±.15
Sausage	APC	25	100	4.08	5.9	4.8± .10
	Coliform	5	20	2.48	3.30	2.9±.01
	Staph. aureus	6	24	2.30	2.90	2.6±.10

*significant differences ($P<0.05$)

Table (2) Acceptability of the examined meat products in comparison to E.O.S. (2005)

Meat products	Microorganisms	Positive samples		Accepted		Unaccepted		E.O.S.Q.C, (2005)
		No	%	No	%	No	%	
Luncheon	APC	25	100	10	40	15	60	10^4
	Coliform	7	28	-	-	7	28	10^2
	Staph. aureus	4	16	-	-	4	16	0
Minced meat	APC	25	100	12	48	13	52	10^6
	Coliform	9	36	-	-	-	-	-
	Staph. aureus	5	20	-	-	5	20	10^2
Kofta	APC	25	100	21	84	4	16	10^6
	Coliform	8	32	-	-	-	-	-
	Staph. aureus	2	8	-	-	2	8	10^2
Sausage	APC	25	100	25	100	-	-	10^6
	Coliform	5	20	-	-	5	20	10^2
	Staph. aureus	6	24	-	-	6	24	10^2

Table (3) Incidence and serotyping of *salmonella* species isolated from examined samples of meat products

Strains	Luncheon		Minced meat		Kofta		Sausage	
	No	%	No	%	No	%	No	%
S. Enteritidis	-	-	5	20	1	4	1	4
S. Typhi	-	-	1	4	0	0	-	-
S. Typhimurium	-	-	2	8	2	8	1	4
S. Anatum	-	-	1	4	-	-	1	4
S. Newport	-	-	1	4	-	-	1	4
Total	-	-	10	40*	3	12*	4	16*

*Samples exceeded permissible limit according to E.O.S.Q.C (2005a-b-d)

Table (4) Incidence and serotyping of *E-Coli* species isolated from examined samples of meat products.

Identified strains	Luncheon no	%	Minced meat no	%	Kofta no	%	sausage no	%
O55:K59	-	-	2	8	-	-	-	-
O111: K58	-	-	-	-	3	12	2	8
O124: K72	-	-	2	8	-	-	2	8
O125: K70	-	-	1	4	-	--	-	-
O126: K71	-	-	2	8	-	-	2	8
O128:K67	-	-	-	-	2	8	-	-
O119: K69	-	-	1	4	2	8	-	-
total	-	-	8	32*	7	28*	6	24*

*Samples exceeded permissible limit according to E.O.S.Q.C (2005a-b-d).

4. DISCUSSION

Aerobic Plate Count of any food article is not a sure indicative for its safety for consumption, yet it is of supreme importance in judging the hygienic conditions under which it has been produced, handled and stored (Jay, 1997). The results illustrated in table (1) revealed that Aerobic Plate Count was in agree with Erdem-Ayten et al. (2014) ($9x10^6$ CFU/g in minced meat). But lower ones were reported by Salem-Amany et al., (2010) (5.61 $x10^5$CFU/g in minced meat) and El-Dosoky et al. (2013) (3.6 log CFU/g in luncheon) and (3.6 log CFU/gin sausage). Higher result was reported by Gönülalan and Köse (2003) that was ($5.3x10^9$ in minced meat). High Aerobic Plate Count may be attributed to the contamination of the product from different sources or unsatisfactory processing as well as unsuitable condition during storage (Zaharan-Dalia, 2008).

Regarding to Coliform Count results were nearly similar to those obtained by Salem-Amany et al. (2010) (5.12 $x10^3$ CFU/g in minced meat). Meanwhile, higher result was obtained by El-

Dosoky et al. (2013) were (3.1 and 3 log CFU/g in luncheon and sausage, respectively). and, Erdem-Ayten et al. (2014) ($4.5x10^7$ cfu/g in minced meat). Consequently, high Coliforms count indicates poor hygienic quality of meat and may be responsible for economic losses and presence of enteric pathogens which constitute public health hazards (Yadav et al.,2006). Also, results of *S. aureus* were similar to those obtained by Morshdy et al. (2013) (4.3×10^2/g in minced meat), Hassanien-Fatin, (2004) (7.01 X 10^2/g in luncheon). Higher result obtained by Al- kour (2001) ($4.13x10^3$/g in minced meat), Zaki-Eman, (2003) ($1.8x10^3$/g in sausages). and Hassanien-Fatin, (2004) (1.12 X 10^4 /g in sausages and 2.51 X 10^3 /g in kofta). Presence of *S. aureus* indicates its contamination from food handlers and inadequately cleaned equipment (ICMSF, 1978). Thus, the high counts of *S. aureus* in examined meat product samples may reflect the amount of handling and when the conditions are favorable for growth and multiplication of such organism enterotoxins are produced and subsequently the food is dangerous (NAS, 1985).

All food of animal origin may be a vehicle transmission of *Salmonellae* to man. Meat and chicken products may be contaminated by human excreta at any step in the chain of processing during handling from raw material in the preparation of such food in kitchen (Fathi et al., 1994). In the current study, *Salmonella spp.* failed to be isolated from luncheon samples this result agreed with EL-Dosoky et al. (2013), Ouf-Jehan (2001), Eleiewa-Nesreen (2003) and Sharaf-Eman et al. (2011). Meanwhile, Ahmed- Zeineb (2012) and Mohamed (2013) could isolated *Salmonella spp.* from luncheon samples. Absence of *Salmonella spp.* in luncheon could be due to heat treatment during manufacture and presence of chemical preservatives Hosein et al. (2008). These positive results exceeded permissible limit recorded by E.O.S. (2005a-b-d) as negative *salmonella*.

Furthermore, similar results found by Mohamed (2013) (40% in minced meat) and Hassanien-Fatin (2004) (12% in sausages). low results founded by Stock and Stolle (2001) (15.8% in minced meat) and Sharma et al. (2002) (3.23% in kofta). Higher results founded by Fritzen et al. (2006) (69.5% in minced meat) and Mrema-Neema et al. (2006) (26% in sausage) The identified *Salmonella spp.* isolates in some extend agreed with Hassanien-Fatin, (2004) who isolated (*S. Typhimurium* and *S. Enteritidis* in sausage) and Mrema- Neema et al., (2006) Since *Salmonella. Typhi* is mostly associated with humans Forsythe (2000) who suggested that the food handlers also contributed to the contamination of these meat products. Historically, *S. Typhimurium* has been the most frequent serotype and *S. enteritidis* acts as a causative agent of human gastroenteritis throughout the world. An annual average of 186 cases was recorded during 1982-1986 in Norway Sharma et al. (1996). The presence of even small numbers of *Salmonella* in carcass meat and edible offal may lead to heavy contamination of minced meat and sausage when meat is cut into pieces; more microorganisms are added to the surfaces of exposed tissue. Raw meats, particularly minced meats have very high total counts of microorganisms and *Salmonellae* are likely to be present in large numbers Darwish et al. (1986).

The incidence of *E-Coli* (table 4) were nearly similar to those obtained by Ouf-Jehan (2001) (25% in sausages). Higher result by Zaki-Eman (2003) (40% in sausages) and lower ones founded by Abou-Hassien-Reham (2004) (12% in sausages). Meanwhile, presence of *E. Coli* in meat indicates a general lack of cleanness during slaughtering, evisceration, dressing, transportation and handling of meat ICMSF, (1996). The identified *E-Coli.* isolates similar found by Hassanien-Fatin (2004) ***(****O124:K72* in sausage). In Egypt, Marzonk (1985) incriminated EPEC as a cause of 54% of diarrhoea in infants. On the other hand, *EHEC (O111)* was implicated in severe outbreaks of diarrhea in young children (Evans et al. 1979) characterized by sudden onset of severe crampy abdominal pain followed, by watery diarrhoea with later becomes grossly bloody. In the summer of 1976, more than 2200 visitors at a national park in USA suffered from diarrhea due to consumption of sausage contaminated with *ETEC (O128)* producing heat labile toxin (Rosenberg et al., 1977). These positive results exceeded permissible limit recommended by E.O.S. (2005a-b-d) as negative *E-Coli***.**

The variation in the results between different authors may be due to the differences in manufacture practices, handling from producers to consumers and the effectiveness of hygienic measures applied during production. The presence of *E. coli* in food is considered as an indicator of faults during preparation, handling, storage or service. So there are 3 main routes by which microorganisms enter the food through raw food used, food handlers and the surrounding environment. Fecal contamination of the carcass can act as cross contamination of raw food which is never sterile and careful working practices are essential source of *E. coli* infection Roberts (1990).

Finally, the current study allows to conclude that the possibility of contamination of meat products with such serious pathogens remains as a public health problem. Thus all precautions of proper sanitation during manufacture, handling and storage of such meat products should be adopted to control these serious pathogens and to obtain a maximum limit of safety to consumers.

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