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Quality indices of some ready-to-eat meat products

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ABSTRACT

A total of 90 random samples of ready-to-eat meat products (30 of each) of Kofta, Shawerma and Hawawshi samples were collected randomly at different periods of time from various restaurants in Benha city, Qalyubia governorate, Egypt., at different levels of sanitations. Samples were examined for assessment of their bacteriological indices. The mean values of AP Cand. Coliform counts in the examined samples were $5.87\times10^4\pm 1.14\times10^4$&$2.17\times10^3\pm 0.39\times10^3$ (cfu/g)in Kofta samples; $9.92\times10^4 \pm 2.01\times10^4$ &$5.61\times10^3\pm 0.82\times10^3$(cfu/g)for Shawerma; $3.64\times10^5\pm 0.58\times10^5$&$1.32\times10^4 \pm 0.25\times10^4$ (cfu/g)for Hawawshi samples, respectively. While The mean values of *Staphylococcus aureus* count *were* $4.59\times10^3\pm 0.73\times10^3$ (cfu/g)in Kofta samples,$8.05\times10^3\pm 1.48\times10^3$ (cfu/g)for Shawerma and $2.16\times10^4 \pm 0.31\times10^4$ (cfu/g)for Hawawshi samples. Also Enteropathogenic *E.coli* strains wereO26 : H11 , O111 : H2 , O113 : H2 and O127 : H6in Kofta samples;O26 : H11 , O55 : H7, O111 : H2 , O114 : H4 , O127 : H6and O171 : H2inShawerma;O17 : H18 , O26 : H11 , O91 : H21, O111 : H2 , O124and O127 : H6 in the examined Hawawshi samples.

1. INTRODUCTION

Ready-to-eat (RTE) foods are processed foodstuffs gained popularity in recent times since they can be ingested without further thermal treatments (Rodriquez *et al*., 2010). Also, RTE and ready-to-use (RTU) foods reflect consumer demand for convenient foods, consumers are looking for RTE foods that are fresh, healthy, safe, nutritious and free of additives (Fang, 2005).

Ready–to-eat meat is especially concern because it can be consumed without further cooking and is known to be excellent growth substrates for pathogenic microorganisms. In addition, ignorance about food borne diseases was considered as important risk factor for contamination of food and existence of food borne bacteria that could cause serious health problems for consumed people (Derbew *et al*., 2013). The number of microorganisms in raw ingredients introduced in RTE meat sandwiches is important, however, many factors such as processing, handling, storage and display may increase the microbiological contamination of final RTE meat sandwiches at restaurants (Angelidis *et al*., 2006). Moreover, the presence of specific microorganisms such as *Escherichia coli* and *Staph. aureus* in foods attributes to the lack of knowledge on the part of the food handlers about proper hygienic practices. *Escherichia coli* is heat sensitive so, presence of *Escherichia coli* could be referred to fecal contamination from the hands of food handlers (Lues *et al*., 2006).

Escherichia coli was considered as one of the common diarrheagenic bacteria within the family Enterobacteriaceae (Torres *et al*., 2005). *E. coli* is a human pathogen worldwide associated with meat and meat products, vegetables and water. It is recognized as a bacterium causing hemorrhagic colitis. Diarrheal diseases linked to *E. coli* infections are characterized by blood, cramping, abdominal pain, fever, nausea, and vomiting (Abongo and Momba, 2009). *Staph. aureus* intoxication is a worldwide problem where several food poisoning outbreaks were reported due to consumption of meat products contaminated with this organism. Accordingly, the total *Staph. aureus* count can be taken as index of sanitary conditions under which the meat and its products are manufactured and handled(Potter, 2001). Staphylococcal food poisoning is due to the absorption of staphylococcal enterotoxins preformed in the food and the symptoms of Staphyloccal food poisoning are abdominal cramps, nausea, vomiting, sometimes followed by diarrhea (never diarrhea alone). The onset of symptoms remission is observed after 24 h(Le Loir *et al*., 2003).

Therefore, the current study was planned out to assess bacteriological indices of some RTE-meat products in different restaurants in Benha city, Qalyubia governorate, Egypt.

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2. MATERIAL AND METHODS

2.1. Samples collection

A total of 90 random samples of RTE products of Kofta, Shawerma and Hawawshi (30 of each) were collected at different periods of time from various restaurants in Benha city, Qalyubia governorate, Egypt. Each sample was put in a separated and detected sterile plastic bag and preserved in an ice box then all collected samples were transferred without undue delay to the laboratory under complete aseptic conditions. The collected samples were subjected to the bacteriological examination.

2.2. *Bacteriological Examination*

2.2.1. Preparation of samples (FDA, 2002):

Twenty-five grams of the sample were weighed and transferred into a sterile homogenizer flask containing 225 ml of sterile peptone water (0.1%). The content of the flask was homogenized for 3 minutes at 14000 rpm then allowed to stand for 5 minutes at room temperature. One ml from the homogenate was transferred into a separate tube containing 9 ml of sterile peptone water (0.1%) from which tenfold serial dilutions were prepared. The prepared samples were subjected to the following examinations:

2.2.2. Aerobic plate count. It was carried out according to ISO (2002).

2.2.3. Coliform count: It was prepared according to ISO, (2004).

2.2.4. Screening for Enteropathogenic Escherichia coli:

It was carried out according to FDA (2002).

Identification of Enteropathogenic Escherichia Coli (Mac Faddin, 2000):

The suspected isolates were examined morphologically (ISO, 1995), biochemically (Mac Faddin, 2000) and serologically (Kok *et al.*, 1996).

2.2.5. Enumeration and identification of Staph. aureus: It was carried out according to FDA (2001).

2.2.6. Statistical analysis:

The obtained results were statistically evaluated according to Feldman *et al.* (2003).

3. RESULTS

Table (1) showed that APC/g of the examined samples of RTE meat products ranged from 6.7×10^3 to 4.3×10^5 with mean $5.87\times10^4\pm1.14\times10^4$ cfu/g for kofta, 8.1×10^3 to 1.5×10^6 with mean $9.92\times10^4\pm2.01\times10^4$ cfu/g for Shawerma, 2.9×10^4 to 5.2×10^6 with mean $3.64\times10^5\pm 0.58\times10^5$ cfu/g for Hawawshi. So, Hawawshi was the most contaminated RTE meat product followed by Shawerma and then Kofta samples. This could be attributed to the fact that Hawawshi and Shawerma may receive more handling during preparation as well as addition of spices which may be contaminated with high number of microorganisms.

According to table (2) coliform was detected in Kofta, Shawerma and Hawawshi at rate of 63.33%, 73.33%, and 80%, respectively.

From the results given in table (3) it was obvious that Hawawshi samples were the most contaminated RTE meat, followed by Shawerma then Kofta samples.

Table 1 Aerobic plate (count/g) (APC) in the examined samples of ready to eat meat products (n=30).

Meat products	Min.	Max.	Mean ± S.E*
Kofta	6.7×10^3	4.3×10^5	$5.87\times10^4\pm 1.14\times10^4$
Shawerma	8.1×10^3	1.5×10^6	$9.92\times10^4\pm 2.01\times10^4$
Hawawshi	2.9×10^4	5.2×10^6	$3.64\times10^5\pm 0.58\times10^5$ ++

S.E* = Standard error of mean. ++ = High significant differences (P<0.01).

Table 2 Incidence of coliform bacteria in the examined samples of ready to eat meat products (n=30).

Meat products	No. of examined samples		
		No.	%
Kofta	30	19	63.33
Shawerma	30	22	73.33
Hawawshi	30	24	80
Total	90	65	72.22

Table 3 Coliform (counts/g) in the examined samples of ready to eat meat products (n=30)

Meat products	Min.	Max.	Mean ± S.E*
Kofta	1.0×10^2	1.1×10^4	$2.17\times10^3\pm 0.39\times10^3$
Shawerma	1.0×10^2	3.8×10^4	$5.61\times10^3\pm 0.82\times10^3$
Hawawshi	1.0×10^2	7.3×10^4	$1.32\times10^4\pm 0.25\times10^4$ ++

It was obvious from the results demonstrated in table (4) that Enteropathogenic *E. coli* were isolated from RTE meat products at the highest level from Hawawshi (30%) followed by Shawerma (26.67%), then Kofta (16.67%) samples.

According to table (5) *Staph. aureus* were detected in 46.67% of Kofta, 56.67% of Shawerma, and 60% of Hawawshi.

Table (6) indicated that the total Staphylococcal count in the examined samples of RTE meat products ranged from 1.0×10^2 to 3.0×10^4 with mean $4.59\times10^3\pm0.73\times10^3$ cfu/g for Kofta, 1.0×10^2 to 5.0×10^4 with mean $8.05\times10^3\pm 1.48\times10^3$ cfu/g for Shawerma and 1.0×10^2 to 9.0×10^4 with mean $2.16\times10^4\pm0.31\times10^4$ cfu/g for Hawawshi.

Table 4 Incidence of Enteropathogenic *E. coli* in the examined samples of ready to eat meat products (n=30)

Meat products	No. of examined samples	No.	%
Kofta	30	5	16.67
Shawerma	30	8	26.67
Hawawshi	30	9	30
Total	90	22	24.44

Table 5 Incidence of *Staphylococcus aureus* in the examined samples of ready to eat meat products (n=30).

Meat products	No. of examined samples	No.	%
Kofta	30	14	46.67
Shawerma	30	17	56.67
Hawawshi	30	18	60
Total	90	49	54.44

Table 6 *Staphylococcus aureus* (counts/g) in the examined samples of ready to eat meat products (n=30).

Meat products	Min.	Max.	Mean ± S.E*
Kofta	1.0×10^2	3.0×10^4	$4.59\times10^3\pm 0.73\times10^3$
Shawerma	1.0×10^2	5.0×10^4	$8.05\times10^3\pm 1.48\times10^3$
Hawawshi	1.0×10^2	9.0×10^4	$2.16\times10^4\pm 0.31\times10^4$ ++

From the results given in table (7), it was obvious that the serotyping and incidence of enteropathogenic *E. coli* isolated from the examined samples of RTE meat products were O17:H18 that isolated from Hawawshi (3.33%); O55:H7 from Shawerma (3.33%), Also O113:H2 from Kofta (3.33%) while O114:H4 was isolated from RTE Shawerma (3.33%) and O171:H2 was isolated from RTE Shawerma (3.33%). Also. The data obtained in table (7) revealed that the serotyping and incidence of Enterohemorrhagic *E. coli* isolated from the examined samples of RTE meat products were O111:H2 was isolated from ready to eat Kofta (6.67%), Shawerma (6.67%) and Hawawshi (10%) samples; O26:H11 from Kofta (3.33%), Shawerma (6.67%) and Hawawshi (3.33%) samples and O91:H21 only was isolated from Hawawshi (3.33%). Moreover, the serotyping and incidence of Enterotoxigenic *E. coli* isolated from the examined samples were (ETEC) O127 : H6 was isolated from Kofta (3.33%), Shawerma (3.33%) and Hawawshi (6.67%), while Entero-invasive (EIEC) O124 was only isolated from (3.33%) of Hawawshi samples.

Table 7 Incidence and serotyping of Enteropathogenic *E. coli* isolated from the examined samples of ready-to-eat meat products (n=30).

Meat status *E. coli* strains	Kofta		Shawerma		Hawawshi		Strain characteristics
	No.	%	No.	%	No.	%	
O17 : H18	-	-	-	-	1	3.33	EPEC
O26 : H11	1	3.33	2	6.67	1	3.33	EHEC
O55 : H7	-	-	1	3.33	-	-	EPEC
O91 : H21	-	-	-	-	1	3.33	EHEC
O111 : H2	2	6.67	2	6.67	3	10	EHEC
O113 : H2	1	3.33	-	-	-	-	EPEC
O114 : H4	-	-	1	3.33	-	-	EPEC
O124	-	-	-	-	1	3.33	EIEC
O127 : H6	1	3.33	1	3.33	2	6.67	ETEC
O171 : H2	-	-	1	3.33	-	-	EPEC
Total	5	16.67	8	26.67	9	30	

4. DISCUSSION

According to the results of APC cfu/g recorded for Kofta they were relatively agree to some extent with those obtained by El-Taher-Amna (2009) ($5.38x10^4$), Saad *et al.* (2011) (3.92×10^4) and Ibrahim-Hemmat *et al*. (2014), who found that APC in the examined samples of Kofta was $1.83\times10^4\pm0.39\times10^4$. while, the lower results were recorded by Aly-Samar (2016) (6.41×10^3) cfu/g. Also, the higher results were recorded by Abd El-Fatah-Rabab (2015) (2.69×10^5) and Hazaa-Wafaa (2015) ($8.51x10^5$).

Regarding to the examined Hawawshi samples, the result of APC /g was nearly similar to those reported by Sobieh (2014) (2.24×10^5).

APC of Hawawshi samples were lower than those obtained by Ismail-Soad (2006) ($4x10^6$), Ghanem-Shereen (2009) (2.13×10^7) and Hazaa-Wafaa (2015) (6.76×10^6), while higher than those obtained by Aly-Samar (2016) (9.33×10^3) cfu/g.

The hygienic conditions of RTE sandwiches were very poor and may constitute a considerable hazard to human health due to using of low-quality raw materials, sufficient heat treatment and inadequate cleaning and sanitization of utensils (Abd-El-Malek, 2014).

The high number of TBC indicated the poor hygienic conditions during food preparation and serving (Durmaz *et al*., 2015).

According to the results of Coliform (counts/g)recorded for Kofta they were relatively agree to some extent with those obtained by Abd El-Fatah-Rabab (2015) (5.5×103/g) and Aly-Samar (2016) (1.86×103/g). While lower results obtained by Saad *et al*., (2011) (5.2×102/g), Sobieh (2014) (7.9×102/g) and Hazaa-Wafaa (2015) (9.2×102/g).Also, higher results were recorded by El-Mossalami (2003) (1.9×10^5/g), Ghanem-Shereen (2009) (4.5×10^4/g) and Abd El-Raheem (2013) (2.6×10^5/g).

While the current results of Coliform (counts/g) for Hawawshi samples were nearly similar to those obtained by Ghanem-Shereen (2009) (1.17×10^4/g) and Hazaa-Wafaa (2015) (1.12×10^4/g). The lower results were recorded by Ismail-Soad (2006) (9.3×10/g), Sobieh (2014)(6.6×10^3/g), and Aly-Samar (2016)(4.27×10^3/g), while the higher results were obtained by Al-Tawwab (2004)(5.6×10^5/g).

Coliform bacteria, mainly fecal coliform are enteric bacteria that naturally inhabit the intestinal tract of human and its presence indicates the presence of fecal or sewage contamination introduced to food via contaminated water and equipment or from the unsanitary environment or via handlers' hands (Pelczar *et al*., 2005).

It is obvious from the results illustrated in table (4) that the Incidence of Enteropathogenic *E. coli* of kofta were higher than those obtained by Saad *et al.* (2011) (10%), Sobieh (2014) (13.3%) and Hazaa-Wafaa (2015) (15%), while lower than the results recorded byEl-Taher-Amna (2009) (26.67%), El-Mossalami (2003) (50%) and Abd El-Fatah-Rabab (2015) (33.3%).

Moreover, the recorded results of the Incidence of Enteropathogenic *E. coli* for Hawawshi were nearly similar to the results recorded by Hazaa-Wafaa (2015) (30%); they were higher than those obtained by Ismail-Soad (2006) (17.3%) and Ghanem-Shereen (2009) (20%) and lower than those obtained by Abdallah and Hassan (2000) (33.3%), Sobieh (2014) (33.3%) and Aly-Samar (2016) (35%).

The current results given in table (6) show that *Staph. aureus* cfu/g in kofta samples were agree to the results recorded by El-Mossalami (2003) (3.3×10^3), El-Taher-Amna (2009) (6.9×10^3)and Abd El-Fatah-Rabab (2015) (2.31×10^3). While the highest results were obtained by Al-Tawwab (2004) (9×10^4).The lowest samples of *Staph. aureus* in kofta samples were obtained by Saad *et al.* (2011) (9.14×10^2), Sobieh (2014) (9.35×10^2), and Hazaa-Wafaa (2016) (8.13×10^2) cfu/g.

The recorded results of *Staph. aureus* count cfu/g for the examined Hawawshi samples were comparatively similar to those obtained by Al-Tawwab (2004) (7×10^4), Ghanem-Shereen (2009) (8.43×10^4) and Hazaa-Wafaa (2015) (6.11×10^4). The lowest results were recorded by Ismail-Soad (2006) (2×10^2), and Sobieh (2014) (8.12×10^3) cfu/g.

The pathogenic strains of *E.coli* were previously isolated from different RTE meat products by Abd El-Fatah-Rabab (2015), Hazaa-Wafaa (2015), who could identify these pathogenic *E.coli* strains in different ready to eat meat products.

5. CONCULOSIONS

Therefore, to improve the hygienic status of ready–to–eat meat products, thoroughly washing of hands, especially after using toilets, before handling of cooked meat and after handling raw materials and unsanitary objects with soap and warm water for 20 seconds at least. Also, application and implementation of Hazard Analysis and Critical control point (HACCP) system may be the appropriate solution to ensure quality and safety of ready–to–eat meat products especially during preparation and serving.

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