



## Street Vended Meat Products as Potential Sources of *Staphylococcus aureus*

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### ABSTRACT

A total of 90 random samples of street vended meat products represented by beef burger, kofta and sausage (30 of each) were collected from several street vendors in Menofya government. for isolation and identification of *S. aureus* as well as detection of Staphylococcal enterotoxins. The obtained results indicated that the mean values of Staphylococci count (cfu/g) in the examined samples were  $4.27 \times 10^3 \pm 0.69 \times 10^3$  for beef burger,  $9.15 \times 10^3 \pm 2.01 \times 10^3$  for kofta and  $1.62 \times 10^4 \pm 0.37 \times 10^4$  for sausage. The results obtained indicated that 16 (53.33%) samples of beef burger, 19 (63.33%) samples of kofta and 21 (70%) samples of sausage were unaccepted according to their Staphylococci counts/g according to Egyptian Organization for Standardization "EOS" (2005). The incidence of *S. aureus* in the examined samples of sausage was 53.33% followed by kofta samples (40%). While, the lowest incidence of *S. aureus* was recorded in the examined beef burger samples (30%). The study obtained "one" enterotoxin A, enterotoxin C and enterotoxin A+D produced by *S. aureus* in the sausage samples of meat product. While, enterotoxins B and enterotoxin D failed to be detected in sausage samples of meat product. concerning kofta samples, 2 enterotoxin D produced by *S. aureus*. While, enterotoxins A, B and C were not detected in kofta and beef burger samples. Finally, the probable sources of contamination of meat products with such serious pathogen and some recommendation to control its enterotoxins production were discussed.

**Keywords:** *S. aureus*, incidence, enterotoxins.

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(BVMJ-35(1): 197-202, 2018)

## 1. INTRODUCTION

Meat products are of great concern in the human diet where they supply the human body with easily digestible proteins and they supply all nutrients that contribute significantly to the dietary balance of meal. Further, Meat products attract the consumers for their palatability, low price and easily preparation in comparison with fresh meat (Azab, 2010).

One of the serious problems that affect the consumption of meat products is the contamination of meat itself and other additional microbial hazard due to further handling, processing or modification of the environment. All these risks represent a public health hazard (Nosseur, 2010).

Foodborne illness is a serious public health problem, and is associated with

reduced economic growth. *Staphylococcus aureus* is the second or third most important cause of these illnesses throughout the world (Normanno et al. 2005).

*Staphylococcus aureus* recognized worldwide as an important food-borne pathogen because of its ability to produce a wide range of extracellular toxin proteins and virulence factors typically resulting in sudden onset of nausea, violent vomiting, abdominal cramps and sometimes diarrhea (Rosengren et al., 2013).

Enterotoxins of *S. aureus* are groups of single chain protein (polypeptides) with molecular weight 28.000- 35.000 Daltons resistant to high temperature (heat stable) and proteolytic enzymes. The enterotoxigenic strains of *S. aureus* produce several types of enterotoxins (A, B, C, D and E) which can cause symptoms of intoxications such as vomiting, diarrhoea and abdominal cramping (Korpysa et al., 2005).

So, the aim of this study achieved to detect of the incidence of *S. aureus* in meat products with reference to its enterotoxins.

## 2. MATERIALS AND METHODS

### *Collection of Samples:*

A total of 90 random samples of street vended meat products represented by beef burger, kofta and sausage (30 of each) were collected from several street vendors in Menoufia government. Each sample was kept in a separated sterile plastic bag and preserved in an ice box then transferred to the laboratory under complete aseptic conditions without undue delay and examined as quickly as possible. The collected samples were subjected to the bacteriological examination to for isolation and identification of *S. aureus*.

### *Preparation of samples (ICMSF, 1996):*

To 25 grams of the sample, 225 ml of sterile peptone water were added and thoroughly

mixed using sterile blender for 1.5 minutes, from which ten fold serial dilutions was prepared. The prepared samples were subjected to the following examinations:

### *Determination of total Staphylococci count (FDA, 2001):*

One ml from each of previously prepared serial dilutions was spread over Baird Parker agar plate using a sterile bent glass spreader. The inoculated and control plates were inverted and incubated at 37°C for 48 hours. After which they were examined for colony character. The developed colonies (shiny black colonies) were enumerated and total staphylococcal count/g was calculated.

### *Detection of Staphylococcus aureus enterotoxins:*

The serologically identified *S. aureus* strains were examined for their ability to produce enterotoxins using Staphylococcal Enterotoxin –Reverse Passive Latex Agglutination kit (SET-RPLA) and Sac culture method recommended by Oda et al. (1979).

## 3. RESULTS

The mean value of Staphylococci counts (cfu/g) in the examined samples were  $4.27 \times 10^3 \pm 0.69 \times 10^3$  for beef burger,  $9.15 \times 10^3 \pm 2.01 \times 10^3$  for kofta and  $1.62 \times 10^4 \pm 0.37 \times 10^4$  for sausage. The results obtained indicated that 16 (53.33%) samples of beef burger, 19 (63.33%) samples of kofta and 21(70%) samples of sausage Unaccepted according to their Staphylococci counts/g. as recorded in table (1).

The incidence for isolation of *S. aureus* in the examined samples of street vended meat products was recorded in the examined sausage samples at percentage of 53.33% followed by kofta samples at percentage of 40%. While the lowest incidence for isolation

of *S.aureus* in the examined samples was recorded in beef burger samples at percentage of 30%.

The study obtained "one" enterotoxin A, enterotoxin C and enterotoxin A+D produced by *S. aureus* in the sausage samples of meat product. While, enterotoxins B and enterotoxin D failed to be detected in sausage

samples of meat product. For kofta samples there is "two" enterotoxin D produced by *S. aureus*. While, enterotoxins A, B and C failed to be detected in kofta samples of meat products. Also, enterotoxins A, B, C and D failed to be detected in beef burger samples of meat products as recorded in table (2).

Table 1: Statistical analytical results of total Staphylococci counts and Acceptability in the examined samples of meat products (n=30).

Products	Positive samples		Staphylococci count /g			Unaccepted samples		
	No.	%	Min	Max	Mean ± S.E*	MPL*	No.	%
Beef burger	17	56.67	1.0×10 <sup>2</sup>	8.5×10 <sup>3</sup>	4.27×10 <sup>3</sup> ± 0.69×10 <sup>3</sup>	> 10 <sup>2</sup>	16	53.33
Kofta	22	73.33	1.0×10 <sup>2</sup>	2.9×10 <sup>4</sup>	9.15×10 <sup>3</sup> ± 2.01×10 <sup>3</sup>	> 10 <sup>2</sup>	19	63.33
Sausage	24	80	1.0×10 <sup>2</sup>	5.3×10 <sup>4</sup>	1.62×10 <sup>4</sup> ± 0.37×10 <sup>4</sup>	> 10 <sup>2</sup>	21	70
Total (90)	63	70					56	62.22

MPL\*: Maximum permissible limit stipulated by E.O.S (2005).

Table 2: Incidence of enterotoxin producing *Staphylococcus aureus* isolated from the examined samples of meat products (n=30).

Enterotoxin Products	Incidence of <i>S. aureus</i>		+ve strains		A		B		C		D		A+D	
	No.	%	No	%	No	%	No	%	No	%	No	%	No	%
Beef burger	9	30	0	0	0	0	0	0	0	0	0	0	0	0
Kofta	12	40	2	16.7	0	0	0	0	0	0	2	16.7	0	0
Sausage	16	53.33	3	18.9	1	6.3	0	0	1	6.3	0	0	1	6.3
Total (90)	37	41.11	5	13.5	1	2.7	0	0	1	5.4	2	5.4	1	2.7

#### 4. DISCUSSION

The illustrated results in table (1) revealed that the Staphylococci counts (cfu/g) in the examined samples of beef burger agree with those obtained by Hassanien et al. (2015) " $1.57 \times 10^3 \pm 0.36 \times 10^3$ ", while the lower results were recorded by Ragab et al. (2016) " $4 \times 10^2$ " and the higher results recorded by Ibrahim (2016) " $2.08 \times 10^5 \pm 5.56 \times 10^4$ ".

The present results of kofta samples were nearly similar to those obtained by EL-Hanafy (2016) " $8.61 \times 10^3 \pm 2.17 \times 10^3$ ". and lower results were recorded by Shafik (2013) " $5.4 \times 10^2 \pm 1.2 \times 10^2$ " and Sobieh (2014) " $9.35 \times 10^2 \pm 2.08 \times 10^2$ ".

The obtained results of examined sausage samples lower results recorded by Abd El-Hamid (2010) " $2.2 \times 10^3 \pm 4.54 \times 10^2$ ", higher results were recorded by Amin (2004) " $5.38 \times 10^5 \pm 9.7 \times 10^4$ ". On contrast, Ragab et al. (2016) failed to detect staphylococci in sausage samples.

Acceptability of the examined samples of meat product based on their Staphylococci count/g is shown in table (1), respectively, 53.33%, 63.33% and 70% of the examined samples of beef burger, kofta and sausage were unaccepted where they exceeded the safe permissible limit recommended by Egyptian Organization for Standardization "EOS" (2005), which stated that Staphylococci count / g should not be more than  $> 10^2$ .

The presence of staphylococci including *S.aureus* is considered as a good indicator for personal hygiene of factory workers with respiratory infection and suppurative lesions. Therefore, Staphylococci continue to be an important problem for food processors, food service works and consumers.

The results illustrated in table (2) revealed that the incidence of *S. aureus* recorded for

beef burger was relatively similar to those obtained by Ibrahim (2016) "30%", while the lower results were recorded by Salah and Salah El-Din (2005) "10%" and the higher results recorded by Amin (2004) "68%".

The results of kofta samples were similar to those obtained by EL-Hanafy (2016) "40%". while the lower results were recorded by Hassanien (2004) "24%" and higher results recorded by Hassanien et al. (2015) "60%".

The obtained results of examined sausage samples similar to those obtained by Hassanien (2004) "52%", while lower results recorded by EL-Dosoky et al. (2013) "20%" and higher results were recorded by Ibrahim (2008) "85%". But Sachindra et al. (2005) failed to detect *S.aureus* in sausage samples.

The obtained higher results of sausage may be due to insufficient heat treatment during cooking or the heat treatment did not reach to the core of the product as well as the bad handling of the product.

A total of 37 *S. aureus* strains from each of the meat product samples were tested for enterotoxin production, table (2). From kofta, 2 strains produced toxin D while in strains isolated from sausage, 3 strains only produce toxin A, C and A+D. but in strains isolated from beef burger no strains produce toxins. These results were in agreement to Guven et al. (2010) and EL-Dosoky et al. (2013).

#### 5. Conclusion

As conclusion, street vended meat products sandwiches sold on the street of Menoufia governorate constitute a potential hazard to human health. Vendors should receive education in food hygiene. All precautions of proper sanitation during manufacture, handling and storage of meat products should be adopted to control these serious pathogens

and to obtain final products with a maximum limit of safety.

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