Incidence of Staphylococcus aureus in meat products with special reference to enterotoxins

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ABSTRACT

The present study was designed to throw spot light upon the incidence and detection of Staphylococcal enterotoxins. The incidence for isolation of *S. aureus* in the examined samples of street vended meat products was recorded in the examined hawawshi samples at percentage of 31.4% followed by kofta samples at percentage of 25.7%. While the lowest incidence for isolation of *S.aureus* in the examined samples was recorded in shawerma samples at percentage of 22.8%. The percentages of antimicrobial susceptibility of *S. aureus* isolates from the examined samples of meat products were very susceptible to erythromycin (E) (89.3%), followed by norfloxacin (NOR) (82.1%), ampicillin (AM)(60.7%), ciprofloxacin (CP)(53.6%), streptomycin (S)(35.7%) and amoxicillin (AMX)(25.0). The study obtained "one" enterotoxin A and enterotoxin D produced by *S. aureus* in the Hawawshi samples of meat product. There is "one" unaccepted Hawawshi sample with a percentage (3.6%). While, enterotoxins B and enterotoxin C failed to be detected in Hawawshi samples of meat product. For kofta samples there is "one" enterotoxin D produced by *S. aureus*. There is "one" unaccepted kofta sample with a percentage (3.6%). 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 shawerma samples of meat products.

Key words: *S. aureus,* incidence, antimicrobial sensitivity, enterotoxins.

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1. INTRODUCTION

Data collected from street- vended food enterprises and on vendors, they provide a variety of ready-to-eat (RTE) food, their handling and trading practices is not permit to obtain safe food. While, the street-vended foods easily contaminated by food borne pathogens (Nicolas et al. 2007). Street vendors were investigated to assess the microbiological quality of the food being sold. The overall microbiological quality of the foods served by the street vendors was found to be within acceptable safety limits, although the presence of specific microorganisms such as, *S. aureus* is indicative of a degree of ignorance on the part of the food handlers towards proper hygienic practices (Lues et al. 2006). In Egypt, the most ready-to-eat sandwiches sold in street vendors and fast food restaurants are kofta, hawawshi and shawerma. This tremendous growth has of M.O. led to serious concerns over the safety of products due to presence of food poisoning pathogens (Murphy *et al*. 2001). Meat products are considered as a major vehicle of most reported outbreaks of food-borne diseases (ICMSF 1980), and spoilage bacteria and/or food-borne pathogens (Gracey et al. 1999), but raw meat is rarely involved in food poisoning than RTE meat and their products (Cliver 1990). *Staphylococcus aureus* is considered as a major bacterial contaminant of fast foods, because workers during preparation and processing may touch fast foods which are usually eaten without sufficient cooking or heating (Soliman 1988).

Staphylococcus aureus have implicated in cases of severe diarrhea, as well as, the main cause of food poisoning gastroenteritis among consumers (Davies and Board 1998). So, the aim of this study achieved to detect of the incidence of *S. aureus* in meat products with reference to its enterotoxins.

2. Material and methods:

2.1. Collection of Samples:

A grand total of 105 random samples of marketed meat products (35 of each) were collected from different markets at El-Kalyobia governorate. The collected samples were transferred directly to the laboratory in an ice box under complete aseptic conditions without undue delay and then subjected to the following bacteriological examination.

2.2. Preparation of Samples (ISO, 2003):

Twenty-five grams of the examined samples were transferred to aseptic stomacher bag and 225 ml of 0.1 % sterile peptone water were aseptically added to the content. Each sample was then homogenized in the stomacher (stomacher lab. Blender, 400 seward lab., London) at 2000 r.p.m for 1-2 minutes to provide a homogenate with dilution of 10-1, the homogenate was then allowed to stand for 15minutes at room temperature. from the original dilution, one ml was transferred aseptically with sterile pipette into a test tube containing 9 ml of sterile peptone water 0.1% and mixed well to produce the next dilution from which further decimal serial dilutions were prepared. The prepared dilutions were subjected to the following examinations.

2.3. Antibiogram for antibiotic sensitivity of isolated S. aureus:

Antimicrobial susceptibility of *S. aureus* was tested by the single diffusion method according to (Deresse et al. 2012). Sensitivity discs with variable concentrations were used to determine the susceptibility of the isolated *S. aureus* strains (*Oxoid Limited, Basingstoke, Hampshire, UK*) Agar plate method was applied by using of nutrient agar as a substrate for growth of the tested bacterium for its antibiotic sensitivity. The bacterial culture was uniformly spread on the surface of nutrient agar. Then the antibiotic discs were placed over the surface of inoculated plate. Moreover, the plate was then incubated at suitable temperature (25°C) for 2-7 days and checked for the growth of the bacterium around the antibiotic discs. The maximal inhibition zone for the growth of microbes said to that antibiotic had maximum effect on the microbe growth. Therefore, the antimicrobial susceptibility testing was applied according to the guidelines stipulated by National Committee for Clinical Laboratory Standards "NCCLS" (2001).

3. RESULTS

The highest incidence for isolation of *S. aureus* in the examined samples of street vended meat products was recorded in the examined hawawshi samples at percentage of 31.4% followed by kofta samples at percentage of 25.7% as recorded in table (1). Acceptability of enterotoxins produced by S. aureus was "one" enterotoxin A and enterotoxin D produced by *S. aureus* in the Hawawshi samples were obtained with a percentage (3.6%). There was "one" unaccepted Hawawshi sample with a percentage (3.6%). While, enterotoxins B and C failed to be detected in Hawawshi samples as recorded in table (2). The antimicrobial discs and their concentrations as well as the diameters of the zones of inhibition for the tested strains are demonstrated in table (3).

Table (1): Statistical analytical results of *S. aureus* in the examined samples of meat products (n=35).

Products	Positive samples			Accepted samples	
	N0.	%	MPL*	No.	%
Shawerma	8	22.8	Free	27	77.1
Hawawshi	11	31.4	Free	24	68.6
Kofta	9	25.7	Free	26	74.3

MPL*: Maximum permissible limit stipulated by E.O.S (2005). % was calculated according to the total number of samples.

Table (2): Typing and acceptability of enterotoxins produced by *S. aureus* in the examined samples of meat products (n= 28).

Enterotoxins	A		B		C		D		Unaccepted Samples*	
Meat products	No.	%	No.	%	No.	%	No.	%	No.	%
Shawerma	-	-	-	-	-	-	-	-	-	-
Hawawshi	1	3.6	-	-	-	-	1	3.6	1	3.6
Kofta	-	-	-	-	-	-	1	3.6	1	3.6

Table (3): Antimicrobial discs, concentration and interpretation of their action on the isolated *S. aureus* strains.

Antimicrobial agent	Sensitivity disc content (ug)	Resistant (mm)	Intermediate (mm)	Susceptible (mm)
Amoxicillin(AMX)	30	14 or less	15-18	19or more
Ampicillin (AM)	10	13 or less	14-17	18or more
Chloramphenicol (C)	30	12 or less	13-17	18or more
Ciprofloxacin (CP)	5	15 or less	15-19	20or more
Erythromycin (E)	15	13 or less	14-22	23or more
Gentamicin (G)	10	12 or less	13-14	15or more
Kanamycin (K)	30	13 or less	14-17	18or more
Nalidixic acid (NA)	30	13 or less	14-18	19or more
Neomycin (N)	30	12 or less	13-16	17or more
Norfloxacin (NOR)	10	12 or less	13-15	16or more
Oxytetracycline (T)	30	14 or less	15-18	19or more
Penicillin (P)	10 IU	20 or less	21-28	29or more
Streptomycin (S)	10	11 or less	12-14	15or more
Sulphamethoxazol (SXT)	25	10 or less	11-15	16or more

4. DISCUSSION

The present study recorded the highest incidence of *S. aureus* in the examined samples of street vended meat products in the examined hawawshi samples at percentage of 31.4% followed by kofta samples at percentage of 25.7%. While the lowest incidence for isolation of *S. aureus* in shawerma samples at percentage of 22.8%. The current results of kofta were agreed to some extent to that obtained by Morshdy et al. (2014) (2.67 log 10 cfu/g), while higher results were obtained by Edris and Mohammed (1995) (2.8 x 10^4cfu/g), Al-kour (2001) (4.13 x 10^3cfu/g), Zaki –Eman (2003) (3,3 x 10^3cfu/g), Al-Tawwab (2004) (9x10^4cfu/g), Ammar (2005) (1×10^3cfu/g), Adam (2009) (6.14X10^3cfu/g) and Ali-Sohaila (2011) (7.20×10^4cfu/g). But, *S. aureus* failed to be detected in kofta by Masoad –Nagwa (2013), while detected by Ibrahim (1991) (20%), El-Shewehy (1994) (20%), Zaki-Eman (2003) (10%), Adam (2009) (10%), El-Taher-Amna (2009) (60%), Ghanem-shereen (2009) (46.67%), Saad et al. (2011) (35%), Morshdy et al. (2014) (65.62%) and Sobieh (2014) (6.67%). The current results of shawerma were agreed to some extent to that obtained by Odu and Akano (2012) (13.6%), while higher results were obtained by Ali and Abd El-Aziz (2014) (8.98 x 10^3cfu/g) (25%). The current results for hawawshi samples were nearly similar to that obtained by Ali- Sohaila (2011) (2.75×103cfu/g), while higher results were recorded by Al-Tawwab (2004) (7 x 10^4cfu/g). Also, *S.aureus* were recovered from hawawshi by many investigators such as Ghanem-shereen (2009) (40 %) and Sobieh (2014) (20%).

Acceptability of enterotoxins produced by S. aureus was "one" enterotoxin A and enterotoxin D produced by *S. aureus* in the Hawawshi samples which were 3.6% for enterotoxin A and enterotoxin D. There was "one" unaccepted Hawawshi sample with a percentage (3.6%). While, enterotoxin B and enterotoxin C failed to be detected in Hawawshi samples. The obtained result for kofta samples was "one" enterotoxin D produced by *S. aureus* with percentage (3.6%). There was "one" unaccepted kofta sample with a percentage (3.6%). Enterotoxins A, B, C and D failed to be detected in shawerma samples. Meat products should be free from *S. aureus* enterotoxins according to EOS (2005). Similar results reported by Normano et al. (2005), Rosec et al. (1997), Sohaila and Doaa (2015).

This study concluded that street vended meat products sandwiches sold on the street of kalyobia governorate were constitutes a potential hazard to human health Vendors should therefore receive education in food hygiene. Special attention should be given to the causes of diarrhea, the transmission of diarrheal pathogens, the handling of equipment and cooked food, hand-washing practices and environmental hygiene.

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