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DETECTION OF ENTEROTOXIGENICITY OF *STAPHYLOCOCCUS AUREUS* ISOLATED FROM COMMUNITY AND HOSPITAL FOOD HANDLERS IN MAKKAH, SAUDI ARABIA

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Abstract: Enterotoxin production by *Staphylococcus aureus* has been recognized as a major health problem. Staphylococcus enterotoxins have been isolated in the community and hospitals environments. The present study detected the prevalence of *S. aureus* and SEs in food handlers of community- and hospital-located kitchens. About 400 adult food handlers, who working in community and hospitals kitchens were selected in the study. *S. aureus* was detected in 88 and 61 of food handlers in community and hospital-located kitchens respectively. Staphylococcus enterotoxins were shown in 47.7% in food handlers of community-located kitchens and in 55.8% in those of hospital-located kitchens. Staphylococcus enterotoxin type A was the most predominant. It was concluded that the incidence of *Staphylococcus aureus* was higher in food handlers from community located-kitchens and there was no significant difference in the staphylococcal enterotoxigenicity between community- and hospital-located kitchens.

Key Words: *S. aureus*, Enterotoxins, Food handlers, Community, Hospitals, Hand swabs, Nasal swabs.

INTRODUCTION

Staphylococcus aureus (*S. aureus*) produces numerous toxins including Staphylococcus enterotoxins (SEs) which responsible for staphylococcal food-poisoning (SFP) and toxic shock syndrome. These toxins are called microbial super antigens and have been designated as SEs type A (SEA), SEs type B (SEB), SEs type C (SEC), SEs type D (SED), SEs type E (SEE) and SEs type H (SEH) [1]. SFP is one of the most common food borne diseases (FBD) and is a major concern in public health programs worldwide [2]. It is estimated that *S. aureus* is persistent in 20% of the general population and 60% are intermittent carriers [3]. Intoxication is commonly acquired when improper food handling or food handlers who are carriers contaminate food during preparation. The most important sources of SFP are nasal and hand carriage of enterotoxigenic *S. aureus* in restaurants, kitchens and fast food outlets [4]. SEs have also been isolated in the natural and hospitals environment. The presence of enterotoxigenic *S. aureus* in food occurs frequently due to inappropriate manipulation of food by carriers of *S. aureus* [5]. FBDs are a major public health concern worldwide [2]. *S. aureus* is a significant cause of FBD, causing an estimated 241,000 illnesses per year in the United States [6]. Food poisoning outbreaks result in huge financial losses to restaurants, the loss of reputation and confidence among the public. In the USA, SFPs account for 14–20% of outbreaks. They are estimated to cause 6 – 81 million illnesses and near to 9000 deaths [7]. The present study aimed to investigate the percentage of contaminated workers with *S. aureus* and SEs production by *S. aureus* isolated from food handlers in community- and hospital-located kitchens in Makkah, Saudi Arabia.

MATERIAL AND METHODS

S. aureus isolates were collected from 400 adult food handlers, 200 of them were working in public restaurants and kitchens, while other 200 were working in hospitals restaurants and kitchens in Makkah, Saudi Arabia. All selected food handlers were following personal hygiene; glove, mask and hair cover use, during handling techniques. A total of 400 swabs (200 were nasal and 200 were from hands) from each group were collected. Samples were collected from the hands (inter digital region, index fingers, thumbs and palms of both right and left hands) and anterior nares of the food handlers during meal preparation. After sampling, swabs were immediately transferred into 5 mL nutrient broth and incubated for 18-24 h at 37°C. Ten 10µl of the enriched cultures were streaked on Baird Parker Agar; a Staphylococcus selective medium. Identification of *S. aureus* was confirmed on the basis of Gram stain, catalase, culture properties, detection of hemolysis on blood agar and coagulase reaction. The isolates were stored at -70°C in Tryptic Soy broth with 20% glycerol till further investigations. The isolated *S. aureus* isolates were inculated into Tryptone Soya Broth at 37°C for 18-24 hours, after centrifuging at 3000 rpm at 4°C for 20 minutes, the supernatant was used for enterotoxin evaluation. The enterotoxins A, B, C and D were detected by using RPLA diagnostic kits (SET-RPLA) according to manufacturer instructions.

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RESULTS

The results showed that total of 88 (44%) of the community-located swabs were carriers for *S. aureus*, 52 (59%) of them were from hands while 36 (41%) were from nasal. Also 61 (30.5%) of the hospital-located swabs were carriers for *S. aureus*, 28 (45%) were from hands and 37 (55%) were from nasal. Detection of SEs types showed that 42 (47.7%) of *S. aureus* isolates in community-located kitchens were positive for one or more of these SE type while those in hospital-located kitchens were 34 (55.8%). The prevalence of SEs in *S. aureus* isolates is shown in (Table1).

Table 1: Prevalence of SEs in *S. aureus* isolated from community and hospital based food handlers.

Type	Community-located kitchens (42)		Hospital-located kitchens (34)	
	No	%	No	%
SEA	28	66.6	14	41.2
SEB	2	4.8	1	2.9
SEC	-	-	14	41.2
SE A+B	-	-	2	5.9
SE A+C	8	19	2	5.9
SE C+D	2	4.8	1	2.9%
SEA+B+C	2	4.8	-	-
Total	42	100	34	100.0%

DISCUSSION

Food handler either in community or hospital may be a vector of FBD spreading because of inadequate personal hygiene (eg. hand washing), or cross contamination [8]. The results in this study showed that 44% and 30.5% of food handlers were positive for *S. aureus* in community- and hospital-located kitchens respectively. Previously, many authors have shown that 10-50% of the human population are healthy carriers of *S. aureus* and that about 30% of these strains are enterotoxigenic *S. aureus* [1]. The lower incidence of *S. aureus* in the hands of the hospital workers might be due to implementation of hospital control measures to prevent bacterial transmission. In hospitals, the preventive measures of infection control for *S. aureus* include hand washing, gloving, linen handling and environmental cleaning. Workers in community kitchens are mostly lacking proper training in preventive measures of infection control, food handling operations, mass feeding specially during hajj and sanitary practices [9]. In a similar study, it was found that no difference in incidence of *S. aureus* between workers from community- and hospital-located kitchens [1]. From the decade of the 80s, the *S. aureus* have emerged as main causes of hospital infections. Nasal carriage by health care workers represents an important hospital reservoir of *S. aureus*. Approximately 25% of all hospital-based healthcare workers are stable nasal carriers [10]. In the present study, the nasal carriage rate of *S. aureus* was 41% and 55% in community and hospital-located kitchens respectively and consistent with the results of previous studies carried out in healthy young adults [11, 12]. Also, the study indicated that *S. aureus* strains isolated from the nose were more dominant in hospitals. In the present study 42 (47.7%) of *S. aureus* isolates in community–located kitchens were positive for one or more of these types of enterotoxins while those in hospital-located kitchens were 34 (55.8%). This frequency was higher when compared to other studies [13-16]. In previous studies in Makkah, it was found that enterotoxic positive *S. aureus* represented 36% [17] and 43.9% [18] of *S. aureus* isolated from food handlers. In other countries, Adesiyun *et al.*, [19] and Yılmaz *et al.*, [20] found that 55.4% and 63.2% of *S. aureus* in hospitals produced SEs, singly or in combination. In the present study, the prevalence of SEA was 66.6% among the workers of community kitchens and 41.2% among workers in hospital-located kitchens. Similarly, Yılmaz *et al.*, [20] reported 59.1% of the positive isolates were hospital-located *S. aureus*, and 40.9% of them were community-located *S. aureus* and SEA was as the most prevalent SE followed by SEC. Also Adesiyun *et al.*, [21] found that SEA was the most produced SE, followed by SEC and SED. In contrast, one study reported that *S. aureus* strains producing SEB were the most common isolates [22]. It could be concluded that the incidence of specific enterotoxin types among *S. aureus* isolates from food handlers in community and hospitals is variable. The incidence of *S. aureus* was higher in food handlers from community-located kitchens and there was no significant difference in the staphylococcal enterotoxigenicity between community- and hospital-located kitchens.

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