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Prevalence and Antibiotics Resistance Pattern of *Staphylococcus aureus* among Food Handlers of Jigjiga University Student's Cafeteria

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***Abstract* – Staphylococcal poisoning is caused by ingestion of foods containing enterotoxins produced by some species of staphylococci. It is characterized by sudden onset of symptoms, including nausea, vomiting, abdominal cramps, and diarrhoea within 1to 6 hr after ingestion of toxin-contaminated foods. The aim of this study was to determine prevalence and antibiotics resistance patterns of *S. aureus* isolates among food handlers. The study was conducted from March to May 2014. All food handlers in Jigjiga University students' cafeteria regardless of their age, religion were the study population; 300 volunteer individuals were selected randomly. Mannitol Salt Agar, and Nutrient Broth supplemented with 7.5% (w/v) sodium chloride were used for culturing. Among these food handlers none of them had got food safety training. Educational status of the study participants was mainly 160 (53.3%) illiterate and primary school level. From a total of 300 individuals examined 160 (53.3%) food handler's hands were found to be positive for *S. aureus*. Isolates of *S.aureus* exhibited different sensitivity to antibiotics 160 (100%) were resistant to Streptomycin and Ampicillin,155(96.87%)Penicillin.Incontrast,160(100%) were sensitive to Amikacin, Ciprofloxacin, Norfloxacin. Higher prevalence of *staphylococcus aureus* among the female food handlers is due to the poor hand washing trends than the male food handlers.The high resistance pattern of the isolates to antibiotics is may be due to blind use of antibiotics in the community and adaptation to these antibiotics. Food handlers in students' cafeteria have been found poor in hand washing practice and have high prevalence of S. *aureus*.**

***Keywords* – Jigjiga University, Students Cafeteria, Food Handlers, *S. aureus*, Antibiotics Resistance.**

I. INTRODUCTION

Staphylococcus aureus is a common bacteria found usually in the noses, eye, throats and skin of people and animals. These bacteria are present in persons with skin, eye, nose, or throat infections and also in healthy individuals. *Staphylococcus* can cause food poisoning if food, contaminated by food handlers, is ingested.

Food-borne diseases are spread throughout the world. World Health Organization (WHO) estimated that in developed countries, up to 30% of the population suffers from food borne diseases annually, whereas in developing countries up to 2 million deaths are estimated yearly (Mulat*etal.,* 2012). Food poisoning caused by *S.aureus*is one of the most common food-borne diseases, results from ingestion of one or more staphylococcal entero toxins (SEs) in foods(Argudín*etal.*,2012). *S. aureus* is a Gram-positive bacterium which is a major human pathogen that produces certain exo proteins that cause various types of disease symptoms. Some *S. aureus* strains produce pyrogenic exotoxins, such as staphylococcal enterotoxins (SEs) and toxic shock syndrometoxin1 (Klotz*etal.,* 2003). Some foods offer a suitable growth environment for toxin-producing *S.aureus*, these foods are milk products, mixed foods, meat and meat products, egg and egg products, cakes and icecream etc(Jenny *etal.*,2011).

Food-handlers with poor personal hygiene working in food-service establishments could be potential sources of infection due to pathogenic organisms. One of these common pathogens is *S.aureus* (Gashaw*etal.*,2008).

Enterotoxigenic strains of *S.aureus* responsible of a type of food poisoning. It accounts for 14–20 in the USA. In a study conducted in Makkah, 22.4% of food handlers were carriers for *S.aureus*, 20.6% of them were enter otoxigenic *S.aureus* (Atif*etal.*,2006).This organism may exist on food handler's nose or skin, from which it may be transmitted to foods, and become intoxication agent, if these foods are kept without refrigerating or freezing (Mulat*etal.*,2012). The presence of *S.aureus* in nose, throat and mouth is considered a potential risk of infection.

II. MATERIALS AND METHODS

Food handler's specimens:

Clinical specimens were collected from300 food handlers (270 females and 30 males) of different age group and ethnicity, whom applied to working jigjiga university students' cafeteria in Ethiopia. The specimens, which included nails wabs (300),were examined for presence of *S.aureus.*

Detection of *Staphylococcus aureus*:

Nutrient broth supplemented with 7.5% sodium chloride medium was used to transport these specimens to the laboratory within three hours. These specimens were sub-cultured directly on mannitol saltagar. Any morphologically suspected colonies of *S.aureus* were examined using coagulase test, and then confirmed by catalase test, Gram staining and DNase test.

Sensitivity test:

The recommended medium in this test is Mueller Hinton agar, and Kirby-Bauer test method was used. In this study, the control strain (*S.aureus* ATCC-25923) was

inoculated on a separate Petriplate medium. The inoculation of the medium's surface with the test organism was made with a cottons wab from broth culture standardized to 0.5 MacFarland. Multi-disks antibiotics were placed on inoculated medium by sterile forceps and each disk was pressed slightly to ensure close contact with the medium. The Plate was then incubated aerobically over night at 37ºC. The radius of the inhibition zones was measured from the edge of the disk to the edge of the inhibition zone. Size of inhibition zones of all isolates were compared with the size of the inhibition zones for *S. aureus* (ATCC-25923).

III. RESULTS

Table 1: Socio-demographic characteristics of food handlers at Jigjiga University students' cafeteria, May 2014 (n=300

Characteristics		**Frequency**	**Percent%**
Sex	Male	30	10
	Female	270	90
Age	<19	30	10
	19-34	220	73.3
	35-50	50	25.6
	>50	0	0
Educational status	Illiterate	40	13.3
	Literate	260	86.7
Marital status	Single	140	46.7
	Married	160	53.3

Table 2: The prevalence of *S. aureus* from food handlers based on their gender difference Jigjiga, may 2014 (n=300)

Gender	**Sample size**	***S. aureus* positive**	**% *S. aureus* positive**	**P value**
Male	30	10	33.3	p=0.034
Female	270	150	55.56	
Total	300	160	53.3	

A total of 160 isolates were tested against twelve commonly used antimicrobials viz. including Penicillin G (6 µg), Erythromycin (15 µg), Ampicillin (10 µg), Amikacin (30 µg), Chloramphenicol (30 µg), Gentamycin (10 µg), Streptomycin (10 µg), Kanamycin (30 µg), Methicillin (10 µg), Ciprofloxacin (5 µg), Tetracycline (25 µg) and Norfloxacin (10 µg) following NCCLS 2000 guidelines. The results of the sensitivity test are shown in (Table. 3).

Among all the antimicrobials tested, Streptomycin (100%) and Ampicillin (100%) were the most resisted drugs followed by Penicillin G (97.1%), Methicillin (92.7%), Kanamycin (76.8%), Chloramphenicol (72.5%), Tetracycline (20.3%) and Gentamycin (8.7%). Norfloxacin (0%), Amikacin (0%) and Ciprofloxacin (0%) showed maximum activity.

Table 3: antimicrobial resistance of *Staphylococcus aureus* isolates of Jigjiga University students' cafeteria (n=160)

Antimicrobial disc	Total *S. aureus* (n=160) isolate	Total number (%) isolates resistant from kitchen sponges of	
		Male food handlers n=10(%)	Female food handlers n=150(%)
Tetracycline	32(20)	6(60%)	26(17.3)
Streptomycin	160(100)	10(100)	150(100)
Penicillin G	155(96.87)	9(90)	146(97.3)
Norfloxacin	0(0)	0(0)	0(0)
Methicillin	148(92.5)	10(100)	138(92)
Kanamycin	123(76.9)	8(5)	115(71.9)
Gentamycin	6(3.75)	1(10)	5(3.3)
Erythromycin	46(28.75)	4(40)	42(28)
Ciprofloxacin	0(0)	0(0)	0(0)
Chloramphenicol	115(71.9)	6(60)	44(29.3)
Ampicillin	160(100)	10(100)	150(100)
Amikacin	0(0)	0(0)	0(0)

Where AMP= Ampicillin, STR= Streptomycin, NOR= Norfloxacin, TET= Tetracycline, KAN= Kanamycin, GEN= Gentamycin, CHL= Chloramphenicol, CIP= Ciprofloxacin, AMK= Amikacin, ERY=Erythromycin, MET= Methicillin, PEN= Penicillin G

A total of 300 specimens from 300 food handlers were examined. About 160 (53.3%) were *S.aureus* positive table 2. Table 3 illustrated that the isolates of *S.aureus* exhibited different sensitivity to antibiotics i.e. 160 (100%) were resistant to Streptomycin and Ampicillin, 155 (96.87%) to Penicillin G, 148 (92.5%) to Methicillin, 123(76.9%) to Kanamycin, 115 (71.9%) to Chloramphenicol. In contrast, 160 (100%) were sensitive to Amikacin, Ciprofloxacin, Norfloxacin, 154 (96.25%) to Gentamycin, 128 (80%) to Tetracycline and 114 (71.25%) to Erythromycin.

IV. DISCUSSION

S.aureus can contaminate food by direct contact with carrier body, through skin wounds, respiratory droplets produced when people cough and sneeze. This might be occurred by food handlers when they are preparing or handling foods. The consumption of bacterial contaminated foods may resulting food borne diseases. Such diseases remain a major public health problem globally, particularly in developing countries due to lack of ability to monitor and secure hygienic food handling practices (Ife a dike *etal*., 2012). Food handlers are considered as reservoir of *S.aureus however* the bacterium can present in natural environmentig water, air and soil. Many studies isolated such bacteria from restaurant workers e.g. in study conducted among restaurant workers from Kuwait City; it was found that *S.aureus* and coagulase-negative *staphylococci* (CNS) were isolated from the hands of food handlers in 50 restaurants in Kuwait City (Udo*etal.,*1999).

In the present study most of *S.aureus* were isolated from female food handlers (93.75%). *Staphylococcal* food poisoning resulting from the growth of enterotoxigenic *staphylococci* in foods with the production of enterotoxinis the most common food illness found in almost all parts of the world (Udo*etal.,*1999). In a study implemented in Jigjiga University, Ethiopia, among food handlers in university students cafeteria, it was found that *S.aureus* represented 53.3% of S. aureus isolated from nails swab of food handlers (Atif*etal,*.2006).

S.aureus nail swab is a well-defined risk factor of infection with this bacterium (Verhoeven *etal.,* 2010). Onlyone (0.28%) isolate was observed in nail specimens as well as in throat while there was no isolates in stool samples. (20.5%) food handlers were positive fornasal carriage of *S. aureus* (Mulat*etal.,* 2012). In a study conducted in Ethiopia, the prevalence of *S.aureus* in fingernail specimens was 16.5% (Gashaw *et al.,* 2008). About 7.1% was found in finger nail samples and zero in stool samples of food handlers in the Federal Capital Territory of Nigeria (Atif *et al.,* 2006). To observe the differences between these isolates and their susceptibility to some antibiotics, the sensitivity test was performed. The results of the Antimicrobial sensitivity test for 160 *S.aureus* isolates showed different antibiotic resistance patterns. All isolates were resistant to Streptomycin and Ampicillin, while all of them 160 (100%) were sensitive to Amikacin, Ciprofloxacin, Norfloxacin. In addition to our results *S. aureus* were found to be resistant to several antibiotics (Kitara *etal.,* 2011). It is a potential risk of spread of drug resistant *S. aureus* infection.

V. CONCLUSION

Food handlers in public food premises who are harbouring *S. Aureus* may represent potential risk resulting transmission of food poisoning. Most of *S.aureus* had resistance to certain antibiotics.

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REFERENCES

[1] Andargie, Gashaw, Afework Kassu, FelekeMoges, MogesTiruneh, and KahsayHuruy. 2008. "Prevalence of Bacteria and Intestinal Parasites among Food-handlers in Gondar Town,Northwest Ethiopia." *J Health PopulNutr*26: 451-455.

[2] Argudín, M. A., M. C. Mendoza, M. A. González-Hevia, M. Bances, B. Guerra, and M. R. Rodicio. 2012. "Genotypes, Exotoxin Gene Content, and Antimicrobial Resistance of Staphylococcus aureus Strains Recovered from Foods and Food Handlers." *Applied and Environmental Microbiology*78: 2930– 2935.

[3] Atif, A., Z. Tariq, and M. Aiman. 2006. "Bacteriological and Serological Survey of Infectious Diseases among Food Handlers in Makkah." *Ann Saudi Journal* 26: 141-144.

[4] Dagnew, Mulat, MogesTiruneh, FelekeMoges, and Zinaye Tekeste. 2012. "Survey of nasal carriage of *S. aureus* and intestinal parasites among food handlers working at Gondar University, Northwest Ethiopia." *BMC Public Health*12: 837.

[5] Ifeadike, C. O., O. C. Ironkwe, P. O. U. Adogu, C. C. Nnebue, O. F. Emelumadu, S. A. Nwabueze, and C. F. Ubajaka, 2012. "Prevalence and pattern of bacteria and intestinal parasites among food handlers in the Federal Capital Territory of Nigeria."*Niger Med J*53: 166–171.

[6] Kitara, L.D., A.D. Anywar, D.Acullu, E. Odongo-Aginya, J. Aloyo, and M. Fendu, 2011. "Antibiotic susceptibility of Staphylococcus aureus in suppurative lesions in Lacor Hospital, Uganda."*African Health Sciences*11: 34-38.

[7] Klotz, M., S. Opper, K. Heeg, and S. Zimmermann. 2003. "Detection of Staphylococcus aureus Enterotoxins A to D by Real-Time Fluorescence PCR Assay." *J. Clin. Microbiol*41: 4683-4687.

[8] Schelin, Jenny, Nina Wallin-Carlquist, Marianne Thorup Cohn, Roland Lindqvist, Gary C. Barker and Peter Radstrom. 2011. "The formation of *S. aureus* enterotoxin in food environments and advances in risk assessment." Virulence 2: 580-592.

[9] Udo, E. E., M. A. AL-Bustan, L. E.Jacob, and T. D. Chugh. 1999. "Enterotoxin production by coagulase-negative staphylococci in restaurant workers from Kuwait City may be a potential cause of food poisoning." *J. Med. Microbiol* 48: 819-823.

[10] Verhoeven, P.O., J. Gagnaire, E. Botelho-Nevers, F. Grattard, A. Carricajo, F. Lucht, B. Pozzetto, and P. Berthelot. 2010. "Detection and clinical relevance of Staphylococcus aureus nasal carriage: an update." *J MicrobiolImmunol Infect*. 43:70-73.

[11] BergdollMS:1989 Staphylococcusaureus. In,Doyle MP(Ed): Foodbornebacterial pathogens.pp.463-523, MarcelDekker, Inc., NewYork .

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