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NASAL CARRIAGE OF *STAPHYLOCOCCUS AUREUS* AMONG FOOD HANDLERS AND RESTAURANT WORKERS IN EKPOMA EDO STATE, NIGERIA

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ABSTRACT

Food handlers have been recognized to play a major role in the transmission of food borne diseases; contributing significantly to the global incidence and burden of the diseases. This study therefore, assesses the nasal carriage of *staphylococcus aureus* among food handlers and restaurant workers in Ekpoma, Edo State, Nigeria. A total of 100 nasal swab samples were collected and analyzed for *Staphylococcus aureus* using standard methods. The results showed that the prevalence of nasal carriage of *Staphylococcus aureus* among food handlers and restaurant workers in Ekpoma was 60%. The males had the highest prevalence of 58%, while the females had a prevalence rate of 42%. Those within age 26-30 had the highest prevalence of 67%, followed by those within the age group of ≤25 (17%) and 31-35(17%). Antibiotic sensitivity results showed that Gentamycin, Levofloxacin, Septrin, Rocephin and Ciprofloxacin had 100% sensitivity pattern, while Pefloxacin and Ampiclox exhibited 75% and 25% sensitivity patterns respectively. Ampicillin however, showed no sensitivity (0%). It is our opinion that concerted efforts need to be made to educate food handlers and restaurant workers on the importance of personal hygiene and the use of protective gadgets like nose masks while handling food products; since they serve as potential sources of *staphylococcal* food poisoning.

Keywords: Food Handlers, Food borne diseases, *Staphylococcus aureus*, Nasal Carriage, Restaurants

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INTRODUCTION

Staphylococcus aureus remains a significant cause of mortality and morbidity in tropical countries (Kluytmansm *et al*., 1997; Onile *et al.,* 1985). Available reports have also shown that about 30-50% of the human population are carriers of *Staphylococcus aureus* especially in the nasopharynx (Hennekinne *et al.,* 2010) and that the nasal carriage of *Staphylococcus aureus* is implicated in most community and hospital infections (Von Eiff *et al.,* 2001; Olonitola *et al.*, 2007; Gorwitz *et al.,* 2008; Onanuga and Temedie, 2011; Guido *et al*., 2012).

Of interest however, is the evidence that food borne diseases can be spread by food handlers. This had remained a common and persistent problem worldwide (Zain and Naing, 2002; Scott, 2003) and food handlers with poor personal hygiene serve as potential sources of pathogenic organisms like *Staphylococcus aureus* (Gashaw *et al.,* 2008). Such food poisoning may also result from infections with enterotoxigenic strains of *Staphylococcus aureus (*Carmo *et al.,* 2003; Arbuthnott *et al.,* 1990; Buckle *et al.,* 1993; Mossel and Netten, 1990; Tranter and Brehm, 1994 and Todd, 1998).

Indeed, restaurants have been classified as the second most important place for acquiring *staphylococcal* food poisoning and it accounts for 14–20% of outbreaks involving contaminated food in the USA and United Kingdom (Wieneke *et al.,* 1993 and Ughes and Tauxe, 1990). Obviously, the ingestion of preformed toxins by enterotoxigenic strains in food often leads to the development of food poisoning

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symptoms like nausea, vomiting, diarrhea and abdominal pain (Hennekinne *et al.,* 2010).

Unfortunately, *Staphylococcus aureus* have a record of developing resistance quickly and successfully to antibiotics via a mechanism that involves the acquisition and transfer of antibiotic resistance plasmids (Tenover *et al.,* 2004), as well as the possession of intrinsic resistance mechanisms (Kloos, 1998). More so, *Staphylococcus aureus* has been recognized as a persistent nosocomial and community acquired pathogen with a capacity to evolve different mechanisms of resistance to most antimicrobial agents (Montefiore *et al*., 1989). In fact, the emergence of antibiotic resistant bacterial constitutes a major problem in antibiotic therapy due to antibiotics drug-abuse (Nwankwo and Nasiru, 2011).

Considering therefore, the rising concerns over food safety and the lack of research to ascertain the extent of *Staphylococcus aureus* colonization among food handlers, this study was designed to assess the prevalence, antibiotics sensitivity pattern, and potential risk factors associated with nasal carriage of *Staphylococcus aureus* amongst food handlers and restaurant workers in Ekpoma, Edo State, Nigeria.

MATERIALS AND METHODS

Study Area: The study was carried out in Ekpoma –a town located in Esan West Local Government of Edo State, Nigeria, within longitude 6.130E and latitude 6.730N and incidentally, the headquarters of Esan West Local Government Area.

Sample Collection: A total of 100 nasal swab samples were collected using swab sticks from apparently healthy food handlers and restaurant workers in Ekpoma, Edo State, Nigeria. The ages of the subjects ranged from 21-40 years. The swab sticks were immediately and carefully returned to their sterile containers and sealed with an adhesive tape. The collected specimens were then taken to the diagnostic laboratory for bacteriological analysis.

Inclusion and Exclusion Criteria: Only the food handlers and restaurant workers who have not being treated with antibiotic agents or inhaler spray for at least one month prior to the day of specimen collection, were included in this study, while those who do not fall into this category were excluded.

Ethical Consideration: Informed consent was requested and granted by the food handlers and restaurant workers under investigation. The concept of the study was explained to them and having understood its dimensions, granted their informed consent.

Sample Analysis: The nasal swab specimens were inoculated on mannitol salt agar and the plates were incubated at 37^{o}C for 24 hours under aerobic conditions. After 24 hours of incubation, the culture plates were examined macroscopically to evaluate the appearance, size, colour, and morphology of the colonies. The bacterial isolates were identified using standard bacteriological procedures, including Gram staining, microscopic examination and biochemical tests as described by Cheesbrough (2004).

Antibiotics sensitivity test: A commercially prepared multidisc with known minimum inhibitory concentration (MIC) was used for this test. The sensitivity test was conducted using a 1: 100 dilution of an overnight broth culture of the organism to flood the surface of the nutrient agar media to ensure that the broth culture was poured out from the plates and left on the bench in an inverted position for 30 minutes. The antibiotic sensitive discs were aseptically placed on the surface of the agar and incubated for 24hours. The zone of inhibition for each antibiotic was measured using the National Committee for Clinical Laboratory Standards (NCCLS, 2002).

RESULTS

The results showed that the prevalence of nasal carriage of *Staphylococcus aureus* among the food handlers in Ekpoma was 60% (n=60). The results also showed that the prevalence of nasal carriage according to gender was highest among the males (58%; n=35) as against that of the females (42%; n=25) (*see* table 1). Similarly, results on the prevalence of *S. aureus* according to age, indicated that those within the age range of 26-30 had the highest prevalence of 67% (n=40), followed by those within the age range of ≤25 and 31-35 (17% each respectively) (*see* table 2). Results on the antibiotic sensitivity to *Staphylococcus aureus* shows that gentamycin, levofloxacin, septrim, rocephin and ciprofloxacin exhibited the highest sensitive pattern (100%; n=60), followed by pefloxacin 75% (n=45),

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ampiclox 25% (n=15). Ampicillin however, exhibited no sensitive pattern (0%; n=0) (Table 3).

DISCUSSION

Nasal carriage is an important risk factor in outbreaks of food-borne diseases in which *Staphylococcus aureus* is implicated and it has remained one of the battled bacterial agents of infection in the African continent. The overall prevalence of nasal carriage of *Staphylococcus aureus* amongst the restaurant workers and food handlers in our study recorded a high prevalence rate (60%) and this is in line with the findings of Soto *et al.* (1997) and Loeto *et al.* (2007) who reported the high prevalence of nasal carriage of 65% and 57.5% respectively.

Table 1: The prevalence of staphylococcus aureus in the Nasal carriers among the food handlers in Ekpoma according to gender.

SEX	NUMBER OF SAMPLES	PREVALENCE (%)
Male	50	35(58%)
Female	50	25(42%)
Total	100	60(60%)

Table 2: Prevalence of *staphylococcus aureus* in the nasal carriers among the food handlers in Ekpoma according to age.

AGE	NUMBER OF ISOLATES	PREVALENCE (%)
≤25	10	17%
26-30	40	67%
31-35	10	17%
36-40	0	0%

Table 3: Antimicrobial sensitivity pattern of the bacterial isolates

DRUGS	SENSITIVE (%)	RESISTANCE (%)
Pefloxacin	45(75)	15(25)
Gentamycin	60(100)	0(0)
Ampicillin	0(0)	60(100)
Levofloxacin	60(100)	0(0)
Ampiclox	15(25)	45(75)
Rocephin	60(100)	0(0)
Ciprofloxcin	60(100)	0(0)
Septrin	60(100)	0(0)

Meanwhile, the prevalence of the *Staphylococcus aureus* in this study is higher than those observed in similar studies in US (23%) (Mainous *et al.,* 2006) and UK (25%) (Wieneke *et al.,* 1993) and among food handlers working in Ethiopia (20.5%) (Dagnew *et al.,* 2012), Turkey (23.1%) (Simsek *et al.,* 2009) and Brazil (29%) (Carmo *et al.,* 2003). Similarly, lower prevalent rates of 30%, 31% and 44.6%, have been reported in Brazil, Egypt and Botswana respectively (El-Shenawy *et el.* 2013; Acco *et al*., 2003; Loeto *et al*., 2007). Varying prevalent rates have also been recorded for hospital personnel in Cameroon (23.7%) (Eyoh *et al.,* 2012), and among healthy subjects working in hospitals in Iran (35.7%), India (37.3%) and Nigeria (50%) (Kluytmansm *et al*., 1997), while studies conducted by Teferi *et al.* (2012)

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found that 20.5% of food handlers working in a University students' canteen were nasal carriers of *Staphylococcus aureus*. Above all, the prevalent rate observed in this study (60%), especially within the age range of 20-31%, contradicts some of these existing findings.

These variations in nasal carriage rates are probably due to the ecological differences between the study populations (Bassyonni *et al.*, 2012). Generally, there exists considerable variation of nasal carriage of *S. aureus* prevalence within regions, countries and even inside each country. Global trends of staphylococcal nasal carriage demonstrated that nasal carriage is high in developed countries, as compared to underdeveloped and developing countries (Sivaraman *et al*., 2009) which is not in line with the result of this study.

However, gender has become a predisposing factor for nasal carriage of *Staphylococcus aureus* as shown by the findings of this study; with males having a high prevalence of 58% compared to females with 42%. This is in line with report from several studies that male gender has more risk factors for nasal carriage of *Staphylococcus aureus* (Bischoff *et al.,* 2004 and Riewerts Eriksen *et al.,* 1995); though the present findings disagrees with those of Khorvash *et al*., (2012), Ghasemian et al. (2010) and Isibor and Otabor (2014), who found no significant difference between gender and rate of nasal carriage of the pathogen.

On the other hand, age has been identified in earlier studies as a factor influencing nasal colonization with *Staphylococcus aureus* (Bischoff *et al.,* 2004). The prevalence of *Staphylococcus aureus* according to age in this study showed that the age range of 26-30 has the highest prevalence of 50% which is attributed to the maturity and sexually active age of the correspondents. Our findings in this study is not in line with the report by El-Shenawy *et al*. (2014), Warren (2012), Ibe and Wariso (2005) and Donker *et al*. (2009) whose findings show that the prevalence of Staphylococcus aureus is higher in higher age group of above 70 years and teenage age group of 13-18 years.

Moreover, the antibiotic susceptibility profile of the isolates to commonly used antibiotics showed high susceptibility except ampicilin and ampiclox. This is in line with the findings by Deng *et al. (*2014), Isibor and Octabor (2014), Chatterjee *et al.* (2009) and Erami *et al.*(2014) who reported high susceptibility of Gentamycin and ciprofloxacin among Staphylococcus aureus nasal carriage individuals. Also the report by Dagnew *et al.* (2012) and Eke *et al.* (2012) on the antibiotic susceptibility of Gentamycin, Ciprofloxacin and Septrin above 70% as well as Ampicicillin below 30% are within the range observed in our finding in this study. Nevertheless, our findings disagrees with Udo *et al.* (2009) who reported 92.5% of bacterial isolates resistance to antibacterial agents in his study on the prevalence of antimicrobial resistance and carriage of virulence genes in *Staphylococcus aureus* isolated from food handlers in Kuwait City restaurants as well as those found in *Staphylococcus aureus* isolates from food handlers in Chile and Botswana (Figueroa *et al.,* 2002 and Loeto *et al.*, 2007).

In conclusion, a relatively high prevalence rate of *Staphylococcus aureus* nasal carriage was recorded among the investigated food handlers and restaurant workers. These findings resurges the imperative need for protective measures including increased public awareness programs, regular monitoring of food handlers for food borne pathogens and intensive training on primary health care and hygiene. The use of nose masks by food handlers and restaurant workers and periodical medical examination of correspondents could help to prevent spread of resistant strains of *Staphylococcus aureus*. Finally, the current findings clearly highlights the significance of implementation of efficient quality control systems in areas of direct contact with food product as good manufacturing practices and standard operational procedures and future research addressing effective methods for sustained eradication of staphylococcal nasal carriage are clearly warranted to reduce the high risk of subsequent infection.

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REFERENCES

Acco, M., Ferreira, F. S., Henriques, J. A. P and Tondo, E. C (2003). Identification of multiple strains of *Staphylococcus aureus* colonizing the nasal mucosa of food handlers. *J Food Microbiol*; 20(5)**:**489-493.

Arbuthnott, J. P., Coleman, D. C and Azavedo, J.C. (1990). Staphylococcal toxins in human disease. *J. Appl. Bacteriol*; 69:101-107.

Bassyouni, R.H., El-Sherbiny, N., Hefzy, E. H and Wegdan, A. A. (2012). Perception of food safety and prevalence of *Staphylococcus aureus* and *Salmonella* species carriers among Fayoum University food handlers. *Life Sci. J*; 9(4):2934 -2940.

Bischoff, W.E., Wallis, M.L., Tucker, K.B., Reboussin, B.A. and Sherertz, R, J (2004). *Staphylococcus aureus* nasal carriage in a student community: prevalence, clonal relationships, and risk factors. *Infect. Control Hosp. Epidemiol*; 25:485-491.

Buckle, K.A., Davey, J.A., Eyles, M.J., Hocking, A. D., Newton, K.G and Stuttard, E.J. (1993). *Food borne microorganisms of public health Significance.* Sydney: J. M Sydney Executive Printing Service Pty Ltd. Pp. 271-284.

Carmo, L.S., Dias, R.S., Linardi, V.R., Sena, M.J and Dos Santos, D.A. (2003). An outbreak of staphylococcal food poisoning in the municipality of Passos, Minas Gerais, Brazil. *Braz Arch Biol Technol*; 46:581-586.

Carmo, L.S., Dias, R.S., Linardi, V.R., Sena, M.J. and Dos Santos, D.A. (2003). An outbreak of staphylococcal food poisoning in the municipality of Passos, Minas Geralis, *Brazil. Braz. Arch. Biol. Technol*; 46:581-586.

Chatterjee, S.S., Ray, P., Aggarwal, A., Das, A. and Sharma. M. (2009). A community-based study on nasal carriage of *Staphylococcus aureus. Indian. J. Med. Res*; 130: 742-748.

Cheesebrough, M. (2004). District laboratory practice in tropical countries. Part 2. Cambridge University Press, p. 357.

Dagnew, M., Tiruneh, M., Moges, F. and Tekeste, Z. (2012). Survey of nasal carriage of *Staphylococcus aureus* and intestinal parasites among food handlers working at Gondar University, Northwest Ethiopia. *BMC public health*; 12:837.

Dagnew1, M., Tiruneh, M., Moges M and Tekeste, F. (2012). Survey of nasal carriage of Staphylococcus aureus and intestinal parasites among food handlers working at Gondar University, Northwest Ethiopia. *BMC Public Health*; 12:837.

Deng, J. J., Xiao, G. G., Zhu, Y., Zhou, W and Wan, C. M. (2014): Staphylococcus aureus Nasal Carriage and Its Antibiotic Resistance Profiles in Tibetan School Children in Southwest China. *HK .J. Paediatr*; (new series). 19:75-78.

Donker, G.A., Deurenberg, R.H., Driessen, C., Sebastian, S., Nijs, S and Stobberingh, E.E (2009): The Population Structure of *Staphylococcus aureus* among General Practice Patients from The Netherlands. *Clinical Microbiology and Infection*; 15: 137-143.

Eke, S., Abdulkadiri, S., Okoro, C.J., Ekoh, S.N., Mbachi, N.G. (2012). The prevalence and resistivity pattern of staphylococcus aureus isolates from apparently healthy university students in ekpoma, edo, nigeria. *International Journal of basic, Applied and Innovative Research*; 1(4): 183 - 187.

El-Shenawy1, M., El-Hosseiny, L., Tawfeek, M., El-Shenawy, M., Baghdadi, H., Saleh, O., Mañes, J and Soriano, J. M (2013). Nasal Carriage of Enterotoxigenic *Staphylococcus aureus* and Risk Factors among Food Handlers-Egypt. *Food and Public Health*; 3(6): 284-288.

Erami, M., Soltani, B., Ardakani, T. M., Moravveji, A., Rezaei, M. H., Soltani, S and Moniri, Z (2014). Nasal Carriage and Resistance Pattern of Multidrug Resistant *Staphylococcus aureus* Among Healthy Children in Kashan, Iran. *Iran Red Crescent Med J*; 16 (9): 21346.

Eyoh, A., Toukam, M., Okomo, M., Fokunang, C., Atashilli, J., Lyonga, E., Ikomey, G., Mukwele, B., Messembe, M., Akongnwi, E. and Ndumbe, P. (2012). Nasal carriage of *Staphylococcus aureus* by

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hospital personnel of three health institutions in Yaounde Cameroon. *IRJM*; 2:271-274.

Figueroa, G., Navarrete, P., Caro, M., Troncoso, M and Faundez, G (2002): Carriage of enterotoxigenic *Staphylococcus aureus* in food handlers. *Rev. Med. Chil*; 130:859-864.

Gashaw, A., Kassu, A., Moges, F., Tiruneh, M and Huruy. K (2008). Prevalence of Bacteria and Intestinal Parasites among Food-handlers in Gondar Town,Northwest Ethiopia." *J Health Popul Nutr*; 26(4): 451-455.

Ghasemian, R., Najafi, N., Makhlough, M and Khademloo, M (2010): Frequency of nasal carriage of *Staphylococcus aureus* and its antimicrobial resistance pattern in patients on hemodailysis. *Iran. J. Kidney Dis*; 4(3): 218-22.

Gorwitz, R.J., Kruszon-Moran, D., McAllister, K. S., McQuillan, G., McDougal, L. K., Fosheim, G. E., Jensen, B. E., Killgore, G., Tenover,F. C and Kuehnert, M. J (2008). Changes in the Prevalence of Nasal Colonization with *Staphylococcus aureus* in the United States, 2001–2004. *The Journal of Infectious Diseases*; 197:1226 –1234.

Guido, A.G., Lingscheid, T., Tobudic, S and Burgmann, H (2012). Low nasal carriage of drug-resistant bacteria among medical students in Vienna. *GMS Krankenhhyg Interdiszip*; 7(1): doi: 10.3205/dgkh000188

Hennekinne, J.A., Ostyn, A., Guillier, F., Herbin, S., Prufer, A.L., and Dragacci, S (2010). How Should Staphylococcal Food Poisoning Outbreaks Be Characterized? *Toxins*; 2:2106-2116.

Ibe, S.N. and Wariso, B. A (2005): Carriage of *Staphylococcus aureus* on Armpits of School and University Students in Port Harcourt, Nigeria. *African Journal of applied Zoology and Environmental Biology*. 7: 125-130.

Isibor, J. O. and Otabor, E. (2014): Asymptomatic carriage of plasmid-mediated multidrugresistant *Staphylococcus aureus* in nasal tracts of persons in a semi-urban area of Nigeria. *American Journal of Life Sciences*; 2(4): 200-204.

Khorvash, F., Abdi, F. B., Fattahi,N. H., Hasanzadeh, K. H and Narimani, T (2012): Nasal carriage of *Staphylococcus aureus*: Frequency and antibiotic resistance in healthy adults. *J. Res. Med. Sci*; 17(2): 229-232.

Kloss, W.E., Topley, A and Wilson, J. (1998). Staphylococcus in microbiology and microbial infections. London, Edward Arnold Vol 2. 9th edition Pp. 602-611.

Kluytmans, J., Van Belkum, A and Verbrugh, H (1997). Nasal carriage of *Staphylococcus aureus*: epidemiology, underlying mechanisms and associated risks. *Clin. Microbiol. Rev*; 13: 505-520.

Kluytmansm, J., van Belkum, A. and Verbrugh, H. (1997). "Nasal carriage of *Staphylococcus aureus*: epidemiology, underlying mechanisms, and associated risks". *Clin. Microbiol. Rev.* 10 (3): 505–20.

Loeto, D., Matsheka, M. I and Gashe, B. A (2007). Enterotoxigenic and antibiotic resistance determination of *Staphylococcus aureus* strains isolated from food handlers in Gaborone, Botswana. *J. Food Prot*; 70:2764-2768.

Loeto, D., Matsheka, M. L and Gashe, B. A. (2007): Enterotoxigenic and antibiotic resistance determination of *Staphylococcus aureus* strains isolated from food handlers in Gaborone, Botswana. *J. Food Protect*; 70(12)**:**2764-2768.

Loeto, D., Matsheka, M.I. and Gashe, B.A. (2007). Enterotoxigenic and antibiotic resistance determination of *Staphylococcus aureus* strains isolated from food handlers in Gaborne, Botswana. *J. Food Prot*; 70: 2764-2768.

Mainous, C, A.G., Hueston, W.J., Everett, C.J and Diaz, V.A. (2006). Nasal carriage of *Staphylococcus aureus* and methicillin-resistant *S. aureus* in the United States, 2001-2002. *Ann. Fam. Med*; 4:132–137.

Montefiore, D., Rotimi, V. O and Adeyemi-Doro, F. A (1989). The problem of bacterial resistance to antibiotics among strains isolated from hospital patients in Lagos and Ibadan. Nigeria. *J. Antimicrob. Chemother;* 23(4):641-651.

Endorsed By*: Innovative Science Research Foundation (ISREF).* ***Indexed By****: African Journal Online (AJOL); Texila American University; Genamics; Scholarsteer; EIJASR; CAS-American Chemical Society*; and *IRMS Informatics India* (*J-Gate)*

Mossel, D. A and Netten, P (1990). *Staphylococcus aureus* and related staphylococci in foods: ecology, proliferation, toxinogenesis, control and monitoring. *J. Appl. Bacteriol*; 19:123-145.

National Committee for Clinical Laboratory Standards (NCCLS) (2002). Performance standards for antimicrobial disc susceptibility tests Twelfth informational supplement, M100-S12.

Nwankwo, E.O.and Nasiru, M.S. (2011). Antibiotic sensitivity pattern of *Staphylococcus aureus* from clinical isolates in a tertiary health institution in Kano, Northwestern Nigeria. *The Pan African Medical Journal*; 8:4.

Olonitola, O. S., Inabo , H. I., Olayinka, B. O and Bugo, B. I (2007). Nasal carriage of methicillin-resistant *Staphylococcus aureus* by primary school pupils in a university staff school, Zaria, Nigeria. *International Journal of Biological & Chemical Sciences*; 1(1): 71-75.

Onanuga, A and Temedie, T.C (2011). Nasal carriage of multi-drug resistant *Staphylococcus aureus* in healthy inhabitants of Amassoma in Niger Delta region of Nigeria. *African Health Sciences.* 11(2): 176 – 181.

Onile, B. A., Odugbemi, T. O and Nwofor, C. (1985). Antibiotic susceptibility of Bacterial agents of Septicemia in Ilorin. *Nig Med Pract*; 9(4):16-18.

Riewerts Eriksen, N.H., Esperen, F., Thamdrup Rosdahl, V. and Jensen, K (1995). Carriage of *Staphylococcus aureus* among 104 healthy persons during a 19-month period., *Epidemiol. Infect;* 115,51-60.

Scott, E. (2003). Food safety and food borne diseases in 21st century homes. *Can. J. Infect. Dis*; 14:277-280.

Simsek, Z., Koruk, I., Kopur, A.C. and Gurses, G. (2009). Prevalence of *Staphylococcus aureus* and intestinal parasites among food handlers in Sanliurfa, Southeastern Anatolia. *J. Public Health Manag. Pract*; 15:518-523.

Sivaraman, K., Venkataraman, N and Cole, A.M (2009). *Staphylococcus aureus* nasal carriage and its contributing factors. *Future Microbiol*; 4:999-1008.

Teferi, M. D., Wube, M. T., Yehuala, F. M and Mehari, Z. T. (2012). Survey of nasal carriage of *Staphylococcus aureus* and intestinal parasites among food handlers working at Gondar University, Northwest Ethiopia. *BMC Public Health*; 12 (1): 837. Tenover, F.C and Moellering, R.C.J (2007). The rationale for revising the clinical and laboratory standards institute vancomycin minimal inhibitory concentration interpretative criteria for *Staphylococcus aureus*. Clin Infect Dis; 44:1208-1215.

Todd, E. C. D (1998). Food borne disease in six countries. A comparison. *J. Food Protect*; 4:559-565.

Tranter, H. S and Brehm, R. D (1994): The detection and aetiological significance of staphylococcal enterotoxins. *J. Rev. Med. Microbiol*; 5:56-64.

Udo E. E., Al-Mufti, S and Albert, M. J (2009). The prevalence of antimicrobial resistance and carriage of virulence genes in *Staphylococcus aureus* isolated from food handlers in Kuwait City restaurants. *BMC Research Notes*; 2:108

Ughes, J.M and Tauxe, R.V (1990). Food borne diseases. In *Principles and Practice of Infectious Diseases*. 3rd edition. Edited by Mandell GL, Douglas RG, Bennett JE. New York: Churchill Livingstone. p 879.

Von Eiff, C., Becker, K.. Machka, K., Stammer, H and Peters, G (2001). Nasal carriage as a source of *Staphylococcus aureus* bacteremia. Study Group. *N. Engl. J. Med*; 344(1):11-16.

Warren, R (2012). *Staphylococcus aureus* A Cross Sectional Study of Prevalence and Risk Factors in One General Practice. *Australian Family Physician*; 41: 325-328.

Wieneke, A. A., Roberts, D and Gilbert, R. J (1993): Staphylococcal food poisoning in the United Kingdom, 1969–1990. *J. Epidemiol Infect Dis*. 110:519-531.

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Zain, M. and Naing, N. (2002). Sociodemographic characteristics of food handlers and their knowledge, attitude and practice towards food sanitation: a preliminary report. *Southeast Asian J. Trop. Med. Public Health*; 33: 410-417.

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