Research Article

Frequency of *Staphylococcus aureus* Carriage among Food Handlers in Restaurants of Atbara Market

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Abstract:

Introduction: The health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene guidelines may play an important role in control of faeces-to-hand to-mouth spread of potentially pathogenic transient microorganisms.the objective of this study was to determine the frequency of *Staphylococcal aureus* carriage among food handlers in Restaurants of Atbara market.**Method:** A total of 50 hand swabs and 50 nasal swabs, were collected from food handlers, and then inoculated in Blood agar and MacConkeyagarmedia, incubated at 37c for 24 hours. *Staphylococcus aureus*were identified according to their colonial morphology, indirect gram staining reaction, and biochemical tests.**Results:** The study revealed that 29(58%) of food handlers were carrying *S.aureus* in their nostrils, while only 19(38%) were carrying *S. aureus* in their hands. The study denoted that there was no significant statistical association between education level, job position, and carriage of *Staphylococcus* on nose or hand, but the study found that there was significant statistical association with service year and carriage of *Staphylococcus* on hand.The study recommended that future studies should be done to determine frequency of others food borne pathogen like *Salmonella, Shiglla, E.colli*, *Listeria*, *Campylobacter*, *Bacillus* and *Clostridia species.*

Keywords*: Atbara Market, Frequency, Food Handlers, Staphylococcus aureus Carriag*

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Introduction

Food handler is a person who works for a food company and handles food,

regardless whether preparing or serving it. They could transmit microorganisms to the food through their skin, nasal secretions, and bowel, also from the contaminated food prepared or served by them.[1]

Foods borne disease have a dramatic impact in both developing and developed countries. The Food workers health status, their personal hygiene, knowledge and practice of food hygiene play an important role in food contamination.Food workers hands are important medium for food cross-contamination so that improved personal hygiene and hand washing would lead to the fundamental control of fecal-to-hand to-mouth spread of potentially pathogenic transient microorganisms.[1]

Staphylococcus aureus, *Escherichia coli* survive for hours or even days after initial contact with the microorganisms on hands and surfaces. These microbes have been associated with food borne illness for decades, causing disease and even death to many people each year, an immeasurable economic cost and human suffering.[1]

The Centers for Disease Control and Prevention has diagnosed more than400 food related illnesses. About two thirds than 400food borne illnesses one of third of all outbreaks involve bacteria. The diseases are caused either by the microorganisms themselves or by the toxins they release. [2]

Food becomes unsafe when it was contaminated with harmful organisms and/or chemical ingredients, unsafe food generates a vicious cycle causing food-borne diseases ranging from self-limiting or mild gastrointestinal symptoms (such as abdominal pain, mild diarrhea) to severe form of diseases like illness such as severe diarrhea, dysentery or cancers. [3]

Often unhealthy food handlers who have not receive appropriate health inspection can be sources of food-borne diseases to their consumers.[4]

The consumption of foods contaminated by food borne pathogenic microorganisms and the toxin they produce cause's deaths, illnesses, hospitalization, and economic losses. Due to their widespread nature, food borne diseases, in particular gastro-intestinal infections represent a very large group of pathologies with a major negative impact on public health.[2]

Many cases food-borne illness are reported every year in Africa. Numerous factors, contribute to this high number of incidents.[2]

However, it is extremely important to note that most cases offood-borne illness in the region are not reported, so the true extent ofthe problem is unknown. In most countries of the region, the surveillance infrastructure for food-borne diseases of both microbiological and chemical etiology is weak or non-existent.

This absence of reliable data on the burden of food-borne illness Impede understanding about its public health importance and prevents the development of risk based solutions to its management.[2]

In study conducted in South Africa by Lues and Tonder (2005), sample collected from hands and aprons of food handlers, the study revealed that *Staphylococcus aureus* was isolated from 88% of the population. [5]

In other study carried out in Saudi Arabia by Mushtag Ahmed Khan in (2018), 50 food handlers were screened for presence of bacteria, single non repetitive hand swab, nasal swab and swab from any wound were collected from each individual for screening, *Staphylococcus aureus* was isolated from 7.5% of the study population.[6]

In study conducted in Myanmar by Aung A, (2020). The study found that the major contaminant pathogen of hand (42.3%) and nose (54.9%) was *Staphylococcus aureus*. [7]

In Sudan Study conducted by and Hamid, 2010), who denoted that the rate of *Staphylococcus aureus* carriage was56(21.6%) of 259 food handler. [8]

In Ethiopia, the study conducted by Assefa*et al*, (2007). The study found that there are no significant statistical association was found between bacterial contamination and (gender, education level, medical checkup, training status, hand washing habit and finger nail status) of the food handler, however there was significant association between bacterial hand contamination and service years.[2]

There are no enough studies conducted in Sudan to determine the frequency of food handler's carriage of possible contaminating pathogens which can threat human health. This study aimed to isolate and identify *staphylococcus aureus strains* which carried by food handlers work in different cafeterias of Atbara market.

Method:

Collection of specimens

A total of 50 nasal swabs, 50 swabs from right hands and left hands were collected. Nasal swab was collected aseptically from food handlers' nostrils rolling several times by applicator stick tipped with cotton and moistened with sterile normal saline. Hand swab was collected by rolling several times inside and outside the hand, between fingers and under nail from right and left hand using separate applicator stick tipped with cotton and moistened with sterile normal saline swabs were labeled with patients name and age. All specimens were transferred during two hour to the laboratory.

Culture of specimens

All samples were cultured in Blood agar and MacConkey agar medium, incubated at 37 c for24hrs.

Identification of *Staphylococcus aureus*

Colonial morphology

The growing colonies were morphologically examined for size, color, shape, and

hemolysis on blood agar by observation of the zone around colony, clear zone alpha hemolysis, green zone beta hemolysis in blood agar media, and the colonies were examined on MacConkey for lactose fermentation, pink color indicate lactose fermentation, and yellow color indicate non lactose fermentation .

Indirect gram stain

Dry smear is prepared by emulsifying a colony in a drop of physiological saline and spread evenly in clean dry slide, then allowed to dry, and then the smear was fixed by passing over the flame for seconds.

Crystal violet was added to cover fixed smear for one minute, then washed by tab water, lugol's iodine was added for one minute and washed off by tab water, then decolorized by using acid alcohol for 15-20 seconds and also washed by tab water, finally safranin was added for 2 minutes and washed off by tab water then wiped the back of slide, let to dry and examined under microscope by oil immersion lens (x100).[9]

Biochemical tests

Catalase test

2ml of 3% hydrogen peroxide was transfer into sterile test tube and by using wooden stick apportion from growth of organism under test was added so release of air bubbles indicate positive result, no air bubbles indicate negative result. Positive results appear as formation of air bubbles but in negative result no air bubbles are formed.[9]

DNase test

By using of sterile straight loop under aseptic condition the organism under test was inoculated in the DNase agar plate and making heavy spot, the plate were incubated at 37 °C for overnight at incubator. In the end of incubation period the plate cover with hydrochloric acid, the presence of clear zone around the spot indicates positive result.[9]

Coagulasetest

This test used to differentiate between S.aureus (positive) from other Staphylococci (negative) the test was performed by emulsifying portion of colonies from pure growth in a drop of undiluted plasma then formation of clots in positive strains.[9]

RESULTS

A total of (50) samples of nasal and (50) hand (right and left) swabs were collected from (50) food handlers work in different Restaurants of Atbara market.In this study the participants age ranged from (12) to (60) years, most of them (**46%**) were within the age group (20-40years) **(Table.1).**

Table (1): The distribution of study population according to age

Age (years)	No	Frequency
Less than 20	19	38%
20—40	23	46%
More than 40	8	16%
Total	50	100%

Most of the study population (84%) in this study they do not complete their study and just

reach the elementary and secondary levels and only (12%) of study population they reach the university level **(Table2).**

Table (2): The distribution of study population according to the educational level

Educational level	No	Frequency
Illiterate	2	4%
Elementary	22	44%
Secondary	20	40%
University	6	12%
Total	50	100%

The percentage of hand carriage of *Staphylococcus aureus* among study population was (38%) **(Table3).**

Table (3): The percentage of hand carriage of *Staphylococcus aureus* among study population.

Food handlers	Hand carriage	
	No	Percentage
***S. aureus* carriage**	19	38%
No *S. aureus* carriage	31	62%
Total	50	100

In this study (58%) of the study population were carrying *Staphylococcus aureus* in their nostrils (**Table4)**.

Table (4): The percentage of nasal carriage of *Staphylococcus aureus* among study population.

Food handlers	Nasal carriage	
	No	Percentage
S. aureus carriage	29	58%
No *S. aureus* carriage	21	42%
Total	50	100

There was no statistically significant association between carrying of *Staphylococcus*aureus on hand and education level (*Pvalue*=0.2) **(Table5).**

Table (5): The percentage of hand carriage of *Staphylococcus aureus* among different educational level of food handlers.

Educational level	Hand carriage		*p value*
	No	Percentage	
Illiterate (n=2)	**0**	**0**	**0.2**
Elementary (n=22)	**7**	**31%**	
Secondary (n=20)	**9**	**45%**	
University (n=6)	**3**	**50%**	

The study denoted that there is no statistically significant association between carrying of *Staphylococcus aureus* on nose and education level (*Pvalue*=0.5) **(Table6).**

Table (6). The percentage of Nasal carriage of *Staphylococcus aureus* among different educational levels of food handlers.

Education level	Nasal carriage		*p value*
	No	Percentage	
Illiterate (n=2)	1	50%	**0.5**
Elementary (n=22)	12	54%	
Secondary (n=20)	14	70%	
University (n=6)	2	33%	

There was statistically significant association between carrying of *Staphylococcus aureus* on hand and service year (*P value*=0.01) **(Table7).**

Table (7): The percentage of Hand carriage of *Staphylococcus aureus* among food handlers according to service years.

Service years	Hand carriage		p value
	No	Percentage	
<5 (n=39)	11	28%	0.01
5-10 (n=8)	0	0%	
>10 (n=12)	8	66%	

The study found that there is no statistically significant association between service year and carrying of bacteria on nose (*P value*=0.12) **(Table 8).**

Table (8): The percentage of nasal carriage *of Staphylococcus aureus* among food handlers according to service years.

Service year	Nasal carriage		p value
	No	Percentage	
<5 (n=39)	17	43.6%	0.124
5—10 (n=8)	7	87.5%	
>10 (n=12)	5	41%	

This study denoted that there was statistically significant association between carrying of *Staphylococcus aureus* on hand and job position (*Pvalue*=0.99) **(Table 9).**

Table (9): The percentage of hand carriage of *Staphylococcus aureus* among food handlers according to job position.

Job position	Hand carriage		p value
	No	Percentage	
Cooker (n=37)	14	37.8%	**0.99**
Waiter (n=8)	3	37.5%	
Cleaner (n=5)	2	40%	

The study found thatthere is no statistically significant association between carrying of *Staphylococcus aureus* on nose and job position (*P value*=0.09) **(Table 10)**

Table (10): The percentage of nose carriage of *Staphylococcus aureus* among food handlers according to job position.

Job position	Nasal carriage		p value
	No	Percentage	
Cooker (n=37)	20	54%	0.09
Waiter (n=8)	5	62%	
Cleaner (n=5)	4	80%	

Discussion

In this study out of 50food handlers work in different cafeterias of Atbara market, who were examined 29(58%) were found to be harboring *S. aureus* in their nostrils, this result was slitly similar to result reported in Botswana by (Loeto*et al.,* 2007),who found that the result of nasal carriage of *Staphylococcus aureus* was(44.6%).[10] However, this finding was found to be higher than that reported in Sudan by (Saeed and Hamid, 2010), who denoted that the rate of

Staphylococcus aureus carriage was 21.6%. This variation has been attributed to the differences in the environmental and personnel hygiene of the study population.[8]

In this study out of 50 food handlers the hands of 19(38%) were contaminated with *S. aureus*, this finding similar to that reported in Egypt by (Bassyouni *et al.,* 2012)as they found *S. aureus* on the hands of (36.1%) of food handlers work at fayoum university.[11]

However this result is lower than that reported in South Africa by (Lues and Tonder, 2007) as they found 88% of food handlers hands were contaminated with *S. aureus* this variation in studies has been attributed to the differences in the degree of safety measure and hand washing habits in different geographic regions.[6]

Bacterial hand contamination rate in this study, showed significant association with service years(P value=0.013), in which the highest rate of hand carriage was found among those who worked form more than 10 years. This finding was in difference with study done in Ethiopia by (Asseefa *et al.,* 2015), who found that the highest carriage rate was among those who serve for less than 2 years.[2]

In this study *Staphylococcus aureus* nasal carriage rate was insignificantly associated with service years (*Pvalue*=0.124), this This result was in agreement with study done in Ethiopia by (Getnet*et al*., 2016) as they found that there were no significant association between service year and carriage of *Staphylococcus aureus* on nostril.[12]

In this study there was no significant association between job position and carriage *of Staphylococcus aureus* on hand (P value=0.995%). The rate of *Staphylococcus aureus* hand carriage was higher in cleaners (40%) than cookers (37.8%) and waiters (37.5%), this result was similar to finding obtained by (Asseefa *et al*., 2015) in Ethiopia, who found that the rate was higher also in cleaner (58%) than cookers (43.8%),and waiters (48.5%).[2]

In this study there was no significant association between job position and carriage of *Staphylococcus aureus* on nostril (P=0.094%) This result was in disagreement with study done in Ethiopia by (Getnet*et al,*(2019) as they found that there was significant association between job position and carriage of *Staphylococcusaureus* on nose(P value0.0013).This difference may be due to difference in Geographical area and the level of aware ness among the food handlers. [12]

In this study there was no association between education level and carriage of *Staphylococcus aureus* on hand (p=0.500).This result was in disagreement with study done in Ethiopia by (Asseefa*et al.,* 2015). As they found significant association between educational level and contamination of on hand, in which the rate of carriage was highest among illiterate persons 14(50%).[2]

In this study there was no association between education level and carrying of *Staphylococcus aureus* on nostril (p=0.225). This result is in agreement with study done in Ethiopia by (Getnet*et al*., 2019) as they found that there was no association between service year and carriage of *Staphlococcusaureus* on nose and education level.[12]

Conclusion

The study concluded that:Carriage of *Staphylococcusaureus* on hand was (38%) and in nose was (58%) ,also found that there was no significant statistical association between educational level and carriage of staphylococcus on hand, and nose,there was no significant statistical association between service year and carriage of staphylococcus on nose, but there was significant statistical association between service year and carriage of *Staphylococcus* on hand, and there is no statically significant association between service year and carriage of *Staphylococcus* on nose, and there was no significant statistical association between job position and carriage of *Staphylococcusaureus* on hand, and nose.

REFERENCES:

1. **H.K.Allam, M.A.AL-Bantany, A.S.Seif and E.T.Awad.**(2016), Hand contamination among Food handlers. *British Microbiology Research Journal*,13(5):1-8
2. **AsseefaT, TasewH, Wondafrash B, Beker**. (2015), Contamination of Bacteria and Associated factors among Food Handlers Working in the Student Cafeteria of Jimma University MianCampus, Jimma, South West Ethiopia. *Alternative& Integrative Medicine*.5(2);1-8
3. **WHO.**(2017) Food Safety. World Health Organization.. http://www.who.int/news-room/fact- sheets/detail/food-safety. Accessed 25 Dec 2018.
4. **Mudey AB, Kesharwani N, Mudey GA, Goyal RC, Dawale AK, Wagh VV.**(2010) Health Status and Personal Hygiene Among Food Handlers Working at Food Establishment Around a Rural Teaching Hospital inWardha District of Maharashtra, India. *Global Journal of Health Science*.2(2):198.
5. **Mushtag Ahmed Khan**, (2018), Detectionof Colonized pathogenic bacteria from food handlers in saudi Arabia *Journal of Pure and Applited Microbiology*; 12(3),1301-1306**.**
6. **J.F.R. Lues , I. Van Tonder.** (2007), The occurrence of indicator bacteria on hands and aprons of food handlers in the delicatessen sections of a retail group *Food Control*

   18: 326-332
7. **AungAungNew.** (2012) Bacteria assessment and their antibiotic Sensitivity Patterns of nasal and hand swab Specimens From Food Handler in Hospital compound in Mandalay, Myanmar .*Research Square,* 10: 5-14

8. **Saeed HA, Hamid HH.**(2010), Bacteriological and parasitological assessment of food handlers in the Omdurman area of Sudan. *J Microbial Imanol Infect,* 43: 70-73.

9. **Cheesbrough, M.** Laboratory practice in tropical countries, (2000)part 2. USA, Cambridge university press.

10. **Daniel Loeto, M I Matsheka, B A Gashe**. (2007)Enterotoxigenic and antibiotic resistance determination of S.aureus strains isolated from food handlers in Gaborone, Botswana. *Journal of Food Protection,*70(12):2764-8.

11. **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.*Lifescince Journal*;9(4):2934-29-38.

12. **GenetBeyene, GirmaMano, TesfayeKassa, GetentTasew, andSeidTikuMereta.**(2016), Nasal and Hand Carriage Rate of Staphlococcusaureus among Food Handlers Working in Jimma Town,-South west Ethiopia. *Ethiopia Journal of Health Scince*:19(29):605-6.