



Original Article

Bacteriological and Parasitological Assessment of Food Handlers in the Omdurman Area of Sudan

Humodi Ahmed Saeed^{a*}, Hatim Hassan Hamid^b^aCollege of Medical Laboratory Science, Sudan University of Science and Technology, Khartoum, Sudan.^bKhartoum North Hospital, Sudan.

BACKGROUND/PURPOSE: Pathogenic organisms are thought to be widely distributed among food handlers. This study was designed to assess the prevalence of carriers of some pathogenic bacteria and intestinal parasites among food handlers in the city of Omdurman, Sudan.

METHODS: A total of 518 nasal swabs and stool specimens were collected. Nasal swabs were cultured on bacteriological culture media. Stool specimens were examined microscopically for intestinal parasites.

RESULTS: Of the total subjects examined, 30.1% were found to be carriers of pathogenic organisms. The pathogens isolated and identified were the bacteria *Staphylococcus aureus*, *Salmonella typhi*, and *Shigella boydii*, and the intestinal parasites, *Giardia lamblia* and *Entamoeba histolytica/dispar*. Bacteria and intestinal parasites were most prevalent among storekeepers (41%), followed by restaurant workers (24.4%), bakers (24.4%), butchers (5.1%), milk distributors (2.6%), and fruits/vegetables sellers (2.6%). *S. aureus*, the most abundant pathogen, was most prevalent in storekeepers (44.6%), followed by restaurant workers (25%), bakers (17.9%), butchers (5.4%), milk distributors (3.6%), and fruit/vegetable sellers (3.6%).

CONCLUSION: The findings from this study indicate a key role for food handlers in the spread and transmission of food communicable diseases and reveal the need for protective measures.

KEYWORDS: *Entamoeba histolytica/dispar*, food handlers, *Giardia lamblia*, *Staphylococcus aureus*, Sudan

Introduction

The spread of disease via food handlers is a common and persistent problem worldwide.^{1–3} Many diseases are

communicable and caused by living organisms that enter the body via food.⁴ Numerous outbreaks of gastroenteritis have been associated with ingestion and consumption of raw foods, foods incorporating raw ingredients or foods obtained from unsafe sources.^{5,6} Food poisoning has been reported to be a result of infection with *Staphylococcus aureus*, especially enterotoxigenic staphylococcal strains.⁷ This organism may exist on food handler's skin, from which it may be transmitted to cooked moist protein-rich foods, and become intoxication agents if these foods are then kept for several hours without refrigeration or stored in containers. Food handlers have also been incriminated as vehicles of *Salmonella*.⁸ The frequency of reported foodborne infections

*Corresponding author. P.O. Box 407, Khartoum, Sudan.

E-mail: biotechsust@hotmail.com

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of animal origin, in particular, *Salmonella*, *Campylobacter*, and *Escherichia coli*, has increased in recent years due to changes in food production and processing methods, in parallel with changes in eating habits and other social factors, such as mass catering and the use of convenience foods. In contrast, infections which are primarily of human origin, in particular, typhoid, paratyphoid and bacillary dysentery, are now much less frequently associated with food-borne spread.⁹ The aim of this study was to assess the prevalence of carriers of some pathogenic bacteria and intestinal parasites among food handlers in the city of Omdurman, Sudan.

Methods

The study was conducted in the city of Omdurman and its suburbs. Ten areas, namely Abosaed, Algarafa, Althora, Ombada, Lybia market, Omdurman market, Bet-Almal, Alarda, Almorada, and Al-Hetana, were randomly selected. A total of 259 (249 males and 10 females) food handlers, whose ages ranged from 14 to 57 years with an average of 35.5 years, were selected randomly and divided into six groups: restaurant workers ($n=76$), bakers ($n=41$), storekeepers ($n=111$), milk distributors ($n=6$), butchers ($n=14$), and fruit/vegetable sellers ($n=11$). A nasal swab and a stool sample were collected from each food handler, totally 518 specimens. Intestinal parasites were examined and identified by direct microscopic examination of wet stool preparations, with a small amount of the respective stool sample emulsified in a drop of physiological saline, placed it on a microscope slide, and covered by a cover slide. For bacteriological investigations, stool samples and nasal swabs were cultured in appropriate culture media (Oxoid Co. Ltd, Cambridge, UK). Significant bacterial growth was purified and identified using standard bacteriological methods according to Barrow and Feltham.¹⁰

Results

A total of 60 bacterial strains and 18 intestinal parasites were isolated from the 259 food handlers examined (Table 1). The main pathogens isolated were *Staphylococcus aureus* from nasal swabs, *Salmonella typhi*, *Shigella boydii*, *Giardia lamblia*, and *Entamoeba histolytica/dispar* from stools. Of the

Table 1. Prevalence of pathogenic bacteria and intestinal parasites among 259 food handlers examined^a

Pathogens	Number of positive carriers
Pathogenic bacteria	60 (23.2)
Intestinal parasites	18 (6.9)
Total	78 (30.1)

^aData presented as n (%).

Table 2. Identity, number and distribution of pathogens isolated from food handlers^a

Pathogen group	Food handlers
Nasal <i>Staphylococcus aureus</i>	56 (71.8)
<i>Salmonella typhi</i>	3 (3.8)
<i>Shigella boydii</i>	1 (1.3)
<i>Entamoeba histolytica/dispar</i>	2 (2.6)
<i>Giardia lamblia</i>	16 (20.5)
Total	78 (100)

^aData represented as n (%).

total food handlers examined, 71.8%, 20.5%, 3.8%, 2.6%, and 1.3% tested positive for *S. aureus*, *G. lamblia*, *S. typhi*, *E. histolytica*, and *S. boydii*, respectively (Table 2). Among the food handlers groups, storekeepers had the highest number of carriers with pathogenic bacteria and intestinal parasites (41.0%), followed by restaurant workers and bakers (24.4% each), butchers (5.1%), milk distributors and fruit/vegetable sellers (2.6% each) (Table 3).

The distribution of individual pathogens varied within the food handlers groups (Table 3). *S. aureus* was most abundant (44.6%) in storekeepers, followed by restaurant workers (25.0%), bakers (17.9%), and butchers (5.4%). Milk distributors and fruit/vegetable sellers displayed approximately equal infestation (3.6% each). The second most abundant pathogen *G. lamblia* had its highest incidence in storekeepers (43.0%), followed by restaurant workers and bakers, who displayed equal infection (25% each). Butchers and milk distributors showed no infection. The other pathogens, *S. typhi*, *E. histolytica/dispar*, and *S. boydii*, were less abundant and showed limited distribution (Table 3). *S. typhi* and *S. boydii* were detected only in bakers. *E. histolytica/dispar* was recorded only in restaurant workers and bakers (Table 3).

Table 3. Distribution of individual pathogens among different food handlers groups^a

Group	Individual pathogens					Total ^b
	<i>S. a</i>	<i>S. t</i>	<i>Sh. b</i>	<i>E. h/d</i>	<i>G. l</i>	
Restaurant workers	14 (25.0)	0	0	1 (50.0)	4 (25.0)	19 (24.4)
Bakers	10 (17.9)	3 (100)	1 (100)	1 (50.0)	4 (25.0)	19 (24.4)
Storekeepers	25 (44.6)	0	0	0	7 (43.8)	32 (41.0)
Milk distributors	2 (3.6)	0	0	0	0	2 (2.6)
Butchers	3 (5.4)	0	0	0	1 (6.3)	4 (5.1)
Fruit/vegetable sellers	2 (3.6)	0	0	0	0	2 (2.6)
Total ^c	56 (100)	3 (100)	1 (100)	2 (100)	16 (100)	78 (100)

^aData presented as *n* or *n* (%); ^btotal within group; ^ctotal within pathogens. *S. a*=*Staphylococcus aureus*; *S. t*=*Salmonella typhi*; *Sh. b*=*Shigella boydii*; *E. h/d*=*Entamoeba histolytica/dispar*; *G. l*=*Giardia lamblia*.

Discussion

This study revealed that about 30.1% of the food handlers in the city of Omdorman and its suburbs were carriers of one or more of the pathogenic organisms, mainly *S. aureus*, *S. typhi*, *S. boydii*, *E. histolytica/dispar*, and *G. lamblia*. Of these pathogens, *S. aureus* and *G. lamblia* were the most common and represented 92.3% of the total infections. Of the 259 food handlers examined, 56 (21.6%) were found to be harboring *S. aureus* in their nostrils, this number was significantly higher than that reported among hospital workers (13.2%) in Sudan.¹¹ However, the infection rate recorded in this study was lower than that obtained by Soto et al¹² who reported that 65.5% of food handlers were carriers of *S. aureus*. The frequency of occurrence of *S. aureus* carriers was highest in storekeepers (44.6%), followed by restaurant workers (25%) and was relatively low among milk distributors and fruit/vegetable sellers (3.6% each) and butchers (5.4%).

S. typhi showed a very low frequency of occurrence. Of the 259 stool samples examined, it was detected in only one sample (Table 3). *S. boydii* also showed a very low incidence with only one sample testing positive (Table 3). The low frequency of *S. boydii* recorded in this study is in line with that previously reported by Alwia¹³ who found that only 10 of 400 (2.5%) patients with diarrhea tested positive for the pathogen. However, the small sample size in both studies may account for the low incidence.

The intestinal parasite *G. lamblia* was detected in 20.5% of the samples examined (Table 2). This finding is inconsistent with previous reports on prevalence (2–5%) of the parasite in developing countries.¹⁴ The relative distribution of *G. lamblia* among the food handlers groups was high in storekeepers (43.8%), restaurant workers and bakers (25.0% each), and butchers (6.3%). Milk distributors and fruit/vegetable sellers did not carry the parasite (Table 2). Besides, *E. histolytica/dispar* was diagnosed in only two subjects, a baker and a restaurant worker.

The study indicates clearly the relatively high frequency of occurrence of pathogenic organisms (30.1%) among food handlers in the city of Omdurman and its suburbs. Among the pathogenic organisms identified, nasal *S. aureus* and the intestinal parasite *G. lamblia* were the most prevalent. These findings indicate that the spread of food-linked pathogens and diseases is highly likely and that there is an imperative need for protective measures, including increased public awareness about foodborne diseases, regular monitoring of food handlers for pathogenic organisms, and intensive training on primary health care and hygiene.

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