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# Prevalence of *Salmonella* species among asymptomatic food handlers in Khartoum State, Sudan

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Foodborne diseases are a widespread and growing public health problem affecting developed and developing countries, with microbiologically contaminated food and water being the major causes of diarrhoeal diseases.

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Although the global incidence is difficult to estimate, it is generally estimated that the percentage of the population suffering from foodborne diseases each year could be up to 30% in industrialised countries, and even higher in developing countries.[1,2]

Approximately 10–20% of foodborne disease outbreaks are due to contamination by food handlers. Among the top five risk factors of foodborne outbreaks in food service operations include improper holding temperatures, inadequate cooking, contaminated equipment, purchase and receipt of food from unsafe sources, and poor personal hygiene. These are all directly related to food-handler intervention.[3-5]

*Salmonella* species are a significant cause of foodborne disease around the world,[6] and are known to cause a wide range of diseases including typhoid and paratyphoid fevers, gastroenteritis and bacteraemia.[7] Salmonellas represent a hazard to human health, with sixteen million cases of typhoid fever and 500,000 cases of *Salmonella*-related deaths annually recorded worldwide.[8] Poultry, eggs and dairy products are the most common vehicles of salmonellosis.[9]

Food handlers can transmit the bacteria that cause illness. In fact, humans are the major source of food contamination via their hands, breath, hair and perspiration, and from unguarded coughs and sneezes, which can transmit microorganisms capable of causing illness.[10] The poor hygiene among food handlers and the prevalence of *Salmonella* spp. could adversely affect the health of consumers. Furthermore, the emergence of antimicrobial-resistant *Salmonella* has become a major public health concerns.[11]

This study aims to determine the prevalence of *Salmonella* spp. among food handlers in Khartoum State, Sudan, and investigate the antimicrobial resistance of the recovered strains.

The cross-sectional study took place at Alengaz Medical Centre, Khartoum North, during the period April to September 2009. A total of 594 stool specimens were collected from food handlers who attend for biannual medical check.

Each stool specimen was inoculated in a test tube containing 10 mL selenite cystine broth (Merck, Darmstadt, Germany). After incubation for 24 h, a loop of each broth was streaked on the surface XLD agar medium (Oxoid, Basingstoke, Hampshire, UK) and incubated at 37°C for 24 h. The isolates were identified using biochemical tests (i.e., urease, indole, Voges-Proskauer, lysine decarboxylase) and growth on triple sugar iron (TSI) agar.

Antimicrobial susceptibility was determined by disk diffusion following the guidelines of the Clinical Laboratory Standards Institute (CLSI).[12] The antimicrobial agents used were ampicillin (10 µg), ciprofloxacin (5 µg), chloramphenicol (10 µg), co-trimoxazole (25 µg), nalidixic acid (30 µg) and tetracycline (30 µg).

All *Salmonella* isolates were sent to the Instituto de Acuicultura, University of Santiago de Compostela, Spain, for serotyping using commercial antisera (Statens Serum Institut, Copenhagen, Denmark). Polyvalent *Salmonella* O and H antisera were used to obtain a presumptive diagnosis, and the definitive antigenic designation was determined with monovalent antisera.

A total of 13 (2.6%) *Salmonella* isolates were obtained from

the 594 stool specimens studied. Ten separate serovars were identified: Muenster (*n*=3), Livingstone (*n*=2) and Haifa, Urbana, Westerstede, Agona, Ohio, Orion, Senftenberg and Lockleaze (*n*=1 each).

Of the 13 *Salmonella* isolates subjected to antimicrobial susceptibility testing only four isolates (serovars Senftenberg, Muenster, Livingstone and Lockleaze) showed resistance to one or more of the antimicrobials used in this investigation. Two isolates were resistant to nalidixic acid (15.4%) and one isolate showed resistance to ampicillin (7.6%). The Lockleaze isolate was resistant to tetracycline and co-trimoxazole. The remaining isolates were susceptible to all agents.

Infected food handlers are commonly associated with outbreaks of foodborne disease and were responsible for 18% of the outbreaks of infectious intestinal disease reported in Ireland during 1998–99.[13] However, the association between the infected food handler and the transmission of foodborne disease frequently presents a challenge. Careful outbreak investigation may reveal the infected food handler and the potential carrier of the disease. During the past decade, various studies have analysed food hygiene and food safety knowledge, attitudes and behaviour in defined populations,[14] but not specifically among food handlers.

The occurrence of *Salmonella* spp. among food handlers in this study is consistent with estimates for developing countries,[15] with a study conducted in Ghana[16] reporting a prevalence of 2.6% among food handlers, The results of the present study indicate that a significant proportion of those investigated were shedders or carriers of *Salmonella*, resulting in the increased likelihood of transfer of the infection to others through the contamination of food, although the 2.6% incidence is higher than that found in Japan (0.032%)[17] and Saudi Arabia (1.83%),[18] but lower than that in India (17.3%)[19] and Nigeria (5.7%).[20]

In conclusion, the detection of multiple serovars from food handlers may indicate cross-contamination from different sources; therefore, adequate training in the role of food in disease transmission as well as on the rules of personal hygiene and approved practices in handling food is essential.                            □

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