



# Research Journal of **Microbiology**

ISSN 1816-4935



Academic  
Journals Inc.

[www.academicjournals.com](http://www.academicjournals.com)

## Isolation and Susceptibility to Antimicrobial Agents of *Salmonella paratyphi* from Cheese in Khartoum (Sudan)

<sup>1</sup>Sanaa O. Yagoub, <sup>1</sup>Nada A.M. Oshi and <sup>2</sup>Ibtisam E.M. El Zubeir

<sup>1</sup>Department of Microbiology and Molecular Biology, Faculty of Science and Technology, El Neelain University, P.O. Box 12702 Khartoum, Sudan

<sup>2</sup>Department of Dairy Production, Faculty of Animal Production, University of Khartoum, Postal code 13314 Khartoum North, Sudan

---

**Abstract:** This study was done to investigate the presence of Salmonellae in Sudanese white cheese at Khartoum State. Two hundred cheese samples were purchased from restaurants, retailers and shops, distributed in Khartoum and Omdurman. The isolated *Salmonella paratyphi* (6%) were equally identified as *paratyphi* A and *paratyphi* B. The sensitivity to antibiotics for the isolated *Salmonella* spp. were also tried and multiple sensitivity was observed. Ciprofloxacin, Chloramphenicol and Ofloxacin were the most effective drugs against the tested isolates. The resistance was more frequent to Tetracycline, Gentamycin, Ampicillin, Penicillin and Co-trimoxazole. The present study concluded that *Salmonella paratyphi* A and *Salmonella paratyphi* B were isolated from cheese marketed in Khartoum State. Hence it is recommended that strict hygienic measurement and periodical survey and examinations should be done to ensure safety of food.

**Key words:** Cheese, *Salmonella paratyphi*, antibiotic resistant, Sudan

---

### Introduction

Food safety is an increasingly important public health problem issue. Hence, all governments are intensifying their efforts to improve food quality and safety measures. Health hazards associated with food consumption create numerous social and economic burden on communities and affect their bray systems (WHO, 1997). De Buyser *et al.* (2001) reported that the major cause of food borne diseases were *Salmonella* spp., *Staphylococcus aureus*, *Listeria monocytogenes* and pathogenic *Escherichia coli*. *Salmonellae* are responsible for about 15% of all cases of food poisoning (Stoffman, 1995).

Grieger *et al.* (1976) found that during microbiological examination of food frequent occurrence of *S. agona* serotype was detected in milk products namely in ewe's mild cloddy cheese, ewe's milk curd and hard cheese. Desenclos *et al.* (1996) found that the magnitude of a nation wide outbreak of infection in France in 1993 was due to *Salmonella enterica* serotype *paratyphi* B and concluded that the outbreak emphasizes the potential health hazards of widely distributed unpasteurized milk products. Ingham *et al.* (2000) showed that cheese brine could support the survival of contaminating *S. typhimurium* and *E. coli* for several weeks under typical brining conditions

Bezanson *et al.* (1985) reported that more than 2000 confirmed cases of food poisoning occurred in Canada particularly in Ontario during the second and third quarters of 1984 were due to *Salmonella typhimurium* from Cheddar cheese.

---

**Corresponding Author:** Sanaa O. Yagoub, Department of Microbiology and Molecular Biology, Faculty of Science and Technology, El Neelain University, P.O. Box 12702 Khartoum, Sudan Fax: 00249-83-776338

Villar *et al.* (1999) and Cody *et al.* (1999) reported that multi-drug resistant *Salmonella typhimurium* DT 104 was emerged as a cause of Salmonellosis in Yokima country and Mexican- style soft cheese made from unpasteurized milk is an important vehicle. Similarly, De valk *et al.* (2000) showed that unpasteurized soft cheese is an effective vehicle of *S. typhimurium* transmission. Similarly, Cody *et al.* (1999) showed that raw milk products pose a risk for multi-drug resistant *Salmonella typhimurium* DT 104 infections.

D'Aoust (1994) found that *Salmonella partyphi B* was resistant to Ampicillin, Chloramphenicol and Trimethoprim, Sulfamethoxazole. Cody *et al.* (1999) and Villar *et al.* (1999) reported that *Salmonella typhimurium* DT 104 infection was resistant to Ampicillin, Chloramphenicol and Streptomycin, Sulfamethoxazole and Tetracycline.

The present study was undertaken to:

- Estimate the incidence and types of pathogenic *Salmonella* spp. associated with soft white cheese in Khartoum and Omdurman.
- Determine antibiotics resistance of the isolated *Salmonella* spp.

## **Materials and Methods**

### *Source of Cheese Samples*

The present study was conducted to investigate contamination of Sudanese white cheese with *Salmonella* spp. The survey covered retailers, shops and restaurants from Omdurman and Khartoum cities during the period from February to November 2001.

### *Collection of Cheese Samples*

Two hundred samples were collected randomly from restaurants, retailers and shops distributed in different regions of Khartoum and Omdurman. The samples were collected aseptically in sterile containers and transported in an ice box to the Microbiology laboratory, Faculty of Science and Technology, EL Neelain University, Khartoum, where the analysis was done.

### *Isolation and Identification of Organisms*

Preparations of the cultural media and identification was done as described by Barrow and Felthman (1993). The samples were first inoculated in nutrient broth medium and incubated at 37°C for 24 h. Using sterile swabs the growths were then transferred to selenite F broth medium and incubated at 37°C for 24 h, then streaking on MacConkey's agar medium was done and the cultures were incubated at 37°C for 24 h. The creamy coloured colonies from the growth were cultured in Salmonella and Shigella agar. The pure colonies were then subjected to the primary and secondary confirmatory tests (Barrow and Felthman, 1993).

### *Antibiotics Sensitivity Test*

Muller and Hinton agar medium was used. The sensitivity multi-discs were placed centrally with sterile forceps on the plates inoculated with the organisms. The plates were inverted and incubated for 24 h at 37°C. The multi-disc contained the following antibiotics: Ciprofloxacin, Chloramphenicol, Ofloxacin, Nalidixic acid, Tetracycline, Gentamicin, Ampicillin, Penicillin and Co-Trimoxazole.

Table 1: Prevalence of *Salmonella* spp. in Sudanese white cheese from Khartoum and Omdurman

Area	Restaurants		Retailers		Shops		Total
	Samples surveyed	Positive samples	Sample surveyed	Positive samples	Samples surveyed	Positive samples	
Khartoum	35	4 (11.43%)	30	1 (3.33%)	35	1 (2.86%)	6 (6%)
Omdurman	35	1 (2.86%)	30	1 (3.33%)	35	2 (5.71%)	4 (4%)
Total	70	5 (7.14%)	60	2 (3.33%)	70	3 (4.29%)	10 (5%)

Table 2: Antibiotic sensitivity of *Salmonella paratyphi* (A and B) isolated from white soft cheese in Khartoum and Omdurman

Antibiotic	<i>Salmonella paratyphi</i> A	<i>Salmonella paratyphi</i> B
Ciprofloxacin (5)	+++	+++
Chloramphenicol(30)	+++	+++
Ofloxacin (10)	++	++
Nalidixic Acid (30)	++	++
Tetracycline (30)	+	+
Ampicillin (30)	+	+
Gentamicin (10)	+	+
Penicillin (30)	0	+
Co-trimoxazole (25)	0	0

Key: +++ = 0.2 mm, ++ = 0.15 mm, + = 0.05 mm, 0 = zero

## Results

On selenite F broth, turbidity was noticed and colonial morphology were observed on SSA as soft, circular margin, medium size and creamy with black centre. On MacConkey's agar, the colonies were soft, mucoid and had creamy colour. Moreover, those isolates were identified as *Salmonella paratyphi* A. and *Salmonella paratyphi* B.

Six percentage of the examined samples collected from Khartoum revealed positive isolation of *Salmonella* spp., they were found as 4 (11.43%) from restaurants samples, 1 (3.33%) and 1 (2.86%) from samples collected from retailers and shops, respectively. On the other hand 4 (4%) of the samples that collected from Omdurman showed positive isolation of *Salmonella* spp. as 1 (2.86%), 1 (3.33%) and 2 (5.71%) from restaurants retailers and shops, respectively. The total percentage of isolation of *Salmonella* spp. was 5% in Khartoum and Omdurman (Table 1).

Table 2 shows the sensitivity to antibiotics tested against the isolated *Salmonella* spp. from white soft cheese. Diverse sensitivity to different antibiotics used was observed. Ciprofloxacin, Chloramphenicol and Ofloxacin were the most effective drugs against the tested isolates. The resistance was more frequent to Tetracycline, Gentamycin, Ampicillin, Penicillin and Co-trimoxazole.

## Discussion

This study revealed the presence of *S. paratyphi* A and *S. paratyphi* B in white soft cheese that was collected from Khartoum and Omdurman and this supported the findings of Ingham *et al.* (2000). This may refer to the ability of *Salmonella* spp. to grow and survive in salted food such as cheese (Cody *et al.*, 1999). The presence of *Salmonella paratyphi* as a pathogenic microorganism is a health problem and this is in accord with the findings of Gazzar and Marth (1992) who reported that *Salmonella* spp become a major concern for the dairy industry due to outbreaks of illness. Moreover, Asperger *et al.* (1994) stated that any food may be contaminated with *Salmonella* as a consequence of mishandling or improper hygiene or might be due to widely distributed unpasteurized milk

product. In this study, the relatively higher prevalence of *Salmonella* in Khartoum Restaurants poses a serious health problem. This indicates improper hygiene, with possible wide spread of infection among consumers. Similarly, Desenclos *et al.* (1996), Villar *et al.* (1999) and De Valk *et al.* (2000) reported cases of *Salmonella* infection due to consumption of contaminated dairy products.

Both strains of *Salmonella* showed multiple reactions to tested antibiotics as stated by D'Aoust (1994), Cody *et al.* (1999) and Villar *et al.* (1999). The resistance may be acquired and transferred to human through consumption of raw milk products thus rendering the resistant food related infections difficult to be treated (Manie *et al.*, 1999).

The present study concluded that *Salmonella paratyphi* A and *Salmonella paratyphi* B considered as health hazard were isolated from different food distributing vehicles. It is recommended that people who came in contact with food processing and marketing should be free from food-borne diseases specially salmonella infections. Periodical health examination and surveillance should be done to all food distribution places. Heat treatment of milk before manufacturing of dairy products is needed to reduce the risk of survival of microbial contamination.

## References

- Asperger, H., H. Beker, G. Vlaemyneck, M. Rea and M.C. Fleming, 1994. The significance of Pathogenic Microorganisms in raw milk. International Dairy Federation (IDF), Belgium
- Bezanson, G.S., R. Khakhria, D. Duck and H. Lior, 1985. Molecular analysis confirms food source and simultaneous involvement of two distinct but related subgroups of *Salmonella typhimurium*. Bacteriophage type 10 in major interprovincial *Salmonella* outbreak. *Environ. Microbiol.*, 50: 1279-1284.
- Barrow, G.I. and R.K.A. Feltham, 1993. *Cowan and Steel Manual for the Identification of Medical Bacteria*. 2nd Edn., Cambridge.
- Cody, S.H., S.L. Abbott, A.A. Marfin, B. Schulz, P. Wagner, K. Robbins, J.C. Mohle-Boetani and D.J. Vugia, 1999. Two outbreaks of multidrug-resistant *Salmonella serotype typhimurium* DT 104 infection linked to raw milk cheese in Northern California. *J. Am. Med. Assoc.*, 281: 1805-1810.
- D'Aoust, J.Y., 1994. *Salmonella* and the international food trade. *International J. Food Microbiol.*, 24: 11-31.
- Desenclos, J.C., P. Bouvet, E. Benz-Lemoine, F. Grimont, H. Desqueyroux, I. Rebiere and P.A. Grimont, 1996. Large outbreak of *Salmonella enterica serotype paratyphi* B infection caused by a goats' milk cheese, France, 1993: A case finding and epidemiological study. *Br. Med. J.*, 312 : 91-94
- De Valk, H., E. Delarocque-Astagneau, G. Colomb, S. Ple, E. Godard, V. Vaillant, S. Haeghebaert, P.H. Bouvet, F. Grimont, P. Grimont and J.C. Desenclos, 2000. A community-wide outbreak of *Salmonella enterica serotype typhimurium* infection associated with eating a raw milk soft cheese in France. *Epidemiological Infection*, 124: 1-7.
- De Buyser, M.L., B. Dufour, M. Maire and V. Lafarge, 2001. Implication of milk and milk products in food borne diseases in France and different industrialised countries. *J. Food Microbiol.*, 67: 1-17.

- Grieger, C., J. Havrila, H. Hromada, G. Lengyel, M. Pakanova, R. Perl and F. Verdon, 1976. Rennet as a source of *Salmonella* occurrence in various dairy products. *Veterinary Medicine (Praha)*, 21: 221-227.
- Gazzar, F.E., Y.C. Su and E.H. Marth, 1992. *Salmonellae*, *Salmonellosis* and dairy foods : A review. *J. Dairy Sci.*, 75: 2327-2343.
- Ingham, S.C. and D.S. Spangenberg, 2000. Survival of *Salmonella typhimurium* and *Escherichia coli* O157: H7 in cheese brines. *Intl. J. Food Microbiol*, 61: 73-79
- Manie, T., V.S. Brozel, N.J. Veith and P.A. Gouws, 1999. Antiamicrobial resistance of bacterial flora associated with bouine products in South Africa. *J. Food Protection*, 62 : 515-618.
- Stoffman, P., 1995. *The Family Guide to Preventing and Treating 100 Infectious Illness*, John Wiley and Sons. New York.
- Villar, R.G., M.D. Macek, S. Simons, P.S. Hayes, M.J. Goldoft, J.H. Lewis, L.L. Rowan, D. Hursh, M. Patnode and P.S. Mead, 1999. Investigation of multidrug-resistant *Salmonella serotype typhimurium* DT 104, infections linked to raw milk cheese in Washington State. *J. Am. Med. Asso.*, 281: 1811-1816.
- WHO, 1997. *Hazard Analysis Critical Control Point System of Food Processing and Manufacturing*. WHO, Geneva.