

Prevalence of *Salmonella* Carriers among Food Handlers and Detection of Drug Resistance of Isolates in Hamadan

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Abstract

Background: *Salmonella* is one of the major causes of human diseases related to food consumption. *Salmonella typhi* and *S. para-typhi* are causes of typhoidal and para-typhoidal infections. Some infected individuals recovering from this infection become temporary or permanent carriers, harboring the organisms in the gallbladder, biliary tract, or rarely in their intestines. The aims of this study were determination of prevalence of *S. typhi* and *S. para-typhi* carriers among food handlers in Hamadan city and detection of antibiotic resistance of isolates by disc diffusion method.

Methods: In this study, 210 persons who were working in supplying and distribution of the food-stuffs were investigated. The fecal samples from food handlers were collected from both sexes and cultured on a suitable media including, Selenite F and S-S agar, and eventually the organisms were identified by biochemical tests and antisera method. Antibiotic resistance of strains was also detected by disc diffusion (Kirby-Bauer) method. The data was gathered through questionnaire and analysed using EPI6 statistical software.

Results: Of 210 stool cultures, 5 cases (2.38%) were positive for *Salmonella* species. Two cases (0.94%) were *S. typhi*, two (0.94%) *S. para-typhi* B and one (0.47%) *Salmonella* non-typhi. Positive cases were tested again after one month and one of them (Non-typhi) was negative in culture. So, the rate of infection (typoidal *Salmonella* carrier) was 1.8%. Most isolates were resistant to ampicillin, sulfamethoxazole and tetracycline, and were sensitive to gentamycin, ceftriaxone and ciprofloxacin.

Conclusion: Our results showed that prevalence of *S. typhi* and *S. para-typhi* carriers among food handlers in Hamadan was approximately similar to the developing countries (0.1% to 3%). Since food handler carriers are at high risk for transition of microorganisms, which involved in foodborne diseases, they must be checked regularly for health and be trained by health public authorities.

Keywords: salmonella, typhoid, carrier, food handler, drug resistance

Introduction

The genus of *Salmonella* is one of the most important members of Enterobacteriaceae family that are mostly related to food consumption (1). Salmonellosis refers to a group of infectious diseases caused by exposure to *Salmonella* bacteria. This group includes food poisoning, blood poisoning and typhoid fever. Food poisoning is the most common type of salmonellosis in many countries (1-3).

S. typhi and *S. para-typhi* are causes of typhoidal and para-typhoidal infections, whereas non-typhoidal *Salmonella* with 2200 serotypes (for example *S. typhimurium*, *S. virchow*, *S. hawana*, *S. derby* and *S. enteritidis*) are causes of non-typhoidal infections such as gastroenteritis and septicemia (1, 4). Food contamination due to *Salmonella* species is the cause of large numbers of human food-borne illnesses worldwide. Some *Salmonella* are highly adapted to human or other animal hosts. Animal adapted strains generally do not cause

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human disease, while human adapted strains, often cause typhoid fever and diarrhea (1, 3). *Salmonella* species can be found in milk and dairy products, eggs, poultry, and processed meats (5). The disease could be spread after handling food or utensils contaminated with the bacteria. Infected people and pets such as dogs, and turtles can also spread the disease. Because the cause of clinical typhoid fever is almost always human-adapted *Salmonella*, most cases can be traced to a human carrier. The proximate cause is most often water but may also be food contaminated by a human carrier. Some persons continue to harbor *Salmonella* in their tissues (gallbladder or biliary tract) for variable lengths of time. The organism residing in the bile (even inside stones), intermittently reaches the lumen of the bowel, and is excreted in the stool, thereby contaminates water or food (1, 3, 6). By these means human becomes the major source of infection. Chronic carriers are generally over 50 years old, are more commonly women than men, and often have gallstones. Asymptomatic food handlers carriers who are working in supply and distribution of the food-stuffs can transfer *Salmonella* species to their customers (1). The objectives of this study were determination of prevalence of *S. typhi* and *S. para-typhi* carriers among food handlers in Hamadan city and detection of antibiotic resistance of isolates by disc diffusion (Kirby-Bauer) method.

Materials and Methods

This project was a descriptive cross-sectional study which was performed during a two-year period between 1999-2000 in Hamadan city, the West of Iran. From 1162 food handlers who were working in supply and distribution of the food-stuffs, 210 persons were randomly involved in the study. Among 210 persons who were studied, 85.5% was male and 14.5% was female. The ranges of age groups of participants were between 10 to > 60 years old. Food handlers who were investigated consisted of bakers, confectioners, restaurant workers, roasted liver sellers, sandwich sellers and fruit

juice sellers. The data including sex, age, occupation, education and underlying diseases was gathered through questionnaire and analyzed using EPI6 statistical software. The fecal samples from food handlers were collected and inoculated into an enrichment medium (Selenite F broth). The specimens were transferred to medical microbiology laboratory immediately and incubated at 37° C for 24 hours. The specimens were cultured again on selective medium (S-S agar) and incubated for 24-48 hours. Black colonies on S-S agar with urease negative reaction were isolated and eventually were identified by biochemical tests and antisera method (7, 8). Biochemical tests were as follows: Indole production, Methyl red reaction, Urease production, H₂S production, TSI reactions, VP reaction, Motility test and Phenylalanine deaminase production. Serotyping of strains was performed by Biomerieux polyvalent and monovalent antisera (made in France). The samples were serotyped by anti O, anti H and anti Vi antisera. Antibiotic resistance of strains was also detected by disc diffusion (Kirby-Bauer) method (9). Eight antibiotics including tetracycline (TE), chloramphenicol (CH), ciprofloxacin (CP), cephalexin (CF), ceftriaxone (CT), gentamycin (GM), ampicillin (AM), trimethoprim-sulfamethoxazole (SXT) were used.

Results

Among 210 stool cultures, 5 cases (2.38%) were positive for *Salmonella* species on the basis of biochemical and serotyping tests. Four persons (1.88%) had typhoidal *Salmonella* and one person (0.47%) had also non-typhoidal *Salmonella*. Two cases (0.94%) were *S. typhi*, two (0.94%) *S. para-typhi B* and one (0.47%) *Salmonella* species (Non-typhi). Positive cases were tested again after one month and one of them (Non-typhi *Salmonella*) was negative in stool culture, therefore, the rate of infection (typhoidal *Salmonella* carrier) was 1.8%. None

of the carriers had any symptoms of this disease both in the past and in present either.

Table 1 show the occupation of individuals who were studied. The most frequency of age groups of food handlers who had positive culture was 21-32 years old. Seventy five percent of carriers were male and 25% were female. Seventy five percent of carriers were educated whereas 25% were uneducated.

Table 2 shows the drug resistance of the strains isolated from carriers. Most isolates were resistant to ampicillin, trimethoprim-sulfamethoxazole and tetracycline, and were sensitive to ceftriaxone and ciprofloxacin.

Forty percent of typhoidal *Salmonella* including *S. typhi* and *S. para-typhi B* were resistant to chloramphenicol and cephalexin. All typhoidal *Salmonella* were sensitive to ciprofloxacin and ceftriaxone.

Table 1: Frequency of participants and carriers in different occupations

Occupations	Frequency of participants		Frequency of carriers	
	Count	Percent	Count	Percent
Confectioners	49	23/3	1	25
Sandwich sellers	23	10/95	1	25
Bakers	54	25/7	0	0
			1	25
Restaurant workers	68	32/4	1	25
Roasted liver sellers	11	5/2	0	0
Total	210	100	4	100

Table 2: Frequency of antibiotic resistance in investigated isolates

Isolates	Antibiotics*								
	CH	TE	CP	CF	CT	GM	AM	SXT	
	%	%	%	%	%	%	%	%	%
<i>Salmonella typhi</i>	50	100	0	50	0	0	100	50	
<i>Salmonella para-typhi B</i>	50	50	0	50	0	50	100	100	
<i>Salmonella non-typhi</i>	0	100	0	0	0	100	0	0	

*CH= Chloramphenicol, TE= Tetracycline, CP= Ciprofloxacin, CF= Cephalexin, CT=Ceftriaxone, GM=Gentamycin, AM= Ampicillin, SXT= Trimethoprim -sulfamethoxazole

Discussion

Parallel with improvement in environmental sanitation in developed countries, the incidence of typhoidal *Salmonella* (*S. typhi* and *S. para-typhi*) infections has dramatically decreased. However, in the developing countries typhoid fever still is one of the major problems of public health affairs (3). From 1985 to 1996, the typhoid incidence was only 508 cases per year in the United States, accounting for just over 1 percent of all *Salmonella* isolates (1, 4). Typhoid in the endemic countries is due to contact with carriers or to food borne outbreaks, which are often associated with food handlers or domestic workers who are working in supply and distribution of the food-stuffs. The feces of persons who have unsuspected subclinical disease or are carriers, are a more important source of contamination than frank clinical cases that are promptly isolated. The prevalence

of *S. typhi* and *S. para-typhi* carriers in developing countries is around 0.1% to 3% (1, 3). In an investigation which was performed in Hong Kong by Lari and his colleague in 1992, the prevalence of chronic carriers was 0.15%, they found out the relation between gallbladder-stone and exertion of organisms to intestine (10). In other studies performed in Peru by Lantana in 1990, the prevalence of *S. typhi* chronic carriers in food handlers was 262 per 100.000 populations (11). There are a few studies on prevalence of *Salmonella* carriers among food handlers in our country Iran. In a prospective study conducted in Ahwaz, the prevalence of *S. typhi* carriers among food handlers was 0.5% (12). In another study in Guilan province, the prevalence of *Salmonella* carriers was 2.3% (13). In our study, the rate of prevalence of *S. typhi* and *S. para-typhi* carriers among food handlers in Hamadan was 1.8%.

None of these carriers had any background of salmonellosis or typhoid fever in their healthy records. At the same time they did not have any underlying disease. Therefore, we can conclude that most of the carriers can be infected to light form of the disease. The prevalence of *S. typhi* and *S. para-typhi* carriers among food handlers in Hamadan is approximately the same as in the developing countries (0.1% to 3%). Considering the relatively high prevalence of salmonellosis in food handlers or asymptomatic carriers who are working in supply and distribution of the food-stuffs. So, finding and following up of these carriers will help to control the disease. Our results also showed that 40% of typhoidal *Salmonella* were resistant to chloramphenicol, whereas this antibiotic has been known as a choice drug for treatment of typhoid fever. Most strains were also resistant to trimethoprim-sulfamethoxazole and tetracycline. We suggested that further study be conducted for detection of drug resistance of *salmonella* strains.

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