



## ORIGINAL RESEARCH ARTICLE

# The incidence of *Shigella* and *Salmonella* in the stool of pediatric patients

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## Abstract

**Objective:** Gastroenteritis is a common illness in the pediatric age group, the causes could be viral, bacterial and fungal. This study was focused on bacterial pathogens like *Shigella* and *Salmonella*.

**Methods:** About 1399 stool samples were collected in a period between January 2010 and May 2011 at the child welfare hospital, all the samples were cultured on suitable culture media and then biochemical activities were tested using API-E 20 and sugar fermentation tests, the isolates were sent for sensitivity test with a group of antibiotics.

**Results:** Out of 1399 cases 50 cases only showed a positive growth for *Shigella* and *Salmonella* as pathological microorganisms.

**Conclusion:** The incidence of *Shigella* and *Salmonella* was considered low when compared to other causes of gastroenteritis among children as enteropathogenic *Escherichia coli* or viral causes.

**Keywords:** *salmonella*, *shigella*, pediatric group

## Introduction

*Salmonella* and *Shigella* bacteria are two of several gram-negative bacterial pathogens that can cause diarrheal diseases. According to the Centers for Disease Control, 40,000 U.S. cases of *Salmonella* infections are reported every year, while *Shigella* accounts for 14,000 reported cases.

*Shigella* and *Salmonella* are pathogens that cause gastroenteropathy in humans<sup>1</sup>. Alimentary canal infections are mostly caused by *Salmonella*, which has a broad distribution throughout the natural world and a widespread occurrence in animals, especially in poultry and swine<sup>2</sup>.

There are about 2,500 subtypes (serotypes) of *Salmonella* shown in Table 1 and 40 subtypes of *Shigella* shown in Table 2. *Salmonella* sometimes spreads from the intestine to the bloodstream (bacteremia), while *Shigella* usually does not. Bacteremia makes *Salmonella* more potentially life-threatening than *Shigella*. *Salmonella* infection causes salmonellosis, an infection with symptoms of diarrhea, abdominal cramps and fever.

The most common types found in the U.S. are *Salmonella typhimurium* and *Salmonella enteritidis*, while *Shigella*

infection causes shigellosis. In rare cases, the body's reaction to *Shigella* or *Salmonella* infection causes post-infectious arthritis, which can last for months or years after recovery<sup>3,4</sup>.

Both *Salmonella* and *Shigella* infections cause diarrhea, fever and abdominal cramps. However, *Salmonella* mainly attacks the small intestine, while *Shigella* usually invades the large intestine. A key difference is that *Shigella* causes bloody diarrhea, while *Salmonella* does not.

*Shigella* infection is spread mainly through contaminated human stools, and also through flies and contaminated food and water. People get *Salmonella* mostly through contaminated food, and also through contact with pets' contaminated feces<sup>5</sup>.

In most cases, salmonellosis and shigellosis resolve within a week with oral fluids. Antibiotics and intravenous fluids can help in severe cases, but many *Salmonella* and *Shigella* bacteria have become resistant to antibiotics<sup>6,7</sup>.

*Salmonella* and *Shigella* infections can be prevented by proper sewage disposal, proper handling and cooking of food, good personal hygiene and a safe water supply<sup>8,9</sup>.

## Patients and Methods

A total of 1399 stool samples were collected from children admitted to Child Welfare Hospital/Baghdad. Their age ranged between 1 month and 10 years, starting from January

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**Table 1 Representative antigenic serotypes of *Salmonella***

Representative antigenic serotypes of <i>Salmonellae</i>	
Group and type	Serotype
D	<i>Salmonella typhi</i>
A	<i>Salmonella paratyphi A</i>
C <sub>1</sub>	<i>Salmonella choleraesuis</i>
B	<i>Salmonella typhimurium</i>
D	<i>Salmonella enteritidis</i>

**Table 2 Pathogenic species of *Shigella***

Pathogenic species of <i>Shigella</i>	
Present designation	Group and type
<i>Shigella dysenteriae</i>	A
<i>Shigella flexneri</i>	B
<i>Shigella boydii</i>	C
<i>Shigella sonnei</i>	D

2010 to May 2011, samples were sent for diagnosis and cultured on appropriate media like MacConky and SS media (*Salmonella-Shigella* media) and incubated at 37°C for 24 hr. More identification was done for the lactose non-fermenting colonies by culturing the suspected isolates on API-E 20 test with a set of sugar for bacterial biochemical activity as IMViC, Kligler iron test, indole test and lysine and urea test at 37°C for 24 hr. Accurate diagnosis was made using specific polyvalent antisera for both *Salmonella* and *Shigella*.

Antibiotic sensitivity was done for the diagnosed colonies using nutrient agar for culture and the antibiotic discs used<sup>10,11</sup> were as follows:

[Imipenem (IPM) 10 µg, cephalothin (CF) 30 µg, amikacin (AK) 30 µg, ciprofloxacin (Cip) 5 µg, f gram negative bacteriacefexime (CFM) 5 µg, methacilin (ME) 5 µg, ceftriaxone (COR) 30 µg, aztreonam (ATM) 30 µg, tricorcin (TIM) 1.25 + clovanicacid 10 µg, trimethoprim (COT) 1.25 µg, cefotaxime (CTX) 30 µg, chloramphenicol (C) 30 µg, ampicillin (AMP) 10 µg, ceftazidime (CAZ) 30 µg, ticarcillin (TIC) 1.25 µg] and the results are shown in next day.

## Results

The total examined cases were 1399 after culturing the samples on MaConkey agar plate, the non-lactose fermentor were isolated and send for API-E 20 testing to confirm the diagnosis of *Shigella* and *Salmonella*. The study showed that only 31 (2.21%) children infected with *Shigella* and 19 (1.39%) cases of *Salmonella* out of the total 1399 cases as shown in Table 3. About 60% of them were males and 40% females, the distribution according to age groups shown in Table 2. The cases were mostly seen in the first year of age 56% of the total.

Culture characteristics and sensitivity tests were done using Müller-Hinton agar media, the results were indicated as red in next day, and the tested drugs are shown in Table 3.

**Table 3 The incidence of *Salmonella* and *Shigella* in diarrhea pediatric patients**

Infective microorganisms	No. of cases	Percentage
<i>Salmonella</i>	19	1.39%
<i>Shigella</i>	31	2.21%

**Table 4 The distribution of the patients infected with *Salmonella* or *Shigella* according to age and sex**

Age	No. of patients	Male	Female
1–6 months	16 (32%)	10	6
7–12 months	16 (32%)	10	6
1–2 years	6 (12%)	4	2
3–6 years	9 (18%)	4	5
7–10 years	2 (4%)	1	1
>10 years	1 (2%)	1	0
Total	50 100%	30	20

**Table 5 Antimicrobial sensitivity for both *Salmonella* and *Shigella* isolates**

Antibiotics	<i>Shigella</i> spp.		<i>Salmonella</i> spp.	
	Sensitive S	Resistant R	Sensitive S	Resistant R
CTX	11	1	3	0
IMP	14	1	6	0
CIP	10	5	2	1
ME	7	0	0	1
CAZ	7	10	0	5
TIM	8	0	3	1
CF	8	5	4	1
ATM	4	2	1	0
CFM	4	2	1	0
COR	3	5	0	0
C	3	5	1	4
TIC	2	5	7	0
AK	2	7	0	4
AMP	0	12	0	4
COT	2	6	2	5

Notes: IPM 10 µg, CF 30 µg, AK 30 µg, Cip 5 µg, CFM 5 µg, ME 5 µg, COR 30 µg, ATM 30 µg, TIM 1.25 + 10 µg, trimethprim COT 1.25 µg, CTX 30 µg, C 30 µg, AMP 10 µg, CAZ 30 µg, TIC 1.25 µg.

*Shigella* species were strongly sensitive to IMP, CTX and CIP, respectively, and moderately sensitive to CAZ, ME, CF, while some of them were resistant to AMP, CAZ, AK, COT, C, CF and TIC.

For *Salmonella*, it was strongly sensitive to TIC, IMP, moderately sensitive to CTX, TIM, and weakly sensitive to the effect of ATM and CFM antibiotics *in vitro*, but resistant to CO, CAZ, AMP, AK and C which should be not given to the children in those cases, as shown in Table 5.

## Discussion

Result revealed that incidence of *Salmonella* and *Shigella* was very low, which could be related to the predominance of viral causes of gastroenteritis (rotavirus and others) or due to the early administration of antibiotics before sending the patients stool for culture and sensitivity examination as recommended,<sup>12,13</sup> mostly the infections seen during the first year of life, which could be related to low immunity developed against gram-negative bacteria during the first year of life. Probably most of the babies were not breast fed with poor hygienic conditions.<sup>14,15</sup> This study excluded other bacteria like enteropathogenic *Escherichia coli* and *Pseudomonas* to concentrate on both *Salmonella typhi* and *Shigella* in pediatric age group.

The pattern of antibiotic sensitivity in *Shigella* infection was as follows: sensitive to imipenem, cefotaxime and ciprofloxacin, but resistant to most of the commonly prescribed antibiotics in practice, such as ampicillin, amikacin, cotrimoxazole and chloramphenicol.

For *Salmonella*, imipenem and ticarcillin were the effective antibiotics in the treatment of such infection, but resistant to the rest of the list like cotrimoxazole, ceftazidime, ampicillin and chloramphenicol used in daily practice and this is comparable to a similar study in Turkey.<sup>16,17</sup>

In conclusion, ampicillin, chloramphenicol and cotrimoxazole are no longer used in empiric treatment. The alternatives for acute diarrheal infection is third generation cephalosporins and its limited uses in pediatric patients, as it is not recommended below the age of 14 years old; reducing the choices to a very narrow scale during the treatment of acute bacterial gastroenteritis, but still, the prevention is the best treatment of such case indeed.

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