Occurrence and Antibiogram of Salmonella Isolates from Patients Attending Bingham Hospital, Jos, Nigeria

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Author’s contribution
The sole author designed, analyzed and interpreted and prepared the manuscript.

ABSTRACT
This study was carried out from Dec. 2011 to Jan. 2012 and occurrence and susceptibility patterns of salmonella isolates were determined. Five hundred and fifty samples (comprising of 355 from stool and 200 from blood) were collected from patients with symptoms of salmonella infection attending Bingham University Teaching Hospital. Antibiotic sensitivity of the isolates was performed with the following drugs: septrine (30µg), streptomycin (30µg), chloramphenicol (30µg), sparfloxacin (10µg), ciprofloxacin (10µg), trivid (10µg), amoxacillin (30µg), augmentin (30µg), gentamicin (10µg) and pefloxacin (30µg) using Kirby-Bauer’s method. Only 12 (2.2%) out of 555 examined samples yielded Salmonella species. Twelve Salmonella spp. were isolated from females (58.3%, n=7) while 5 from males (41.7%, n=5). The difference was however not statistically significant (p ≥ 0.05). The most infection age range was 35-39 years old while ages 0-4 years and 10-14 years showed no infection. Nine isolates of Salmonella sp. exhibited multi drug resistance character while only 3 were sensitive, one of these three showed complete sensitivity to the entire antibiotic tested. The Salmonella species isolates showed most sensitivity (58%) to ciprofloxacin, augmentin and gentamicin followed by trivid, streptomycin and chloramphenicol (50% each). The least sensitivity of the isolates to the antibiotics was 25% in both amoxacillin and sparfloxacin. This preliminary investigation suggests that there may be possible distribution of

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multidrug resistant Salmonella strain (MDRSS) in this environment. Also the recommended drugs to be used are ciprofloxacin, gentamycin and augmentin. Also periodic antibiotic susceptibility pattern should be done to curtail further emergence of MDRSS. Thus this research can serve as a guide since there is no documented data on antibiotic profile of salmonella in this study area.

Keywords: Occurrence; enteric fever; salmonellosis; multidrug resistant Salmonella species; antibiotic profile.

1. INTRODUCTION

Typhoid fever (TF), also known as enteric fever is caused by the bacterium Salmonella typhi. The paratyphoid fever is caused by Salmonella paratyphi A, B, and C and salmonellosis is caused by other species of Salmonella (non-typhoidal salmonella). These etiologic agents (Salmonella typhi and Paratyphi) are highly adapted human specific pathogens occurring more frequently in under-developed regions of the world where there is poor sanitation and crowdedness. These pathogens can be transmitted by ingestion of food or water contaminated by faeces from typhoid carriers [1]. The disease can also be contracted when faeces from Salmonellae carriers are used as manure to fertilize vegetables [2].

Typhoid fever remains a serious health problem in many regions of the globe. According to the best globe estimates, there are at least 16 million new cases of typhoid fever each year with 6,000.00 deaths [3]. According to Rahul [4], between 1-5 of patients with acute typhoid infection have been reported to become chronic carriers of the infection, depending on age, sex and treatment regimen. Also, it has been reported that typhoid fever is a global infection with fatality rate of 10% [5]. The disease is a cause for concern and a major public health problem in developing countries (Asia, Africa) especially in Nigeria due to inadequate health facilities and lack of or inadequate potable water.

Salmonellosis is said to be often restricted to the gastro-intestinal tract and can be a self limiting disease [6]. For instance many individuals infected with Salmonella typhimurium experience mild gastrointestinal illness accompany with diarrhea, chills, abdominal cramps, fever, head and body aches, nausea and vomiting have been reported [7]. Nevertheless extra intestinal infection(systemic illness) can occur, especially among very young, elderly and immunocompromised patients [8,9]. It has been stated that every year approximately 40,000 cases of salmonellosis are reported in the United States [6]. In Nigeria due to poor documentation and lack of adequate diagnostic, salmonellosis cases are not certain.

The medical importance of typhoid fever and salmonellosis is not just the occurrence but the causative agents posing resistance to antimicrobial drugs used for treatment. Resistance is actually a natural biological defense mechanism used by bacteria to survive in the presence of a threatening antibiotic [10]. Antibiotic – resistant gene can also be acquired by susceptible strains from resistant strains thus allowing more bacteria to become resistant to the antibiotic [11].

However, in developed countries, the incidence of cases and death has been greatly decreased by a combination of improved sanitation and hygiene, vaccine and effective antimicrobial chemotherapy [12].

Data on the antibiotic susceptibility pattern is very inadequate in Nigeria [13] likely due to lack of well equipped laboratory facilities to perform culture and sensitivity testing [14, 15] and lacking the act of documentation. Thus, this study is aimed at determining the occurrence of the Salmonella species and its susceptibility pattern to some antibiotics commonly purchased at the market and in most hospitals in Jos. This can form a basis for choice of antibiotics in this study area therefore reducing further emergence of multidrug Salmonella species strains.

2. MATERIALS AND METHODS

2.1 Samples Collection

Three hundred and fifty five stool specimens were collected from patients with abdominal pain and/or diarrhea attending Bingham Teaching Hospital (BUTH), Jos, formerly known as Jankwano Hospital. Each of the stool specimens was cultured on Salmonella-Shigella agar (HiMedia Laboratories Pvt. Ltd, India) and incubated for 24 hours at 37°C. Two hundred blood samples were collected from patients with
fever. Three to 5ml of the blood sample were inoculated into 8-10ml of thioglycolate broth respectively and incubated for 24 hours at 37°C. Samples from the incubated blood culture bottles (inoculated broth) were sub cultured on Salmonella-Shigella agar (SSA) the second day and re-incubated at 37°C for 24 hours. The incubation of blood cultured bottles was extended to up to 10 days for subcultures that failed to yield any bacterial growth. The periodic subcultures were made after 2, 5, 7, and 10 days on SSA [16] with slight modification. No growth after 10 days was regarded as a negative and discarded. The suspected colonies from both stool and blood samples were sub cultured on SSA and incubated for 24 hours at 37°C for purification. The suspected colonies were further screened by sub culturing on Xylose Lysine Deoxycholate (XLD) agar and were further confirmed using standard biochemical tests [17]. The positive isolates were then sub cultured on agar slant and stored in the refrigerator at 8°C until required for susceptibility test.

### 2.2 Antibiotic Susceptibility Testing

The isolated *Salmonella* species were tested by Kirby-Bauer disc diffusion method for drug susceptibility according National Committee for Clinical Laboratory Standards (NCCLS) guidelines [18]. The Mueller-Hinton Agar plates were smeared evenly using a sterilized wire loop with *Salmonella* isolates. This was then impregnated with antibiotic sensitivity discs using sterile forceps and then gently pressed down onto the agar and incubated for 24 hours at 37°C. The antibiotics used were, septrine (30µg), streptomycin (30µg), chloramphenicol (30µg), sparfloxacin (10µg), ciprofloxacin (10µg), trivid (10µg), amoxicillin (30µg), augmentin (30µg), gentamicin (10µg) and pefloxacin 30µg).

### 2.3 Ethical Clearance

The ethical clearance was obtained from the Ethical Committee of the Bingham University Teaching Hospital, Jos, Plateau State.

### 2.4 Statistical Analysis

The Chi- Square test was implored using SPSS version 17.0 and P-value < 0.05 was considered as significant.

### 3. RESULTS

Out of the 555 samples analysed, 4 blood samples and 8 stool specimens yielded *Salmonella* sp. Five (41.7%) were screened from males while 7 (58.3%) were isolated from females. The most infectious ages were from 35-39 years old while ages 0-4 years and 10-14 years yielded no *Salmonella* sp. (Table 1).

Nine isolates exhibited multidrug resistant characteristic while only 3 isolates were sensitive strains (non multidrug resistant). Out of the 3 sensitive strains, one of them showed complete susceptibility to all the antibiotics while the other 2 were resistant only to either amoxicillin or sparflroacin respectively (Table 2).

Fig. 1 showed antibiotics susceptibility pattern of the *Salmonella* isolates. The antibiotics that the isolates showed highest sensitivity were ciprofloxacin, augmentin and gentamicin (58% each), followed by trivid, streptomycin and chloramphenicol (50% each). The least sensitivity exhibited by the *Salmonella* isolates to antibiotics were amoxicillin and sparflroacin both having 25%.

| Age (years) | No. isolated (%) | Sample | Sex |  |
|------------|------------------|--------|-----|---|
|            | Blood | Stool | Male (%) | Female (%) |
| 0-4        | 0     | 0     | 0 (0)    | 0 (0)      |
| 5-9        | 1     | 1     | 1 (8.3)  | 0 (0)      |
| 10-14      | 0     | 0     | 0 (0)    | 0 (0)      |
| 15-19      | 1     | 1     | 1 (8.3)  | 0 (0)      |
| 20-24      | 1     | 1     | 1 (8.3)  | 0 (0)      |
| 25-29      | 2     | 2     | 2 (16.7) | 1 (8.3)    |
| 30-34      | 2     | 2     | 2 (16.7) | 1 (8.3)    |
| 35-39      | 3     | 3     | 3 (25)   | 1 (8.3)    |
| 40-44      | 1     | 1     | 1 (8.3)  | 0 (0)      |
| 45-49      | 1     | 1     | 1 (8.3)  | 0 (0)      |
| TOTAL      | 12    | 4     | 5 (41.7) | 7 (58.3)   |

*P* ≥ 0.05
Table 2. Antibiotic resistance and susceptibility in *Salmonella* sp isolated from patients in BUTH, Jos

| Isolate I.D.no | Antibiotics | MDR | Sensitive |
|---------------|-------------|-----|-----------|
|               | SXT | CH | SP | CPX | AM | AU | CN | PEF | DFX | S |
| 3             | R   | S  | R  | S   | R  | S  | S  | S   | S   | R  | + | - |
| 10            | R   | R  | R  | S   | R  | R  | S  | S   | S   | R  | + | - |
| 15            | R   | R  | R  | R   | S  | S  | S  | S   | S   | S  | + | - |
| 16            | S   | S  | S  | S   | S  | S  | S  | S   | S   | S  | - | + |
| 18            | S   | S  | S  | S   | S  | S  | S  | S   | S   | R  | - | + |
| 24            | R   | R  | R  | R   | R  | S  | S  | S   | S   | S  | + | - |
| 28            | S   | S  | S  | S   | R  | S  | S  | S   | S   | S  | - | + |
| 29            | R   | R  | R  | R   | R  | R  | R  | R   | R   | R  | + | - |
| B4            | R   | R  | R  | R   | R  | R  | R  | R   | R   | S  | + | - |
| B5            | R   | R  | R  | R   | R  | S  | R  | R   | R   | s  | + | - |
| B6            | S   | S  | R  | S   | S  | S  | R  | R   | R   | R  | + | - |
| B11           | R   | S  | R  | S   | S  | R  | R  | R   | R   | S  | + | - |
| TOTAL         | 9   | 3  |     |     |     |     |     |     |     |     |   |   |

B= isolate from blood, MDR- Multidrug resistant, R= resistant, S= Sensitive, + = Yes, - = No, SXT (septrine), CH (chlorамphenicol), S (streptomycin), SP (sparfloxacin), CPX (Ciprofloxacin), OFX (Trivid), AM (Amoxacillin), AU (Augmentin), CN (Gentamicin) and PEF (pefloxacin), I.D.no=identification number

4. DISCUSSION

Typhoid and non typhoid diseases caused by *Salmonella typhi* and non typhoid *Salmonella sp* respectively have posed health challenge to mankind worldwide, especially in developing countries.

This study has revealed a low rate of 2.2% occurrence of *Salmonella sp* associated with diarrheal and enteric fever patients. This is in variance with a popular assertion of almost every diarrheal and enteric fever case being linked to typhoid fever. This also indicates a drop in infections by *Salmonella* sp contrary to earlier reports by some scholars such as [5,19,20]. The age range that was most infected were the young adults (35-39 years old ) [Table 1], which is in agreement with [21] who reported most infected ages of 29-39 years to be more susceptible to *Salmonella typhi*. This could probably due to the fact this is the active age group. The results also
showed that more females (58.3%) were infected with Salmonella sp than males (41.7%), although not significant (P≥0.0.5) as seen in Table 1. This is in line with the report of [1]. This may be due to the fact that females are often associated with edible items, cleaning up children and domestic sanitation.

All the isolates showed resistance to more than 2 antibiotics used, except 3 isolates with one of them showing complete susceptibility while the other showed resistant to either streptomycin or amoxicillin respectively (Table 2). From the total species of Salmonella isolated, 9 were multidrug resistant (MDR) while only 3 were non-multidrug resistant. These observations demonstrate wide range of multidrug resistant characteristics among the Salmonella species in this area. The antibiotics susceptibility pattern of the Salmonella species isolated indicated highest sensitivity to ciprofloxacin, augmentin and gentamicin (58% each), followed by tarivid, streptomycin and chloramphenicol (50% each) while amoxicillin and sparfloxacin showed the least activities of 25% each (Fig. 1). This result shared the similar view with that of [22] and [1]. This phenomenon suggests that most of the Salmonella sp possessed resistant factors which may due to drug abuse as a result of self medication against any abdominal pain and enteric fever thought to be typhoid. Thus, the use of ciprofloxacin, augumentin and gentamicin are recommended for treatment of typhoid fever and salmonellosis in this area. The use of antibiotics like sparfloxacin and amoxacin against Salmonella should be avoided to curtail further emergence of multidrug resistant Salmonella strains (MDRSS). This is in line with earlier finding of [22] who recommended the use of levofloxacin, ciprofloxacin and ofloxacin but discouraged the use of ampicillin, vancomycin and cephalothin in treatment of diarrheal diseases caused by pathogenic bacteria such as Salmonella and Shigella species.

5. CONCLUSION

This study presumes the possible circulation of MDR Salmonella species in Jos, Nigeria. Therefore, there is need to enlighten the people about the danger of multidrug resistant and encourage the prudent use of antibiotics. Also, periodic determination of the antibiotics susceptibility patterns should be promoted to serve as empirical therapy guide.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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