

Original Research Article

PREVALENCE AND SUSCEPTIBILITY PATTERNS OF SALMONELLA ISOLATES FROM PATIENTS ATTENDING BINGHAM UNIVERSITY TEACHING HOSPITAL, JOS, PLATEAU STATE, NIGERIA.

ABSTRACT

The occurrence and susceptibility patterns of salmonella isolates were determined. Five hundred and fifty samples (comprising of 355 from stool and 200 from blood) from patients with bacteraemia and enteric fever attending Bingham University Teaching Hospital from Dec., 2011 to Jan. 2012. Antibiotic susceptibility to 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 twelve (2.2%) of the samples yielded *Salmonella* species out of the 555 samples analysed. Twelve *Salmonella* spp were isolated from more females (58.3%, n=7) than males (41.7%, n= 5). The difference was however not statistically significant ($p \geq 0.05$). 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 all the 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 amoxallin and sparfloxacin. There is distribution of multidrug resistant *Salmonella* strain (MDRSS) in this environment. The recommended drugs to be used are ciprofloxacin, gentamincin and augmetin. Also periodic antibiotic susceptibility pattern should be done to curtail further emergence of MDRSS.

Key words: Occurrence, Enteric fever, Salmonellosis, Multidrug resistant *Salmonella* species, Antibiotic profile.

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34 **INTRODUCTION**

35 Typhoid fever (TF), also known as enteric fever is caused by the bacterium
36 *Salmonella typhi*. The paratyphoid fever is caused by *Salmonella paratyphi* A, B, and
37 C and salmonellosis is caused by other species of *Salmonella* (non-typhoidal
38 salmonella. These etiologic agents (*Salmonella typhi* and *Paratyphi*) are highly
39 adapted human specific pathogens occurring more frequently in under-developed
40 regions of the world where there is poor sanitation and crowdedness. These
41 pathogens can be transmitted by ingestion of food or water contaminated by faeces
42 from typhoid carriers (Ital and Uweh, 2005). The disease can also be contracted when
43 faeces from Salmonellae carriers are used as manure to fertilize vegetables. 

44 Typhoid fever remains a serious health problem in many regions of the globe.
45 According to the best globe estimates, there are at least 16 million new cases of
46 typhoid fever each year with 6,000.00 deaths as reported by Ivanoff (1995).
47 According to Rahul (2009), between 1-5 of patients with acute typhoid infection have
48 been reported to become chronic carriers of the infection, depending on age, sex and
49 treatment regimen. Also, Doughari *et al* (2007) reported that typhoid fever is a global
50 infection with fatality rate of 10%. The disease is a cause for concern and a major

51 public health problem in developing countries (Assia, Africa) especially in Nigeria
52 due to inadequate health facilities and lack of or inadequate potable water.

53 Salmonellosis is said to be often restricted to the gastro-intestinal tract and can be a
54 self limiting disease (*Olowe et al.*,2007).For instance many individuals infected with
55 *Salmonella typhimurium* experience mild gastrointestinal illness accompany with
56 diarrhea, chills, abdominal cramps ,fever, head and body aches, nausea and vomiting
57 as reported by Honish(1999).Nevertheless extra intestinal infection(systemic illness)
58 can occur, especially among very young, elderly and immunocompromised
59 patients(Angulo and Swerlow ,1995,Thuluvath and McKendrick, 1998).It has been
60 stated that every year approximately 40,000 cases of salmonellosis are reported in the
61 United States(*Olowe et al.*,2007).In Nigeria due to poor documentation and lack of
62 adequate diagnostic,salmonellosis cases are not certain.

63 The medical importance of typhoid fever and salmonellosis is not just the occurrence
64 but the causative agents posing resistance to antimicrobial drugs used for treatment.
65 Resistance is actually a natural biological defense mechanism used by bacteria to
66 survive in the presence of a threatening antibiotic (*Onyango et al.*, 2008). Antibiotic
67 – resistant gene can also be acquired by susceptible strains from resistant strains thus
68 allowing more bacteria to become resistant to the antibiotic (Pratt and Palmer, 1990).

69 However, in developed countries, the incidence of cases and death has been greatly
70 decreased by a combination of improved sanitation and hygiene, vaccine and
71 effective antimicrobial chemotherapy (Leslie *et al.*, 1998).

72 Data on the antibiotic susceptibility pattern is very inadequate in Nigeria (Malonza *et*
73 *al.*, 1997) likely due to lack of well equipped laboratory facilities to perform culture
74 and sensitivity testing (Kakai and Wamola, 2002, Kakai, 2011) and lacking the act of
75 documentation. Thus, this study is aimed at determining the occurrence of the
76 *Salmonella species* and its susceptibility pattern to some antibiotics commonly
77 purchased at the market and in most hospitals in Jos. This can form a basis for choice
78 of antibiotics in this study area therefore reducing further emergence of multidrug
79 *Salmonella species* strains.

80 MATERIALS AND METHODS

81 Samples collection:

82 Three hundred and fifty five cal samples were collected from patients with
83 abdominal pain and /or diarrhea attending Bingham Teaching Hospital (BUTH), Jos,
84 formerly known as Jankwano. Each of the feecal samples was cultured on
85 nonella-shigella agar (SSA) and incubated for 24 hours at 37°C. Two hundred
86 blood samples were collected from patients with enteric fever. Three to 5ml of the 
87 blood sample were inoculated into 8-10ml of thioglycolate broth respectively and

88 incubated for 24 hours at 37⁰c. Samples from the incubated blood culture bottles
 89 (inoculated broth) were sub cultured on SSA the second day and re-incubated at 37⁰c
 90 for 24 hours. The incubation of blood cultured bottled was extended to up to 10 days
 91 for subcultures that failed to yield any bacterial growth. The periodic subcultures
 92 were made after 2, 5, 7, and 10 days on SSA according to Manga *et al* (2010) with
 93 slight modification. No growth after 10 days was regarded as a negative and
 94 discarded. The suspected colonies from both stool and blood samples were sub
 95 cultured on SSA and incubated for 24 hours at 37⁰c for purification. The suspected
 96 colonies were further screened by sub culturing on Xylose Lysine Deoxycholate
 97 (XLD) agar. The suspected colonies were further confirmed using standard
 98 biochemical tests. The positive isolates were then sub cultured on agar slant and
 99 stored in the refrigerator at 8⁰c for further analysis.

100 **Antibiotic Susceptibility Testing**

101 The isolated *Salmonella sp* were tested by Kirby-Bauer disc diffusion method for
 102 drug susceptibility according National Committee for Clinical Laboratory Standards
 103 (NCCLS) guidelines (Cormican *et al.*, 2001). The Mueller-Hinton Agar plates were
 104 smeared evenly using a sterilized wire loop with *Salmonella* isolates. This was then
 105 impregnated with antibiotic sensitivity discs using sterile forceps and then gently
 106 pressed down onto the agar and incubated for 24 hours at 37⁰c. The antibiotics used
 107 were, septrine (30μg) ,streptomycin (30μg), chloramphenicol (30μg), sparfloxacin

(10µg), ciprofloxacin (10µg), trivid (10µg), amoxacillin (30µg), augmentin (30µg), gentamicin (10µg) and pefloxacin 30µg).

Ethical Clearance

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

Statistical Analysis

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

RESULTS

Out of the 555 samples analysed (255 from stool, 200 from blood) only 12 (2.2%) yielded *Salmonella* sp. Five (41.7%) were screened from males while 7 (58.3%) were isolated from females. The most infectious ages were from 35yrs-39 yrs 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 sparfloxacin respectively (Table 2).

Figure 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 sparfloxacin both having 25%

Table 1. Occurrence of *Salmonella* isolates according to Age and Sex

Age (years)	No. isolated (%)	Sex	
		Male (%)	Female (%)
0-4	0 (0)	0 (0)	0 (0)
5-9	1 (8.3)	1 (8.3)	0 (0)
10-14	0 (0)	0 (0)	0 (0)
15-19	1(8.3)	1(8.3)	0 (0)
20-24	1 (8.3)	0 (0)	1 (8.3)
25-29	2 (16.7)	1 (8.3)	1 (8.3)
30-34	2 (16.7)	0 (0)	2 (16.7)
35-39	3 (25)	2 (16.7)	1 (8.3)
40-44	1 (8.3)	0 (0)	1 (8.3)
45-49	1 (8.3)	0 (0)	1 (8.3)
TOTAL	12 (100)	5(41.7)	7 (58.3)

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P ≥0.05

134 Table 2:

135 Antibiotic Resistance And Susceptibility In *Salmonella* sp Isolated From Patients In
136 BUTH, Jos

Isolate	Antibiotics										MDR	Sensitive
I.D.no												
	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	R	R	R	S	+	-
15	R	R	R	R	R	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	R	S	R	R	R	+	-
28	S	S	S	S	R	S	S	S	S	S	-	+
29	R	R	R	R	R	S	S	R	R	R	+	-
B4	R	R	R	R	R	R	R	R	R	R	+	-
B5	R	R	R	R	R	R	S	R	R	S	+	-
B6	S	S	R	S	S	S	R	R	R	R	+	-

B11	R	S	R	S	R	R	R	R	S	S	+	-
TOTAL											9	3

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

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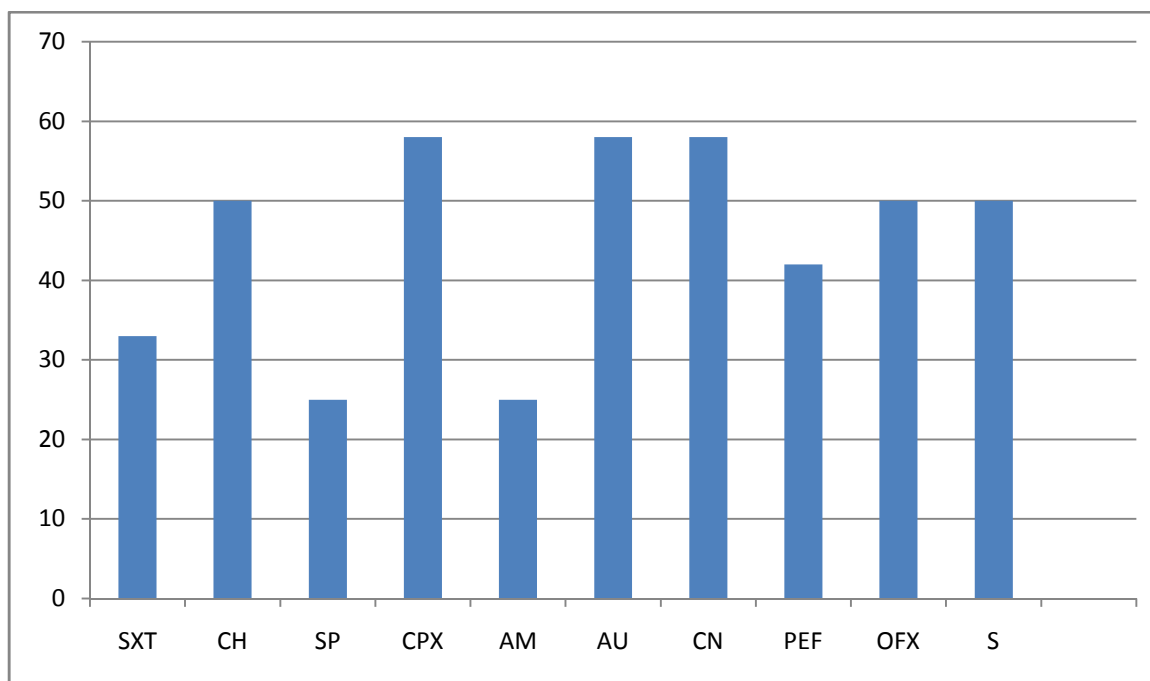
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153 Fig. 1 Antibiotic susceptibility pattern of the salmonella isolates in BUTH, Jos



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155 SXT (septrine), CH (chloramphenicol), S (streptomycin), SP (sparfloxacin) CPX
 156 (Ciprofloxacin), OFX (Trivid), AM (Amoxacillin), AU (Augmentin), CN
 157 (Gentamicin) and PEF (pefloxacin).

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164 DISCUSSION

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

168 This study has revealed a low rate of 2.2% occurrence of *Salmonella sp* associated
169 with diarrheal and enteric fever patients. This is in variance with a popular assertion
170 of almost every diarrheal and enteric fever case being linked to typhoid fever. This
171 also indicates a drop in infections by *Salmonella sp* contrary to earlier reports by
172 some scholars such as Doughari *et al* (2007), Karinki *et al* (2000) and Mills –
173 Robertson *et al* (2002). The age range that was most infected were the young adults
174 (35-39 years old) [Table 1], which is in agreement with Naj –Rammal and
175 Bedrossian (2010) who reported most infected ages of 29-39 years to be more
176 susceptible to *Salmonella typhi*. This could probably due to the fact this is the active
177 age group. The results also showed that more females (58.3%) were infected with
178 *Salmonella sp* than males (41.7%), although not significant ($P \geq 0.05$) as seen in Table
179 1. This is in line with the report of Itah and Uweh (2005). This may be due to the fact
180 that females are often associated with edible items, cleaning up children and domestic
181 sanitation.

182 All the isolates showed resistance to more than 2 antibiotics used, except 3 isolates
 183 with one of them showing complete susceptibility while the other showed resistant to
 184 either streptomycin or amoxicillin respectively (Table 2). From the total species of
 185 *Salmonella* isolated, 9 were multidrug resistant (MDR) while only 3 were non-
 186 multidrug resistant. These observations demonstrate wide range of multidrug resistant
 187 characteristics among the *Salmonella* species in this area. The antibiotics
 188 susceptibility pattern of the *Salmonella* species isolated indicated highest sensitivity
 189 to ciprofloxacin, augmentin and gentamicin (58% each), followed by tarivid,
 190 streptomycin and chloramphenicol (50% each) while amoxicillin and sparfloxacin
 191 showed the least activities of 25% each (Fig 1). This result shared the similar view
 192 with that of Tambekar *et al* (2008) and Itah and Uweh (2005). This phenomenon
 193 suggests that most of the *Salmonella sp* possessed resistant factors which may due to
 194 drug abuse as a result of self medication against any abdominal pain and enteric
 195 fever thought to be typhoid .Thus, the use of ciprofloxacin, augumentin and
 196 gentamicin are recommended for treatment of typhoid fever and salmonellosis in this
 197 area. The use of antibiotics like sparfloxacin and amaxocilin against *Salmonella*
 198 should be avoided to curtail further emergence of multidrug resistant *Salmonella*
 199 strains (MDRSS). This is in line with earlier finding of Tambekar *et al* (2008) who
 200 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.

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CONCLUSION

This study confirms the circulation of MDR *Salmonella* species in Jos, Nigeria as a similar incidence has been reported in Lagos, Nigeria by Akinyemi et al (2004).

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.

INTEREST.

There is no conflicting interest with any one with respect to this paper.

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UNDER PEER REVIEW

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