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.

Short Communication

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, gentamincin and augmetin. 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.

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 thioglycholate broth respectively and incubated for 24 hours at 37°C. Samples from the incubated blood culture bottles (inoculated broth) were sub cultured on Salmonela-Shigella agar (SSA) the second day and re-incubated at 37°C for 24 hours. The incubation of blood cultured bottled 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), amoxacillin (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 sparfloxacin 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 sparfloxacin both having 25%.

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

Age (years)	No. isolated (%)	Sample		Sex	
		Blood	Stool	Male (%)	Female (%)
0-4	0 (0)	0	0	0 (0)	0 (0)
5-9	1 (8.3)	0	1	1 (8.3)	0 (0)
10-14	0 (0)	0	0	0 (0)	0 (0)
15-19	1(8.3)	1	0	1(8.3)	0 (0)
20-24	1 (8.3)	0	1	0 (0)	1 (8.3)
25-29	2 (16.7)	1	1	1 (8.3)	1 (8.3)
30-34	2 (16.7)	0	2	0 (0)	2 (16.7)
35-39	3 (25)	0	3	2 (16.7)	1 (8.3)
40-44	1 (8.3)	1	0	0 (0)	1 (8.3)
45-49	1 (8.3)	1	0	0 (0)	1 (8.3)
TOTAL	12 (100)	4	8	5(41.7)	7 (58.3)

P ≥0.05

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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	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

B= isolate from blood, MDR- Multidrug resistant, R= resistant, S= Sensitive, += Yes, - = No, SXT (septrine), CH (chloramphenicol), S (streptomycin), SP (sparfloxacin), CPX (Ciprofloxacin), OFX (Trivid), AM (Amoxacillin),AU (Augmentin), CN (Gentamicin) and PEF (pefloxacin ,I.D.no=identification number
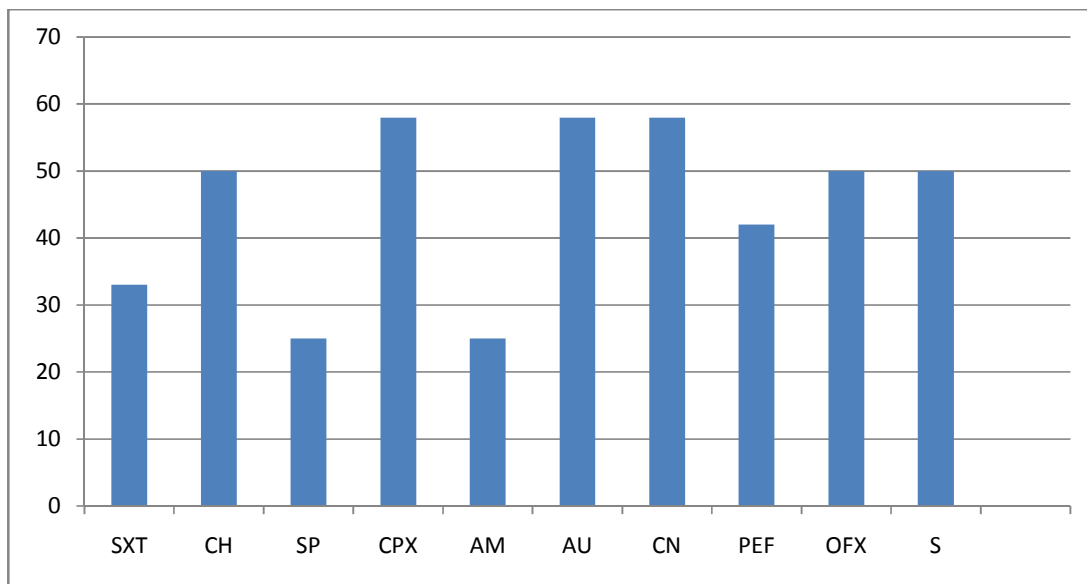
Fig. 1. Antibiotic susceptibility pattern of the salmonella isolates in BUTH, Jos
SXT (septrine), CH (chlorampphenicol), S (streptomycin), SP (sparfloxacin) CPX (Ciprofloxacin), OFX (Trivid), AM (Amoxacillin),AU (Augmentin), CN (Gentamicin) and PEF (pefloxacin)

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

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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 amaxocilin 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 ampillicin, 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.

REFERENCES

1. Itah AY, Uweh EU. Bacteria isolated from blood, stool and urine of typhoid patients in a developing country. South East Asian J Trop Med. Public Health. 2005;36(3)673 – 677
2. McGuirk S, Peak S. Salmonellosis in cattle:A review. Preconvention Seminar 7:Dairy Herd Problem Investigation Strategies. American Association of Bovine Practitioness, 36th Annual Conference, Columbus, OH; 2003.
3. Ivanoff B. Typhoid fever: global situation and WHO recommendations .South African J Trop Med Public Health. 1995;26(Suppl 2):1 – 6
4. Rahul M. Nanotechnology and the Diagnosis of Typhoid fever. Digest Journal of Nanomaterials and Biostructures. 2009;4(1)109-11.
5. Doughari JH, Elmahmood AM, Nggada NP. Retrospective Study in the Antibiotic Resistant Pattern of *Salmonella Typhi* from some Clinical Samples: African Journal of Microbiology Research. 2007;033 – 036.
6. Olowe OA, Okanlawon BM, Olowe RA, Adedosu OT, Olayemi AB. Multiple drug resistant pattern of *Salmonella typhimurium* infections in Osogbo, South Western Nigeria. Journal of American Science. 2007;3:4.
7. Honish L. Restaurant-associated outbreak of *Salmonella typhimurium* phage type 1 gastroenteritis-Edmonton. Can Commun Dis Rep. 1999; 200(26):25.
8. Angulo FJ, Swerdlow DL. Bacterial enteric infections in persons infected with human immunodeficiency virus. Clin Infec Dis. 1995;21(suppl1):S84-93
9. Thuluvath PJ, McKendrick MW. *Salmonella* and complications related to age-Sheffield experience. QJ Med. 1998;67:497-503.
10. Onyango, Machoni, Kakai R, Waindi EN. Multidrug resistance of *Salmonella enteric serovars Typhi* and *Typhimurium* isolated from clinical samples at two rural hospitals in Western Kenya. J. infectect Developing Countries. 2008; 2(2):106-11.
11. Pratt BW, Palmer T. Principles of drug action. The basics of pharmacology 3rd

ed.[edited by] William B. Pratt, Palmer Taylor. Churchill Livingstone Inc., 650 Avenue of the Americas New York, NY10010. Drug resistance. 1990;565-638.

12. Leslie C, Balows A, Sussman M. Topley and Wilson's Microbiology and Microbial Infections.9th Ed. 1989;969-997.

13. Malonza IM, Omari MA, Bwayo JJ, Mwatta AK, Mubere AN, Murage EM Ndwaya-Achola JO. Community acquired bacterial infections and their antimicrobial susceptibility in Nairobi, Kenya East Afri. Med, J. 1992; 74(3):166-170.

14. Kakai R, Wamola IA Minimizing antibiotic resistance to *Staphylococcus aureus* in developing countries. East African. Med J. 2002;79 (11): 574 – 579.

15. Kakai R. Laboratory diagnostic services in rural health centres, Western Kenya. East African. Med. J. 2001;78(7):S34 – S35

16. Manga SB, Amehi IG, Bashir S, Muazu AG, Danjuma B, Ibrahim ML, Abdullahi K, Mawak J. Antibiotics Susceptibility of *Salmonella* isolates from Widal Test Positive Patients at Federal Medical Centre, Gasau. Jos Journal of medicine. 2010;5(1)20.

17. Nkogwe C, Raletobana J, Stewart-Johnson A, Suepaul S Adesiyum A Freguency of Detection of *Escherichia coli, Salmonella* spp*., and Campylobacter* spp. in the Faeces of Wild Rats (*Rattus* spp.) in Trinidad and Tobago. Veterinary Medicine International; 2011. Article ID 686923.

18. Cormican M, Whyte T, Hanahoe B. Antimicrobial Suceptibility testing in Ireland: An Introduuction to the Method of the National Committee for Clinical Laboratory Standards (NCCLS). Department of Medical Microbiology, University of College Hospital Galway and Department of Bacteriology. National University of Ireland Galway; 2001.

19. Kariuki S, Gilks C, Revathi G, Hart CA. Genotypic analysis of multidrug resistant *Salmonella enteric Serovar Typhi.* Kenya. Emerg. Infect. Dis. 2002;6:649-651.

20. Mills- Robertson F, Addy ME, Mensah P, Crupper SS. Molecular characterization of antibiotic resistance in clinical *Salmonella typhi* isolated in Ghana. F.E.Ms Microbiol lett. 215:249-253.

21. Naji–Rammal S, ad Bedrossian N. (2010). Typhoid Fever in Lebanon: Epidemiological Study. Pub Mesh. 2002;20(2):81.

22. Tambekar D, Dhore HR, Kotwah AD, Shirbhate AP Solav PG. Prevalence and Antibiotic Sensitivity Profile of Human Enteric Pathogens from Different Water Sources in Salinity Affected Villages of Vidarbha (India). Research Journal of Agriculture and Biological Science. 2008;4(6):712-716.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=825&id=8&aid=7047