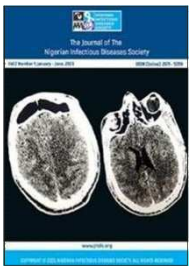
https://www.jnids.org ISSN: 2971-5059

Journal of the Nigerian Infectious Diseases Society



Original Article

Evaluation of Antibiotics Sensitivity Pattern of Bacterial Isolate from Stool in a Referral Hospital in North-Central, Nigeria.

Bello SO[1]*, Zakou A[2], Audu ES[3], Katoh AD[4], Ogunkunle TO[1], Anazodo MC[5], Babatunde JO[5], Abubakar YH[6], Ter E[7], Rowland M[7], Isah YO[8], Hassan II[5]

1. Department of Paediatrics, Dalhatu Araf Specialist Hospital, Lafia Nasarawa State, Nigeria.
2. Microbiology unit, Laboratory Department, Dalhatu Araf Specialist Hospital, Lafia Nasarawa State, Nigeria.
3. Medical Microbiology Department, Dalhatu Araf Specialist Hospital, Lafia Nasarawa State, Nigeria.
4. Pharmacy Department, Dalhatu Araf Specialist Hospital, Lafia Nasarawa State, Nigeria.
5. Community Medicine Department, Dalhatu Araf Specialist Hospital, Lafia Nasarawa State, Nigeria.
6. Information Communication Department, Dalhatu Araf Specialist Hospital, Lafia Nasarawa State, Nigeria.
7. Nursing Department, Dalhatu Araf Specialist HospitaL, Lafia Nasarawa State, Nigeria.
8. Family Medicine Department, Dalhatu Araf Specialist Hospital, Lafia Nasarawa State, Nigeria.

***Corresponding author:**

surajudeenbello4@gmail.com

Received: 30 June 2023
Revised: 11 September 2023
Accepted: 13 September 2023
Published: 31 October 2023

DOI
10.58539/JNIDS.2023.2119

Quick Response Code:

Abstract

Background: The global burden of antimicrobial resistance is high. Antibacterial resistance is particularly worrisome due to poor hygiene, lack of appropriate storage facility and irrational use of antibiotics. Hence the need for strengthening of prescription surveillance system and evidence-based treatment.

Objectives: To determine the bacteria isolates in stool specimens and their sensitivity pattern among patients managed in Dalhatu Araf Specialist Hospital.

Methods: All patients managed within January 2021 to December 2021, who had stool microscopy done were included in this study while those with incomplete records were excluded. Ethical approval was obtained from the Research Ethics Committee of the Hospital. Data was entered into a computer and Statistical Package for Social Science (SPSS) used for data analysis. A significant p was <0.05

Results: Overall, more than a quarter of culture positive stool sample were among children under five while the least was seen in those ≥ 65 years. Salmonella species were isolated in 62.71% of the patients while 36.31% grew Escherichia coli. Salmonella sp. showed sensitivity to Ofloxacin, Gentamycin and Ciprofloxacin. Resistance to Salmonella sp. was found with Augmentin in this study. The highest Escherichia coli sensitivity was with Gentamycin, Ofloxacin and Ciprofloxacin. Resistance to Escherichia coli is highest with Augmentin, Cefuroxime and Amoxicillin.

Conclusions: There is good positivity from stool sample in this study. Salmonella species and Escherichia coli were the two commonly cultured bacteria pathogen from stool sample. There are good sensitivities to the Quinolones, Aminoglycosides and Macrolides while resistance was mostly to the Penicillins and Cephalosporins.

Key words: Antimicrobial, Bacteria, Resistance, Sensitivity, Stool.

INTRODUCTION

Antimicrobials are chemical agents that either destroy or diminish the survival of disease-causing microbes such as bacteria, viruses, fungi and parasites.[1] Antimicrobial resistance (AMR) is impacting negatively on public health across the world.[2,3] Low- and Middle-Income Countries (LMICs) are worse affected due to higher infectious disease burden and poorer health indices occasioned by inadequate healthcare services availability and accessibility.[4] Developing countries like Nigeria have enormous AMR burden due to limited regulations, weak enforcement and ineffective control leading to adaptation and or resistance from irrational use of antimicrobials.[5,6] The rise in AMR is particularly worrisome for antibacterial resistance among children as a result of insufficiency of access to potable water, poor environmental sanitation and hygiene coupled with reduced immunity.[7]

The World Health Organization (WHO) recognized the huge AMR challenges on human survival and recommended the strengthening of surveillance system(s) on antimicrobial prescription, monitoring usage, enhancing prompt diagnosis and evidence-based treatment through instituting Antimicrobial Stewardship (AMS).[8] A study by Ogunsola *et al*[9] in Lagos over three decades ago showed some sensitivity to the third generation Cephalosporins. In addition, Afolabi *et al*[10] in a 2019 study among under five children in Ilorin reported 28.2% bacterial positivity with Escherichia coli and Klebsiella the commonest isolated pathogen. Bejide and colleagues[11] in the year 2023 in Ibadan found a predominance of Escherichia coli (43.1%) among children. Others are Cryptosporidium and Cyclospora species. A livestock study in Zaria in year 2017 revealed largely Salmonella species and Escherichia coli with both having high resistance to Ampicillin, Cefuroxime, Ceftazidime and Cotrimoxazole.[12]

Due to paucity of data involving hospital wide sensitivity and resistance pattern across all age groups in Nasarawa State, this study determines the magnitude, the resistance and sensitivity pattern using stool sample over a period of time. The hospital is the only state-owned tertiary health facility and with a huge patient turn-over in Lafia, the state capital.

MATERIALS AND METHODS

Study Design

This was a retrospective study among patients seen at DASH who were seen from 1st January 2021 to the 31st December 2021.

Study Population

The study was carried out among newborn, children, adolescents and adults attended to at the Special Care Baby Unit (SCBU), Emergency Paediatric Unit (EPU), Children Medical Ward (CMW), Children Surgical Wards (CSW), Casualty, General Outpatient Department, Male Medical and Surgical wards as well as Female Medical and Surgical wards of the DASH Lafia.

Study Site

The study was done at the Dalhatu Araf Specialist Hospital Lafia. Lafia is the state capital of Nasarawa state. The state is one of the six North-Central states of Niger, Kwara, Kogi, Plateau and Benue alongside the Federal Capital Territory (FCT). The Hospital is a 377 bedded Health facility with various cadres of healthcare workers including specialist doctors as the facility has accreditations to train specialist doctors in Paediatrics, Internal Medicine, Family Medicine, Surgery and Obstetrics & Gynaecology departments.

Sample Size

Sample size determination was done using the Fischer's formula

$$n = \frac{Z^2pq}{d^2}$$

n is the calculated sample size.

Z is the standard deviate at 95% = 1.96

P is the prevalence from previous study, where p = 29%, 0.29

q is 1 – p = 1 – 0.29 = 0.71

d is the degree of precision which will be 5% in this study, i.e d = 0.05

$$n = \frac{1.96^2 \text{ x } 0.29 \text{ x } 0.71}{0.05^2} \qquad n = \frac{3.8416 \; x \; 0.29 \; x \; 0.71}{0.0025}$$

$$n = \frac{0.79098544}{0.0025}$$

n = 316

calculating for attrition at 10% = 32. Hence, a minimum sample size of 348 was calculated for this study.

All patients managed within the study period who had the investigation of interest done at DASH were included in this study while those with incomplete records were excluded from the study.

Sampling Technique

All records of patients managed within the period was retrieved.

Sampling Procedure

Secondary data from the medical records and laboratory departments were used to generate data retrospectively over twelve months (January 2021 to December 2021).

Data Analysis

Data was entered into a computer. Statistical Package for Social Science (SPSS) version 23 was used for data analysis. Categorical variables were reported as frequencies with percentages in tables or graphs. A significant p was <0.05

RESULTS

Of the 4,140-stool sample sent to the laboratory within the study period, there are 1,366 positive culture (33.0%). A total of 1171 (85.7%) had complete records with 195 (14.3%) missing data (age, gender or both).

Our findings revealed that children under the age of five years accounted for most 317 (27.1%) culture positive stool sample, with the least 28 (2.4%) been those ≥ 65 years. There were more 649 (55.4%) females with a male to female ratio of 1:1.2 **Table 1**.

Table 1: Socio-demographics of the patient

Variables	Frequencies n	Percentages %
Age (years)		
1 – <5	317	27.1
5 – 14	179	15.3
15 – 24	131	11.1
25 – 34	147	12.6
35 – 44	130	11.1
45 – 54	170	14.5
55 – 65	69	5.9
≥ 65	28	2.4
Total	1171	100.0
Gender		
Male	522	44.6
Female	649	55.4
Total	1171	100.0

Missing data = 195

A total of 857 (62.74%) cultured *Salmonella species*, 496 (36.31%) grew *Escherichia coli*. Others are *Shigella species* 7 (0.51 %) and *S. aureus* 6 (0.44%) **Table 2** below.

Table 2: Distribution of cultured pathogen

Organism	Frequency n	Percentage %
Salmonella species	857	62.74
E. coli	496	36.31
Shigella species	7	0.51
S. aureus	6	0.44
Total	1366	100.00

Salmonella species showed 61.8% sensitivity to Ofloxacin, 46.2% to Gentamycin and 45.4% to Ciprofloxacin respectively. While, high resistance to *Salmonella sp.* was found with Augmentin in this study. The Escherichia coli had its highest sensitivity to Gentamycin (67 .9%). Others are, Ofloxacin (64 .1%), Ciprofloxacin (45 .4%) and Streptomycin (39 .9%) respectively. *E. coli* resistance is highest with Augmentin (56.5%), Cefuroxime (39.9%) and Amoxicillin (25.0%).

Shigella species had very good sensitivities to Ofloxacin (100%) and Gentamycin (85.7%). Others are; Ceftriaxone and Ceftazidime respectively. *Shigella* resistance was highest with the Ampicillin (85.7%), Ciprofloxacin (28.6%) and Imipenem (14. 3%). Also, in this study, *S. aureus* susceptibility was found with Ciprofloxacin (80%) and Erythromycin (60%) while resistance was with Cotrimoxazole (60%). Others are, Ceftazidime and Amoxycillin at 40% each **Table 3.**

Table 3: Bacterial Isolates from stool and their percentage sensitivities

Isolate	Susceptibility to Antibiotics													
	AM	CT	GM	AMC	OF	CP	NA	NT	LV	CF	CFT	CFZ	ER	ST
Salmonella	75.6	72.3	46.2	NT	61.8	45.4	75.1	24.0	21.7	21.0	17.9	19.7	NT	NT
E. coli	75.0	77.2	67.9	43.5	64.1	45.4	78.0	NT	37.3	60.1	24.0	NT	79.6	39.9
Shigella	NT	28.6	85.7	14.3	100	71.4	71.4	28.6	NT	28.6	42.9	42.9	NT	14.3
S. aureus	60.0	40.0	20.0	20.0	20.0	80.0	NT	20.0	NT	20.0	NT	60.0	60.0	20.0

NT: Not Tested, AM: Amoxycillin, CT: Cotrimoxazole, GM: Gentamycin, AMC: Amoxycillin-clavulanic acid, OF: Ofloxacin, CP: Ciprofloxacin, NA: Nalidixic acid, NT: Nitrofurantoin, LV: Levofloxacin, CF: Cefuroxime, CFT: Ceftriaxone, CFZ: Ceftazidime, ER: Erythromycin, ST: Streptomycin.

DISCUSSION

A third of the stool samples yielded a culture positive with a bacterial microbial agent in this study. This is similar to an earlier finding among children in Ilorin Nigeria.[10] This may also not be unconnected with the well-known knowledge of bacterial agent not being the commonest cause of diarrhea disease especially among children, as buttressed by the fact that almost half of the subjects in this study are children. Our finding is lower compared with the report of Bejide et al[11] in Ibadan among children, using a much smaller size and some of their study population known to be HIV infected. These probably explains the discrepancy observed.

Of the five bacterial agents under consideration in the present study, two featured prominently with *Salmonella species* and *E. coli* accounting for approximately two-thirds and a third of the cases cultured respectively. Others, such as *Shigella species* and *S. aureus* accounted for less than 1 percent in this study. Bejide et al[11] in Ibadan reported both *Salmonella* and *E. coli* in their study but with the predominance of the latter. Unlike the present study which cut across various ages, their study was among children. Besides, *E. coli* is known to be the commonest bacteria pathogenic agents from stools of children under the age of five years.[11]

Salmonella specie are highly susceptible to Ofloxacin in this study. Others with high sensitivities included Gentamycin and Ciprofloxacin. The highest resistance to *Salmonella species* was found with Amoxycillin – clavulanic acid, Amoxycillin and Nalidixic acid in this study. The *Salmonella* resistance in this study is comparable to that of Ifeanyi *et al*[13] in an earlier study which largely cultured *Salmonella species* as well.[13]

E. coli was mostly sensitive to Gentamycin, Ofloxacin, Ciprofloxacin and Streptomycin but resistant to Augmentin, Cefuroxime and Amoxicillin in that order. This resistance pattern is similar to earlier studies.[14,15] In this study also, sensitivities to *Shigella* were found to be quite perfect with Ofloxacin and Gentamycin. It equally showed some sensitivities to Ceftriaxone and Ceftazidime respectively. While, resistance to *Shigella* was highest with the Penicillin, others with some resistance to *Shigella* are Ciprofloxacin and Imipenem in that order. This is in contrast to a study by Ogunsola *et al*[9] in Lagos that reported a high sensitivity to both the Quinolones and the third generation Cephalosporins. This study was done almost three decades ago, with the rampant and irrational use of antibiotics partly to blame for this finding. Others are, quackeries, fake medications and poor drug storage etc. *S. aureus* had good sensitivities to Ciprofloxacin and Erythromycin. It is resistant to Cotrimoxazole, Ceftazidime and Amoxycillin respectively.

Non distinction of the cultured organism based on the ages of participants for comparison with other findings is a limitation. That could have afforded us the opportunity of knowing the age group commonly affected with *E. coli* and *Salmonella* species respectively. This however, does not invalidate our study findings.

Salmonella species and *E. coli* were the two commonly cultured bacteria pathogen from stool sample in this study. Most organisms cultured in this study are sensitive to the Quinolones, Aminoglycosides and Macrolides respectively. Resistance on the other hand were mostly to the Penicillin and the Cephalosporins. This will be of guide clinical practice and be of great help to reducing unnecessary prescriptions especially in low-income countries like ours where healthcare coverage is not universal yet.

DECLARATIONS

Competing Interest: None

Funding: None

Authors Contributions: **BSO, AES, KAD, OTO, AMC, AYH, MMH and HII**: Conceive the idea; **All authors (BSO, AES, KAD, OTO, AMC, AYH, MMH, HHI, BJO, IYO, TE, RM):** Design the work, participate in acquisition, analysis and interpretation of data; revise the manuscript and approved the final version to be published; as well as agreed to be accountable for all aspects of the work.

Acknowledgement: We appreciate all the clinicians as well as the laboratory scientists and technicians working at the microbiology unit for their contributions to the success of this study.

Ethical Consideration: Ethical approval was obtained from the Research Ethics Committee of the Dalhatu Araf Specialist Hospital. Permission was sought from the head of the laboratory and medical records departments of DASH. Complete privacy and confidentiality of participants were ensured.

REFERENCES

1. World Bank Group Executive Summary's Final Report on Drug-Resistant Infections: A Threat to Our Economic Future. 2017: 17 – 29.
2. Nwaiwu O, Onyeaka H. Acquired antimicrobial resistance genes of Escherichia coli obtained from Nigeria: in silico genome analysis. Journal of Food Quality and Hazards Control. *Journal of Food Quality and Hazards Control*. 2021; 8: 186 – 9. DOI: 10.18502/jfqhc.8.4.8260
3. Chukwu EE, Oladele DA, Enwuru CA et al. Antimicrobial resistance awareness and antibiotic prescribing behavior among healthcare workers in Nigeria: a national survey. *BMC Infectious Diseases*. 2021; 21: 22 – 33.
4. Obasanya JO, Ogunbode O and Landu-Adams V. An appraisal of the contextual drivers of successful antimicrobial stewardship implementation in Nigerian health care facilities. Journal of Global Antimicrobial Resistance. 2022; 31: 141 – 148.
5. Manga MM, Mohammed Y, Suleiman S et al. Antibiotic prescribing habits among primary healthcare workers in Northern Nigeria: a concern for patient safety in the era of global antimicrobial resistance. PAMJ - One Health. 2021;5(19). 10.11604/pamj-oh.2021.5.19.30847
6. Nasir IA, Babyo A, Emeribe AU, Sani NO. Surveillance for Antibiotic Resistance in Nigeria: Challenges and Possible Solutions. Trends in Medical Research. 2015; 10 (4): 106 – 113. DOI: 10.3923/tmr.2015.106.113

7. Tam PYI, Dramowskid A, Labie AK, Mujuruf HA, Ogunbosi BO. Antimicrobial resistance among children in Africa: need for paediatric clinical trials. Editorial on Expert Review of Anti-Infective Therapy. 2020; 18 (10): 955 – 956. DOI: 10.1080/14787210.2020.1782741
8. Mohammed Y, Ibrahim BS, Galalain SM, Dalhat MM, Nguku P. Antimicrobial resistance surveillance system in Nigeria: Suggested models. Sahel Medical Journal. 2018; 21: 179 – 180.
9. Ogunsola FT, Kesah CN, Odugbemi T. Antimicrobial resistance in Nigeria: An overview. Nig. Qt. J. Hosp. Med., 1997; 7 (1): 57 – 61.
10. Afolabi OF, Saka AO, Ojuawo A. Acute diarrhoea in hospitalized under-five children in Ilorin, Nigeria: Relationship between isolated enteropathogens and clinical outcome. Niger J Paediatr 2019; 46 (4):182 – 188. doi:http://org/10.4314/njp.v46i4.5
11. Bejide OS, Odebode MA, Ogunbosi BO et al. Diarrhoeal pathogens in the stools of children living with HIV in Ibadan, Nigeria. Front. Cell. Infect. Microbiol. 2023; 13:1108923. doi: 10.3389/fcimb.2023.1108923
12. Ejeh FE, Lawan FA, Abdulsalam H, Mamman PH, Kwanashie CN. Multiple antimicrobial resistance of Escherichia coli and Salmonella species isolated from broilers and local chickens retailed along the roadside in Zaria, Nigeria. Sokoto Journal of Veterinary Sciences. 2017; 15 (3): 45 – 53.
13. Ifeanyi CIC, Bassey BE, Ikeneche NF, Gallas NA. Molecular characterization and antibiotic resistance of Salmonella in children with acute gastroenteritis in Abuja, Nigeria. J Infect Dev Ctries. 2014; 8(6):712-719. doi:10.3855/jidc.4185
14. Omolajaiye SA, Afolabi KO, Iweriebor BC. Pathotyping and Antibiotic Resistance Profiling of Escherichia coli Isolates from Children with Acute Diarrhea in Amatole District Municipality of Eastern Cape, South Africa. BioMed Research International, 2020; 10: 1 – 10. https://doi.org/10.1155/2020/4250165
15. David EE, Yameen MA, Igwenyi IO et al. The frequency of virulent genes and antimicrobial resistance patterns of diarrheagenic Escherichia coli isolated from stools of children presenting with diarrhea in a tertiary hospital in Abakaliki, Nigeria, Int. J. One Health. 2020; 6(2): 147-152. doi: www.doi.org/10.14202/IJOH.

How to cite this article : Bello SO, Audu ES, Katoh AD, et al. Evaluation of antibiotics sensitivity pattern of bacterial isolate from stool in a referral hospital in North -Central , Nigeria . J Nig Infect Dis 2023; 2(1):60-65.