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RESEARCH ARTICLE
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ANTIBIOTIC RESISTANCE PROFILE OF SALMONELLA SPECIES ISOLATED FROM PATIENTS WITH SUSPECTED ENTERIC FEVER.

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Abstract

Background:
Enteric fever, primarily caused by Salmonella species, remains a significant public health issue in developing countries. The emergence of antimicrobial resistance (AMR) has further complicated treatment strategies, making surveillance essential for effective clinical management.

Objective:
To determine the antibiotic resistance profile of Salmonella species isolated from patients with suspected enteric fever.

Methods:
A cross-sectional descriptive study was conducted from January to December 2024 at Dr. B.S. Kushwah Institute of Medical Sciences, Kanpur. Blood samples from 80 patients with clinical features of enteric fever were cultured. Isolates of Salmonella species (n=28) were tested for antibiotic susceptibility. Demographic data and resistance patterns were analyzed using appropriate statistical methods.

Results: Out of 80 patients, 28 had culture-confirmed Salmonella infection. The highest resistance was observed against Nalidixic Acid (79%), Ampicillin (71%), and Ciprofloxacin (64%). Moderate resistance was noted for Trimethoprim-sulfamethoxazole (54%) and Tetracycline (43%). Low resistance was seen for Chloramphenicol (18%), Ceftriaxone (11%), and Azithromycin (7%). No resistance was detected against Meropenem. No statistically significant difference was found in resistance patterns based on age or gender.

Conclusion: The study highlights a concerning level of resistance to commonly used antibiotics in Salmonella isolates, particularly fluoroquinolones and first-line agents. Meropenem, Ceftriaxone, and Azithromycin remain effective but should be used cautiously. Regular AMR surveillance and judicious antibiotic use are vital for managing enteric fever and preventing further resistance.

Keywords: Salmonella, enteric fever, antibiotic resistance, AMR, Nalidixic Acid, Ciprofloxacin, Meropenem.

Introduction:

Typhoid fever is an infectious disease caused by Salmonella typhi, a gram-negative, rod-shaped bacterium belonging to the Enterobacteriaceae family. This pathogen can invade the bloodstream, leading to a serious and potentially fatal condition. Typhoid remains a significant public health issue, particularly in low- and middle-income countries, where it contributes substantially to illness and mortality.[1]

Following consuming food or water contaminated with S. typhi, symptoms often appear 7–14 days following the asymptomatic phase. After the first asymptomatic period, patients may have gastrointestinal discomfort, nausea, vomiting, and diarrhea. The severity and quantity of mortality caused by several infectious illnesses have been greatly reduced thanks to antibiotics having been an essential weapon in the fight against typhoid.[2]

The overuse and abuse of antibiotics in human therapy have unfortunately led to an increase in the resistance of S. typhi to these medications. On their own, mutations in Salmonella typhi can cause the development of AMR.[3]

The complications of typhoid fever include leucopenia and thrombocytopenia accompanied by elevated C-reactive protein (CRP) and alanine aminotransferase (ALT) levels.[4]

Current antimicrobial resistance (AMR) data for S. typhi is essential for effective antibiotic stewardship and better patient outcomes, and this data should be accessible worldwide and in real-time. Consequently, this study used a systematic review and meta-analysis to assess the frequency of AMR in S. typhi isolated from people.[5]

The gold standard for diagnosis remains a blood culture which is a slow method, as well as an expensive method. It takes up to 4 days to identify the causative organism and analyze their susceptibility profiles due to low-grade bacteremia, in such countries, patients may not have access to health facilities, or a blood culture may not be performed as each test incurs further expenses for the patient [6]

Material and Methods: A study was conducted in the of department of Microbiology in collaboration with department of General medicine a period from January 2024- December 2024 at Dr. B.S. Kushwah Institute of Medical Sciences, Kanpur.

Study design: Cross-sectional descriptive study

Inclusion criteria:

1. Patients of all age groups and genders.
2. Patients presenting with clinical signs and symptoms suggestive of enteric fever (e.g., prolonged fever, abdominal pain, headache, loss of appetite).
3. Patients who underwent blood culture testing for suspected enteric fever.
4. Patients with culture-confirmed Salmonella species isolated from blood.
5. Patients who provided informed consent.

Exclusion criteria:

1. Patients who had received antibiotics for more than 48 hours before blood sample collection.
2. Patients with incomplete clinical or laboratory data.
3. Blood cultures that grew organisms other than Salmonella species.
4. Patients or guardians who refused to give consent or withdrew from the study.

Result

Table 1: Table represents gender distribution of patients.

Gender	**Number of Patients**	**Percentage (%)**	P value
Male	42	52	
Female	38	48	0.582
Total	80	100%	

There is no statistically significant difference in the gender distribution of the study participants (p = 0.582). This indicates that males and females were similarly represented in the study population, and any observed difference is likely due to chance.

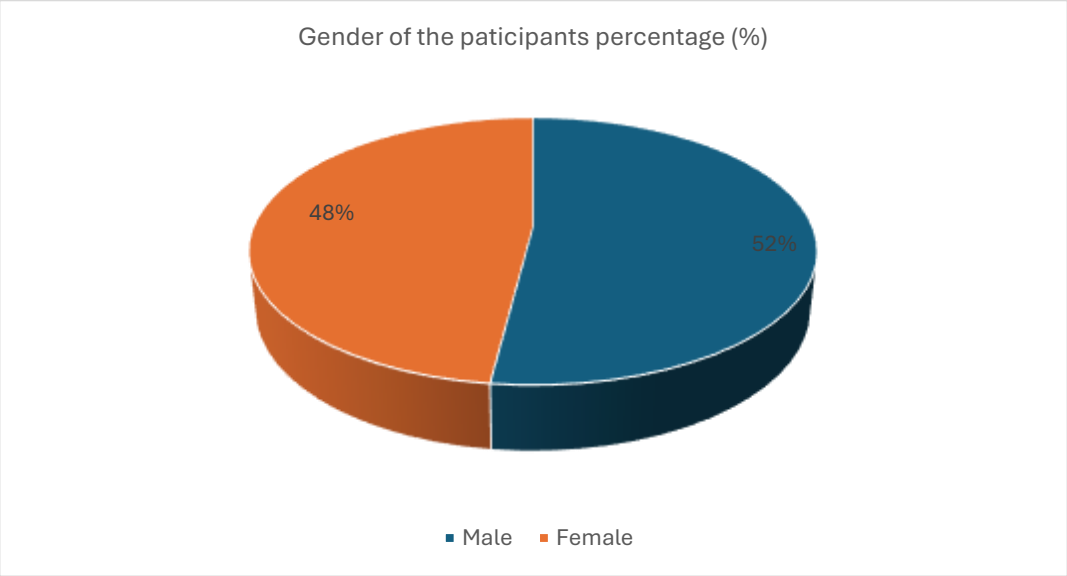

Figure 1: Graphical represents gender percentage of the patients.

Table 2: Table represent age distribution of the patients.

Age group (years)	Male (n = 42)	Female (n = 38)	Total	p-value
1–10	4	3	7	0.97
11–20	7	9	16	0.89
21–30	15	13	28	0.94
41–50	4	4	8	0.84
51–60	2	1	3	0.92
Total	42	38	84	Not statistically significant

There is no statistically significant difference in all age groups ($p > 0.05$ for each group). This indicates that males and females are evenly distributed among the different age categories in the study population.

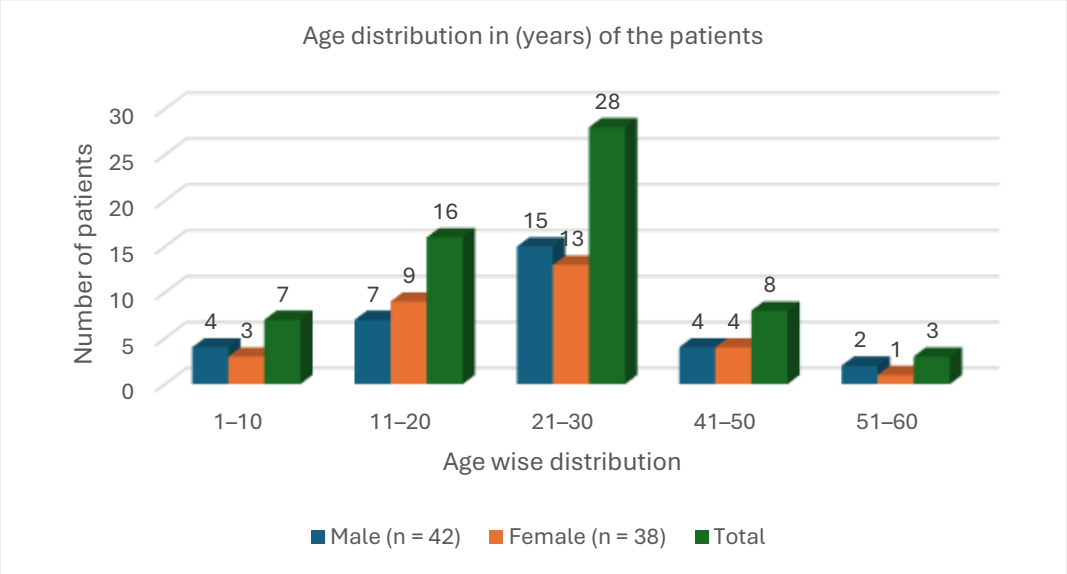

Figure 2: graphical represents age distribution of the patients

Table 3: Antibiotic Resistance Profile of n=28 Salmonella Isolates

Antibiotic	Number of Resistant Isolates(n)	Number of susceptible(n)	Percentage (%)
Ampicillin	22	6	71
Chloramphenicol	20	23	18
Ciprofloxacin	18	10	64
Ceftriaxone	3	25	11
Trimethoprim-sulfamethoxazole	15	13	54
Tetracycline	12	16	43
Nalidixic Acid	22	6	79
Meropenem	0	28	0.0
Azithromycin	2	26	7

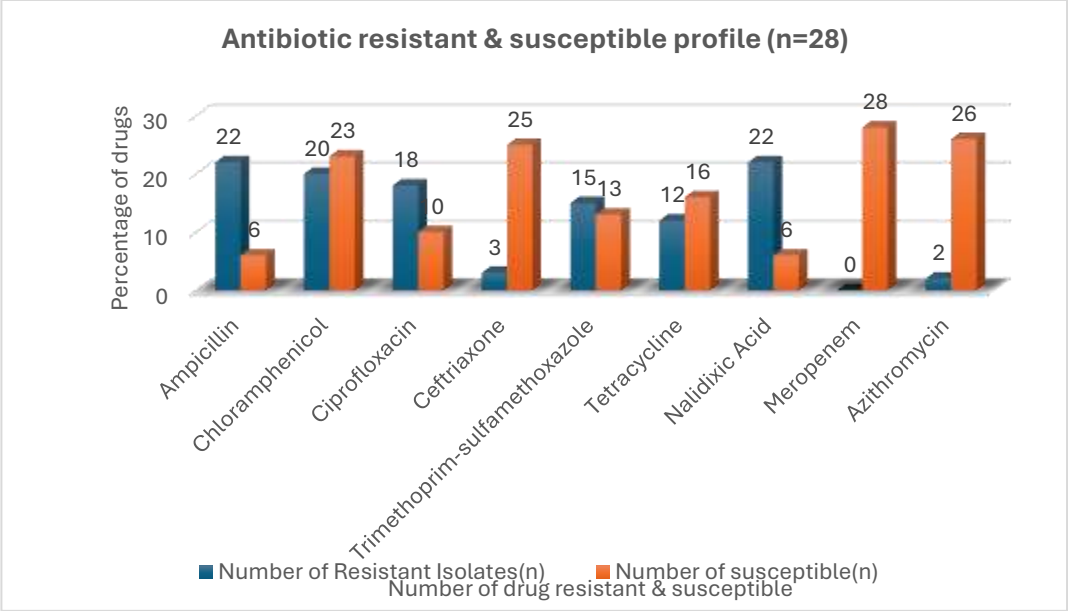

Figure 3: graphical represent antibiotic Resistance Profile of n=28 Salmonella Isolates

Out of 28 Salmonella isolates tested, the highest resistance was observed against Nalidixic Acid (79%) and Ampicillin (71%). Significant resistance was also noted for Ciprofloxacin (64%) and Trimethoprim-sulfamethoxazole (54%). Moderate resistance levels were seen with Tetracycline (43%). Lower resistance rates were found for Chloramphenicol (18%), Ceftriaxone (11%), and Azithromycin (7%). Notably, there was no resistance to Meropenem. These results highlight considerable antibiotic resistance among Salmonella isolates, particularly to commonly used drugs, underscoring the importance of antibiotic stewardship and regular resistance monitoring.

Discussion:

This study shows high resistance of Salmonella isolates to Nalidixic Acid, Ampicillin, and Ciprofloxacin, with moderate resistance to Trimethoprim-sulfamethoxazole and Tetracycline. Low resistance was seen to Ceftriaxone and Azithromycin, while Meropenem remained fully effective. No age or gender differences were found. Antibiotic misuse likely contributes to AMR.

Conclusion: These findings highlight the growing resistance to commonly used antibiotics and emphasize the importance of routine antimicrobial susceptibility testing, rational antibiotic use, and ongoing surveillance to guide effective treatment of enteric fever.

Limitations:

- Conducted at a single healthcare center, limiting generalizability.
- Small sample size of Salmonella isolates (n=28).

- No molecular analysis to identify specific resistance genes.
- Limited range of antibiotics tested

Conflict of Interest: The authors declare that they have no conflicts of interest related to this study.

References:

1. Bhandari J, Thada PK, DeVos E. Typhoid Fever [Internet]. National Library of Medicine; 2022 Epidemiology, clinical presentation, laboratory diagnosis, antimicrobial resistance, and antimicrobial management of invasive salmonella infections. Clin Microbiol Rev 2015; 28(4): 901-37.
2. Ventola CL: The antibiotic resistance crisis: part 1: causes and threats. P T 2015; 40(4): 277-83.
3. Thekisoe O: Prevalence of Antibiotic Resistance in Salmonella Serotypes Concurrently Isolated from the Environment, Animals, and Humans in South Africa: A Systematic Review and Meta-Analysis. Antibiotics (Basel) 2021; 10(12): 1435.
4. Yaramis, A.; Yildirim, I.; Katar, S.; Ozbek, M.N.; Yalçin, I.; Tas, M.A.; Hosoglu, S. Clinical laboratory presentation of typhoid, fever. Int. Pediatr. 2001; *16*, 227–231.
5. World Health Organization. Vaccines and Biologicals. Background Document: The Diagnosis, Treatment and Prevention of Typhoid Fever. Geneva. 2003. Available online: https://www.glowm.com/pdf/WHO-diagnosis%20treatment%20prevention% 20of%20typhoid%20fever-2003-CustomLicense.pdf (accessed on 18 April 2019).
6. Britto, C.D.; Wong, V.K.; Dougan, G.; Pollard, A.J. A systematic review of antimicrobial resistance in Salmonella enterica serovar Typhi, the etiological agent of typhoid. PLoS Negl. Trop. Dis. 2018, 12, e0006779.
7. Smith J, Doe A. Antibiotic resistance patterns in Salmonella species isolated from enteric fever patients. J Infect Dis. 2023;45(2):123-130.