

Comparative Evaluation of Three Methods for the Diagnosis of Typhoid Fever and Antibiotic Resistance Pattern of *Salmonella* Typhi Isolates against Commonly Used Antibiotics

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Abstract: Background: *Salmonella enterica* serotype Typhi infection is one of the major causes of morbidity and mortality worldwide. Isolation of *S. Typhi* from blood, stool and urine is the most reliable confirmatory test for this infection. However, the technique requires adequate laboratory equipment and well trained personnel beyond the capability of most primary health care facilities in developing countries. In addition, the practise of self-medication and abuse utilisation of antibiotics in the community often hampers the isolation of this bacteria in the perspective of treatment with appropriate agents. This study evaluated the performance of three methods of diagnosing typhoid fever, and the resistance pattern of *S. Typhi* isolates against commonly used antibiotics.

Methods: A cross-sectional study was conducted from November 2020 to January 2021 on volunteer who came for routine consultation at the Dschang District Hospital. Blood and stool samples were collected from those who gave their consent. Demographic features and symptoms of enteric fevers were recorded using a questionnaire. The diagnosis of infection was carried out using stool culture, slide agglutination Widal and Felix test, and Typhidot test. The resistance profile of *S. Typhi* against commonly used antibiotics was determined by disk diffusion method.

Results: A total of 100 individuals participated in this study. The prevalences of *S. Typhi* infection in the study population were 54%, 47% and 39% as revealed by the Widal test, Typhidot test and stool culture, respectively. Fever, headache, abdominal pain and constipation were the main observed signs and symptoms of this infection. The Widal and Typhidot tests displayed sensitivities of 71.79% and 94.87%; specificities of 57.37% and 83.60%; positive predictive values of 51.85% and 78.72%; negative predictive values of 76.08% and 96.22%, respectively when compared to stool culture. Ceftriaxone (100%), ciprofloxacin (100%), ofloxacin (100%) and cefotaxim (100%) were active against all *Salmonella* Typhi and Paratyphi isolates from study participants. However, these isolates were resistant to gentamicin (100%), and they displayed limited susceptibility to amoxicillin (10.25%), ampicillin (20.5%), chloramphenicol (50.3%), co-trimoxazole (89.74%) and pefloxacin (89.74%). Finally, the presence of multi-drug-resistant (MDR) *S. Typhi* was observed in the study population.

Conclusion: The present study showed high sensitivity and specificity of Typhidot rapid diagnostic test for the diagnosis of typhoid fever compared to the Widal test, using stool culture as gold standard. These observations, added to limited susceptibility of isolates to commonly used antibiotics supported the need of performing antibiogram before any antibiotic treatment.

Keywords: Typhoid fever, prevalence, serodiagnosis, coproculture, sensitivity, specificity, resistance profile, MDR *Salmonella* Typhi.

I. INTRODUCTION

Enteric fevers caused by *Salmonella enterica* serotypes Typhi (Eberth bacillus) and Paratyphi A, B or C [1], are major determinants of morbidity and mortality worldwide. About 16.6 million new infections occur each year with an estimated 600,000 deaths [2]. These infections are endemic in Africa, South America and the Indian subcontinent, including Bangladesh, Southeast Asia and the Far East. The annual incidence of typhoid fevers has been reported to be over 13 million cases in Asia [3]. Typhoid fever can occur in all age groups with the highest incidence in children [4]. Serotypes of *Salmonella enterica* are food poisoning agents in humans that may exceptionally evade systemic circulation, especially in immunocompromised and leukemic patients [5]. In addition, these ubiquitous serotypes can cause epidemics in pediatric services [3]. *Salmonella* Typhi is also responsible for extra digestive manifestations, which, although not frequent, occur mainly in subjects at risk with multiple clinical presentations depending on the site of the infection. These extra digestive manifestations can be associated with sepsis or typhoid fever. This is the case of *S. Typhi* osteitis usually observed in sickle cell patients and especially in children from 6 months to 10 years [5].

The source of contamination is the feces from patients or healthy carriers. Disease transmission is sustained as long as the excretion of the bacteria persists, usually throughout the period of illness and convalescence [6]. The resistance of *S. Typhi* strains to antibiotics has greatly increased in the past decades in developing countries due to the misuse of antibiotics for livestock farming as well as the treatment of human bacterial infections [7]. On the other hand, typhoid and paratyphoid fevers have declined dramatically in western countries, but are still prevalent in developing countries, where socio-economic conditions and lack of hygiene promote microbial spread.

The detection of these infections relies on sero-diagnosis, isolation of the bacterium by blood culture, stool culture, uroculture and bone marrow culture. However, self-medication and inappropriate consumption of antibiotics in the community often hinder isolation of this bacterium. Instead, serological test is therefore widely used for the diagnosis of typhoid and paratyphoid fevers in most developing country laboratories. Unfortunately, none of the available sero-diagnostic tools including the most widely distributed Widal test, has proven optimal sensitivity and specificity for use in typhoid fever endemic areas. Moreover, requests for laboratory examinations usually lacks local data on the performance of the recommended tests, with a risk of misinterpretation of results, mainly in settings where multiple uncontrolled agglutination tests are available for diagnosis purpose. Typhidot test is an example of immediate, rapid enzyme dot assay (EIA), which detects IgG and IgM antibodies specific for *Salmonella* outer membrane antigens. Typhidot test becomes positive from the first week of fever; the results are interpreted visually and are available within an hour. It is therefore necessary to understand the diagnostic value of various typhidot, in comparison to other tests that are available for typhoid and paratyphoid fever diagnosis, as well as an update on the antibiotic resistance profile of *S. Typhi* isolates from febrile patients in consultation at Dschang District Hospital with respect to commonly used antibiotics. This study evaluated the diagnostic performances of three methods of diagnosis of typhoid fever and established the resistance profile of the *S. Typhi* isolates against commonly administered antibiotics.

II. MATERIALS AND METHODS

II.1. Study design, site and population

A cross-sectional hospital based study was conducted in the laboratory of the Dschang District Hospital from November 2020 to January 2021. The study protocol was approved by the National Committee for Ethics in Human Health (CNERSH), Yaounde, Cameroon (ref: 2020/11/73/CE/CNERSH/SP). This hospital is located in the Menoua Division, Western Region of Cameroon. Blood and stool specimens of 100 volunteers (53 males and 47 females) who attended this health facility for consultation, either presenting or not typhoid or paratyphoid fevers symptoms, and who gave their consent to participate in this study were collected. Patients on antibiotic therapy whose spectrum of action includes *Salmonella Typhi* bacteria were not included in this study.

II.2. Collection and analysis of blood and stools

Blood collection was specifically performed by a qualified laboratory technician using the standard procedure. The antecubical vein of the forearm was selected and disinfected with a cotton swab impregnated with 70% alcohol. Five milliliters of venous blood were drained into a dry tube pre-labeled with an anonymized patient code. The blood specimens were allowed to clot completely, and sera were collected using a 1 ml micropipette tip after centrifugation at 5000 rpm for 5 min, and stored separately in tightly screwed microtubes (Eppendorf) at -20 °C.

Detections of anti-O and anti-H and *Salmonella*-specific IgM and IgG were performed by the slide agglutination Widal and Felix test and Dot Enzyme Immunoassay (TyphiDot; Malaysian Biodiagnostic Research SDN BHD, Kuala Lumpur, Malaysia) test, respectively, following the instructions of the manufacturers of the sero-diagnosis kits.

Stool specimens were self-collected in sterile appropriate containers by instructed patients. The samples were quickly transported to the Laboratory of the Dschang District Hospital for microbiological analysis. Three grams of stools were introduced into 3 mL of sterile physiological saline and mixed. Then, 1 mL of the mixture was removed aseptically and inoculated into enriched selenite broth (9 mL) and incubated at 37 °C for 24 h. In the presence of turbidity / bacteria, aliquot from stool culture bottles were sub-cultured onto a SS agar plate to obtain pure isolates. These pure isolates were inoculated in nutrient agar slant and stored at +4 °C for further characterization and identification. Identification of bacteria from positive culture plates was done with the use of standard microbiology techniques which included colony morphology, Gram stain, biochemical tests and serotyping [8]. The microbiological analysis of the stool for *S. Typhi* search was conducted according to the French Standardization Agency (AFNOR) method NF U 47-100 of February 2005, followed by a sensitivity test to commonly administered antibiotics by the Kirby-Bauer agar plate disk diffusion method described by the Clinical and Laboratory Standards Institute [9]. Results of disc diffusion tests were then interpreted using the M100-S25 scale [10]. Each assay was done in triplicate. The antibiotics tested were penicillins (ampicillin and amoxicillin), cephalosporins (ceftriaxone, ceftriaxone), fluoroquinolones (ciprofloxacin, ofloxacin, and pefloxacin), phenicols (chloramphenicol), aminoglycosides (gentamycine), sulfonamides (co-trimoxazole), quinolones (nalidixic acid) and tetracyclines (tetracycline). *Salmonella Typhi* isolates were regarded as multidrug resistant (MDR) when they were resistant to one or more antibiotics in three or more classes of antimicrobials that the isolate is expected to be susceptible.

II.3. Statistical analysis

Sensitivity (Se), specificity (Sp), predictive value (PPV) and negative predictive value (NPV) were calculated according to standard methods. For primary analysis, sensitivity (true-positive rate) was defined as the probability of the serological test result being positive when the stool culture confirmed the presence of *S. Typhi*; while the specificity (true-negative rate) was defined as the probability of the serological test result being negative when *S. Typhi* was not isolated from the stool culture. The PPV was the probability that culture confirmed typhoid when the serological test was positive, and NPV was the probability that culture was negative for typhoid when the serological test was negative. For antibiotic susceptibility testing, inhibition zone diameters were subjected to analysis of variance (ANOVA) and when the differences between the averages existed, they were separated by the Waller Duncan test. The chi-square test was used to compare the frequencies of the clinical signs and symptoms of *S. Typhi* infection in the different groups. The analyzes were performed using the EPI Info v 3.4.3 software (Centers for Disease Control and Prevention, USA) and Statistical Package for Social Science (SPSS). The level of significant was set at 5%.

III. RESULTS

III.1. Study population

In this study, 100 volunteers were recruited amongst patients who visited Dschang District Hospital presenting or not symptoms of *S. Typhi* infection. The distribution of participants according to their gender and age group is presented in Table 1. Males (53%) were more represented than females (47%). Only 5% was the representation of each of the extreme age groups (≤ 5 and ≥ 60 years old). The age ranges 6 – 20, 21 – 29, and 30 – 39 accounted for 12%, 42%, and 36 % of participants, respectively.

Table 1: Distribution of the study population according to their gender and age range

Variable	Gender	
	Absolute frequency	Percentage (%)
Sex		
Male n(%)	53	53
Female n(%)	47	47
Age group (years)		
≤ 5	5	5
6 – 20	12	12
21 – 29	42	42
30 - 59	36	36
60+	5	5
Total	100	100

III.2. Prevalence of *S. Typhi* infection based on stool culture

The result on the prevalence of *S. Typhi* based on stool culture per gender is illustrated in Figure 1. Out of the 100 stool specimens cultured, a total of 39 were identified positive for *S. Typhi*, given an overall prevalence of 39% (95% CI: 29.6 – 49.3). The prevalence of *S. Typhi* infection was found to be higher in males (45.28%) than in females (31.91%), although the difference was not statistically significant ($p = 0.171$).

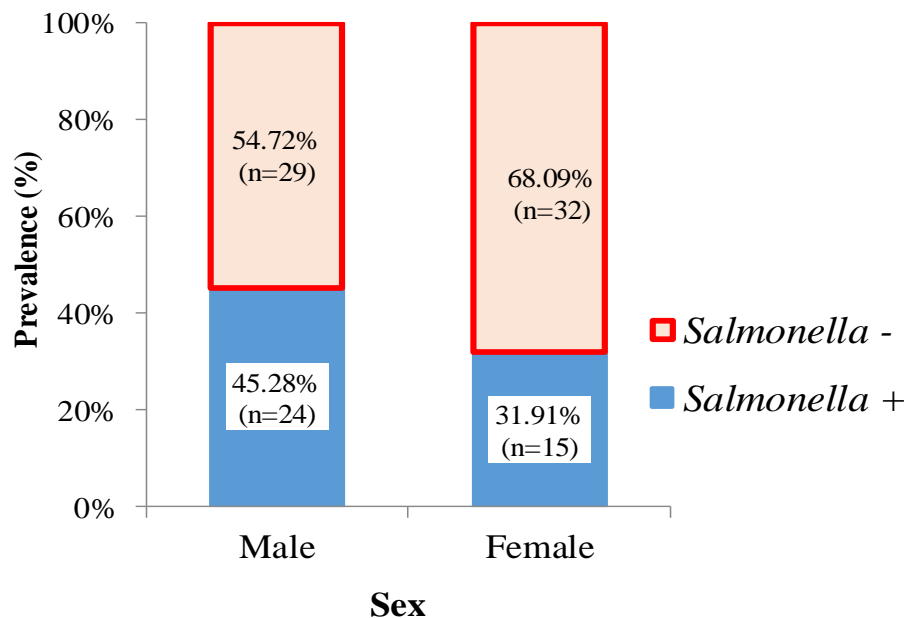


Fig 1. Distribution of *S. Typhi* according to the participants' sex
 Statistics: X^2 -value = 1.871; $df = 1$; p -value = 0.171

The prevalence of *S. Typhi* was also distributed according to participants' age groups as shown in Figure 2. Although the age groups of 21 to 29 years (42%) and 30 to 59 years (36%) were the most represented (Table 1), high prevalence (80%) of *S. Typhi* infection was instead found among patients aged 60 and above (Figure 2). The lowest prevalence (16.67%) was observed within the

adolescent and young adult range of age (6-20 years). However, the difference in the prevalences of *S. Typhi* infection in the various age ranges were not statistically significant ($p = 0.192$).

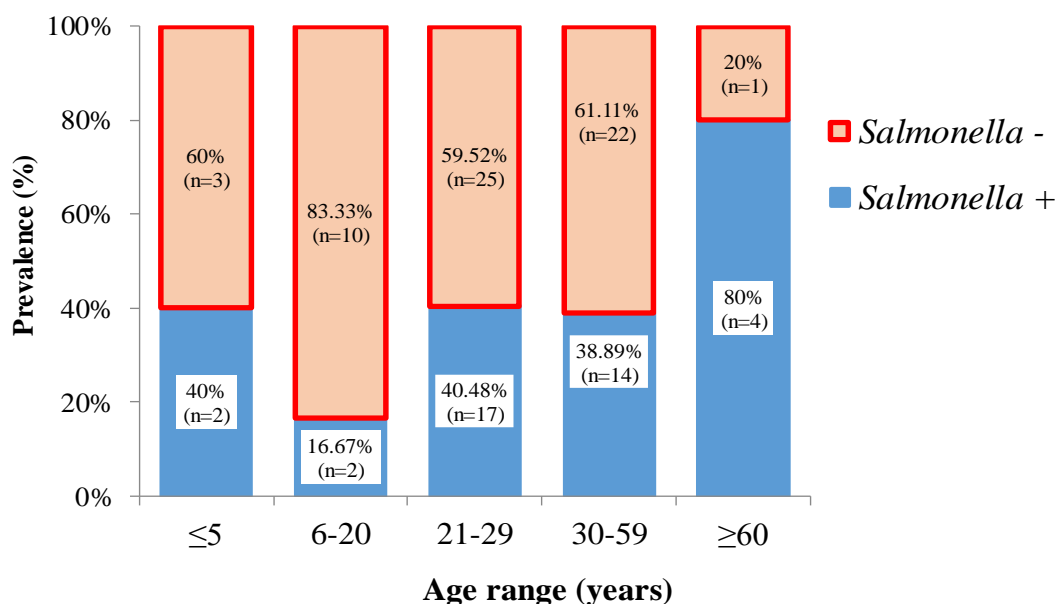


Fig 2. Distribution of the prevalence of *S. Typhi* according to the age group.

Statistics: X^2 -value = 6.090; $df = 4$; p -value = 0.192

With the exception of digestive disorders, cough, diarrhea, anorexia and rectal bleeding, the prevalence of other signs and symptoms of typhoid and paratyphoid fevers were significantly higher in the positive group of patients with *S. Typhi* infection compared to the group of *S. Typhi* negative patients (Table 2). These symptoms that included abdominal pain, fever, headache, and constipation, were frequently found in patient with *S. Typhi* infection.

Table 2: Distribution of the prevalence of signs and symptoms of enteric fever in the study population

Clinical characteristics	<i>S. Typhi</i>		Total n (%)	<i>p</i> -value
	Positive n (%)	Negative n (%)		
Abdominal pain	29 (74.35)	27 (44.26)	56 (63)	0.003*
Digestive disorders	24 (61.53)	35 (57.37)	59 (59)	0.679
Fever	38 (97.43)	32 (52.45)	70 (70)	<0.001*
Headaches	30 (76.92)	33 (54.09)	63 (63)	0.021*
Constipation	23 (58.97)	25 (40.98)	48 (48)	0.049*
Cough	13 (33.33)	38 (62.29)	51 (51)	0.005*
Diarrhea	16 (41.02)	40 (65.57)	56 (50)	0.016*
Anorexia	16 (41.02)	29 (47.54)	45 (45)	0.522
Rectal bleeding	2 (5.12)	8 (13.11)	10 (10)	0.194
Overall	29 (100)	71 (100)	100 (100)	-

*On the same line, the values obtained in the groups of patients positive and negative for *S. Typhi* infection are significantly different at the 5% probability level.

III.3. Diagnostic characteristics of the three tests

Table 3 shows the comparison of the results obtained with the stool culture, Widal, and Typhidot tests. Of the 100 samples analysed for *Salmonella enterica*, 39, 47 and 54 were found positive for stool culture, Typhidot and Widal tests, respectively (Table 2).

Table 3: Comparison between stool culture, Widal and Typhidot tests

Result	Tests
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	Widal <i>n</i> (%)	Typhidot <i>n</i> (%)	Stool culture <i>n</i> (%)
Positive	54 (54)	47 (47)	39 (39)
Negative	46 (46)	53 (53)	61 (61)
Total	100 (100)	100 (100)	100 (100)

Of the 39 positive cases confirmed by stool culture, 28 were detected positive with the Widal test while 11 were negative (Table 4). Of the 61 negative cases with stool culture, 26 were positive with the Widal test and 35 were Widal negative. The Widal test therefore had a sensitivity (Se) of 71.79%, a specificity (Sp) of 57.37%, a positive predictive value (PPV) of 51.85% and a negative predictive value (NPV) of 76.08%. Typhidot detected 37 out of 39 confirmed positive stool cultures. Out of the 61 negative cases, 10 were positive with Typhidot. The Typhidot test therefore displayed a sensitivity of 94.87%, a specificity of 83.60%, a PPV of 78.72% and a NPV of 96.22% compared to the stool culture

Table 4: Diagnostic characteristics of Widal and Typhidot tests with respect to stool culture

Result for serological tests	Stool culture		Total	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
	Positive	Negative					
Widal test							
Positive	28	26	54	71.79	57.37	51.85	76.08
Negative	11	35	46				
Typhidot							
Positive	37	10	47	94.87	83.6	78.72	96.22
Negative	2	51	53				
Total	39	61	100				

PPV: positive predictive value; NPV: negative predictive value.

III.4. Immunoglobulin typing of the study population

Of the 100 patients diagnosed with the Typhidot test, we recorded 47 positive and 53 negative patients (Figure 3). In the 47 positive patients, 33 were positive for type M immunoglobulins (33%), 3 positive for type G immunoglobulins (3%), 11 positive for type M and G immunoglobulins (11%) and finally 53 patients had been negative for type M and G immunoglobulins (Figure 3).

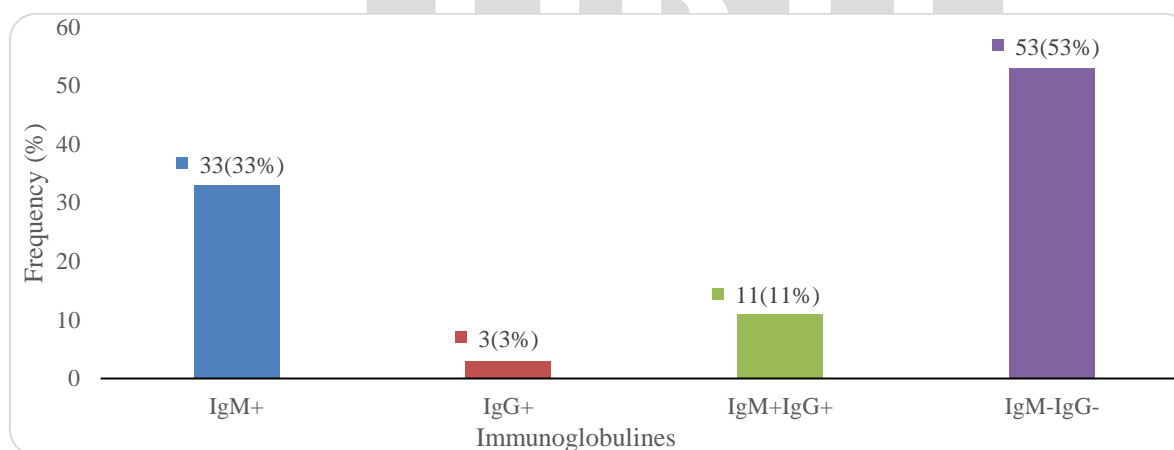


Fig 3. Distribution of immunoglobulins in the study population based on Typhidot test results

III.5. Resistance profile of *S. Typhi* isolates to standard antibiotics

The susceptibility of *S. Typhi* isolates to conventional antibiotics was determined by measuring the diameters of inhibition zones on culture plates. These values were translated into sensitive, intermediate, and resistant patterns. Of the 39 isolates tested in this study, all (100%) were sensitive to cefotaxime, ofloxacin, ceftriaxone and ciprofloxacin (Figure 4). However, only 10.25%, 20.5% and 50.3% of the isolates were sensitive to ampicillin, amoxicillin and chloramphenicol, respectively (Figure 4). All the isolates (100%) were resistant to tetracycline, gentamycin, and nalidixic acid.

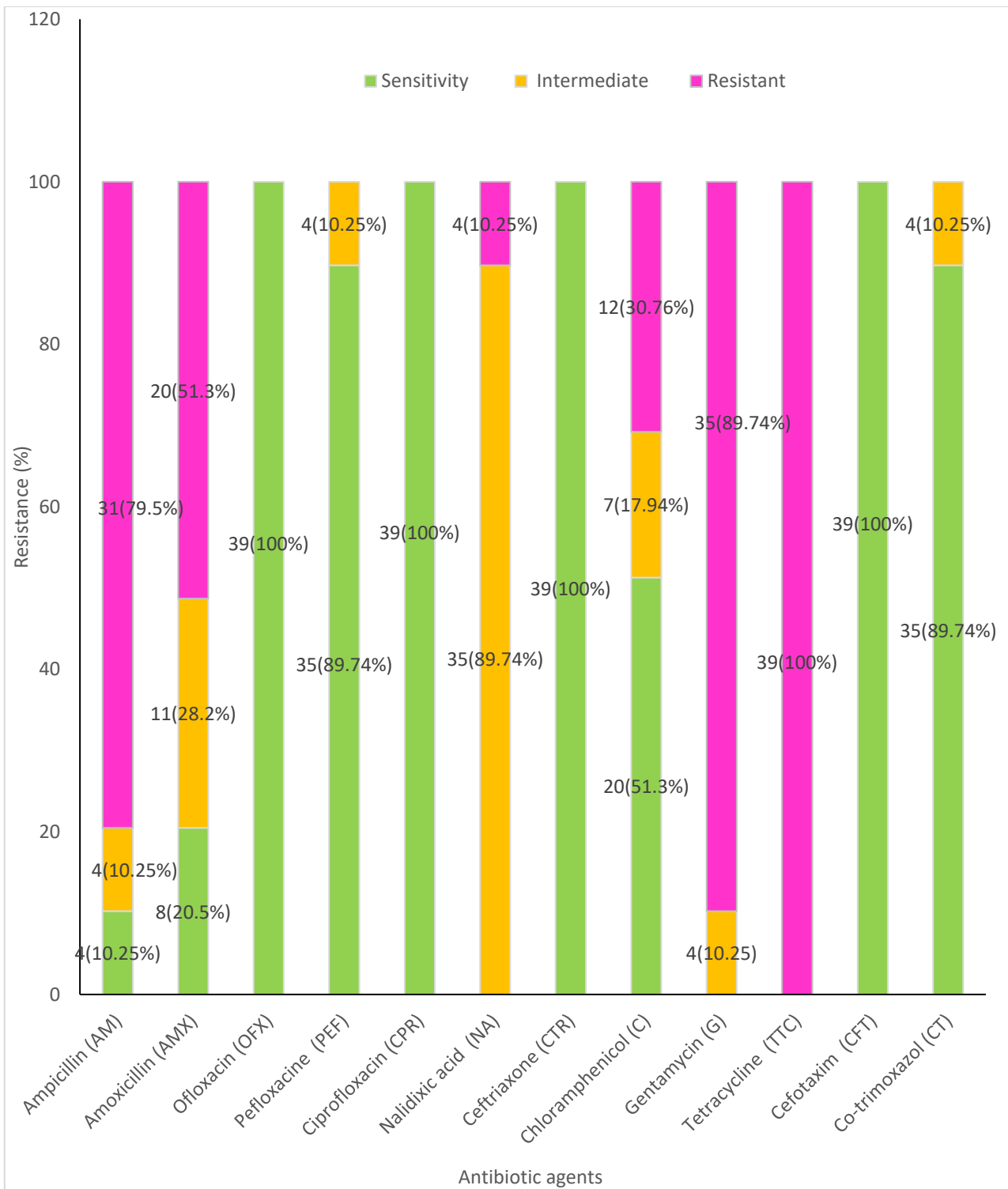


Fig 4. Antibiotic resistance profile of *S. Typhi* isolates to standard antibiotics

S. Typhi isolates showed resistance to three, four and five antibiotic classes (Table 5). The resistance to three antibiotic classes was the most important and observed to chloramphenicol-gentamycin-tetracyclin (10.25%), amoxicillin- ampicillin - chloramphenicol-tetracyclin (10.25%) and amoxicillin- ampicillin - gentamycin-tetracyclin (38.46%). The resistance to four antibiotic classes was recorded to ampicillin - gentamycin-tetracyclin-nalidixic acid (7.69%) and amoxicillin- ampicillin - chloramphenicol-gentamycin-tetracyclin (17.94%). The resistance to four antibiotic classes were observed to pefloxacin- amoxicillin- ampicillin-chloramphenicol-gentamycin-tetracyclin (10.25%) and amoxicillin- chloramphenicol-gentamycin-tetracyclin-cotrimoxazol (7.69%).

Table 5: Multidrug resistance patterns of *S. Typhi* isolates to standard antibiotics

Types of multi-drug resistance	Number of isolates (n = 39)	Resistance (%)
R3		58.96
C ^R -G ^R -TTC ^R	4	10.25
Amx ^R - Amp ^R -C-TTC ^R	4	10.25
Amx ^R - Amp ^R - G ^R -TTC ^R	15	38.46

R4		25.63
Amp ^R -G ^R -TTC ^R -NA ^R	3	7.69
Amx ^R - Amp ^R -C ^R -G ^R -TTC ^R	7	17.94
R5		17.94
Pef ^R - Amx ^R - Amp ^R -C ^R -G ^R -TTC ^R	4	10.25
Amx ^R -C ^R -G ^R -TTC ^R -CT ^R	3	7.69

C: chloramphenicol; G: gentamycin; TTC: tetracycline; Amx: amoxicillin; Amp: ampicillin; NA : nalidixic acid ; Pef : pefloxacin; CT: co-trimoxazol ; R3–R5 = number of antibiotic classes to which a given isolate was resistant.

IV. DISCUSSION

In the perspective of searching improving diagnosis and management of the enteric fever, this study evaluated three methods for the diagnosis of typhoid fever and determined the resistance profile of *S. Typhi* isolates in patients at Dschang District Hospital. A total of 100 volunteers' patients who visited the Dschang District hospital for medical consultation were screened. The most represented age group was 21-29 years old with 40.48 % infection as reported by stool culture. Out of the 5 individuals presented at age 60 and above, 4 were found positive with *S. Typhi* infection. Although previous studies have reported contrasting results on the prevalence of typhoid fever in different age groups [11], no significant difference was depicted with regards to the distribution of this infection with age range in this study. The present study also showed that the male sex was the most infected with 45.28% of infection observed against 31.91 infected females although the difference was not significant. The high prevalence of infection in males could be explained by their occupational exposure; where most of them seem to consume food out of their home, which may be potential source of infection. This trend of result has been reported in a previous study that also found high seropositivity of enteric fever in men (65.0%) compared to women (35%) [12]. With respect to the signs and symptoms, this study revealed fever, headache, abdominal pain and constipation as the main clinical features of *S. Typhi* infections. These observations tight with those of previous works [13, 14].

In this study, stool culture was used as a standard test for the diagnosis of enteric fevers; but its usefulness in the diagnosis of enteric fever is limited because it remains negative during the first week of the disease, making the isolation of *S. Typhi* difficult. Of the 100 patients diagnosed for enteric fever, only 39 were positive after stool culture, a positivity of 39% versus 54% and 47% respectively for the Widal and Typhidot tests. These results are consistent with those reported by Jesudasson *et al.* [15]. The low positivity obtained during the stool culture may be the result of frequent and uncontrolled use of usual antibiotics as previously reported [16] or to an early diagnosis. The sensitivity and specificity of the slide agglutination Widal test were 71.79% and 57.37%, respectively. These results are similar to those of another study that showed the sensitivity and specificity of the Widal test of 53 - 80% and 57 - 90%, respectively [17]. The Widal test has been used for more than a century in developing countries, but its diagnostic significance and usefulness have been limited due to its low sensitivity, specificity, positive predictive value, and negative predictive value [18]. In fact, this test may become negative at the beginning of infection or because of anterior biotherapy, while a decreased specificity is attributed to a cross-reaction with other Gram-negative bacteria and non-typhoidal salmonellae [19]. The presence of the O and H antigens of other serotypes other than Typhi and Paratyphi or other Enterobacteriaceae makes the role of the Widal test in the diagnosis of enteric fevers even more controversial [20]. In the present study, the Widal test appeared positive in 54 cases or 54% against only 47% for Typhidot. The seropositivity of the Widal test compared to the Typhidot test is linked to the fact that the Widal test detects both the Typhi and Paratyphi serotypes, unlike the Typhidot test which detects only the Typhi serotypes. In contrast, in endemic areas, there may be high levels of specific cross-reactive antibodies that contribute to false positive results [21]. It is generally accepted that positive predictive value (PPV) is the most important measure of a clinical diagnostic method because it represents the proportion of patients with positive test results who are correctly diagnosed. In our study, slide agglutination Widal test showed a positive predictive value (PPV) of 51.85% and a negative predictive value (NPV) of 76.08% compared to stool culture. Therefore, the PPV of the slide agglutination test was considered to be quite low (51.85%). Similar results in relation to low Se, Sp, VPP and VPN obtained by slide agglutination Widal test have also been reported in previous studies [22, 23]. In settings where the slide agglutination test is the only alternative for the diagnosis of enteric fever, a large number of samples would be false positive and the antimicrobial chemotherapy would be administered. This action could lead to serious consequences by exerting unnecessary pressure on the normal intestinal flora that could ultimately develop antibiotic resistance and thus increase the suffering of the patient [22].

Typhidot is an inexpensive, early diagnosis and high performance serological test that has been marketed and used in many endemic areas with good sensitivity and specificity. It is based on the detection of antibodies appearing in detectable titers as early as the second day of the disease. The present study evaluated the importance and usefulness of the Typhidot test in patients with enteric fever. In this study, the Typhidot test had a sensitivity of 94.87%, a specificity of 83.60%, a PPV of 78.72% and a VPN of 96.22%. These results corroborate findings from studies conducted in India [24], Vietnam [2] and in other countries of the world [4, 18, 25]. A similar study in southern India indicated that the Typhidot test would have a sensitivity of 100%, a specificity of 80% and its usefulness lies in the early diagnosis of typhoid fever [24]. Other studies conducted in Malaysia have also shown that the Typhidot test is better and could replace the Widal test when used with blood culture and/or stool culture [25, 26].

The results of this study with respect to the susceptibility pattern of *S. Typhi* isolates to usual antibiotics showed that ceftriaxone (100%), ciprofloxacin (100%), ofloxacin (100%) and cefotaxime were the most active. Our results were partially in agreement with those of a previous report [27]. However, our data differ in part from those obtained by Ali Shah and contributors [28] who reported limited sensitivity of *S. Typhi* isolates to ceftriaxone (50%) and ciprofloxacin (3.7%). It was also observed that *S. Typhi* isolates are insensitive to gentamicin (0%), and have low sensitivity to amoxicillin (10.25%) and ampicillin (20.5%). These data are consistent with those found in a study in Pakistan, which reported that *S. Typhi* isolates were resistant to the first-line

antibiotics (amoxicillin 57.6%, co-trimoxazole 61.4%, chloramphenicol 46.9%) [29]. Chloramphenicol, a molecule used in the first-line treatment of the typhoid fever, was active in only 50.3% of the isolates. This frequency, however, is higher than that reported by Soude [30] who found a sensitivity of *S. Typhi* isolates of 12.5% against chloramphenicol. The results of our study showed that no *S. Typhi* isolates were sensitive to gentamycin (Aminoside). This result is similar to that found by Olodo (1996) [31] who reported a sensitivity rate of 33.3% of *S. Typhi* isolates in a previous study. The result of this study indicates that ofloxacin (which is no longer commonly used for the treatment of typhoid fever in the study area) was 100% effective against *S. Typhi* isolates. This observation is consistent with the hypothesis that a microorganism that was previously resistant to a particular antibiotic may become sensitive if treatment with that antibiotic is suspended for a long time [32].

V. CONCLUSION

The prevalence of *S. Typhi* infection in the patients attending the Dschang District Hospital was found to be 54%, 47% and 39% for the Widal test, Typhidot test and stool culture, respectively. Fever, abdominal pain, headache and constipation were the main signs and symptoms of *Salmonella Typhi* infection. The Widal and Typhidot tests displayed sensitivities of 71.79% and 94.87%; specificities of 57.37% and 83.60%; positive predictive values of 51.85% and 78.72%; negative predictive values of 76.08% and 96.22%, respectively, compared to stool culture. Ceftriaxone (100%), ciprofloxacin (100%), ofloxacin (100%) and cefotaxime were active against all *S. Typhi* isolates. In contrast, these isolates were resistant to gentamicin (100%), and showed limited sensitivities to amoxicillin (10.25%), ampicillin (20.5%), chloramphenicol (50.3%), co-trimoxazole (89.74%) and pefloxacin (89.74%). The results of this study indicate that Typhidot is an early and rapid diagnostic test that has high sensitivity and specificity for the diagnosis of enteric fevers compared with the Widal test. These results underline the need of advocating the Typhidot test over Widal test for the diagnosis of typhoid fever and further support the need for antibiotic susceptibility testing before any antibiotic treatment.

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