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Carrier Rate of Typhoid Organisms in Enugu, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Short Communication

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ABSTRACT

Aims: To determine the carrier rate of typhoid and paratyphoid organisms in Enugu community.
Place and Duration of Study: The project was carried out in Enugu Urban in South Eastern part of Nigeria. Those enrolled in the study that lasted for one year are students, traders and civil servants.
Methodology: Ninety six apparently healthy adults without any complaints, comprising of forty eight males and forty eight females were selected for the study. Blood, urine and stool samples were collected from all in the study group. The samples were subjected to standard bacteriological culture for enteric organisms at the Medical Microbiology Laboratory of University of Nigeria Teaching Hospital, Enugu.
Results: *Salmonella typhi* was isolated from the stool of two (2.08%) of the candidates while *S. paratyphi* was recovered from the stool of another individual (1.04%) of the study group. No candidate gave Widal titre greater than 40 to 'O' agglutinin which is statistically significant (Anova F value 597.7, P value <0.0001). Only Two Candidates positive for *S. typhi* culture gave titre of 160 to' H' antigen, also Statistically significant (Anova F value 1195, P value <0.0001).
Conclusion: Typhoid carrier rate in Enugu Community is 2.1% while that of paratyphoid is 1.0%. From the study females are more likely to be typhoid carriers in Enugu.

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1. INTRODUCTION

Infection with Salmonella organisms remain a world-wide problem. *Salmonella typhi* is a serious source of illness primarily in the developing world, with over 12.5 million cases estimated outside China in 1980 [1]. Salmonellosis is generally acquired through contaminated food and water, although cross contamination occur in hospitals and institutions [2]. Nearly 50% of determined outbreaks are caused by poultry and poultry products. Typhoid fever remains an important public health problem with more than half million deaths occurring throughout the developing world [3]. In Nigeria, up to 30 percent of the patients admitted may die from the infection [3]. A factor of epidemiologic importance is the asymptomatic human carrier state (chronic carrier and temporary excreter), which exist for the agents of typhoidal and non-typhoidal salmonellosis. [4] Approximately, 3 % of persons infected with *S. typhi* and 0.1% of those infected with non-typhoidal salmonellae become chronic carriers which can last from many weeks to years. In chronic typhoid carriers, persistent carriage of very large numbers of organisms is usual- 10^6-10^8 organisms/g of faeces. [5] Children rarely become chronic typhoid carriers[4]. The chronic carrier state is defined as documented excretion of *S. typhi* in stool or urine for a year or more [5]. About one third of the chronic carriers give no history consistent with typhoid fever and the incidence is higher in older patients and more in women. [6] Underlying biliary or urinary tract diseases, especially with stone formation, increase the probability of the chronic enteric or urinary carrier states in patients with typhoid fever [5]. In Nigeria typhoid fever patients are diagnosed on the basis of clinical symptoms and a single Widal test [7]. Bacteriologic culture is seldom done. Vi (capsuler antigens of *S. typhi)* agglutinins are found in the serum of some 85% of chronic carriers at a titre of 5 or more. [8] The measurement of antibodies to Vi by haemagglutination test and by EIA (enzyme immunosobent assay) commonly called Enzyme Linked Immunosorbent Assay (ELISA) can detect chronic *S. typhi* carriers if bacteriologic culture cannot be done [8]. Vaccines against typhoid are available the parenteral vi capsular polysaccharide and the oral live whole-cell *Salmonella typhi* 21a vaccine that provide similar levels of protection. [9] The response to Ty21a vaccine was found to imitate that in natural infection. [10] Worldwide, non-typhoid salmonella (NTS) create a huge public health concern with155,000 deaths and over 90 million cases annually.[11] They are known for their emerging antimicrobial resistance and there are no vaccines against them. The 21a vaccine elicited a higher immune response cross-reactive with several NTS strains and is at the forefront as a surrogate vaccine [11]. There is little report of typhoid carrier rate in Enugu Nigeria. This study aims to determine the carrier rate in this community.

2. MATERIALS AND METHODS

Ninety-six apparently healthy adults (48 males and 48 females) without any complaints during the period of study, were selected for the study. In the group were traders, students and civil servants in Enugu. Blood, urine and stool samples were collected from the candidates. Stool and urine specimens were inoculated onto appropriate bacteriologic agars (MacConkey and Deoxycholate agars) before and after enrichment in selenit-F broth (1gm or 1ml of stool) that was incubated for 24 hrs. Subcultures of stool and urine were plated onto MacConkey and Deoxycholate agars. Urine samples were additionally inoculated on Cystein Lactose Electrolyte Deficient (CLED) agar. The resulting Non Lactose fermenting suspect colonies on the above agars that did not metabolize urea but produced hydrogen sulphide in Bismuth sulphite medium were examined for salmonella including serologic typing by standard methods [12]. Widal agglutination tests were done on the sera resulting from the blood samples. The procedure used was the standard tube dilution method of Freter as described by Ismail [13] with salmonella antigens prepared by Gama Biological.

3. RESULTS

All the 96 candidates were screened for typhoid and other enteric fever organisms. *Salmonella typhi* was isolated from the stool of two (2.08%) of the candidates, while *S. paratyphi C* was recovered from the stool of another individual (1.04%) of the study group (Table 1). With regards to Widal test, none of them gave a titre greater than 40 for '0' agglutinin which is statistically significant (Anova test F value 597.7, P value <0.0001). The two from whom *S. typhi* was recovered, gave titre of 160 against 'H'

antigen also statistically significant (Anova F value 1195, P value <0.0001) see (Table 2). The two typhoid isolates came from females while the paratyphi organism came from a male. Repeat stool cultures from the three culture positive individuals gave similar results after a period of six and twelve months, confirming that they are carriers.

Table 1. Isolation rate, age range and sex distribution of the individuals culture positive for enteric fever organisms (%)

Sex	*S. typhi*	*S. paratyhi* C	Age
Male	0(0)	1 (1.04)	27
Female	2(2.08)	O (0)	30 – 32

4. DISCUSSION

From the results typhoid organisms were recovered from three apparently healthy individuals, even on repeat cultures. The study group were considered healthy since they gave no complaints. The rate of 2.1 percent should be considered the typhoid carrier rate in Enugu. Also 1.0 percent should be taken as the paratyphi salmonella carrier rate.

Typhoid, an illness caused by *Salmonella enteric serovar typhi* is common worldwide; it is transmitted by the ingestion of food or water contaminated with faeces from an infected person [4]. When untreated typhoid fever persists for three weeks to a month [14]. Azithromycin and fluoroquinolone are antibiotics suggested for treatment [14]. Death occurs in between 10% and 47% of untreated cases [15]. A person may become an asymptomatic carrier of typhoid fever, suffering no symptoms, but capable of infecting others. Approximately 5% of people who contract typhoid continue to carry the causative organism after they recover (like Mary Mallon-typhod Mary) [16]. With a global estimate of 16-33 million cases annually resulting in half a million deaths, typhoid is identified as a serious public health problem [15]. Some patients come to the clinic with typhoid "certificates" as evidenced by their previous positive laboratory Widal results [7]. This can contribute to over diagnosis of typhoid [7]. Due to improved surgery and supportive care in some countries, median case fatality rate (CFR) for typhoid perforation (TP) declined from over 50% in 1960 to single digits in the last decade but West Africa lags behind at 16% [17]. There is mounting evidence of the association between hepatobilliary cancer and typhoid carrier state [18,19]. Though some regard Kathmandu, Nepal as the enteric fever capital of the world [20], the global burden of typhoid fever is not in doubt [21]. Public health education campaigns encouraging people to wash their hands after defecating and before handling food are an important component in controlling spread of the disease. Control of carriers can be further done through encouraging them to submit to chemotherapy or be considered for cholecystectomy [19]. It is recommended that health authorities should keep a register of typhoid and paratyphoid carriers. The carriers themselves should be kept under "surveillance" by local health officers who should ensure that the sewage from their dwellings is safely disposed of, give them appropriate instructions in personal hygiene and encourage them not to take employment in food or water industry. However workers in the food or water industry should be individually examined bacteriologically or culture of sewage effluent of large food factories can be done as an alternative to the examination of individual faecal specimen [21]. Chlorination of drinking water, adequate treatment and vaccination against the disease has led to dramatic decreases in the transmission of typhoid fever in the U.S [22].

Table 2. Widal test for (96) healthy normal individuals

Antigens		Titre						
		< 20	20	40	80	160	320	640
'O'	{DO (*S. typhi*)	96	0	0	0	0	0	0
Antigen	{aO *S. paratyphi* A	96	0	0	0	0	0	0
	{bO *S. paratyphi* B	86	2	8	0	0	0	0
	{cO *S. paratyphi* C	86	3	7	0	0	0	0
'H'	{DH	87	7	0	0	2	0	0
Antigen	{aH	96	0	0	0	0	0	0
	{bH	95	1	0	0	0	0	0
	{cH	95	1	0	0	0	0	0

Both paratyphi A and B have no vaccine in clinical use though contentiously Ty 21a-vaccine have been suggested and there is a growing problem of antibiotic resistance among the strains [23]. Strains of *Salmonella enteric* sub sp enteric are amongst the most commonly identified invasive bacterial pathogens in resource-poor settings, and cause significant mortality, particularly in children. But neither of the two available vaccines can be used in infants. Interestingly, Vi conjugate vaccines should offer children excellent protection from typhoid [24].

There is evidence that Ty21a vaccine may have cross-protective efficacy against numerous non typhoidal *Salmonella enteritidis and typhimurium* [9]. Greater effort must be placed on the development of next generation vaccines to address the disease burden resulting from typhi, paratyphi A and non-typhoidal Salmonella NTS infections [25]. Policy-makers therefore should introduce preventive interventions against typhoid, including vaccination [26].

5. CONCLUSION

Typhoid carrier rate in Enugu is taken as 2.1% while that of paratyphoid salmonella carrier rate is 1.0 percent. From the study females with a raised Widal titre160 and above to 'H' antigen are more likely to be typhoid carriers in Enugu. Provision of potable water, proper treatment and vaccination should lower the typhoid carrier rate in the community.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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