



Epidemiological Study of *Salmonella typhi* and Its Month-Wise Effect on Different Age Groups in Dehradun

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Authors' contributions

The work was carried out in collaboration among all authors. Author SM designed the study, wrote the protocol and performed the analysis. Author CK managed the analysis of the study. Authors RKM, Sandeep Singh and Shilpa Semwal contributed in performing the study. Author NS guided in the paper writing. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: *Salmonella typhi* is a bacterial disease caused by contaminated food and water, also known as foodborne and waterborne infection, it transmitted via faeco-oral route.

Materials and Methods: A total of 204 clinical isolates were considered for its proposed study. IgM/IgG rapid card test (CTK Biotech) was used for the detection and Widal test (BEACON) was also performed for the same.

Duration: March 2020 to November 2020.

Results: A total of 204 blood samples were analyzed with clinically suspected cases of typhoid fever, out of which, some cases showed reactivensness and 50.98% showed negative for *Salmonella typhi*. Widal test showed reactive result for O Ag (Somatic Antigen) and H Ag (flagellar antigen) and 8.82% IgG and 42.64% (monthly) IgM antibody showed positive result.

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Conclusion: Typhoid IgM/IgG antibody rapid card test and Widal Antigen test, a simple and rapid method for the detection of *Salmonella typhi* bacterium in patient's serum by serological techniques. Maximum number of positive cases were in the month of August, 2020 and September, 2020. The age group between 21-40 years were most infected by *Salmonella typhi*.

Keywords: Morbidity; typhoid fever; *Salmonella typhi*; gastrointestinal; faeco oral route; bacteremia.

ABBREVIATION

Salmonella typhi : *S. typhi*

1. INTRODUCTION

S. typhi causes gastrointestinal tract infection and bacteremia with typhoid fever [1]. *S. typhi* is a Gram negative bacterium, which belongs to Enterobacteriaceae family and causes systemic infection, hence shows morbidity on the population [2]. Around 2-5% cases get converted from acute phase to chronic phase and the bacteria persist in the biliary tract after resolved symptom [3]. It is coated with specific antigen which helps to identify Typhoid antibody (IgM/IgG). In first week of fever, when patient gets infected with *S. typhi* [4] usually a symptoms subsides in 7-21 days but 1-5% cases shows mortality in hospitalized patients [1]. The clinical symptoms of typhoid fever varies from a mild illness like fever, abdomen and muscles pain, gastrointestinal problems, headache and loss of appetite which shows resemblance with febrile disease [1]. Due to *S. typhi* (12-27 million) illness were detected each year, it is transmitted by faeco-oral route and by consuming contaminated food and water [5]. *S. typhi* infects different body parts such as gut, where it shows their clinical impact, form ulcers in intestinal area, necrosis, hypertrophy, it also form peyer's patches in infected area where *S. typhi* proliferate [6]. Isolation of *Salmonella* serotype can be done from specimen such as urine, stool samples along with blood [7]. Azithromycin (once a day – oral dose) and ceftriaxone (intravenous dose for 7 days) are used for the treatment of uncomplicated typhoid fever [8]. It is a seasonal disease which cause morbidity in the months of June, July, August and September [9].

2. MATERIALS AND METHODS

Thus, in the current work, we worked on the prevalence of *S. typhi* in Dehradun populations. A total of 204 suspected blood samples were tested from different areas of district Dehradun for diagnostic analysis for *S. typhi* in the year of March, 2020 to November, 2020 and the

samples were processed at DNA Labs- A Centre for Applied Sciences (DALCAS), Dehradun, Uttarakhand. There were two tests used for detection of *S. typhi*, Widal and Rapid card test (IgG/IgM antibody detection kit). Serological testing was done for the detection of *S. typhi* by using CTK Biotech (Lot no. F1217Q3H00D) for detection of IgG/IgM antibody [10] and also Widal test was done by BEACON (Lot no. SR-1032) [11]. In 19th century Widal test kit was developed to measures antibodies against O Ag (somatic antigen) and H Ag (flagellar antigen) for *S. typhi* [12]. The typhoid (IgM/IgG) rapid card test is based on the immunochromatographic assay [10]. The test consists of a nitrocellulose membrane strip containing three regions– two test line (IgM /IgG) and a control line (C). The M line is coated with anti-human IgM monoclonal antibody and G line coated with anti-human IgG monoclonal antibody for the detection of *S. typhi* and *S. paratyphi* and the C line is pre-coated with control with antibody [13].

3. RESULTS

The data was arranged in a tabular form as per the age group and month wise. The data was prepared for the month of March 2020 to November 2020. Out of 204 cases for *S. typhi*, the confirmed 18 (8.82%) IgG cases were positive followed by IgM 87.42.64% (monthly) and 14, 6.86% Widal reactive for *S. typhi*.

In this study, total number of 204 cases with symptoms like fever, rash with small red dots, fatigue, loss of appetite, constipation, nausea, diarrhea, and abdominal pain were considered from March 2020 to November 2020. Out of 204 symptomatic cases 18 (8.8%) IgG confirmed positive cases found followed by IgM contributing 87 (42.6%) and 14 (6.86%) reactive for Widal test. Moreover 18 (8.82%) samples were reactive for both IgG+IgM (Table 1).

It was observed that, in the month of August 2020 and September 2020, an increase in number of cases were observed with positive test result and most of the highest risk group infected with *S. typhi* were between 21-30 years and 31-40 years (Table 2).

Table 1. Seasonal variation of typhoid fever in Dehradun population in 2020

Months	Total cases	Rapid Card		Widal	Negative
		IgG	IgM		
March	17(8.3%)	-	01(0.49%)	01(0.49%)	15(7.3%)
April	18(8.8%)	02(0.98%)	02(0.98%)	02(0.98%)	14(6.86%)
May	4(1.96%)	-	1(0.49%)	-	3(1.47%)
June	12(5.88%)	02(0.98%)	05(2.4%)	-	07(3.43%)
July	25(12.2%)	05(2.45%)	11(5.3%)	-	15(7.35%)
August	53(25.9%)	02(0.9%)	21(10.29%)	-	32(15.68%)
September	47(23%)	05(2.45%)	30(14.7%)	07(3.43%)	10(4.90%)
October	17(8.3%)	02(0.98%)	13(6.37%)	01(0.49%)	03(1.47%)
November	11(5.3%)	-	03(1.47%)	03(1.47%)	05(2.45%)

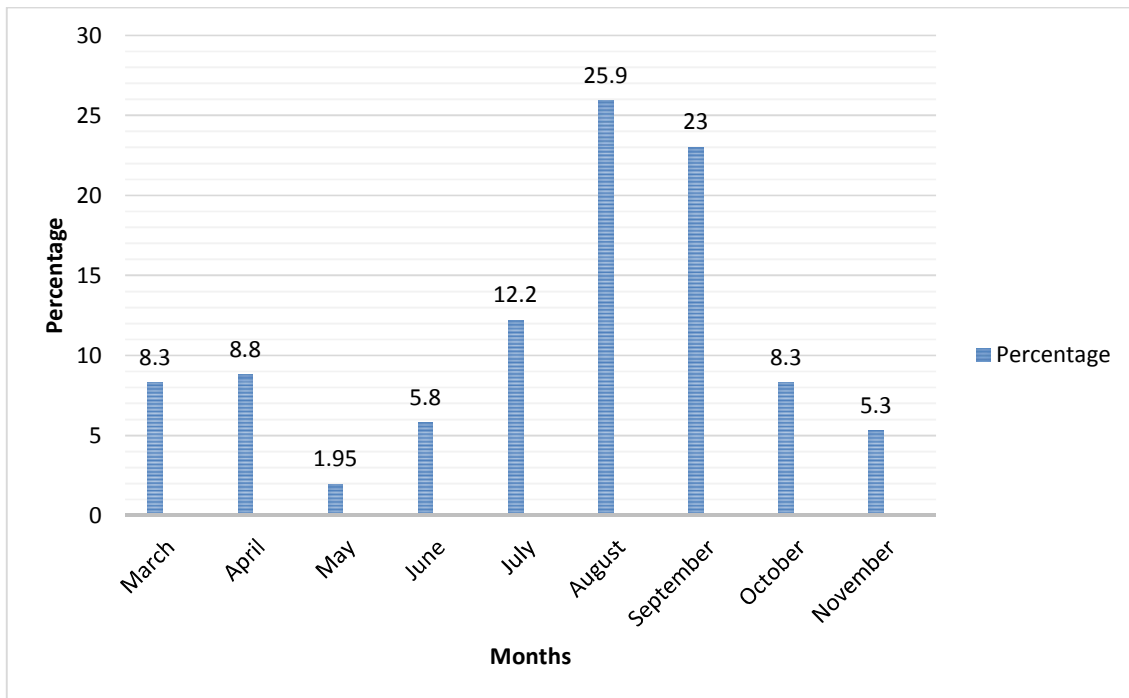


Fig. 1. Bar graph chart of seasonality variation in typhoid fever

Table 2. Age wise serological testing of *Salmonella typhi*

Age group (years)	No. % cases	Serological test for bacterial analysis		
		Immunological testing for <i>S. typhi</i>		Widal test
		IgG	IgM	
0-10	09(4.41%)	-	1(0.49%)	-
11-20	23(11.2%)	-	8(3.92%)	2(0.98%)
21-30	59(28.92%)	2(0.98%)	22(10.78%)	3(1.47%)
31-40	49(24%)	4(1.96%)	22(10.78%)	5(2.45%)
41-50	26(12.7%)	6(2.92%)	12(5.88%)	2(0.98%)
51-60	21(10.29%)	3(1.47%)	11(5.39%)	2(0.98%)
61-70	13(6.37%)	3(1.47%)	8(3.92%)	-
71-80	2(0.98%)	-	1(0.49%)	-
81-90	2(0.98%)	-	-	-
Total no. of cases	204			

4. DISCUSSION AND CONCLUSION

The above result, concluded that typhoid affects people of all the age groups and it is independent of the age. It has been seen that only one kind of species of *S. typhi* cause infection across India where there are three more species (*S. para typhi*, *S. typhimurium*, *S. bongori*) also present which didn't showed any clinical relevant in India [13]. There are various factors which are responsible for the highest prevalence of typhoid fever in the months of August and September [14]. According to the current study there were two factors which mainly contributed to the increased number of positive cases of *S. typhi*, firstly the arrival of rainy season which gave a favorable environment for the development of seasonal bacteria (*S. typhi*), virus (dengue virus), plasmodium species (malarial parasite) etc. The second factor was consumption of poor quality water as it was observed when we compared the population group with and without the facility of filtered water. Therefore, it could be concluded that drinking water conditions and sanitization played an inevitable role in preventing the spread of typhoid fever. The present study was limited up to 204 samples only; it might be possible that any future study with increment in samples may provide more fruitful results and prevail for better understanding for the prevalence of *S. typhi* among human population.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

The study was approved by ethical clearance body of organization, DNA Labs- A Centre for Applied Sciences, Dehradun, 248007-Uttarakhand, India. This study has maintained strict standards for protecting the privacy and confidentiality of respondents during sample collection and data processing.

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areas of Dehradun and also with respect to the processing of samples.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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