

Comparison of *Salmonella typhi* and Paratyphi A Occurrence in a Tertiary Care Hospital

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ABSTRACT

Background: Enteric fever is an important public health problem in many underdeveloped and developing countries. In India, though *Salmonella enterica* serotype Typhi remains the predominant *Salmonella* species causing enteric fever, isolation of *Salmonella enterica* serotype Paratyphi A is increasing. It occurs in all age groups and more common in summer season affecting mainly children.

Aims: To find out the isolation rate of *Salmonella typhi* and paratyphi A with reference to age, sex and seasonal variation attending a tertiary care hospital.

Material and Methods: A descriptive study was done on the *Salmonella* species isolated from blood cultures for 5 years. Data was collected regarding basic information like age, sex, different

months and years.

Results: A total of 292 *Salmonellae* species were included in the study during the period of 5 years. Out of 292 isolates of *Salmonellae*, 160 were *S. typhi* and 132 were *S. paratyphi A*. Both *Salmonella* species showed male preponderance in all age groups. *Salmonella typhi* and paratyphi A were highest in the age group 11 – 20 years followed by 21 – 30 years. Highest number of cases were isolated from July – September (123 cases) followed by October – December (81 cases).

Conclusion: Occurrence of *S. typhi* and paratyphi A are increasing which may be due to the improved diagnostics techniques or increased drug resistance. School going children and adolescents in our study were higher, requiring education classes.

Keywords: Enteric fever, *Salmonella paratyphi A*, *Salmonella typhi*

INTRODUCTION

Enteric fever is a cause of concern in many underdeveloped and developing countries as it is one among the public health issues [1]. Incidence and case fatality rate is low when compared to the developed countries [2]. Around 21 million cases with 700,000 deaths each year are seen globally primarily in South East Asia, Africa and Latin America attributed to rapid population growth and unplanned urbanization, inadequate and improper waste disposal, lack of potable water supply [1,3]. The source of infection are infected and healthy carriers. "Five Fs" (food, fingers, flies, fomites and faeces) play an important role in the spread of the disease [4]. Risk of infection have been modified due to the programmes such as improvement in the safety of water supplies and sanitary conditions [5].

Enteric fever is predominantly caused by *S. typhi* followed by *S. paratyphi A*. For every 10 cases of *Salmonella typhi* infection, there are one or two cases of paratyphoid fever, caused by the human-adapted *Salmonella enterica* serovars Paratyphi A, B and C. Since paratyphoid fever is indistinguishable from typhoid fever in its clinical course, *Salmonella enterica* serovars Typhi, Paratyphi A, B and C are collectively referred to as typhoidal *Salmonella* serovars [6]. *Salmonella enterica* serotype Typhi is endemic in all states. With periodic outbreaks of multidrug resistance, typhoid occurring in epidemic proportions thus posing a public health problem. Enteric fever is seen in all age groups and outbreaks are more common in summer season affecting mainly children [7,8]. Initiation of population-based typhoid fever incidence studies has improved the available typhoid fever incidence data [9,10]. Incidence rates of typhoid fever measured among age cohorts allows us to understand its age distribution and this can be extrapolated to the general population [10].

In India, the predominant *Salmonella* species causing enteric fever is *Salmonella enterica* serovar typhi followed by *Salmonella enterica* serotype Paratyphi A [11,12]. This study was done to find out the

isolation rate of *Salmonella typhi* and *Salmonella paratyphi A* with reference to age, sex and seasonal variation in patients attending the tertiary care hospital.

MATERIAL AND METHODS

A descriptive study was done on *Salmonella* species isolated from blood cultures in microbiology laboratory for 5 years duration from January 2006 to December 2010 in a tertiary care hospital in Karnataka, Southern India. Institutional Ethical committee clearance was obtained and consent of the patients was taken. Non-*Salmonella* species isolated from blood cultures and patients below one year of age were not included in the study. All blood cultures were performed by using fully automated Bact T Alert system (Biomérieux). The culture bottles after inoculating with patients blood were loaded in the chamber. Bottles were labeled with name, age, sex, time and date of collection with IP/OP and Laboratory number. The growth was indicated by flagging. The bottles which flagged were unloaded and subcultures were made on MacConkey agar and Wilson & Blair medium. Further identification was made by using standard biochemical tests and confirmed by agglutination with specific antisera [13]. Data was collected regarding basic information like age, sex, months, years and past medical history.

STATISTICAL ANALYSIS

Data was analyzed with the help of Microsoft excel 2007 and represented by using tables and graphs. Descriptive statistics like ratio and proportion were used to analyse the data and chi-square test was used to calculate the level of significance. A p-value <0.05 was considered as statistically significant.

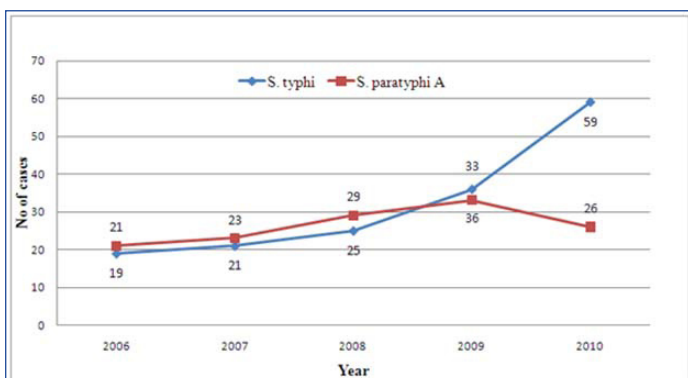
RESULTS

A total of 292 *Salmonella* species were isolated from 14706 blood cultures in the study during the period of 5 years. Out of 292 isolates of *Salmonella*, 160 were *S. typhi* and 132 were *S. paratyphi A*. Both *Salmonella* species showed male preponderance in all age groups

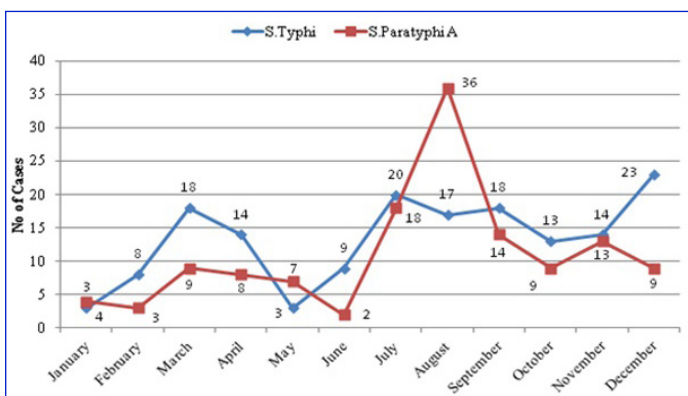
Sl. No.	Age group	No. of patients		Total (%)
		Male (%)	Female (%)	
1	1-10	31 (15.3)	25 (27.0)	56 (19.2)
2	11-20	89 (43.8)	32 (34.8)	121 (41.5)
3	21-30	74 (36.4)	28 (32.6)	102 (34.9)
4	30	9 (4.5)	4 (5.6)	13 (4.4)
Total		203 (100)	89 (100)	292 (100)

[Table/Fig-1]: Age and sex distribution of *Salmonella* isolates

Sl. No.	Age group	<i>Salmonella typhi</i> (%)	<i>Salmonella paratyphi A</i> (%)	Total (%)
1	1-10	30 (18.7)	26 (19.7)	56 (19.2)
2	11-20	67 (41.9)	54 (41.0)	121 (41.5)
3	21-30	56 (35.0)	46 (34.8)	102 (34.9)
4	30	07 (04.4)	06 (04.5)	13 (04.4)
Total		160 (100)	132 (100)	292 (100)

[Table/Fig-2]: Age distribution of *Salmonella typhi* and *Salmonella paratyphi A*[Table/Fig-3]: Year wise distribution of *Salmonella* isolates

Sl. No.	Month	<i>S. typhi</i> (%)	<i>S. paratyphi A</i> (%)	Total Number (%)
1	January - March	29 (18.1)	16 (12.1)	45 (15.4)
2	April - June	26 (16.3)	17 (12.9)	43 (14.8)
7	July - September	55 (34.3)	68 (51.5)	123 (42.1)
10	October - December	50 (31.3)	31 (23.5)	81 (27.7)
Total		160 (100)	132 (100)	292 (100)

[Table/Fig-4]: Seasonal distribution of *Salmonella* isolates[Table/Fig-5]: Monthly Distribution of *Salmonella* Isolates

[Table/Fig-1]. Male and female difference was statistically significant in the age group of 1-10 years. The age ranged from 1 year to 60 years. Two hundred seventy isolates were from patients within the first 3 decades 55, 120 and 103 cases in 1st, 2nd and 3rd decade respectively. Both *S. typhi* and *S. paratyphi A* were highest in the age group 11-20 years followed by 21-30 years [Table/Fig-2]. Age

group of above 30 years showed the lower number of cases of both *S. typhi* and *S. paratyphi A*. Annual chart showed gradual increase in the number of isolates of both *S. typhi* and *paratyphi A* from 2006 to 2010 [Table/Fig-3]. Isolation rate of *S. typhi* has increased from 19 in the year 2006 to 59 in the year 2010. Isolation rate of *S. paratyphi A* has increased from 21 in the year 2006 to 26 in the year 2010. *S. paratyphi A* has outnumbered *S. typhi* in the year 2006 to 2008. In this study highest number of cases were isolated from July-September (123 cases) followed by October-December (81 cases). In the months of July-September, the isolation of *S. paratyphi A* was more when compared to *S. typhi* which was statistically significant [Table/Fig-4]. August month had highest number of cases of *S. paratyphi A* (36 cases) and December month showed the highest number of cases of *S. typhi* (23 cases) [Table/Fig-5]. Lowest cases of *S. typhi* were seen in the month of January and May whereas lowest cases of *S. paratyphi A* were seen in the month of June followed by February.

DISCUSSION

Enteric fever is a public health concern in our country. Males were more infected than females with M: F ratio of 2.3:1. This might be due to our cultural background where male is more likely to report to hospital, at the same time more likely to contract infection due to more outdoor activities [14]. This correlates with the studies of SC Sood and PN Taneja [15] and SN Khosla et al., [16]. Majority (41.50%) of cases were in the age group between 11-20 years. The possible causes for enteric fever being common in this age group include their mobility, consumption of unhygienic food and water in schools and colleges. Health education plays an important role in this age group as illiteracy and low educational status is associated with ignorance, poverty and poor personal hygiene. These observations were consistent with various studies [14,17, 18]. Enteric fever cases have occurred throughout the year in our study which implies that safety of drinking water and sanitation have not improved much over the period or a large number of carriers are present in the society [19].

Salmonella paratyphi A cases ranged from 52.5% in 2006 to 30.6% in 2010 of the total *Salmonella* isolates which correlates with Tankiwale SS et al., [20] and Mendiratta DK et al., [21]. There was a dramatic rise in the number of *Salmonella paratyphi A* isolates from 2006 to 2009 in our study. The increase in proportion of *Salmonella paratyphi A* cases could possibly be due to high degree of clinical suspicion with mild fever cases being investigated for enteric fever, changing host susceptibility, change in virulence of the organism and widespread use of vaccines and quinolones against *Salmonella typhi* in the past decade [22]. Both the *Salmonella* isolates were more common in the later half of the year which correlates with the Umeh EU et al., study. Water is more likely to be polluted in the wet season because the rains may wash debris and littered garbage into wells and streams used as domestic sources of water [23].

CONCLUSION

Occurrence of *Salmonella typhi* and *Salmonella paratyphi A* is increasing which may be due to the improved diagnostics techniques or increased drug resistance. Majority of cases were seen in school going children and adolescents in our study who should be identified as high risk group. Health education of people and in cases of children, educational status of parents especially mothers should be increased through adult education classes. More number of cases were seen in rainy season which may be due to improper drainage and sanitation. The proportion of *Salmonella paratyphi A* and *Salmonella typhi* cases are almost equal which may be possibly due to high degree of clinical suspicion with mild fever cases being investigated for enteric fever, changing host susceptibility, change in virulence of the organism and widespread use of vaccines against *Salmonella typhi* in the past decade.

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