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Original Article

Risk Factors of Enteric Fever in Children — A Study in A Tertiary Care Hospital in Bangladesh

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ABSTRACT

Introduction: *Enteric fever, or typhoid fever, is a systemic infection mainly caused by Salmonella typhi and occasionally by Salmonella paratyphi A, B, and C. It is especially common in children in areas with poor sanitation and limited clean water. Identifying risk factors is essential for effective prevention and control. This study aimed to assess the risk factors of enteric fever in children.* ***Methods & Materials:*** *This case-control type of study was conducted in Department of Paediatrics, Mymensingh Medical College Hospital, Mymensingh, Bangladesh from January, 2023 to June, 2023. In the case group, 59 children with enteric fever were enrolled using purposive sampling. The control group included 59 age-matched healthy children. Data were analyzed using SPSS version 23.0.* ***Results:*** *The study found significant differences between case and control groups in several areas. A higher percentage of cases (61%) were aged 5-10 years compared to controls (24%). Rural residence (17% vs. 12%), use of supply water (20% vs. 17%), crowded living conditions (32% vs. 14%), and poor sanitation habits (7% vs. 5% using hanging toilets, and 2% vs. 3% practicing open defecation) were more common among cases. Monthly family income and raw food consumption habits did not show significant differences.* ***Conclusion:*** *Age range of 5 to 20 years, rural residence, use of supply water, crowded living conditions, and poor sanitation habits are the risk factors risk factors of enteric fever.*

Keywords: *Risk Factors, Enteric Fever, Typhoid Fever, Widal Test, Poor Sanitation, Salmonella Infection*

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INTRODUCTION

Typhoid fever, also known as enteric fever, is a bacterial infection. It is a systemic illness characterized by fever, headache, malaise, abdominal pain, and gastrointestinal symptoms such as diarrhea or constipation. It is typically transmitted through ingestion of contaminated food or water that has been tainted with feces from an infected individual. Poor sanitation and inadequate hygiene practices contribute to the spread of the disease. Typhoid fever, caused by Salmonella typhi and related serotypes paratyphi A, B, and C, is a significant infectious disease[1]. It poses a substantial burden of morbidity and mortality, particularly in developing countries, and is associated with multiple antibiotic resistance[2]. Salmonella typhi and paratyphi A, B, and C are prevalent in regions with inadequate water supply and sanitation infrastructure[3]. While these serotypes have been nearly eradicated in developed nations due to advanced sewage and water treatment systems, they continue to be a significant cause of morbidity and mortality globally. Annually, they are responsible for an estimated 16.6 million new infections and 600,000 deaths[4]. The primary symptoms of the illness encompass malaise, fever, vomiting, constipation, splenomegaly, and hepatomegaly[5]. Research conducted by Mike and colleagues in 2008 suggests that this condition is linked to impoverished socio-economic conditions and inadequate hygiene practices, as humans serve as the sole natural hosts of the infection, thriving optimally at the human body's temperature of 37°C. The disease spreads through the fecal-oral route, typically via contaminated food or water[6]. The Widal test has been widely utilized for the serodiagnosis of enteric fever and continues to be the most accessible diagnostic tool in many developing nations, including Bangladesh[7]. Typhoid fever can lead to significant complications such as internal hemorrhage and perforation[8]. Without effective treatment, the disease carries a fatality rate ranging from 10 to 30%[9]. Typhoid fever poses a significant threat to numerous tropical countries, with a global estimate of approximately 212 million cases and 129,000 deaths annually, with children and young adults being particularly vulnerable[9]. The objective of this study was to assess the risk factors of enteric fever in children.

METHODS & MATERIALS

This was a case-control type of study that was conducted in Department of Paediatrics, Mymensingh Medical College Hospital, Mymensingh, Bangladesh from January, 2023 to June, 2023. A total of 118 children were enrolled in this study, divided into two groups: 59 children with typhoid fever (case group) and 59 age-matched healthy children (control group). Noted. Initially, we enrolled 60 patients in the case group. However, when one patient dropped out, we finally selected 59 participants for the case group and matched the number of participants in the control group accordingly. The case group included children with a first infection by Widal test from a specific locality, while the control group included children from the same locality

and neighbors of the patients. Data were collected on age, gender, educational status, family size, duration of fever, family income, typhoid history, water intake, school attendance, hand washing habits, eating habits, toilet facilities, sanitation conditions, medical facilities, and attitudes towards health centers. A purposive sampling technique was used for sample selection. Proper consent was obtained from all participants before data collection. Inclusion criteria required participants to be between 6 months and 12 years old and from selected areas. Exclusion criteria ruled out patients with other severe diseases. Demographic and clinical information was recorded. Data were analyzed using MS Office and SPSS version 23.0. Regression analysis was done to compare data. A *p*-value <0.05 was considered significant in statistical analyses.

RESULT

In our case group, 24% of participants were under 5 years old, 61% were between 5 and 10 years old, and 15% were older than 10 years. In contrast, our control group had 64% of participants under 5 years old, 24% between 5 and 10 years old, and 22% older than 10 years (**Table I**).

Table – I: Age Distribution of Participants

Age (Year)	Case		Control	
	n	**%**	***n***	**%**
<5	14	24	38	64
5-10	36	61	14	24
>10	9	15	7	22
Total	59	100	59	100

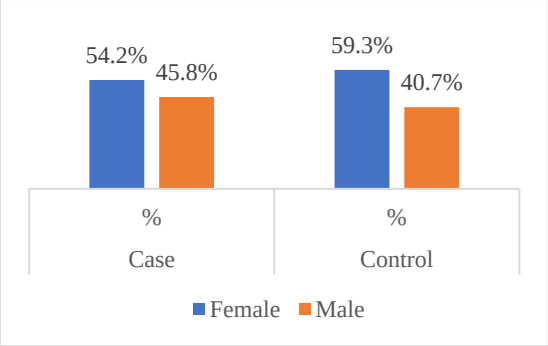

Figure – 1: Gender Distribution

In both the cases and control groups, most of the participants were female (**Table II**). In our study, the monthly family income was 10-20 thousand BDT for 47% of participants in the case group and 56% in the control group.

Table – II: Monthly Family Income

BDT	Case		Control	
	n	**%**	***n***	**%**
<10 thousand	17	29	12	20
10-20 thousand	28	47%	33	56
>20 thousand	14	24	14	24

The distribution of residence locations among participants showed that 83% of the case group and 88% of the control group resided in urban areas, while 17% of the case group and 12% of the control group resided in rural areas (**Table III**).

Table – III: Residence Location

Location	Case		Control	
	n	**%**	***n***	**%**
Urban	49	83	52	88
Rural	10	17	7	12

In the case group, 20% of participants consumed supply water, compared to 17% in the control group (**Table IV**).

Table – IV: Water Consumption

Water Type	Case		Control	
	n	**%**	***n***	**%**
Boiled water	10	17	10	17
Tube well	37	63	39	66
Supply water	12	20	10	17

The living habits of participants revealed that 32% of the case group and 14% of the control group lived in crowded conditions (**Table V**).

Table V: Living Condition

Habit	Case		Control	
	n	**%**	***n***	**%**
Neat	40	68	51	86
Crowdie	19	32	8	14

The habit of sanitation uses among participants showed that 92% of both case and control groups used sanitary facilities. Hanging sanitation was used by 7% of the case group and 5% of the control group, while open sanitation was used by 2% of the case group and 3% of the control group (**Table VI**).

Table – VI: Habit of Sanitation Uses

Sanitation	Case		Control	
	n	**%**	***n***	**%**
Sanitary	54	92	54	92
Hanging	4	7	3	5
Open	1	2	2	3

The habit of raw food intake among participants showed that 7% of the case group and 5% of the control group consumed raw food, while 93% of the case group and 95% of the control group did not consume raw food (**Table VII**).

Table VII: Habit of Raw Food Intake

Food Habits	Case		Control	
	n	**%**	***n***	**%**
Raw food	4	7	3	5
No raw food	55	93	56	95

As per the risk factor analysis, gender distribution was similar between the two groups p=0.5774 (**TYable VIII**). Age distribution showed a significant difference (p=0.027), with 24% of cases and 64% of controls being under 5 years old and 61% of cases and 24% of controls aged 5-10 years. Monthly family income distribution was not significantly different (p=0.185). Residence location showed a significant difference (p=0.041), with 73% of cases and 88% of controls residing in urban areas. Water consumption patterns also differed significantly (p=0.042), with 20% of cases and 17% of controls using supply water. Living habits showed a significant difference (p=0.019), with 32% of cases and 14% of controls living in crowded conditions. Sanitation habits also differed significantly (p=0.021), with 7% of cases and 5% of controls using hanging toilets, and 2% of cases and 3% of controls practicing open defecation. Raw food-taking habits were not significantly different (p=0.698)

Table – VIII: Risk Factor Analysis

Variables	Case		Control		*p*-value
	n	%	*n*	%	
Gender					
Male	27	46	24	41	0.5774
Female	32	54	35	59	
Age (Year)					
<5	14	24	38	64	0.027
5-10	36	61	14	24	
>10	9	15	7	12	
Monthly family income (Thousand BDT)					
<10	17	29	12	20	0.185
10-20	28	47	33	56	
>20	14	24	14	24	
Residence location					
Urban	43	73	52	88	0.041
Rural	16	27	7	12	
Water consumption					
Boiled	10	17	10	17	0.042
Tube well	37	63	39	66	
Supply	12	20	10	17	
Habit					
Neat	40	68	51	86	0.019
Crowdie	19	32	8	14	
Sanitation					
Sanitary	54	92	54	92	0.021
Hanging	4	7	3	5	
Open	1	2	2	3	
Raw food-taking habits					
Yes	4	7	3	5	0.698
No	55	93	56	95	

DISCUSSION

In this study, a higher proportion of children aged between 5 and 10 years were noted in the case group. Similar observations were reported in a study by another researcher[10]. Regarding monthly family income, our study found that 47% of participants in the case group and 56% in the control group had incomes ranging from 10,000 to 20,000 BDT. Research by Vollaard suggests that households in the lower-income category have a higher prevalence of typhoid infection[11]. ***Ram et al. (2007)*** also identified socioeconomic status as a significant risk factor associated with the occurrence of typhoid fever[12]. In our investigation, a predominance of

female participants was observed in both the case and control groups. Additionally, the majority of participants from both groups resided in urban areas, with a higher proportion observed in the control group compared to the case group. Conversely, rural residence was more common among participants in the case group compared to those in the control group. These findings align with those reported in other studies[13,14]. In our analysis of water consumption, we found that 20% of participants in the case group consumed supply water, compared to 17% in the control group. Interestingly, in a separate study, respondents reported different sources of water consumption, with 62.5% obtaining water from pipe-borne sources, while rivers, wells, and other sources accounted for 13.3%, 22.5%, and 10.7%, respectively[14]. As a short-term strategy, the World Health Organization (WHO) recommends typhoid fever vaccination in high-risk areas, which, in conjunction with water and sanitation interventions, can synergistically reduce the incidence of typhoid fever[15]. In our risk factor analysis, we found that a higher percentage of cases were aged between 5 and 10 years compared to controls. Furthermore, cases were more likely to reside in rural areas (17% vs. 12%), rely on supply water (20% vs. 17%), live in crowded conditions (32% vs. 14%), and exhibit poor sanitation practices. These findings are consistent with those reported in previous studies[10,14].

Limitation of the Study

This study was conducted at a single center and involved a relatively small sample size. Additionally, the duration of the study was short. Therefore, it is important to acknowledge that the findings of this study may not fully represent the overall situation of the entire country.

Conclusion

Among the risk factors associated with enteric fever are the age range of 5 to 20 years, residing in rural areas, reliance on contaminated water sources for drinking or domestic use, crowded living conditions, and poor sanitation practices. These factors contribute to the transmission of Salmonella typhi and Salmonella paratyphi, the bacteria responsible for enteric fever, by facilitating the fecal-oral route of transmission. Individuals living in environments characterized by these risk factors are more likely to contract the disease, highlighting the importance of implementing public health interventions aimed at improving water sanitation, hygiene practices, and living conditions in affected communities.

Conflict of Interest

The authors declare no conflict of interest.

Ethical Approval

The study was approved by the Institutional Ethics Committee.

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