IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 8 Ser. 2 (August. 2019), PP 30-34
www.iosrjournals.org

"Risk Factors of Enteric Fever in Children: A Study in A Tertiary Care Hospital, Nilphamari, Bangladesh"

Dr. Mohammad Enamul Haque[1], Dr. Dilip Kumar Roy[2], Md.Jahidur Rahman[3], Dr. Al Amin Mridha[4]

[1]*Senior Consultant, Dept. of Paediatrics, Adhunik Sadar Hospital, Nilphamari, Nilphamari, Bangladesh.*
[2]*Junior Consultant, Dept. of Paediatrics, Adhunik Sadar Hospital, Nilphamari, Nilphamari, Bangladesh.*
[3] *Professor& Head, Department of Paediatrics, Rangpur Medical College Hospital, Rangpur, Bangladesh.*
[4]*Professor&Head, Department of Paediatrics, Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh.*
Corresponding Author: Dr. Mohammad Enamul Haque

Abstract: *Enteric fever caused by Salmonella enterica serotype typhi and Paratyphi A and B, is endemic in the Indian sub-continent including Bangladesh, South-east and Far-east Asia, Africa and South Central America. The disease can occur in all age group with highest incidence among children. The name of enteric was given by Louis (1829) to distinguish it from typhus fever. Budd (1856) pointed out that the disease was transmitted through the excreta of patients. Elberth (1880) described the typhoid bacillus, and Gaffky (1884) isolated it in pure culture. Its causative role was confirmed by Metchnikoff and Bessedka (1900) by infecting experimentally.A case-control type of study was conducted during the period from January 2018 to December 2018in the Department of Paediatrics of Adhunik Sadar Hospital, Nilphamari, Bangladesh to assess the risk factors of enteric fever in children. We select two hundred (200) samples maintaininginclusion criteria. Samples were divided into two groups: Group I case and Group II control. In case group there were 100 and 100 were in control group. The control respondents were near about same aged child but not suffered from enteric fever, collected from surrounded households near the hospital. The Mean ± SD of age were (5.20 ± 3.01) for cases and (3.60 ± 2.48) for controls Age distribution of the children was statistically significant where p - value was 0.0001 for t-test and 0.011490 for chi-square ($p<0.05$). Most of the children were urban dwellers 83% cases and 87% controls. The difference was statistically significant ($\chi2 = 4.028$, $p = 0.0387$) In case of drinking water we found 28.0% of cases drunk supply water in comparison with 19% of controls. There was positive association of drinking supply water with typhoid fever (RR=2.5882 and OR=3.4967 and $\chi2 =11.92$; p-value = 0.0012). Crowdie habitat was reported by 29% of cases and 19% of controls. There may be strong association of crowdie condition of habitat with typhoid fever (RR = 3.5289; OR = 5.2004 and $\chi2 = 20.21$; $p =0.0001$). Widal test result was positive in 79% of cases; the remaining 31% were found to be Widal negative. The difference was statistically significant ($\chi2 = 17.28$, $p =0.0001$).*

Key words: *Enteric fever, Endemic, Salmonella Enterica serotype typhi, Paratyphi A and B*

Date of Submission: 19-07-2019 Date of acceptance: 05-08-2019

I. Introduction

Salmonella enterica serotype typhi and paratyphi A, B and C, occurs in all parts of the world where there is substandard water supply and sanitation.[1] It has almost been eliminated from developed countries because of sewage and water treatment facilities but remains a common disease and a major cause of morbidity and mortality worldwide, causing an estimated 16.6 million new infections and 600,000 deaths each year[2]. It is endemic in the Indian subcontinent including Bangladesh, South-east and Far-east Asia, Africa and South Central America. The disease can occur in all age group with highest incidence among children[3]. The annual incidence of enteric fever has been reported as more than 13 million cases in Asia[4]. Exposure of the individual to contaminated food or water closely correlate with the risk for enteric fever[5,6].Enteric fever is a febrile illness of prolonged duration marked by step-ladder pattern of fever, diffuse abdominal pain, frontal headache, delirium, splenomegaly, hepatomegaly and many other systemic manifestations due to bacteremia and septicemia. However, with indiscriminate use of antibiotics multidrug resistant strains of Salmonella typhi are emerging with changing clinical pattern posing problem in diagnosis7.Widal serological diagnosis test for enteric fever was founded in 1896 by Georges

Fernand Isidore Widal[8].It is an agglutination reaction demonstrating the presence of lipopolysaccharide (LPS) somatic (O) and flagella (H) agglutinins to Salmonella typhi in the serum of a patient using suspensions of O and H antigens[9]. Commercial kits are available for antigens of Salmonella paratyphi A, B and C. The

recommended method of performing the widal test is by the tube agglutination technique were serial two-fold dilutions of the subject's serum from 1:20 to 1:1280 are tested[10]. Now a days a rapid slide test is most commonly used technique in local laboratories and hospitals because of its convenience. Widal test is easy, inexpensive and relatively non-invasive. The widal test has been used extensively in the serodiagnosis of enteric fever and so remains the only practical test available in most developing countries[11], including Bangladesh.The definitive diagnosis of enteric fever requires the isolation of Salmonella typhi or paratyphi from the blood, feces, urine or other body fluids. Enteric fever is endemic in Bangladesh, where there is a high incidence in children[12]. Enteric fever continues to be a major health problem in Bangladesh. Many children with enteric fever are treated at outpatient department as well as inpatient department of the hospital. According to a lot of studies we selected some socio-economic as well as demographic factors to measure the risk of enteric fiver. Such as, age, living area, water intake, sanitation, food habit, family income, education etc. were considered as the pre determiners for the study.

II. Objectives

General objective:
To evaluate the risk factors of enteric fever in childrenin Bangladesh

Specific objectives:
To assess the socio-demographic factors associated with enteric fever in childrenin Bangladesh

III. Material and Methods

A case-control type of study was conducted during the period from January 2018 to December 2018 in the Department of Paediatrics of Adhunik Sadar Hospital, Nilphamari, Bangladesh to assess the risk factors of enteric fever in children. In case group there were 100 participants and in control group there were another 100 participants. A pre-defined detailed questionnaire was devised. The included components were: age, gender, educational status of respondent, family size, duration of fever, monthly income of the respective family, typhoid history, water intake, school going/not, hand washing before eating, eating habits, toilet facility type, sanitation condition, medical facilities and attitude towards health center. Data was particularly scrutinized before the entry. Diagnosis was performed based upon examination, medical history, and positive widal test. Enteric fever was taken as dependent variable and its categories were "present" and "absent". Maximum variables were recorded as numeric and some as status name. All the data were collected and recorded systematically in a questionnaire and were analyzed using computer software SPSS (Statistical Package for Social Sciences). Data were presented in the form tables and graphs. Quantitive data were presented with descriptive statistics and bivariate analysis. The level of significance of 0.05 was used for this study.There were some inclusion and exclusion criteria. For inclusion in case group we considered the age of the patients within 6 months to 12 years, first infection and only from selected locality. Patients with other severe diseases were excluded from the study. In case of control group we included patients from selective locality as well and neighbor of the patients.

IV. Results

It was a case-controlstudy was conducted during the period from January 2018 to December 2018 in the Department of Paediatrics of Adhunik Sadar Hospital,Nilphamari, Bangladesh to assess the risk factors of enteric fever in children. In case group there were 100 participants and in control group there were another 100 participants. The most of the caregiver of the children were female, 74% in cases and 55% in controls. $\chi2 = 3.0574$, df = 1, p-value = 0.07750; which means there were not any association between different gender groups. Mean ± SD of age were (5.2004 ± 2.903) for cases group and for controls group (4.1072 ± 3.1028). The p-value was 0.0001 for t-test and 0.01037 for chi-square, which was significant. In both groups female number is dominating. In cases group 74% and controls group 55% were female. The ratio in male-female distribution between the groups was statistically significant ($\chi2 = 4.284$, df = 1; p-value = 0.03847271) ($p<0.05$). So it was clear that there is an association between female gender and typhoid fever. In this study we found low incoming family was more in cases 29% than controls 19%. Mean ± SD of monthly income was (16,480 ± 9,005) in cases and (17,250 ± 7,122) in controls. There was no association between the groups ($\chi2 = 3.433$, df = 2, p-value = 0.1521). We found, 83% of cases and 87% of controls respondents lived in urban areas. This variable was found statistically significant because, here we got $\chi2 = 4.028$, p = 0.0387. In case of drinking water we found 28% of cases and 19% of controls used to drink supply water. There was positive association of drinking supply water with typhoid fever (RR=2.6281and OR=3.4936 and $\chi2 = 11.92$; p-value = 0.0012). Crowdie habitat was reported by 29% of Cases and 19% of Controls. There may be strong association of crowdie condition of habitat with typhoid fever (RR = 3.5463; OR = 5.1269 and $\chi2 = 20.21$; $p < 0.0001$). In this study we found a few number of patients who used non sanitary latrines and a little number patients who used to eat raw foods. The

picture of both groups was near about same. So we had to deduct those two issues from our consideration in our statistical analysis. Widal test result was positive in 82% of cases; the remaining 18% negative in case group and all 100.0% of the control group were found Widal negative. The difference of Widal test result between the groups was statistically significant $\chi 2 = 17.92$, df = 1; p-value <.0001. ($p < 0.05$)..

Table 1: Socio-economic and demographic variables of respondents (n=200)

Respondents	Case (%)	Control (%)	χ2	P-value
Gender			3.0574	0.07750
Male	26	45		
Female	74	55		
Age of the children			4.0072 (t-test)	0.0001
≤ 5	59	66		
5-10	26	22		
>10	15	12		
Monthly income in BDT			3.433	0.702
≤ 10,000	29	19		
10,000-20,000	49	56		
> 20,000	22	25		
Area of Residence			4.028	0.0387
Urban	83	87		
Rural	17	13		
Water consumption			11.92	0.0012
Boiled water	12	10		
Tube well	60	71		
Supply water	28	19		
Habit			20.21	0.0001
Neat	71	81		
Crowdie	29	19		
Sanitation			NA	NA
Sanitary	91	91		
Hanging	6	5		
Open	3	4		
Food Habits			NA	NA
Raw food	6	5		
No raw food	94	95		

Figure-1: Distribution of Age among respondents (n=200)

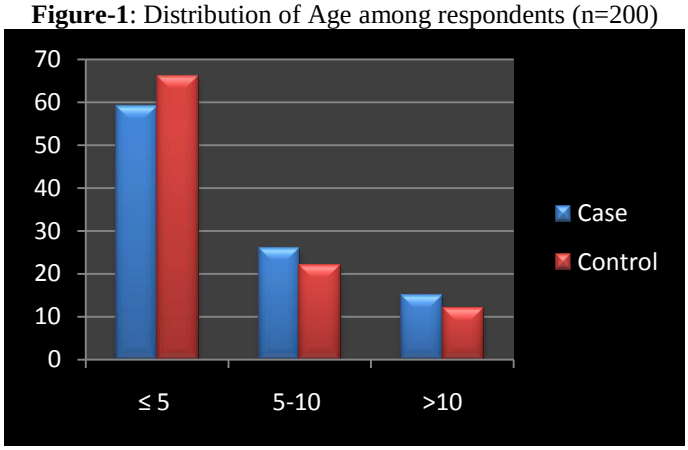

Table II: Laboratory findings of all study participants (n=200)

Lab. Test	Cases(n=100)	Controls(n=100)	St. analysis
Widal Test			$\chi 2$ =17.92, df= 1 & p=0.0001
Positive	82	0	
Negative	18	100	

V. Discussion

It was a case-control study was conducted during the period from January 2018 to December 2018 in the Department of Paediatrics of Adhunik Sadar Hospital, Nilphamari, Bangladesh to assess the risk factors of enteric fever in children. Total number of respondents was 200. In case group there were 100 participants and in control group there were another 100 participants. The name of enteric was given by Louis (1829) to distinguish it from typhus fever. Budd (1856) pointed out that the disease was transmitted through the excreta of patients. Elberth (1880) described the typhoid bacillus, and Gaffky (1884) isolated it in pure culture. Its causative role was confirmed by Metchnikoff and Bessedka (1900) by infecting experimentally. The widal test has been used extensively in the serodiagnosis of enteric fever and so remains the only practical test available in most developing countries, including Bangladesh. The definitive diagnosis of enteric fever requires the isolation of Salmonella typhi or paratyphi from the blood, feces, urine or other body fluids. . Bacteria can be isolated from blood in 73-97% of cases before antibiotic use[13]. But in our country bacteria can be isolated from blood is only 40-60% of the cases. In age distributions of both groups we found in the ≤ 5 years age group; 59% of cases group and 66% of controls group were in the age group. Mean ± SD of age were (5.2004 ± 2.903) for cases group and for controls group (4.1072 ± 3.1028). The p-value was 0.0001 for t-test and 0.01037 for chi-square, which was significant. In both groups female number is dominating. In cases group 74% and controls group 55% were female. The ratio in male-female distribution between the groups was statistically significant ($\chi 2 = 4.284$, df = 1; p-value = 0.03847271) ($p<0.05$). So it was clear that there is an association between female gender and typhoid fever. We found, 83% of cases and 87% of controls respondents lived in urban areas. This variable was found statistically significant because, here we got $\chi 2 = 4.028$, $p = 0.0387$. In case of drinking water we found 28% of cases and 19% of controls used to drink supply water. There was positive association of drinking supply water with typhoid fever (RR=2.6281and OR=3.4936 and $\chi 2$ =11.92; p-value = 0.0012). Crowdie habitat was reported by 29% of cases and 19% of controls. There may be strong association of crowdie condition of habitat with typhoid fever (RR = 3.5463; OR = 5.1269 and $\chi 2 = 20.21$; $p < 0.0001$). Widal test result was positive in 82% of cases; the remaining 18% negative in case group and all 100.0% of the control group were found Widal negative. The difference of Widal test result between the groups was statistically significant $\chi 2 = 17.92$, df = 1; p-value <.0001. ($p < 0.05$). Considering all those factors we can say, enteric fever has some association with the age, living slandered, drinking water, sex and food habit.

Limitations of the study

This study was conducted in a tertiary care hospital in Nilphamari district of Bangladesh. So thefindings of such a single centered study may not reflect the exact scenario of all around the country regarding enteric fever.

VI. Conclusion and Recommendations

Enteric fever is associated with many socio-economic and demographic factors. This study had been conducted on only children. There may have a lot of limitations. To acquire verse knowledge about the risk factors associated to enteric fever in all aged group of patients we should arrange a lot of interventions and studies on the same topics in several places for several groups of patients.

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Dr. Mohammad Enamul Haque. "Risk Factors of Enteric Fever in Children: A Study In A Tertiary Care Hospital, Nilphamari, Bangladesh". IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 8, 2019, pp 30-34.