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Original Article

Assessment of Hematological Profile of Patients with Enteric Fever - An Observational Study

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ABSTRACT

Introduction: *Enteric fever, also known as typhoid fever, is a contagious illness that affects the entire body. Haemoglobin, a crucial component of red blood cells necessary for oxygen transmission, is frequently impacted by enteric fever. Through an observational approach, the current study sought to identify the haematological profile of individuals with enteric fever.* ***Methods and materials:*** *This observational cross-sectional study was conducted at the Department of Medicine, Bangladesh Medical College, Hospital, Dhaka, Bangladesh. The study duration was 3 months from June 2022 to August 2022.* ***Result:*** *Among the study population (N=50), most of them 56.00% were 18 to 29 years old. About half of the study population 52.00% were male. The majority of the study population 52.00% were students. Eighteen 36.00% were married. Most of the study population 86.00% came from urban areas. Among the respondents, six 12.00% had diabetes, and four 8.00% had bronchial asthma. The mean duration of fever reported by the respondents was approximately 6.98 days. Based on CBC findings, the mean hemoglobin, RBC was 13.14, 4.79 respectively. Based on White Blood Cell Variables, the mean total WBC (10^9/L), neutrophil, and lymphocytes, were 6.75, 71.33, and 23.67*

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respectively. ***Conclusion:*** *The study found that enteric fever can have a considerable impact on haematological markers. Salmonella Typhi's entry into the bloodstream triggers an inflammatory reaction that changes several haematological markers. Monitoring haemoglobin levels can aid in assessing the condition's severity and guiding the most effective therapeutic modalities.*

Keywords: *Enteric fever, Hemoglobin, Blood cells*

INTRODUCTION

Enteric fever, also known as typhoid fever, is a systemic infectious disease caused by the bacterium Salmonella enterica serotype Typhi [1]. In many regions of the world with poor sanitation and insufficient access to clean water, enteric fever is a prospectively, multisystemic illness that has been considered a public health concern, mostly in developing nations [2]. High fever, headache, stomach pain, and digestive issues are some of the signs and symptoms of enteric fever. While clinical signs and blood cultures are the mainstays of enteric fever diagnosis, haematological profiles of patients can provide insight into the disease's aetiology and help with patient management [3]. The host's immunological response to the Salmonella Typhi infection has the greatest impact on haematological alterations during enteric fever. Salmonella Typhi's entry into the bloodstream causes a systemic inflammatory response that changes many haematological parameters [4]. The prevalence of highly contagious enteric fever is around 252 per 100,000 people yearly in Bangladesh [5]. South-central Asia and Southeast Asia have the highest prevalence of enteric fever. However major pandemic occurs in sub-Saharan Africa [6]. Typhoid fever is thought to cause between 11 and 21 million cases worldwide every year, along with 200,000 fatalities. Each year, there are reportedly 5 million instances of paratyphoid fever worldwide [7]. Enteric fever frequently affects haemoglobin, an important constituent of red blood cells needed for oxygen transfer. Anaemia may occasionally develop from the infection-induced inflammatory response's reduction of haemoglobin levels [8]. In determining the severity of the illness and directing the most suitable therapeutic interventions, it can be helpful to comprehend the scope and nature of haemoglobin alterations. The white blood cell count plays a vital role in the immune response against infections. The WBC count can exhibit major variations, reflecting the activation of the immune system in response to the Salmonella Typhi bacteria during enteric fever. Monitoring the WBC count can help determine the infection's severity and patients' response to the treatment [9,10]. During enteric fever, platelets which are important for blood coagulation and hemostasis can also be affected. Patients with enteric fever frequently have thrombocytopenia, a haematological condition considered a low platelet count. It is essential to measure the severity and extent of thrombocytopenia because it can develop a patient's tendency to bleed and influence the clinical management of patients [11,12]. This present study aimed to determine the haematological profile of enteric fever patients through an observational approach.

OBJECTIVE

General Objective

- To determine the hematological profile of enteric fever patients through an observational approach

METHODS AND MATERIALS

This observational cross-sectional study was conducted at the Department of Medicine, Bangladesh Medical College, Hospital, Dhaka, Bangladesh. The study duration was 3 months from June 2022 to August 2022. A total of 50 patients (N=50) were enrolled in this study following the inclusive criteria. A complete blood culture was needed for every patient. Blood test was done sincerely. Data were collected using the predesigned semi-structured questionnaire. Verbal consent was taken before recruiting the study population. Ethical clearance was taken from the hospital. All observations were noted in the clinical data sheet. The information was kept confidential only to be used for the study purpose.

Data analysis:

The study coordinators performed random checks to verify data collection processes. Completed data forms were reviewed, edited, and processed for computer data entry. Frequencies, percentages were used for descriptive analysis. The data analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 25.0. The significance level of 0.05 was considered for all tests.

Inclusion Criteria

- Patients who had given consent to participate in the study.

Exclusion Criteria

- Mentally ill.
- Unable to answer the criteria question.
- Exclude those affected with other chronic diseases.

RESULTS

Among the study population (N=50), most of them 56.00% were 18 to 29 years old, and eight 16.00% were less than 18 years old. About half of the study population (26,52.00%) were male. The majority of the study population 52.00% was students. Eighteen 36.00% were married and thirty-two 64.00% were unmarried. Most of the study population 86.00% came from urban areas. The majority of respondents 52.00% preferred home-cooked meals. A smaller percentage 18.00% preferred food from stalls, while fifteen 30.00% enjoyed both home-cooked meals and food from stalls (**Table I**).

Table I: Distribution of the study population based on Sociodemographic Characteristics (N=50)

Variables	Frequency	Percentage
Age Range		
<18	8	16.00%
18-29	28	56.00%
30-39	7	14.00%
40-49	2	4.00%
50-59	3	6.00%
60-69	2	4.00%
Gender		
Male	26	52.00%
Female	24	48.00%
Occupation		
Govt. Employee	2	4.00%
Retired	2	4.00%
Self Employed	3	6.00%
Businessmen	4	8.00%
Home maker	7	14.00%
Other	7	14.00%
Student	26	52.00%
Marital Status		
Married	18	36.00%
Unmarried	32	64.00%
Residence		
Urban	43	86.00%
Rural	7	14.00%
Food Habit		
Home cooked	26	52.00%
Food stalls	9	18.00%
Both	15	30.00%

Among the respondents, six 12.00% had diabetes, two 4.00% had hypertension, four 8.00% had bronchial asthma, two 4.00% had epilepsy, and three 6.00% had hypothyroidism. The majority of the respondents 78.00% do not have any of these comorbidities (**Table II**).

Table II: Distribution of the study population based on Comorbidities (N=50)

Comorbidities	Frequency	Percentage
Diabetes	6	12.00%
Hypertension	2	4.00%
Bronchial Asthma	4	8.00%
Epilepsy	2	4.00%
Hypothyroidism	3	6.00%
None	39	78.00%

The majority of respondents 56.00% reported a fever duration of less than 7 days, while nineteen 38.00% experienced a fever for 7-14 days, and three 6.00% had a fever lasting 15-21 days. The mean duration of fever reported by the respondents was approximately 6.98 days. The mean duration until temperature fall was approximately 2.34 days (**Table III**).

Table III: Distribution of the study population based on Duration of fever (N=50)

Duration of fever	Duration of fever	Duration of fever
<7 days	28	56.00%
7-14 days	19	38.00%
15-21 days	3	6.00%
Mean ± SD fever duration	6.98 ± 4.16	
Mean ± SD duration till temperature fall	2.34 ± 1.44	
Mean ± SD fever duration	4.63 ± 5.2	

Based on CBC findings, mean haemoglobin, RBC, corpuscular volume, corpuscular haemoglobin, and corpuscular haemoglobin concentration were 13.14, 4.79, 77.91, 28.85, and 31.94 respectively (**Table IV**).

Table IV: Distribution of the study population based on CBC Findings (N=50)

CBC Findings	Mean	± SD
Hemoglobin (gm/dL)	13.14	4.46
RBC (10^12/L)	4.79	0.73
Corpuscular volume (fl)	77.91	8.04
Corpuscular Hemoglobin (MCH) (pg)	28.85	3.95
Corpuscular hemoglobin concentration (MCHC) (%)	31.94	4.22

Based on White Blood Cell Variables, mean total WBC (10^9/L), neutrophil, lymphocytes, platelet count, and ESR were 6.75, 71.33, 23.67, 197.04, 31.22 respectively (**Table V)**.

Table V: Distribution of the study population based on White Blood Cell Variables (N=50)

White Blood Cell Variables	Mean	± SD
Total WBC (10^9/L)	6.75	2.25
Neutrophil (%)	71.33	8.03
Lymphocytes (%)	23.67	7.89
Platelet Count	197.04	67.82
ESR (mm)	31.22	20.38

DISCUSSION

Salmonella Typhi (S. Typhi) is the causative agent of enteric /typhoid fever, a dangerous systemic infection that is spread through faces and oral fluids and is directly linked to improper sanitation and poor food handling practices.

The majority of the study population (56.00%) was within the age group of 18 to 29 years. This finding aligned with a related study which reported a higher incidence of enteric fever among young adults. Numerous variables, such as greater exposure to contaminated food or water sources and lifestyle choices that facilitated Salmonella Typhi transmission, may contribute to this age group's heightened susceptibility [13]. It was noted that a significant proportion (16.00%) of the study population consisted of individuals under the age of 18. A study emphasized the impact of enteric fever on children and the need for targeted prevention strategies in this vulnerable

group [14]. A study carried out in Malaysia found that individuals aged 21 to 30 were mostly affected by this contamination fever [15]. Regarding gender distribution, the study found that 52.00% of the study population were male. This observation is consistent with previous studies [15,16]. In terms of marital status, the current study indicated that 36.00% of the participants were married, while 64.00% were unmarried. A contradictory study conducted in Ethiopia found that most of the patients were unmarried [17]. Another study demonstrated in Nigeria showed that most of the patients were single [18].This current analysis found that the majority of the study population (86.00%) was from urban areas. A contradictory study found that most of the study population was from rural areas [17]. In our study, the majority of the study population (52.00%) were students. Another study suggested that most of the patients were self-employed [18]. A related article found that most of the patients were in civil service [19]. The study revealed that a majority of the respondents (52.00%) preferred home-cooked meals. This finding is consistent with a study conducted in Ghana that reported that home-cooked food was the predominant dietary choice among the study population [20]. A study carried out in Cameroon found that patients preferred eating at home [21].In the current study, among the respondents, six (12.00%) had diabetes, two (4.00%) had hypertension, four (8.00%) had bronchial asthma, two (4.00%) had epilepsy, and three (6.00%) had hypothyroidism. Another study suggested that allergic rhinitis, urticarial, and topic dermatitis were the most common co-morbidities [22]. Hypertension, IHD, smoking, and diabetes were the most common comorbidities found in patients with enteric fever [23].The majority of respondents (56.00%) reported a fever duration of less than 7 days, while nineteen (38.00%) experienced a fever for 7-14 days, and three (6.00%) had a fever lasting 15-21 days showed in the present study. A related meta-analysis found that most of the patients had fever from 2 to 4 weeks [24]. A related journal found that patients experienced a longer duration of fever [25]. A related article carried out in India found that typical symptoms of enteric fevers are pain in the abdomen and a high fever duration of 1 to 14 days [26]. An article carried out with children found that the mean duration of fever was 9.5 days at times of presentation [27].

In the case of the present study, based on CBC findings, mean haemoglobin, RBC, corpuscular volume, corpuscular haemoglobin, and corpuscular haemoglobin concentration were 13.14, 4.79, 77.91, 28.85, and 31.94 respectively. A related article found that mean haemoglobin, RBC, and platelets were 11.65, and 4.3, 2.0 [28]. A related article found that haemoglobin was less than 12 was observed in 32% of patients [29]. Another study carried out in tertiary care hospitals found that 73.6% of children's CBC was normal [30].

In our study, the mean total WBC (10^9/L), neutrophil, lymphocytes, platelet count, and ESR was 6.75, 71.33, 23.67, 197.04, and 31.22 respectively. Another similar article found that mean neutrophils, lymphocytes, and eosinophils were 57.16, 41.61 and 1.16 respectively [18]. An article conducted in India showed that mean lymphocytes, neutrophil, eosinophils and WBC (×103/µl) was 31.0, 59.5, 5.5 and 6.8 respectively [28]. Enteric fever is

mainly a clinical diagnosis based on history and physical examination. Gradual onset of fever, especially with one or more abdominal symptoms, should increase suspicion of enteric fever in endemic areas [31]. In areas with poor sanitation and a shortage of clean drinking water, typhoid disease is frequent. Typhoid fever can be prevented by having access to clean water, good sanitation, food handler hygiene, and typhoid vaccine.

CONCLUSION

According to the study, enteric fever can significantly affect haematological parameters. The invasion of Salmonella Typhi into the bloodstream causes an inflammatory response that alters various haematological indicators. Due to the infection-induced inflammatory response, haemoglobin levels may drop, occasionally resulting in anaemia. Monitoring haemoglobin levels can help determine the severity of the condition and direct the best therapy approaches.

RECOMMENDATION

Diagnosis and Monitoring should be recommended. Since enteric fever can frequently affect hemoglobin levels and lead to anemia, it is important to monitor hemoglobin levels to assess the extent and severity of anemia. Monitoring the WBC count can help determine the severity of the enteric fever infection and assess the patient's response to treatment. Significant variations in the WBC count can indicate the activation of the immune system in response to Salmonella Typhi. Regular monitoring of the WBC count can guide treatment decisions and help ensure appropriate management. Given that enteric fever is a significant public health concern, particularly in regions with poor sanitation and limited access to clean water, it is crucial to prioritize public health measures. These may include improving sanitation infrastructure, promoting hygiene practices, and providing access to clean water sources. Vaccination programs can also be implemented to reduce the burden of enteric fever in high-prevalence areas. More research is needed to enhance our understanding of enteric fever and its impact on hematological profiles. This can help improve diagnostic methods, treatment strategies, and patient outcomes. Continued research efforts should focus on identifying new biomarkers and developing more efficient diagnostic tools for enteric fever.

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