

## ELECTROPHORETIC PATTERN OF HEREDITARY HAEMOGLOBIN DISORDERS IN A REFERRAL CENTRE: A ONE YEAR STUDY

Karim MM<sup>1</sup>, Yousuf AKMA<sup>2</sup>, Akhter S<sup>3</sup>, Ahmad M<sup>4</sup>, Sultana S<sup>5</sup>, Al-Azad MAS<sup>6</sup>, Karim MI<sup>7</sup>

### Abstract

**Introduction:** The inherited disorders of haemoglobin are the commonest single-gene disorders with an estimated carrier rate of 7% among the world population. They occur at particularly high frequencies in population of the tropical and subtropical belt.

**Objective:** To find out the electrophoretic pattern of haemoglobin disorders and to evaluate and compare the diseases in study population.

**Methods:** A total number of 1370 subjects of both sexes with age range from 6 months to 73 years were included in the study. The study was conducted in Haematology Department of Armed Forces Institute of Pathology, Dhaka. It was carried out from January to December 2012. Patients were selected on the basis of morphological blood film examination and electrophoresis on cellulose acetate at P<sup>H</sup> 8.6.

**Results:** Among the 1370 subjects, Beta thalassaemia trait was observed in 532(38.83%) cases, HbE trait in 313(22.85%), HbE-Beta thalassaemia in 282(20.58%), HbE disease in 146(10.66%) and Beta thalassaemia major in 97(7.08%) cases.

**Conclusion:** The study reveals that, hereditary haemoglobin disorders are common in Bangladesh and are inherited as autosomal recessive Mendelian pattern affecting both male and female.

**Key-words:** Hemoglobin disorders, Electrophoretic pattern, Beta thalassaemia, Mendelian pattern.

### Introduction

The inherited disorders of haemoglobin are the commonest single-gene disorders, with an estimated carrier rate of 7% among the world population. They occur at particularly high frequencies in population of the tropical and subtropical belt<sup>1</sup> and include haemoglobinopathies, characterized by structurally abnormal haemoglobin variants and thalassaemia by partial or total suppression of normal peptide chains of haemoglobin molecules<sup>2</sup>.

More than hundreds of structural hemoglobin variants have been identified in the last three decades. Majority of these results from single amino acid substitution in one or other of the globin chains. The simple system of presumptive identification of these variants by simple electrophoresis still remains an extremely useful procedure though it does not discriminate between different mutants<sup>3,4,5</sup>. The inheritance of haemoglobin disorders follows a simple mendelian pattern. The heterozygous state for a disorder is called "trait" while the homozygous or genetic compound is called "disease". Thalassaemia is the most common inherited genetic disorder and varies in different population group in the world.

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1. Lt Col Md Mostafil Karim, MBBS, MCPS, DCP, FCPS (Haematology), Asst Prof, Dept of Transfusion Medicine, AFMC, Dhaka Cant; 2. Col AKM Abu Yousuf, MBBS, FCPS (Haematology), HOD of Haematology, AFIP, Dhaka Cantt; 3. Dr Shahina Akhter, MBBS, FCPS (Gynae & Obs), MS (Gynae & Obs), Junior Consultant, Dhaka Dental College; 4. Lt Col Mushtaq Ahmad, MBBS, MCPS, DFM, Assoc Prof & HOD of Forensic Medicine, AFMC, Dhaka Cant; 5. Lt Col Sharmeen Sultana, MBBS, MPhil, Assoc Prof & HOD of Phisiology, AFMC, Dhaka Cantt; 6. Lt Col Md Abdus Samad Al-Azad, MBBS, MCPS, DFM, Dept of Forensic Medicine, AFMC, Dhaka Cant; 7. Lt Col Md Iqbal Karim, MBBS, MCPS, DCP, FCPS (Histopathology), Dept of Pathology, AFMC, Dhaka Cant.
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Haemoglobin disorders will become a major issue in developing countries like Bangladesh in this millennium. It is observed that when the world population finally stabilizes, at least 8% of the population will be carrier or trait<sup>6</sup>. The world population of carrier of Beta thalassaemia trait is reported to be more than 100 million worldwide and about 1,00,000 children with thalassaemia major are born each year. In Bangladesh, no screening program has yet been taken in any population group.

A conservative world health report estimates that 3% of the population are carriers of Beta thalassaemia and 4% are carriers of HbE in Bangladesh<sup>7</sup>. Most of the thalassaemic patients need frequent blood transfusion about every 2-3 weeks interval. As a result good percentage of blood is utilized by them, which is a major burden to the department of transfusion medicine involving a lot of complication and transfusion hazards. So there is a chance of transmission of infectious agents like HCV, HBV, HIV, *Plasmodium* and *Treponema pallidum* etc.

### Methods

This study was conducted in the Haematology Department of Armed Forces Institute of Pathology from January 2012 to December 2012 and total number of 1370 cases of hereditary haemoglobin disorders were studied over a period of one year. Armed Forces Institute of Pathology, Dhaka is a referral centre for Armed Forces personnels. Patients were selected on the basis of morphological evidence of haemolytic anemia in peripheral blood film and haemoglobin electrophoresis on cellulose acetate membrane at P<sup>H</sup> 8.6. Age, sex, presenting complaints and family history were noted.

### Results

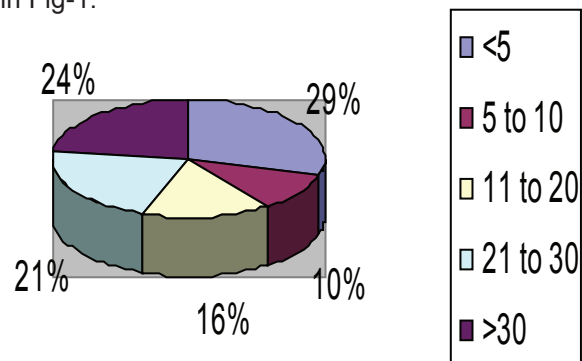
Among the 1370 subjects, Beta thalassaemia trait was observed in 532(38.83%), HbE trait in 313(22.85%), HbE-Beta thalassaemia in 282(20.58%), HbE disease in 146(10.66%) and Beta thalassaemia major was found in 97(7.08%) cases (Table-IV).

Out of 1370 subjects, 398 (29.05%) were of less than 5 years of age, 142 (10.37%) between 5 to 10 years, 216 (15.77%) between 11 to 20 years, 292 (21.31%) between 21-30 years and 322 (23.50%) were of above 30 years of age (Table-I).

**Table-I:** Distribution of population by age.

Age (Years)	No of Patient	Percentage %
<5	398	29.05 %
5-10	142	10.37 %
11-20	216	15.77 %
21-30	292	21.31 %
>30	322	23.50 %
<b>Total</b>	<b>(n=1370)</b>	<b>(100%)</b>

Distribution of population by age (29% of study population below 5 years and 10% of study population between 5 to 10 years of age) is shown in Fig-1.



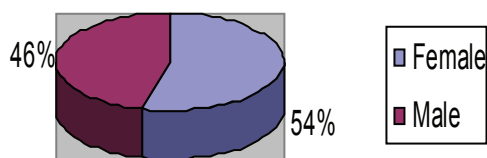
**Fig-1:** Distribution of population by age.

Among the 1370 subjects, 738(53.87%) were female and 632(46.13%) were male.

**Table-II:** Sex distribution (n=1370).

Sex	No of Patient	Percentage
Female	738	53.87 %
Male	632	46.13 %
<b>Total</b>	<b>(n=1370)</b>	<b>(100)</b>

Sex distribution (54% study population are female and 46% are male) has been shown in Fig-2.



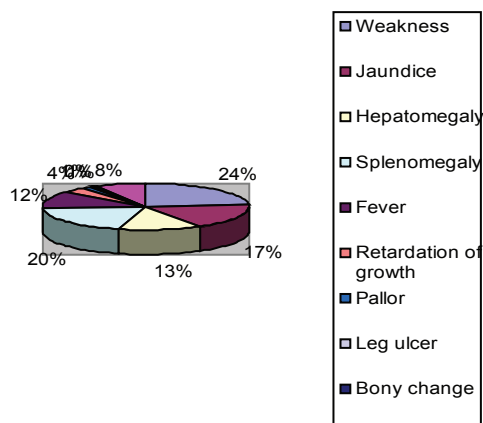
**Fig-2:** Sex distribution ( around 54% study population were female and 46% male).

986 (71.97%), 712 (51.97%), 806 (58.83%), 540 (39.42%) and 504 (36.79%) cases presented with weakness, jaundice, splenomegaly, hepatomegaly and fever respectively. 323 (23.58%) study population were asymptomatic (Table-III).

**Table-III:** Presenting clinical manifestations.

Symptoms	No of Patient	Percentage
Weakness	986	71.97 %
Jaundice	712	51.97 %
Hepatomegaly	540	39.42 %
Splenomegaly	806	58.83 %
Fever	504	36.79 %
Retardation of growth	149	10.88 %
Pallor	53	03.87 %
Leg ulcer	13	0.95 %
Bony change	26	01.88 %
Asymptomatic	323	23.58 %

Common clinical presentation among the study subjects were weakness (24%); jaundice (17%), splenomegaly (20%), hepatomegaly (13%) and fever (12%) respectively which are shown in Fig-3.

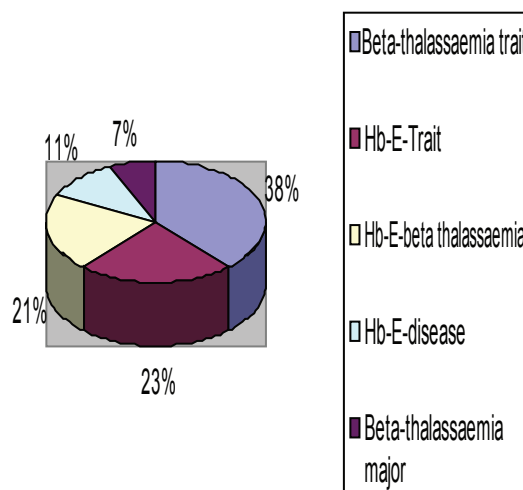


**Fig-3:** Presenting clinical manifestations.

Among the 1370 subjects, Beta thalassaemia trait was observed in 532 (38.83%), HbE-trait in 313 (22.85%), HbE-Beta thalassaemia in 282 (20.58%), HbE disease in 146 (10.66%) and Beta thalassaemia major was found in 97 (7.08%) cases (Table-IV & Fig-4).

**Table-IV:** Pattern of hereditary haemoglobin disorders.

Disorder	No of Patient	Percentage %
Beta-thalassaemia trait	532	38.83 %
Hb-E-Trait	313	22.85 %
Hb-E-beta thalassaemia	282	20.58 %
Hb-E-disease	146	10.66 %
Beta-thalassaemia major	97	7.08 %
<b>Total</b>	<b>(n=1370)</b>	<b>(100)</b>



**Fig-4:** Pattern of hereditary haemoglobin disorders.

## Discussion

In this study, heterozygous Beta thalassaemia trait was found as the most common disorder. Heterozygous HbE and double heterozygous HbE-Beta thalassaemia were next common disorders. Almost similar findings were observed in others studies<sup>8</sup>. In a study, done in the Department of Haematology in Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Beta thalassaemia trait was found in 99(47.14%) cases, HbE-Beta thalassaemia in 65(30.47%),

HbE trait 28(13.3%), HbE disease in 12(5.71%) and Beta-thalassaemia major was found in 7(3.33%)<sup>8</sup> cases. But in our study HbE trait was found to be as more common i.e. in 313(22.85%) cases, and HbE-Beta-thalassaemia as less common i.e. in 282(20.58%) cases which are unlike of the study findings carried out at BSMMU. In a study carried out at Myanmar, HbE trait was found in about 10-20% cases and in Assam<sup>9</sup> 23.9 % cases. In our study prevalence of HbE trait was closely similar to that of the neighboring countries. In another study, prevalence of Beta thalassaemia trait was found to be 18 % in Mediterranean area<sup>10</sup> which was higher (38.83%) in our study. This finding may be due to smaller size of study group.

In another study carried out in Sub-Saharan Africa, the prevalence of Beta-thalassaemia major was found to be 22% and HbE-Beta thalassaemia<sup>11</sup> 19%. Prevalence of HbE-Beta thalassaemia in our study population was 20.58% which was almost similar to above study. But prevalence of Beta-thalassaemia major in our study was 7.08% which was very less than that of the above study. It may be due to the fact that Beta-thalassaemia major was more common in Sub-Saharan Africa than Southeast Asia.

Prevalence of HbE in Southeast Asian countries like Myanmar, Cambodia, Laos, Vietnam and Thailand was 30-40%. In China, Philippine, Turkey, Nepal, Sri Lanka and Pakistan it was 50-70%<sup>12</sup>. In our study prevalence of HbE is 54.09% which is closely similar to above study. Hereditary haemoglobin disorders are manifested at all ages from minimum 06 months to 73 years. In our study it was found that prevalence of hereditary haemoglobin disorders was higher (39.42 %) in the first decade & this finding is similar to a study carried out in the Haematology Department of Bangabandhu Sheikh Mujib Medical University, Dhaka<sup>8</sup>. Homozygous Beta thalassaemia was found in more than 20% of study population in South West Pacific Archipelago of Vanuatu<sup>13</sup>.

But in our study homozygous beta thalassaemia was found in 7.08% cases which is less than that of the above study. In Tribal population in Tripura and North East India, HbE carrier comprised 57.65% of the population and 20.40% were HbE homozygotes<sup>14</sup> which is higher than that of our study. In our study, prevalence of HbE trait was 22.85% and HbE homozygotes comprise 10.66% of the population.

## Conclusion

In the study it is revealed that hereditary haemoglobin disorders are common in Bangladesh and these disorders are inherited as autosomal recessive Mendelian pattern affecting both male and female. So we just cannot ignore the prevalence of these diseases. In this study, we got heterozygous (trait) like both heterozygous beta thalassaemia trait and heterozygous HbE trait in significant number. This population is usually asymptomatic, do not require treatment and lead a reasonably good quality life but risk is there as because of the possibility of homozygous or double heterozygous inheritance through marriage of unaware couples or silent spread as trait. This will cause a serious health threat to our nation, if it is allowed to continue without taking measures for prevention.

Finally, in spite of all limitations of the study we have tried to find out whether the hereditary haemoglobin disorders are very common in Bangladesh, so that the health authorities can focus on this matter. Awareness has to be created at national level to reduce the incidence of hereditary haemoglobin disorders in the community. It is mandatory to detect the trait in general population with large scale study and proper premarital genetic counseling should be done. It is time to think about the molecular and prenatal diagnosis to start with in order to prevent further spread of these diseases like hereditary Hb disorders.

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