# THALASSEMIA AMONG BLOOD DONORS AT THE HOSPITAL UNIVERSITI SAINS MALAYSIA

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Abstract. The aim of this study was to screen and identify the types of thalassemia among blood donors at the Hospital Universiti Sains Malaysia (HUSM). Thalassemia screening was performed by hemoglobin electrophoresis. A total number of 80 blood samples were obtained from donors at the Transfusion Medicine Unit, HUSM. The ethnic origins of the donors were Malays (n=73, 91.3%) and non-Malays (n=7, 8.75%). Males comprised 88.1% of the donors. Thalassemia was detected in 16.25% (n=13) of the blood donors. Of those with thalassemia, 46.2% (6/13) were anemic. Microcytosis and hypochromia were detected in 84.6% (n=11) and 84.6% (n=11) of these donors, respectively. The types of thalassemias detected were Hb E, 11.25% (n=9/80) and β thalassemia trait, 5% (n=4/80). Among the thalassemias detected, the Hb E hemoglobinopathy was comprised of Hb E/α-thalassemia (38.5%: n=5), Hb E /β-thalassemia (23.1%: n=3), Hb E trait (7.6%: n=1) and β-thalassemia (30.8%: n=4). In conclusion, screening for thalassemia trait should be included as part of a standard blood testing before blood donation. Further studies are required to look at the effects of donated thalassemic blood.

## INTRODUCTION

Thalassemias are common autosomal recessive disorders. They are widely prevalent worldwide, especially in Mediterranean, Middle Eastern and Far Eastern populations. In some areas in Southeast Asia, the carrier rate of Hb E may exceed 60% of the population. In Malaysia, Hb E and β thalassemia are the most common inherited hematologic disorders (George and Khuziah, 1984; George, 1998; Weatherall and Clegg, 2001; Fucharoen *et al*, 2004). Previous works from various parts of the world have reported low percentages of blood donors with clinically undetectable thalassemias (Carmona *et al*, 1988; Casado *et al*, 1997). However, such blood is considered suitable for blood transfusion when its hemoglobin level falls within the normal range (Weatherall and Clegg, 2001). Since blood donors provide blood for others, their health is of considerable importance for both the donor and the recipient, hence, blood donors are screened for communicable diseases to avoid their transmission. Likewise, screening for thalassemia may help in providing blood and red blood cell concentrates with maximum functional capacity. Detection of thalassemia in blood donors may reflect the spectrum of the disease in the population.

This is the first published report in Malaysia that identifies thalassemia carriers among blood donors at the Transfusion Medicine Unit at HUSM.

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## MATERIALS AND METHODS

Blood samples were collected from 80 randomly selected donors at the Transfusion Medicine Unit, HUSM, Kelantan. The majority of the donors were Malays 91.3% (n=73), whereas non-Malays comprised the remaining 8.7% (n=7). Written consent was obtained from each donor participating in this study. Ethical approval was issued by the ethics committee at the Health Campus of the university. According to current practice at HUSM, donor history and clinical criteria are taken into consideration. Males with Hb levels <13.5 g/dl and females with Hb levels <12.5 g/dl were considered anemic and could

not donate blood, however they were included in the study. Hypochromia and microcytosis were defined as a mean cell hemoglobin (MCH) value <27pg and a mean cell volume (MCV) value <80fl, respectively.

Blood was collected in ethylenediaminetetraacetic acid (EDTA) tubes and transported to the laboratory. The hematological investigations performed included a full blood count, hemoglobin electrophoresis, and the Hb H inclusion test. Blood counts were obtained using the electronic blood counter, Sysmex 2100. For hemoglobin electrophoresis, hemolysates were prepared and run on cellulose acetate using tris-EDTA-borate buffer at pH 8.6. Hb A2 and F were determined by elution and spectrophotometry following electrophoresis (Lewis *et al*, 2001). For interpretation of the results of Hb electrophoresis, our reference spectrophotometric values for Hb A2E were as follows: 25-35% in HbE trait, 8-25% in HbE/α, 35-80% in HbE/β thalassemia, and >80% in HbE disease. In β thalassemia trait the Hb A2 values ranged from 3.5-8% and /or Hb F ranged from 2-7% (Weatherall and Clegg, 2001).

The Fisher's exact test was applied to determine the association between the hematological parameters and the status of the donor. The level of significance was set as 0.05.

## RESULTS

From the total number of donors tested, 13 (16.25%) were diagnosed with thalassemia. The remaining 67 (83.75%) samples had normal Hb electrophoresis patterns. The types of thalassemias detected were Hb E 11.25% (n=9/80) and β thalassemia trait (5%: n=4/80). Of the thalassemias detected, Hb E hemoglobinopathy was comprised of Hb E/α-thalassemia (38.5%: n=5), Hb E /β-thalassemia (23.1%: n=3), Hb E trait (7.6%: n=1) and β-thalassemia (30.8%: n=4) (Table 1).

The hemoglobin concentrations of the 80 donors ranged from 10.0 to 15.3 g/dl. Anemia was found in 24 donors (30%), of whom 18 were non-thalassemic. Of those with no thalassemia, 2 had microcytosis and 3 had hypochromia. Of the 13 thalassemic donors, 6 were anemic, 11 (84.6%) had MCV and MCH values below reference values. Both values were highly significant for the diagnosis of thalassemia among blood donors ($p < 0.001$). Two thalassemic donors had normal MCV (Table 2).

All the donors had a negative H-inclusion test. Thalassemia was detected in 12 Malay donors, including one female, and in one non-Malay donor.

Table 1
Hematological investigations and distribution of thalassemia types among blood donors according to Hb electrophoresis pattern.

| Hb (g/dl) | MCV (fl) | MCH (pg) | RDW | Hb A2 % | Hb F % | Thalassemia type |
|---|---|---|---|---|---|---|
| 13.3 | 76.9 | 25.4 | 14.2 | 19.3 | 1.1 | E / α |
| 11.6 | 75.5 | 23.9 | 15.3 | 25.0 | 1.6 | E trait |
| 13.0 | 81.0 | 27.0 | 12.4 | 19.9 | 1.4 | E / α |
| 13.1 | 79.5 | 26.5 | 11.7 | 14.5 | 1.8 | E / α |
| 14.6 | 78.9 | 26.7 | 12.3 | 11.3 | 1.1 | E / α |
| 14.5 | 77.9 | 26.5 | 12.8 | 16.9 | 0.6 | E / α |
| 13.7 | 74.2 | 23.0 | 13.5 | 9.1 | 0.9 | β trait |
| 10.5 | 78.7 | 25.7 | 22.4 | 42.5 | 2.2 | E / β |
| 14.6 | 83.9 | 28.1 | 20.7 | 36.6 | 1.6 | E / β |
| 13.5 | 75.7 | 26.3 | 22.5 | 39.2 | 2.3 | E / β |
| 13.8 | 79.0 | 26.6 | 11.4 | 5.7 | 1.2 | β trait |
| 13.1 | 75.9 | 25.4 | 12.3 | 5.4 | 0.9 | β trait |
| 13.8 | 75.5 | 25.8 | 12.7 | 6.8 | 1.2 | β trait |

Table 2
Biodata and hematological parameters obtained from blood donors.

| | Normal donors (n=67) | Thalassemic donors (n=13) | p-values |
|---|---|---|---|
| Hb | | | |
| Anemic | 18 (20.9%) | 6 (46.2%) | |
| Normal | 49 (75.1%) | 7 (53.8%) | 0.194[a] |
| MCV | | | |
| Microcytic | 3 (4.5%) | 11 (84.6%) | |
| Normocytic | 64 (95.5%) | 2 (15.4%) | <0.001[a] |
| MCH | | | |
| Hypochromic | 2 (3%) | 11 (84.6%) | |
| Normochromic | 65 (97.0%) | 2 (15.4%) | <0.001[a] |
| Gender | | | |
| Male | 58 (88.1%) | 12 (92.3%) | |
| Female | 8 (11.9%) | 1 (7.7%) | 1.00[a] |
| Race | | | |
| Malay | 61 (91.0%) | 12 (92.3%) | |
| Non-Malay | 6 (9.0%) | 1 (7.7%) | 1.00[a] |

[a]Fisher's exact test was applied. Level of significance was set at 0.05.

## DISCUSSION

Based on the obtained data, 4 types of thalassemia were described. The distribution of which is similar to that in the general population (George and Khuzia, 1984; George, 1998; Weatherall and Clegg, 2001).

In many hospitals and blood transfusion centers worldwide, it is a common practice to accept blood from thalassemic trait donors with Hb levels more than 13.5 g/dl (Carmona *et al*, 1988). In this study, 6 out of the 13 donors with thalassemia had low Hb levels, rendering them unsuitable for donation. All these are regular donors which may explain their tendency to have a lower Hb. This raises the question of considering thalassemic volunteers for regular donation. The MCV values were < 80 fl in 11 thalassemic donors, where the lowest figure obtained was 74.2 fl, which is higher than those obtained in previous works with antenatal patients (Fucharoen *et al*, 1998; Old, 2003). Although the International Standard guide that MCV less than 80 fl is an indicator of thalassemia, there were 2 donors with normal MCV values where the diagnosis of thalassemia was established following detection of a high hemoglobin A2 on Hb electrophoesis.

A main finding in this study was the detection of thalassemia carriers which comprised 16.25% (n = 13) of blood donors. Previous reports on the incidence of the different types of thalassemia highlighted great differences in distribution among the various ethnic groups. The frequencies of thalassemia carriers among Malaysians are 20% for $\alpha$-thalassemia, 3-50% for Hb E, 3-5% for $\beta$-thalassemia (George and Khuzia, 1984; George, 1998; Weatherall and Clegg, 2001; Fucharoen *et al*, 2004). A similar distribution was seen in our results. In view of the high reported and obtained frequency, screening for thalassemia in all blood donors before donation should be considered as a routine test. As with all routine screens, it must include initial screening tests followed by confirmatory tests. The screening tests include blood smears, automated blood counts, red cell indices, reticulocyte counts, tests to determine iron status, hemoglobin electrophoresis, quantitaton of HbA2, Hb H inclusion test, and high performance liquid chromatography (HPLC) (George, 1998). DNA studies are required for confirmation and precise diagnosis.

Microcytic red blood cells may interfere with and contaminate prepared blood components, such as platelet concentrates and fresh frozen

plasma. In a standard transfusion protocol, ABO compatible components are transfused in a recipient. However, during shortages, mismatched blood group components may be transfused to patients, *eg* group A platelets transfused in group O recipients. This may raise the risk of transfusing contaminating microcytic red cells from a thalassemic donor. Furthermore, the anticipated functional activity and the short half-life of thalassemic erythrocytes may put the feasibility of their use for blood donation in question, especially in children, because of their small body weight.

In conclusion, in this first reported study of thalassemic blood donors in Malaysia, we recommend screening for thalassemia in blood donors to be introduced as routine practice in view of its high prevalence in the population. Follow-up studies may be necessary to examine the effects of transfused blood from thalassemic donors. The report also highlights the significance of hypochromia and microcytosis in the diagnosis of thalassemia.

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