

# Common Hemoglobinopathies for Couples Premarital Individual and its Influence on Hemostasis and Immune State

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## Abstract

Before marriage, couples are screened through a procedure known as premarital screening for different genetic, infectious or bloodborne diseases that can be passed from them to their offspring. The aim of our research was to assessment the premarital screening of couples for hemoglobinopathies and undiagnosed cases with suggestive findings of thalassemia or its variants. and evaluation hematology parameters among common Hb hemoglobinopathy. This study contains 228 individuals with hemoglobinopathy, the participants were couples attending primary health centers for regular premarital inquiries in baquba teaching hospitals, Iraq.  $\alpha$ -thalassemia was enrolled in 3 (1.3%) from all hemoglobinopathy individuals,  $\beta$ -thalassemia was enrolled in 255 (98.8 %), which include  $\beta$ -thalassemia minor in 226 individuals 88.6%, while  $\beta$  thalassemia intermediate in 5 individuals 2.2% from all individuals with hemoglobinopathy Figure 1 and 2. Others thalassemia was recorded 3 Hb-E 1.1%, 1 Hb-S 0.39, 10 Hb-D 3.92, 13Hb-C 5.09. Pre-marital examinations are important to determine hemoglobinopathy and limit transmission to offspring, as well as blood tests are important to identify people with haemoglobinopathy and its influence.

**Keywords:** Hemoglobinopathies, Premarital Individual, hemostasis, immune state.

## Introduction

Before marriage, couples are screened through a procedure known as premarital screening for different genetic, infectious or bloodborne diseases that can be passed from them to their offspring<sup>(1)</sup>. Among the most common autosomal recessive disorders affecting humans, haemoglobinopathies are assessed and are characterized by the existence of qualitative and/or quantitative anomalies affecting the globin chains<sup>(2)</sup>.

The most common qualitative anomalies are haemoglobin (Hb)S, which causes Hb-C or Hb-D disease of the sickle cell (SCD) and others, and the most common quantitative anomalies with decreased or absent alpha- or  $\beta$ -globin chain synthesis lead to alpha- and  $\beta$ -thalassemias, respectively<sup>(3, 4)</sup>. These are the world's

most common single gene disorders, particularly in the Eastern Mediterranean Region, including Iraq<sup>(5)</sup>. Premarital screening for thalassemia and sickle cell anemia was required in 2004 by the Third Royal Decree. According to this decree, couples getting married must receive a certificate specifying their thalassemia and sickle cell anemia status from the approved health centers after being checked. Another essential role of this initiative is the therapy of couples at risk<sup>(6)</sup>.

This study aimed to assess the premarital screening of couples for hemoglobinopathies and undiagnosed cases with suggestive findings of thalassemia or its variants, and evaluation hematology parameters among common Hb hemoglobinopathy.

## Material and Method

This study contains 228 individuals with hemoglobinopathy, The participants were couples attending primary health centers for regular premarital inquiries in baquba teaching hospitals, Iraq. By using standard laboratory procedures the hemoglobin electrophoresis on cellulose acetate (at pH 8.6) was

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carried out on all (228) samples. The HbA2 level was calculated by alkaline denaturation using elution from cellulose acetate and HbF<sup>(7)</sup>.

$\beta$ -thalassemia minor was diagnosed by an elevated HbA2, while  $\beta$ -thalassemia major was diagnosed by an elevated Hb-F, and others (Hb-E, Hb-S, Hb-D, Hb-S) trait by a positive test confirmed by Hb band on electrophoresis.  $\alpha$ -thalassemia trait was diagnosed by an absence of Hb variants or any increases in Hb A2 or HbF<sup>(8)</sup>, table 1.

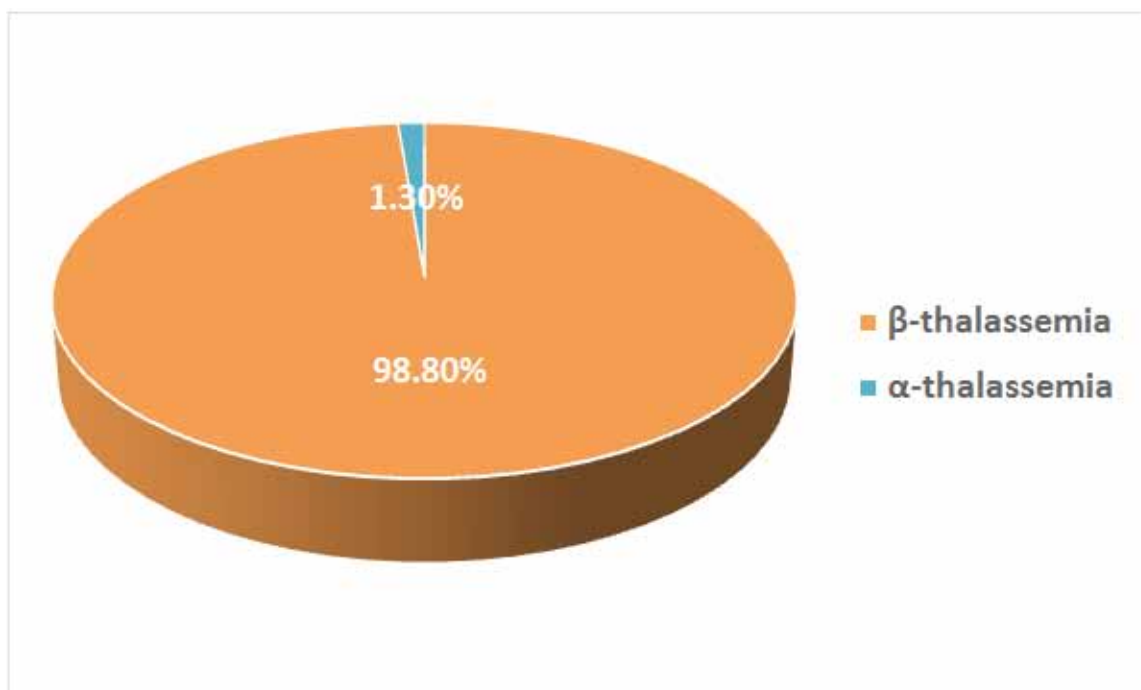
**Table 1: Normal haemoglobins in Fetus and adult blood**

Hemoglobin	Globin chains	Volume
<b>Fetus</b>		
Hb F	$\alpha 2 \gamma 2$	85%
Hb A	$\alpha 2 \beta 2$	5–10%
<b>Adult</b>		
Hb A	$\alpha 2 \beta 2$	96 – 98%
Hb A 2	$\alpha 2 \delta 2$	0.5 – 3.2 %
Hb F	$\alpha 2 \gamma 2$	0.5 – 0.8%

**Statistical Analysis:** Statistical analysis was achieved by using SPSS 20.0 software (SPSS, Inc., Chicago, IL, USA). Continuous variables were expressed as the mean  $\pm$  standard error. Dichotomous variables were expressed as percentages. ANOVA was achieved to estimate the differences in continuous variables between the common hemoglobinopathies groups.  $P < 0.05$  was considered to indicate a statistically significant difference.

**Results**

$\alpha$ -thalassemia was enrolled in 3 (1.3%) from all hemoglobinopathy individuals,  $\beta$ -thalassemia was enrolled in 255 (98.8 %), which include  $\beta$ -thalassemia minor in 226 individuals 88.6%, while  $\beta$  thalassemia intermediate in 5 individuals 2.2% from all individuals with hemoglobinopathy Figure 1 and 2. Others thalassemia was recorded 3 Hb-E 1.1%, 1 Hb-S 0.39, 10 Hb-D 3.92, 13Hb-C 5.09 Figure 3.



**Figure 1: The percentage of  $\beta$ - and  $\alpha$ -thalassemia**

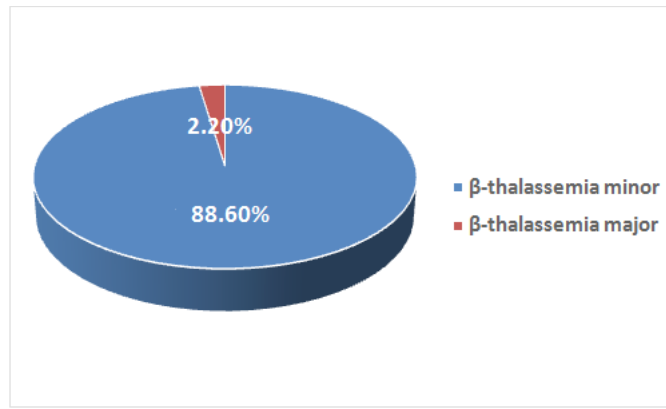


Figure 2: The percentage of β-thalassemia minor and major

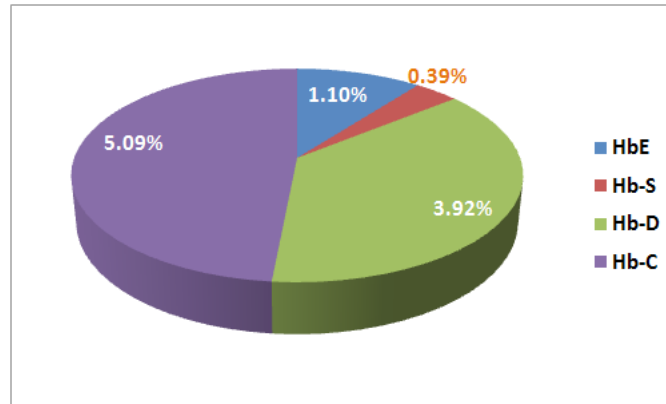


Figure 3: The percentage of others β-thalassemia

Table 2 illustrated Hb electrophoresis, the mean Hb A0, A1c, A2, F level in α-thalassemia patients was (70.5 %, 9.9%, 1.7 %, 25.3% respectively). And in β-thalassemia minor patients was (80.32%, 5.0%, 4.9%, 6.6% respectively). While in β-thalassemia intermediate patients was (48.8%, 5.1%, 6.8%, 30.1% respectively). Others hemoglobinopathies the mean Hb A0, A1c, A2,

F level in Hb E beta thalassemia patients was (64.43%, 4.8%, 25.6%, 0.9% respectively), Hb Sickle disease patients was (58.5%, 5.4%, 3.4%, < 0.8% respectively), Hb D beta thalassemia patients was (54.47%, 5.05%, < 0.8% respectively), and Hb C disease patients was (56.39%, 4.93%, 3.2%, <0.8% respectively).

Table 2: Mean Hb Electrophoresis Results in Various Hemoglobinopathies

Hemoglobinopathy	A0 %	A1c %	A2 %	F %
α-thalassemia	70.5	9.9	1.7	25.3
β-thalassemia minor	80.32	5.0	4.9	6.6
β-thalassemia intermediate	48.8	5.1	6.8	30.1
Hb E beta thalassemia	64.43	4.8	25.6	0.9
Hb Sickle disease	58.5	5.4	3.4	< 0.8
Hb D beta thalassemia	54.47	5.05	5.05	< 0.8
Hb C disease	56.39	4.93	3.2	<0.8

Table 3 illustrated hematological parameters in common hemoglobinopathies the white blood cells showed increased significantly in  $\beta$ -thalassemia intermediate and decrease significantly in Hb E beta thalassemia when compared with others groups. As

well as the platelets showed decrease significantly in  $\beta$ -thalassemia intermediate and increased significantly in in Hb E beta thalassemia when compared with others groups.

**Table 3: Hematological Parameters in Common Hemoglobinopathies**

Hemoglobinopathy	WBC M $\pm$ SE	RBC M $\pm$ SE	PLT M $\pm$ SE
$\alpha$ -thalassemia	8.70 $\pm$ 1.29	5.15 $\pm$ 0.13	154.00 $\pm$ 0.00
$\beta$ -thalassemia minor	10.27 $\pm$ 0.81	6.15 $\pm$ 0.30	305.55 $\pm$ 40.02
$\beta$ -thalassemia intermediate	14.33 $\pm$ 0.00	5.15 $\pm$ 0.00	153.00 $\pm$ 0.00
Hb E beta thalassemia	5.65 $\pm$ 0.78	5.22 $\pm$ 0.02	374.00 $\pm$ 0.00
Hb Sickle disease	7.80 $\pm$ 0.00	4.43 $\pm$ 0.00	357.00 $\pm$ 0.00
Hb D beta thalassemia	11.42 $\pm$ 0.98	4.97 $\pm$ 0.21	283.25 $\pm$ 57.24
Hb C disease	9.38 $\pm$ 0.68	5.67 $\pm$ 0.14	274.91 $\pm$ 35.99

## Discussion

The premarital screening program is essential for genetic disorders as it dictates the prevalence and potential transmission of these disorders to the offspring.

The most prevalent abnormal finding observed in our study was  $\beta$ -thalassemia minor (88.6%), while the  $\alpha$ -thalassemia reached (1.3%). Studies performed in Jeddah (West) and Al-Hassa (East) found that 4.69 percent and 3.4 percent of individuals had  $\beta$ -thalassemia trait<sup>(9,10)</sup>. With an average prevalence of carriers of about 4 percent and an estimated 15,000 registered major/intermediate thalassemia patients throughout the region,  $\beta$ -thalassemia is a common inherited hematological disorder in Iraq. The sickle cells were found in (0.39%) individuals in the studied population. This result is contradictory to the findings of other studies where the recorded prevalence of sickle cell trait  $\beta$  thalassemia is 3.4% and 3.3%<sup>(11, 12)</sup>. Hemoglobin E (1.1 %) was found to be a small proportion of the studied population. In Jeddah, the prevalence of hemoglobin E recorded was 0.85% these percentage is low when compared with our result<sup>(13)</sup>.

In our study the platelets showed decrease significantly in  $\beta$ -thalassemia intermediate and increased significantly in in Hb E beta thalassemia when compared with others groups, platelets are activated by free radical from hemoglobin<sup>(14, 15)</sup>, RBC phospholipids, thrombin<sup>(16)</sup>, and microparticles<sup>(17)</sup>. Then, after their

activation, platelets bind to proteins S and C<sup>(11)</sup>. Release thromboxane A2 (TXA2)<sup>(18)</sup>, and form microparticles of platelets<sup>(17)</sup>. Simultaneously, iron overload is also present in  $\beta$ -thalassemia.] Vitamin C is decreased due to this iron overload, which may result in platelet defect<sup>(19)</sup>.

Several immunological defects can be found in patients with thalassemia, among which the impairment of neutrophils and macrophage phagocytic and killing functions. In our study the white blood cells showed increased significantly in  $\beta$ -thalassemia intermediate and decrease significantly in Hb E beta thalassemia when compared with others groups. In  $\beta$ -thalassemia, The white blood cells defect in thalassemic patients may result from dysregulation of the apoptotic cells death pathway<sup>(20)</sup>.

## Conclusion

Pre-marital examinations are important to determine hemoglobinopathy and limit transmission to offspring, as well as blood tests are important to identify people with haemoglobinopathy and its influence.

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**Ethic Statement:** The researchers already have ethical clearance from all required institution and laboratories.

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