

## *Brief Communication*

# The Impact of Mean Corpuscular Volume in Identifying Thalassaemia Trait Through the Premarital Screening Program in Northern Jordan

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### Abstract

**Objectives:** To study the significance of Mean Corpuscular Volume (MCV) measurement in the identification of thalassaemia trait during a premarital screening program in Irbid in north of Jordan.

**Patients and Methods:** All couples applied for marriage procedures in Irbid city were screened over a one year period. When MCV results were less than 80 fL in both of them, then hemoglobin electrophoresis was performed to both to confirm the diagnosis of thalassaemia trait. The subjects were considered to have the beta-thalassaemia trait if they had a hemoglobin A2 level of more than 3.2% or a hemoglobin F level of more than 2%.

**Results:** During the study period, premarital screening of hemoglobinopathies was evaluated retrospectively in 1752 subjects (876 couples).

MCV less than 80 fL was detected in 568 (32.4%) subjects (284 couples) for whom Hb electrophoresis was further measured. HbA2 higher than 3.2% was found in 110 of them, 47 (16.4%) female subjects and 63 (22.3%) male subjects. The percentage of high HbA2 from the total accounts of subjects evaluated in premarital screening was calculated to be (0.062) and for those with low MCV was (19.4%) with a 95% confidence interval value 0.736 (0.449-1.034). Fourteen couples both of them have high HbA2. HbF was found to be high in another 26 (4.5%) subjects from both sexes, 5 couples both of them have high HbF, and that HbS and HbC were 8 (1.4%) and 2(0.4%), respectively.

**Conclusion:** From this study, we concluded that the measurement of MCV alone is an effective preliminary premarital screening tool to identify possible thalassaemia trait. For those with possible thalassaemia trait, Hb electrophoresis will identify definite cases of thalassaemia trait.

**Keywords:** Thalassaemia Trait, Mean Corpuscular Volume, Hemoglobin Electrophoresis, Premarital Screening.

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## Introduction

Thalassemia is a molecular abnormality that leads to under production of one of the globin chain.<sup>1</sup>

Thalassemia trait is usually not associated with any significant clinical problem. Thalassemia traits in general have reduced Mean Corpuscular Volume (MCV) and reduced Mean Corpuscular Hemoglobin (MCH) with normal Mean Corpuscular Hemoglobin Concentration (MCHC). Specific cut off points for each index vary from laboratory to laboratory. Some laboratories concentrate on both reduced MCV and MCH<sup>2</sup> and some on MCV or MCH alone.<sup>3,4</sup>

Various formulae like Bessman index, Shine and Lal index, England index, Mentzler index<sup>5</sup> are used as good indicators to differentiate between thalassemic and non thalassemic microcytosis.

$\beta$ - thalassemia has a high prevalence in the Middle East and it is a major health problem in Jordan.<sup>1, 6, 7</sup> Four percent of Jordanians are carriers of the gene of thalassemia and currently there are 1200 living Jordanian patients with thalassemia major, quarter of them are from the northern city of Irbid.<sup>8</sup>

Starting from June 2004, in order to reduce the magnitude of thalassemia problem, Jordan health authority adopted a prevention program of obligatory premarital testing for beta-thalassaemia before the issuance of a marriage certificate.<sup>8</sup> This study was conducted to assess the impact of MCV in the detection of people with thalassemia trait.

## Patients and Methods

Princess Rahmah is a pediatric hospital with 110 pediatric beds. It is one of the centers for premarital screening in Jordan and it has a center for treating and counseling patients with thalassemia.

The study was conducted at Princess Rahmah Teaching Hospital over the year 2007 starting from January. The ethical committee of PRTH

approved the study. The inclusion criteria of the study are to include all couples who are about to get married and requested premarital screening for thalassemia. The premarital screening program is obligatory for all couples who are planning to get married. If MCV value for both couples were less than 80 fL, then they are considered as possible thalassemia carriers. For such couples, standard hemoglobin electrophoresis test should follow to measure Hb A2 and HbF to confirm the diagnosis of thalassemia trait. To study the impact value of MCV less than 80 fL to the diagnosis of thalassemia trait, we evaluated retrospectively the MCV of 1752 subjects included in the screening program. The subjects were considered to have the beta-thalassaemia trait if they have a hemoglobin A2 level of more than 3.2% or a hemoglobin F level of more than 2%.<sup>7,9,10</sup>

## Results

Premarital screening of hemoglobinopathies was evaluated in 1752 subjects. Low MCV was detected in 568 (32.4%). The results of Hb electrophoresis performed to those with low MCV show that, higher than 3.2 HbA2 was found in 47 (16.4%) from low MCV female subjects and 63 (22.3%) from low MCV male subjects. 14 couples both of them have high HbA2 and those couples were advised not to get married.

The Thalassemia trait was detected in 136 (24%) subjects, 110 of whom had high HbA2, and 26 of them had high HbF.

The percent of high HbA2 in both sexes from the total number of subjects evaluated in premarital screening was (6%) and the percent of subjects with high HbA2 from the total number of both sexes with low MCV was 110 (19.4%) with 95% confidence interval value 0.736 (0.449-1.034). HbF was found to be high in 26(4.5%) subjects from both sexes, 5 couples both of them have high HbF, and that for HbS and HbC was 8 (1.4%) and 2(0.4%), respectively (Table 1). The highest demand on premarital screenings was in summer (Table 2), which is the time of marriage in our country.

**Table (1): Total number and percent of subjects with low MCV.**

<u>Sex</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
<b>Female</b>	22 (7.8%)	17 (3%)	12 (3.7%)	21 (3.7%)	36 (6.3%)	17 (3%)	28 (4.9%)	53 (9.3%)	21 (3.7%)	25 (4.4%)	16 (2.8%)	17 (3%)
<b>Male</b>	22 (7.8%)	16 (2.8%)	10 (1.8%)	17 (3%)	33 (5.8%)	17 (3%)	30 (5.3%)	60 (10.6%)	22 (3.9%)	23 (4%)	16 (2.8%)	16 (2.8%)
<b>Total (568)</b>	44 (7.7%)	33 (5.8%)	22 (3.9%)	38 (6.7%)	69 (12.1%)	34 (6%)	58 (10.2%)	113 (19.9%)	43 (7.6%)	48 (8.5%)	32 (5.6%)	33 (5.8%)

**Table (2): Frequency of abnormal Hb in subjects with low MCV.**

<u>Sex</u>	<u>HbA2</u>	<u>HbF</u>	<u>HbS</u>	<u>HbC</u>	<u>HbD</u>
<b>Male</b>	63 (11.1%)	17 (2.9%)	3 (.5%)	1 (.2%)	1 (.2%)
<b>Female</b>	47 (8.3%)	9 (1.6%)	5 (.9%)	1 (.2%)	0 (0%)
<b>95% Confidence interval</b>	.736 (.524-1.034)	.394 (.125-1.245)	1.643 (.3963-6.812)	.986(.062-15.687)	1.004(.997-1.011)
<b>Total (147) (25.8%)</b>	110 (19.4%)	26 (4.5%)	8 (1.4%)	2 (.4%)	1 (.2%)

### Discussion

β -thalassemia, one of the thalassemia syndroms, is an autosomal recessive inherited blood disease characterized by a reduction in the synthesis of the B-goblin chain, which leads to a reduction in B-globin chain synthesis and eventually produces hypochromic microcytic anemia.<sup>11-13</sup>

β-thalassemia is widespread throughout the Mediterranean region, Africa, the Middle East, the Indian subcontinent and Southeast Asia.<sup>13-15</sup>

β-thalassemia major causes serious physical and emotional problems for patients and families, and a financial burden for health services.<sup>16</sup> Premarital screening is very useful for detecting carriers of β-thalassemia and for controlling thalassemia major.

The most accurate tests for the detection of a thalassemic carrier subject are genetic detection and globin chain detection, both of which are expensive and not routinely available for premarital screening.<sup>17</sup>

Thalassemic traits in general have reduced the Mean Corpuscular Volume (MCV) and reduced Mean Corpuscular Hemoglobin (MCH) with normal Mean Corpuscular Hemoglobin Concentration (MCHC). Specific cut off points for each index varies from laboratory to laboratory. Some laboratories concentrate on both reduced MCV and MCH<sup>2, 7</sup> and some on MCV or MCH alone.<sup>3,4</sup> This study showed that

low MCV alone is an effective tool for the detection of thalassemic carrier subject as one third of the subjects screened were labeled as possible carriers in countries with a limited economic status. Hb electrophoresis performed to possible thalassemia trait subjects confirmed that 24% of them had thalassemia trait.

The prevalence of β-Thalassemia Trait in our study was found to be 7.7%, a figure nearly similar to the 5-10% reported from Iran.<sup>18</sup> Our result was higher than the 3.4% and the 2% reported from Al-Ihssa Saudi Arabia and Turkey, respectively,<sup>10, 19</sup> and less than the 25% reported from the Gaza Strip.<sup>20</sup>

In countries with a high prevalence rate of hemoglobinopathies, premarital screening is helpful for the identification and prevention of high-risk marriages. From this study we concluded that the measurement of MCV alone is an effective preliminary premarital screening tool to identify possible thalassemia trait. For those with possible thalassemia trait, Hb electrophoresis will identify definite cases of thalassemia trait.

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## تأثير قياس متوسط حجم الكرية الحمراء في تحديد حمل سمة مرض الثلاسيميا في فحوصات ما قبل الزواج في شمال الاردن

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### الملخص

**الهدف:** دراسة اهمية قياس متوسط حجم الكرية الحمراء في تحديد حمل سمة مرض الثلاسيميا من خلال برنامج فحص ما قبل الزواج في اربد شمال الاردن

**طريقة الدراسة:** تمت الدراسة خلال سنة، لكل خاطب ومخطوبة تقدموا لفحص ما قبل الزواج في اربد. اشتملت فحوص المسح على عمل فحص دم لكلا الخاطبين. وعندما يكون متوسط حجم الكرية اقل من 80 fl لكلا الخاطبين، كان يعمل لهما فحص رحلان كهربائي لتأكد من سمة مرض الثلاسيميا، أعتبر الشخص يحمل سمة مرض الثلاسيميا اذا كان A2 أكثر من 3.2 % أو الهيموغلوبين F أكثر من 2%.  
**النتيجة:** خلال مدة الدراسة تم فحص 1752 شخص (876 زوج) لفحوصات ما قبل الزواج. لوحظ ان متوسط حجم الكرية اقل من 80 fl في 568 (32.4%) شخص أي 284 زوج. عمل لهؤلاء رحلان كهربائي. كان A2 مرتفعا في 47 (16.4%) انثى و 63 (22.3%) ذكر. كان A2 مرتفعا بنسبة (0.062) لجميع المرضى. و (19.4%) للمرضى الذين عندهم متوسط حجم الكرية اقل من 80 fl وقيمة الثقة الفاصلة ( CI ) تساوي 0.736 (0.449-1.034). كان A2 مرتفعا في 14 زوج (خاطب ومخطوبة). كان الهيموغلوبين F مرتفعا في 26 (4.5%) شخص من كلا الجنسين، كان الهيموغلوبين F مرتفعا في 5 أزواج. وكان الهيموغلوبين S مرتفعا عند 8 (1.4%) بينما كان الهيموغلوبين C مرتفعا عند 2 (0.4%).

**النتائج:** ان قياس متوسط حجم الكرية الحمراء طريقة جيدة وفعالة لتتحرى عن احتمالية حمل سمة مرض الثلاسيميا في فحوصات ما قبل الزواج في الاردن. ولمن يحتمل حمله السمة الوراثية للثلاسيميا يبقى عمل الرحلان الكهربائي للهيموغلوبين اساسيا ليحدد وبدقة المرضى الحاملين للسمة الوراثية لمرض الثلاسيميا .

**الكلمات الدالة:** سمة الثلاسيميا، متوسط حجم الكرية الحمراء، الرحلان الكهربائي، فحص ما قبل الزواج.