Hemoglobin Variant in Al-Madina Al-Mnora City, Saudi Arabia

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Abstract

Objectives: To study the frequencies of two electrophoretically distinguishable hemoglobin types from Saudi Arabia.

Materials and Methods: Blood samples from 246 residents from Al -Madina Al-Mnora City, Saudi Arabia, belonging to both genders and from all age groups were analyzed electrophoretically.

Results: About 40% of the population had Hb A, 39.4% had A2, 15% had Hb S and 5.6% had Hb F. Majority of the study population had type A hemoglobin. No gross physiological differences were observed in these different hemoglobin types.

Conclusions: The prevalence of abnormal Hb variants in Al-Madina Al-Mnora City was high; electrophoretic pattern showed structural differences in the hemoglobin molecule.

Key words: Hemoglobin, electrophoresis, hemoglobin electrophoresis.

Introduction

Hemoglobin is the iron-containing oxygen-transport metalloprotein in the red blood cells. This protein makes up about 97% of the red blood cells dry content, and around 35% of the total content (including water). Hemoglobin transports oxygen from the lungs to the rest of the body for cell use. Hemoglobin has an oxygen binding capacity between 1.36 and 1.37 ml O2 per gram of hemoglobin, and thus increases the total blood oxygen capacity seventyfolds.

Hemoglobin fraction analysis has the advantage of quantifying HbF, HbA2 and hemoglobin variants of thalassemias and studies have used this investigation for studying hemoglobinopathies and thalassemias in newborn-screening programs. Others have evaluated its performance with various other technologies and in the analysis of complicated α-thalassemia and β-thalassemia syndromes in Southeast Asia or rare hemoglobin variants. We report the results for hemoglobin variant in Al-Madina Al-Mnora City, Saudi Arabia.

Materials and Methods

This study was conducted over four months to determine hemoglobin variant in Al-Madina Al-Mnora City, Saudi Arabia. A total of 246 healthy volunteers, of all ages and both genders living in Al-Madina Al-Mnora City were studied after taking informed consent.

Venous blood was taken and poured in EDTA container (1.9 mg/ml) and mixed well. Very small sample of hemolysates prepared from whole blood were applied to the Titan III® Cellulose Acetate Plate. The hemoglobins in the sample were separated by electrophoresis using an alkaline buffer (pH 8.2-8.6), and were stained with Ponceau S Stain. The patterns were scanned on a scanning densitometer, and the relative percent of each band determined. The collected data were analyzed using SPSS to calculate the frequencies of hemoglobin variants.

Results

Hemoglobin electrophoresis was done in 246 healthy individuals. The data of those individuals who were tested as a part of the genetic study because of their presumptive or predicted hemoglobin type, were excluded from the analysis and only those individuals were sampled who, came at random. Forty percent subjects had Hb A, 39.4% had A2, 15% had Hb S and 5.6% had Hb F (Table-1).

The distributions of hemoglobin types among the selected ethnic groups is shown in Table-2. Type A, A2 and S hemoglobin was found in all groups and type A was the sole type among the Alanazi, while type A2 was common in Alhagog individuals.
beta hemoglobin variant chains but only few are common. Many variants cause no signs or symptoms, while others affect the function and stability of hemoglobin. Early screening for hemoglobinopathies allows for appropriate genetic counseling and an improvement in the outcome of patients with hemoglobinopathies.

References

Table 1: Hemoglobin variants in different ages and genders.

<table>
<thead>
<tr>
<th>Hemoglobin variant</th>
<th>Total N(%)</th>
<th>Male N(%)</th>
<th>Female N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>45(18.4)</td>
<td>53(21.6)</td>
<td>98(40.0)</td>
</tr>
<tr>
<td>A2</td>
<td>52(21.1)</td>
<td>97(39.4)</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>21(8.5)</td>
<td>37(15.0)</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>8(3.2)</td>
<td>14(5.6)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Distribution of hemoglobin types within the populations.

<table>
<thead>
<tr>
<th>Populations</th>
<th>A2</th>
<th>S</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alhagogy</td>
<td>15</td>
<td>35(14.2)</td>
<td>2(2)</td>
</tr>
<tr>
<td>Allanar</td>
<td>20(8.1)</td>
<td>12(5.0)</td>
<td>5(2.0)</td>
</tr>
<tr>
<td>Alanazi</td>
<td>34(14.0)</td>
<td>25(10.1)</td>
<td>7(2.8)</td>
</tr>
<tr>
<td>Alnakhaly</td>
<td>27(11.0)</td>
<td>25(10.1)</td>
<td>10(4.2)</td>
</tr>
<tr>
<td>Total</td>
<td>98(40.0)</td>
<td>97(39.4)</td>
<td>37(15.0)</td>
</tr>
</tbody>
</table>

Discussion

The present study showed hemoglobin A in majority of the subjects. These results are similar to those reported by Bangham19, upon which the theory of genetic control was originally based, and serves to support and strengthen that hypothesis.

Hemoglobin variants are a part of the normal embryonic and fetal development, but they may also occur secondary to pathological mutation of hemoglobin in a population, due to variations in genetics. Some well-known hemoglobin variants such as sickle-cell anemia are responsible for diseases, and are considered hemoglobinopathies. Other variants cause no detectable pathology and are thus considered non-pathological variants28-19.

The incidence of abnormal Hb in various regions ranges from 2.5% for HbA2 to 0.5% for HbF20. In our study, the incidence of abnormal Hb variants was high probably due to intermarriages in our population. High Hb A2 and F accounted for the common Hb variants in the present study and these findings are similar to the study done in Southern Taiwan21. Most Hb variants are seen as a change in the single base pair in the DNA code, resulting in an amino acid substitution and structural alteration. Such structural variants may demonstrate additional peaks in the chromatograms and show clinically as low or high results. More than 700 characterized Hb variants have been reported22 which arise from point mutations in the α, β, γ, or δ Hb chains22.

In the present study electrophoretic differences reflecting structural differences in the hemoglobin molecule were demonstrated. There are several hundred