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Frequency of the ABO and Duffy Phenotypes among Saudi Population in Eastern Provence

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Abstract
Objectives: *To document the frequency of the ABO and Duffy blood groups antigens and phenotypes among Saudi population in eastern province.*
Methods: *Hundred healthy individual adult have participated in this study (50 males, 50 females). Their blood was tested for ABO and for common Duffy antigens by using the tube agglutination method.*
Results: *The O antigen was the most common antigen among the study group (39%), followed by A (35%), B (18%), and the least common antigen was AB (8%). The most common Duffy antigens were Fy^a antigen (16%) and also Fy^b antigen (16%). Regarding to Frequency of Duffy phenotypes, the phenotype Fy (a-b-) was the commonest Duffy phenotype (72%), followed by Fy (a+b-) and Fy (a-b+), and Fy (a+b+) was least common (4%).*
Conclusion: *The O blood group is the most common phenotype in Saudi population, and the AB blood group is the least common phenotype. The phenotypes Fy (a-b-) was found to be of the highest frequency in our study than the other phenotypes. There is no significant difference between males & females of Saudi population in the distribution of ABO & Duffy blood group systems.*

Background

The ABO blood group system was discovered, back on 1900 A.D., by Karl Landsteiner when he classified people into one of the three groups A, B, and C that later called group O based on serologic differences between red cells of different individuals. [1] Two years later, A. Sturli and A. Decastello, who were Landsteiner students, discovered the fourth blood group (AB). [2] ABO blood group system, which considered the most important one among them, is a group of antigens that encoded by alleles at a single gene locus located in chromosome 9. [3] The ABO system is an integral part of the red blood cell membrane and of all the cells throughout the body. [4] The antigens of this blood group system are found also in plasma and other body fluid depends on Se gene inheritance.[5] Knowing the ABO type is a serious matter since the most common cause of death from a blood transfusion is incompatible type of ABO blood. Each individual has antibodies against the antigens that he does not express. For example, group A individual express A antigen on their red blood cells but he does not express antigen B, so he will develop antibodies against antigen B. [1] Furthermore, group AB individual has A and B antigens on their red blood cells, as a result he does not have antibodies

against ABO antigens in the blood stream, which making AB group individual receive any type of blood safely (Universal Recipient). [1] In the other hand, group O individual does not have any ABO antigen on their red blood cells, which leads to formation of antibodies against antigens A and B, resulting to consider O group individual a perfect candidate to donate blood to all types (Universal Donor). [1]

Duffy is considered the second most important clinically blood grouping system, just after the ABO system. Duffy was discovered on 1950 A.D. by Mollison and Parkin, when they founded the antibodies against specific antigen in the serum of Mr. Duffy, who is a hemophilic patient with a history of repetitive blood transfusions. The antigen was named later Fy^a, and the corresponding antibody for this antigen was named anti- Fy^a. [6] on 1951 A.D., the antithetical antigen Fy^b was discovered with its corresponding antibody anti-Fy^b. [6] The others Duffy antigens (Fy3, Fy4, Fy5, and Fy6) were discovered later. The Duffy site is located on the long arm of the chromosome 1. There are four Duffy system phenotypes: Fy(a+b-), Fy(a+b+), Fy(a-b+), and Fy(a-b-), and the four common alleles on the Duffy locus are Fy^a, Fy^b, Fy, and Fyx genes. [7]The Fy^a and Fy^b act as receptors for the entry of malaria parasite (P. vivax) into red blood cells, so that the Fy (a−b−) red cells will be resist the P. vivax merozoites invasion. Fyx gene is a new allele on the Duffy locus that has been described by Chown and his colleagues. Fyx gene produces a weak form of Fy^b antigen that will reacts with some but not all of anti-Fy^b. The difference between Fy^b gene and Fyx gene in quantitative rather than qualitative. The Fy^a and Fy^b antigens are well fully developed on the red cells at birth, but Fy3 and Fy5 antigens will develop later. [8]

Methods

In this study, 100 healthy participants (50 males &50 females) from Dhahran, Saudi Arabia have been recruited during a period of three months (2/2013 – 5/2013). The main goal is to determine the frequency of ABO and Duffy Antigens by using known Antisera (manually and automated).

Particle Immunodiffusion (ID) gel card technique (DiaMed-ID Micro Typing System):

The card contains gels premixed with reagents (antibodies), specified volumes of samples, and a no-wash antiglobulin that eliminates re-suspension of red cell buttons. The sephadex gel captures the agglutinates in a semi-solid medium, which enhances visualization of agglutination as compared to the traditional tube techniques where the agglutinate, particularly in weak reactions, mixes with the free cells at the bottom of the tube making visualization difficult. The gel is a suspension of porous microspheres whose size and distribution were selected to produce settling of non-agglutinated red cells at bottom of the micro tube and retention of agglutinate in the gel at variable levels according to their size. In addition, the gels contain preservatives such as sodium azide and sedimenting agents such as bovine serum albumin. The gel column is about 75 percent packed gel and 25 percent liquid. The microtubes of the card are embedded in a plastic card to allow ease of handling, testing, reading, and disposal. The retention of agglutinated red cells at the top this indicates the positive result. If all red cells are settled at the bottom these indicates the negative result.

Steps for determination of Fy^a, Fy^b by tube method:

1) 2 test tubes have been labeled (A, B) with donor/patient no. Anti-Fy^a, Anti-Fy^b.
2) Once washed, 2-3% suspension of the test cells (3-5 % = 1 drop of washed RBC + 30 drops of N.S) has been prepared.
3) 1drop of anti-Fy^a has been added in tube labeled A, one drop of anti-Fy^b has been added in tube labeled B.
4) 1 drop of 2-3% test cell suspension has been added in the two tubes A and B, mixed, and incubated for 15 minutes.

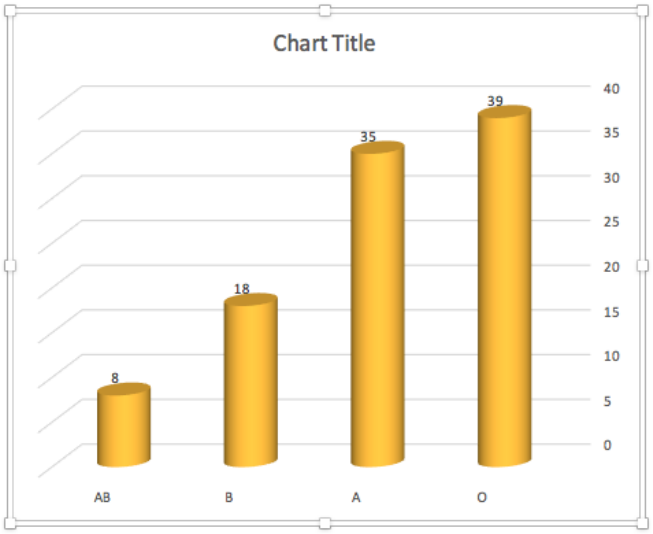
5) After the incubation, wash the tubes by adding normal saline, then centrifuge it for 3 minute.
6) The supernatant has been Decanted in the sink.
7) The cell button has been suspended.
8) Steps 6-7-8 have been repeated for two times.
9) 1-2 drops of AHG have been added to the 2 tubes and centrifuged at 1000 rpm for 20-50 seconds.
10) cell button has been Re-suspended by gently shaking the tubes and read against well-lit background.
11) Results have been Recorded according to grades of agglutination.

Results

The results from ABO antigens testing have shown that the antigen O was the most common antigen among the participates (39%), followed by A (35%), B (18%), and the least common antigen was AB (8%).

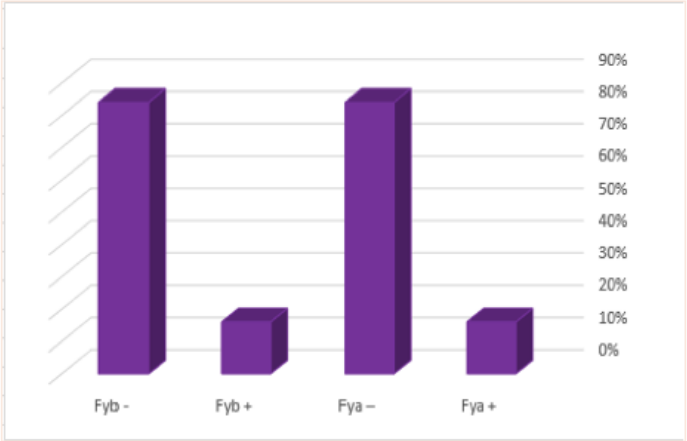
The most common Duffy antigens were Fy^a antigen (16%) and Fy^b antigen (16%). Regarding to Frequency of Duffy phenotypes, the phenotype Fy (a-b-), was the commonest Duffy phenotype (72%) among males and females, followed by Fy (a+b-) and Fy (a-b+) both phenotypes are (12%) and Fy (a+b+) was least common (4%).

Frequency of ABO blood group Among Saudis



Blood Group	Frequency
O	39%
A	35%
B	18%
AB	8%

Frequency of Fy^a&Fy^b Antigens Among Saudis



Fy Antigen	Frequency (%)
Fy^a +	16%
Fy^a –	84%
Fy^b +	16%
Fy^b -	84%

Discussion

The results showed that the frequency of O blood group (39%) was less than the frequency found in Mauritania, Jazan region, and eastern region previous studies. The results also showed that A blood group frequency (35%) and AB blood group frequency (8%) were Higher than the frequencies in the mentioned 3 regions. The frequency of B antigen (18%) found to be close to than the frequencies in the mentioned 3 regions. [9-11]

Fy (a-, b-) phenotype frequency found to be higher than the frequencies obtained in studies from India, and Rosario. Fy (a+, b-) and Fy (a-,

b+) frequencies (both 12%), and Fy (a+, b+) frequency (4%) found to be less than the frequencies in the same studies.[12-13]

Conclusion

Based on our results, the O blood group is the most common phenotype in Saudi population, and the AB blood group is the least common phenotype. The phenotype Fy (a-b-) found to be of the highest frequency in our study than the other phenotypes. There is no significant difference between males & females of Saudi population in the distribution of ABO & Duffy blood group systems.

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