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Distribution of Duffy Blood Group System Antigens Fy^a, Fy^b in Major Tribes of Turaba Province-KSA

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Abstract

Background. *Duffy blood group system is the one of the most minor blood group system has clinical significant in blood transfusion and cause hemolytic disease of the new born (HDN). The Duffy antigen is located on the surface of red blood cells, and is named after the patient in which it was discovered.*
Study design*. This study was desgined to determine the distribution of two antigens of Duffy blood group system Fy^a & Fy^b, in the major tribes of Turaba province, Saudi Arabia. The study was carried out in different parts of the Turaba and consent was taken from the health authority.*
Materials and methods*. Four hundred venous blood samples were collected into EDTA containers from unrelated individuals of major tribes in turaba province. The Duffy blood group antigens were detected using gel immune-diffusion system.*
Results. *Results were showed that the frequency of Fy^a antigen in the major population of Turaba province was 44%, where the frequency of Fy^b was 56%. Also result proved that the frequencies of Duffy phenotypes were Fy(a-b+), Fy(a+b), Fy(a+b+), Fy(a-b-) were* ***38%, 28%,16%, 18%*** *respectively.*
Conclusion. *This study proved that the Duffy blood group antigen Fy^b, was the highest antigen in Turaba province population, while the* ***Fy^a was*** *the lowest, while the Duffy phenotype* ***Fy (a-b+)*** *was the highest, and Duffy phenotype* ***Fy(a+b+)*** *was the lowest.*

Keywords: Fy^a, Fy^b , Immunodiffusion Gel Technique, Turabah Province

Introduction

There are many blood groups present on red cell membrane which is grouped into many systems. Red blood group antigens include various cellular and soluble components of whole blood that interact with specific antibodies, Red blood cells phenotype can be achieved using antibodies and reagents of known specificities .[1] The distribution patterns of **Fy^a and Fy^b** blood groups are complex around the world. Some variation may even occur in different areas within one small country. Significant regional heterogeneity has been reported in **Fy^a and Fy^b** gene frequencies[2]. Moreover one population may exhibit a high degree of similarity with a distant population that can be attributed to the common history of these populations. Studies based on distribution patterns **Fy^a and Fy^b blood Groups** are very helpful for studying complicated evolutionary history of human and population migration. Another important aspect of such studies is that some diseases have been found to be more common in some specific blood groups. (Hoffbrand & Pettit, 2001). Forensic application of blood group studies is of great value in detection of crime and determination of paternity[3]

Both FY and RH genes loci reside on chromosome 1. However, the FY locus is located on the long arm at position 1q22→ q23, whereas RH resides on the short arm.[4] Fy^a and Fy^b are antithetical antigens produced by codominant alleles, Fy^a and Fy^b. Four phenotypes are defi ned by the corresponding antibodies, anti-Fy^a and anti-Fy^b[5]. The Fy (a–b–) phenotype is the major phenotype in Blacks, but is very rarely found in Caucasians. The phenotype found in Blacks is characterized by the presence of Fy^b antigen on nonerythroid cells, but an absence of the Fy^b antigen on RBCs. A mutation in the erythroid promoter GATA-1 binding motif explains why Fy(a–b–) individuals do not make anti-Fyb (see Molecular section). The Fy(a -b–) phenotype found in Caucasians is characterized by a lack of Duffy antigen expression in both erythroid and nonerythroid tissues. Different mutations are present in either the FYA or FYB gene, which prevent the Duffy protein from being formed.

These individuals, interestingly, tend to form anti-Fy3.5 Other alleles have been reported at the Fy[6] locus. The Fy^x phenotype is associated with weak expression of Fyb, Fy3, and Fy5 antigens.

Chown *et al*.6 first reported the Fyx gene and estimated the phenotype frequency in a Caucasian population was not more than 2 percent. It is now known that Fyx is caused by a point mutation in the FYB gene.[7,8] The first antibody was found in a maternal serum and caused hemolytic disease of the newborn in her infant. codominant characteristic but the locus has not been mapped.

Table 1 Frequency of Duffy blood group system antigens in different populations

Duffy blood group antigen	In India	In Whites	In Blacks
Fy^a	86.8%	17%	9%
Fy^b	56.2%	34%	22%

Table 2 Frequency of phenotypes of Duffy blood group system

Duffy phenotype	Black	Caucasian	Whites	Chinese	Indian
Fy(a+b+)	1%	1%	17%	9%	42.6%
Fy(a-b+)	34%	22%	34%	<1%	56.2%
Fy(a+b-)	17%	< 0.1	49%	91%	43.9%
Fy(a-b-)	68%		<0.1%		0%

Materials and Methods

Four hundred venous blood samples were collected from unrelated individuals belonging to the major ethnic populations of Turaba province, Saudi Arabia. Sample size was calculated using the approximate proportion to population size in Turaba province. The study was done in over one year and six months. Each participant, who accepted to participate in the study, received three sheets,(consent form, venipuncture form and questionnaire). Fy^a, and Fy^b antigens were detected in blood samples using immunodiffusion gel System (ID-Gel System).

Immunodiffusion Gel System (ID-Gel System) Reagents

•Reagents

ID-Card , **Duffy-A (Fy^a) & Duffy-B (Fy^b)** The micro-card contains the following monoclonal antibodies: anti- **Duffy-A (Fy^a),** anti- **Duffy-B (Fy^b)**, within each gel matrix. Negative controls were included in each card Caution: All reagents should be treated as potentially infectious.

Procedure

Five percent (5%) of red blood cell suspension was prepared by dispensed of 0.5 ml of ID-Diluent-1 into clean test tube.

Fifty (50) µL of whole blood or 25 µL of packed red cells was added to the same test tube, and was mixed gently. The ID-Card" **Duffy-A (Fy^a) & Duffy-B (Fy^b)**" micro-card was identified with the individual name, tribe and number. The aluminum foil was (is will be) removed. 1- Twelve point five (12.5)µLof the red cell suspension wasas added to all micro-tubes of the ID-Card.2- The ID-Card was centrifuged for 10 minutes in the ID-Centrifuge.

Results

Table 3 Frequency of participants according to gender

Sex	Number of participant	%
Male	213	53.2
Female	187	46.8
Total	400	100

Table 4 Frequency of Duffy Blood Group Antigens Fy^a , Fy^b among Turaba population

No of samples	Fy^a	Fy^b
400	176	224
%	44	56

Tables 5: Frequency of Duffy blood group phenotypes among Turaba Tribes

Phenotype	Fy(a+b-)	Fy (a-b+)	Fy (a+b+)	Fy (a-b-)
Frequency	112	152	64	72
%	28	38	16	18

Discussion

The knowledge of prevalence of different blood group antigens in any given population is always helpful in managing cases of alloimmunization. Multiply transfused patients such as those with thalassaemia, sickle cell anemia; patients on dialysis, cancer patients, *etc*. are likely to develop antibodies against these minor blood group antigens as it is not practically feasible to match all these minor antigens before transfusion so as to avoid immunization. Finding compatible units for such patients without having any knowledge of the prevalence of the implicated antigens in the local population is a difficult task, more so if the patient has developed more than one antibody.

Duffy blood group system is the one of the most minor blood group system has clinical significant in blood transfusion and cause hemolytic disease of the new born (HDN)**.** A total of four hundred samples were collected from unrelated individuals from major tribes of Turaba province- Taif. KSA. All samples were tested for common Duffy blood group system antigens **Fy^a , Fy^b ,** using Immunodiffusion gel technique. This is the first study done in Saudia Arabia to record for the one of the most clinical significant blood group systems, and this data on incidence of Duffy antigens of various blood groups in the

local donor population helps in routine blood transfusion practices of a blood center.

The phenotyping (blood grouping) of red cells depend upon interpretations of serological interactions between red cell antigens and antibodies. Various serological methods and test systems are available to demonstrate these interactions and these must be optimized in order to obtain the appropriate sensitivity and specificity for their intended clinical use regarding to technique using in this study the immune-diffusion system is an accurate technique in detection of blood group system.

This study recorded that the frequency of Fy^b antigen in the major population of Turaba province was **54**%, this is result similar to the study done in India, but little bit different from study done in White and Black people, when the frequency of Fy^a antigen was **44%,** that are approximately similar to the result reported in Sudanese major population [1], and also agreed with the Indian population. [2] This study proved that the most frequent phenotype in Turaba province population was Fy (a-b+) , when the lowest phenotype was Fy (a-b+) which was similar to study results done in Sudanese population. [1], and closed to results done in in Whites and Blacks[3]. Many other countries are lacking for the studies similar to this study.

Conclusion

1. Duffy blood group antigen Fy^b was the commonest antigen in e population of Turaba province, while the Fy^a antigen was the least frequent.

2- Fy (a-b+) phenotype was the most common phenotype of Duffy blood group system in Turaba population while Fy (a+b+) phenotype was the least frequent.

3-There are no significant differences between the frequencies of Duffy blood group antigens, and phenotypes, in Turaba population and other populations

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