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Hematology & Transfusion International Journal

Research Article

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Frequency of the A2-subgroup among blood group a and blood group AB among students of faculty of medicine and health sciences at Alimam Almahadi university, White Nile, Sudan

Abstract

Background: ABO blood group system plays a vital role in transfusion medicine, genetics understanding, inheritance pattern, and disease susceptibility; therefore, it is fundamental to have information on the distribution of these blood groups among any population. There is very slim published data about distribution of ABO blood groups in Sudan and lesser about subgroups.

Methods: Blood samples were collected from 100 students in faculty of Medicine, Al imam Al Mahdi university, Kosti, White Nile state, Sudan. Students were known to have either A or AB blood groups and were typed for A1 and A2 subgroups as well as RhD antigen.

Results: Among the A group there are 93.42% A1 subgroup and 6.6% A2 subgroup. Among the AB group there were 91.6% A1B and A2B was 8.33%.

Conclusion: Frequency of A2 subgroup among A and AB blood phenotypes are equal in Sudanese.

Keywords: blood, group, subgroup A1, subgroup A2, sudanese

Volume 1 Issue 4 - 2016

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Received: October 31, 2015 | **Published:** December 18, 2015

Introduction

Antigens of the ABO blood group system (i.e., A, B, and H antigens) and Rhesus factor were discovered more than one century ago by karl et al.[1,2] who is considering the father of transfusion medicine, and with this discovery he enabling physicians to transfuse blood without endangering the patient's life. The ABO antigens are defined by carbohydrate moieties on the extracellular surface of the red blood cell (RBC) membranes,[3] but they are also highly expressed on the surface of a variety of human cells and tissues, including epithelium, sensory neurons, platelets, and vascular endothelium.[4] The ABO and Rh blood group system remain the most important blood group systems and the classical immuno genetic markers.[5,6] Blood group antigens play a vital role in transfusion medicine, genetics understanding, inheritance pattern, and disease susceptibility.[7] ABO and Rh D system also have a key role in evolutionary biology, anthropology, studying migration patterns, forensic pathology, and medico-legal issues such as unmatched pregnancy and disputed paternity.[8] The frequency of ABO blood groups varies greatly in different races and populations. In most populations, about 50% are Group O, followed closely by group A, with groups B and AB showing a much lower incidence.[3] In Chinese population group B has higher frequencies[9] and it is the commonest group in the Bengalese population.[10]

ABO subgroups are distinguished by decreased amounts of antigens on RBCs and, in secretors, present in the saliva.[3] Variation in A antigen expression was recognized early in the twentieth century[11] and the A blood group was divided into A_1 and A_2[12,13] which are the two principal A subgroups. Subgroups weaker than A_2 are not frequent, and are characterized by a decreasing number of A antigen sites on the RBCs and a reciprocal increase in H antigen activity. Other subgroups of A include A_{int}, A_3, A_x, A_{end}, A_m and A_{el} are met only rarely in transfusion practice, and the last four cannot reliably b identified on the basis of blood typing tests alone.[3] The frequency of the common A subgroups varies greatly among different populations. Approximately 80% of blood type A or AB are classified as A_1 or A_1B, the remaining 20% are either A_2 or A_2 B.[14,15] In study from India the frequency of A_1 and A_2 subgroups among A blood group was respectively 98.14% and 1.07%, in the AB group the frequency of A_1B was 89.28% and that of A_2B was 8.99%, this report described the proportion of A_2B among AB samples as significantly higher than that of A_2 in group A samples[16] and approximately the same distribution is obtained by Bangera.[17] In general frequencies of $A_1$and A_2 phenotypes are compatible with the Hardy-Weinberg equilibrium for the Mendelian inheritance of the allelic A_1 and A_2 genes, but in some populations, such as blacks and the Japanese, the frequency of the A_2B phenotype is significantly higher than the expected frequency based on the frequency of the A_2 phenotype.[18,19]

A_2 and A_2B individuals may have anti-A_1 in their serum, which appears as an atypical cold agglutinin.[16] Approximately 0.4% of A2 and 25% of A_2B individuals have anti-A_1 in the serum,[20] these antibodies become clinically significant when react at 37 °C and cause extensive destruction of A_1 cells.[21,22] These antibodies can interfere in routine blood grouping and can give incorrect blood typing or can rarely cause haemolytic transfusion reactions.[17]

In Sudan there is very slim published data about distribution of ABO blood groups,[23,24] frequency of the Rh antigens[25] and only one report[26] described the general frequency of $A_1$and A_2 among the blood

donors and to the best of our knowledge there is no published work in the literature regarding distribution of subgroups(A_1,A_2) among individuals of group A neither distribution of subgroups (A_1B,A_2B) among individuals with group AB in Sudan. So in this study we aim to determine the frequency of subgroups(A_1,A_2), (A_1B,A_2B) Among individuals of group A and AB respectively in the students of Faculty of Medicine and Health Sciences at AL imam Al Mahdi university, Kosti, White Nile ,Sudan.

Materials and methods

100 students known having blood group A or AB were recurred for this study after an oral informed consent had been obtained. Standard method for ABO blood group was used to confirm the blood group and Rh status. Samples were further tested with anti-A_1 lectin to classify them into A_1, A_2. Whenever the agglutination was 4+ with anti-A antisera but negative with anti-A_1 lectin, the sample was considered as A_2 subgroup. The significance of differences in proportions was analyzed using percent test.

Results

Distribution of A and AB blood groups in the total population of the study is shown in Table 1. 97% of the total sample was positive for Rh D antigen. Distribution of A subgroups and AB subgroups among A and AB respectively are shown in Figure 1 & 2. Frequency of A_2B subgroup among AB group was slightly higher than frequency of A_2 among A group (Table 2) but was statistically insignificant (percent test). Ratio of A_2/A_1 is0.07 and that of A_2B/A_1B is 0.09.

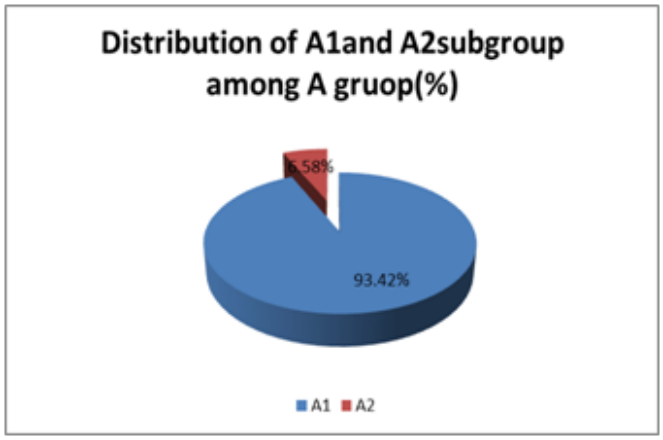

Figure 1 Distribution of A_1 and A_2 subgroup among A group (%).

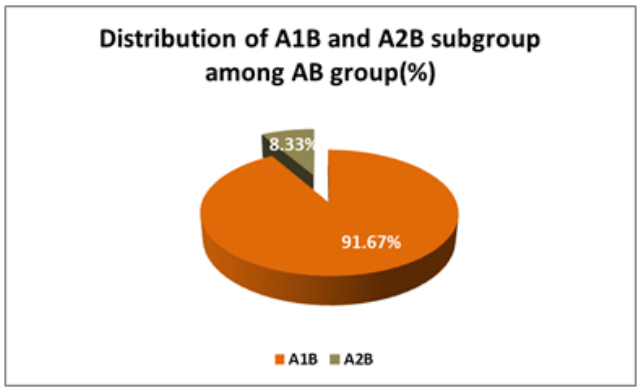

Figure 2 Distribution of A1B and A2B subgroup among AB group (%).

Table 1 Distribution of A and AB blood groups among the study population

ABO blood group	Frequency	Percentage
A	76	76%
AB	24	24%
Total	100	100%

Table 2 Distribution of A and AB subgroups among A and AB groups

Blood group	Subgroup	Number (%)
A	A1	71(93.42%)
	A2	5(6.58%)
AB	A1B	22(91.67%)
	A2B	2(8.33%)
Total		100

Discussion

The frequency of the common ABO phenotypes (A_1, A_2, B, A_1B, A_2B and O) varies greatly among different populations.[14,27] Populations with a high frequency of A phenotype are found mainly in Northern and Central Europe. The B phenotype is most frequent in Central Asia and almost absent in Amerindians. Blood group O is the most frequent phenotype in a global perspective.[4] In this study 100 blood samples we collected from students of faculty of Medicine, Al imam Al Mahdi University, they were known to have either A or AB blood group and this was confirmed in each sample. Among this studied sample there were 76% group A and 24% group AB (Table 1) and this is in consisting with the previous studies done in Sudanese[25,26] which also showed a higher frequencies of A group than AB group.97% of our population were positive for RhD antigen which matches previously reported per cents in Sudanese.[25,26] Our results showed that A_1 is the commonest sub group among A group (Figure 1) and A_1B is the commonest subgroup among AB group (Figure 2) which is in agreement with[16,18,28] which reported the same distributions in Indian, Japanese and South Africans respectively. Which means that A_2 and A_2B are rare subgroups. But still they are important because anti-A_1 antibodies occur in sera of A_2 groups and more common in A_2B subgroups[20] and can be encountered during clinical practice,[29] causing difficulties in blood typing,[30] hemolytic transfusion reaction[22] and complicate organs transplantation.[31] In this study the frequency of A_2B subgroup in AB group is slightly higher than that of A_2 subgroup in A group (Table 2), but this difference is statistically insignificant, so the frequencies of A_2 and A_2B among A and AB groups respectively are in balance, which is in agreement with studies done in Caucasian population,[14,32] but in contrast to studies done in blacks population.[14,28] Indian,[16] Japanese[18] and Chinese[33] because studies performed among all those populations reported imbalance in the frequencies of A_2 and A_2B in A and AB positive individuals, respectively. This imbalance in blacks has been explained by domination of the B gene on phenol typing expression of A_1B causing this A_1 to be expressed as A_2 or A_{int} leading to A_2B excess.[28,34,35] In Japanese the higher frequency of A_2 in AB group was explained by the different expressions of the allele R101, which is expressed as phenotype A_1 in *R101/*O heterozygous individuals, but as phenotype A_2 in *R101/*B hetero zygotes, thus giving rise to a higher A_2B phenotype frequency.[19] This super active B gene has been reported as a control for expression of the super active B* enzyme, exists in both blacks and Japanese.[18]

Citation: Elnour MA, Ali NY, Mohammed HA, et al. Frequency of the A2-subgroup among blood group a and blood group AB among students of faculty of medicine and health sciences at Alimam Almahadi university,White Nile, Sudan. *Hematol Transfus Int J.* 2016;1(4):104–106. DOI: 10.15406/htij.2016.01.00022

Conclusion

In conclusion frequency of A_2 subgroup among A and AB blood phenotypes are almost equal in Sudanese, which is a surprise, because Sudanese ethnic groups are mainly African and the balanced distribution is a character of Caucasian groups. This can be related to the fact that Sudanese are a mixture of different ethnic groups.[36]

Acknowledgements

None.

Conflict of interest

The author declares no conflict of interest.

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