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Original Article

Distribution of ABO blood group and Rhesus factor among students in ASIA Metropolitan University, Malaysia.

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ABSTRACT

Background: Up till now about 200 antigen have been identified. The ABO blood group system was first to be known and rhesus factors (Rh) blood group, both are most essential for blood transfusion purposes. Gene for ABO antigens is on the 9th chromosome and Rh antigen gene is on the first chromosome. **Objective:** This study was conducted to determine the distribution of ABO blood group and Rhesus factor among students in ASIA Metropolitan University, Malaysia. **Materials and Methods:** Blood grouping (ABO) and rhesus factors (Rh) was done by the antigen antibody agglutination test. 1414 randomly chosen health sciences students from ASIA Metropolitan University were screened for their blood group systems. Out of these subjects, 259 were males and 1155 were females. **Results:** Out of 1414 subjects that were randomly selected, 259 (18.32%) were males and 1155 (81.68%) were females. From the total number of males subjects, 257 (99.23%) and from the total number of females subjects, 1134 (98.18%) were found to be Rh positive. Overall 1391 (98.37%) subjects were found of having the Rh-positive and 23 (1.63%) subjects were having Rh-negative. **Conclusion:** In the present study, the frequency of Rh-negative blood group in male and female subjects were O, B, A, AB and B, O, A and AB. Whereas the most common Rh-positive in male and female subjects are O, B, A, AB and O, B, A and AB respectively.

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1. Introduction

Blood is the most important body fluid, which is responsible for circulation of important nutrients, enzymes, and hormones all across the body, besides the most critical substance, oxygen. Blood is man's complete and unchangeable identity [1]. In human beings, 19 blood groups systems with more than 200 antigens have been identified [2].

In 1900, the immunologic era of blood transfusion was introduced when Karl Landsteiner discovered the blood groups by noting the agglutinating properties of the erythrocytes of the some persons with the serum of others. In 1901, Lansteiner drew blood from himself and five other associates, separated the cells and the

serum and mixed each cell sample with each serum. He was inadvertently the first individual to perform forward and reverse grouping [3].

Landsteiner in 1901 named the first 2 blood groups antigens A and B, using the first 2 letters of the alphabet while red blood cells (RBCs) not reacting with anti-A and anti-B were called type C. In 1902, Von Decastello and Sturli described RBCs reacting with both anti-A and anti-B, but did not give these type a name, but continued calling RBCs that did not react with anti-A and Anti-B type C. 1911, von Dungern and Hirszfeld were the first to use the term O to describe RBCs not reacting with anti-A and anti-B and the term AB for RBCs reacting with both anti-A and anti-B [4]. Later Landsteniner and Wiener defined the Rh blood group in 1941. Together these two systems have proved to be the most important, for blood transfusion purposes [5].

Blood groups and Rh antigen are hereditary. Gene for ABO antigens is on the 9th chromosome and Rh antigen gene is on the first chromosome. The distribution ABO blood group is varies regionally, ethnically, and from one population to another [6]. All

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human populations share the same blood group systems although they differ in the frequencies of specific types. The incidence of ABO and Rh groups varies very markedly in different part of the world and in different races [5].

Research on ABO group system has been of immense interest, due to its medical importance in different diseases. The ABO blood group system is not only important in blood transfusion, cardiovascular diseases, organ transplantation, erythroblastosis in neonates but also one of the strongest predictors of national suicide rate and a genetic marker of obesity [7].

Among the first epidemiological studies to establish associations between the blood groups and the diseases, there were some manifestations of high frequencies of the O blood group and non-secretor phenotype of ABO antigens in patients suffering from peptic ulcers [8]. The blood bank is having the most important function in order to offer appropriate blood components, which is highly required by the patient, by preparing certain blood components. Therefore, in the blood bank, the blood grouping has taken the top place [9]. The major blood groups of this systems are A, B, AB, and O [7]. Some of the blood group system beside "ABO" and "Rh" are MNS, P, Kell, Kidd, Duffy, Lutheran systems [3].

Group A blood has type A antigen, group B blood has type B antigen, group O blood has neither A nor B antigen and group AB has both antigen A and B. Plasma from blood group A contain Anti- B antibodies, plasma from person with type B blood contain Anti- A antibodies which act against type A antigen, person with AB blood group contain neither A nor B antibodies and plasma from O type blood has both A and B antibodies [10].

The ABO blood group system not only used in the case of blood transfusion and organ transplantation but also can be utilized in the genetic research, forensic pathology, anthropology and tracing ancestral relation to human [6] and may have some association with duodenal ulcer, diabetes mellitus, urinary tract infection [2]. Anthropologists have used the ABO blood types as a guide to the development of modern humans. Many diseases, particularly digestive disorders, cancer, and infection, show preferences among the ABO blood types [11]. The A and B antigens are expressed on red blood cells (RBCs) and these antigens are inherited co dominantly over O [7].

The human red blood cell membrane contains different types of polysaccharide antigens, called agglutinogen. The antigenic substances are capable of inducing a specific immune response and that specific response results in the production of cells termed as anti-bodies. Blood carries several antigens within it, which form the basis of its reactivity and hence it is not possible to mix the blood of all humans without initiating an immune reaction. Only the blood samples, which share the same antigenic identity, do not initiate an immune response, and hence are termed as compatible [1].

In order to avoid danger of mismatched blood transfusion, it is important to determine the blood groups of those involved prior to a transfusion. These days, to eliminate the risk of transfusion reactions, the practice of autologous transfusion is followed by most of the physicians. The routine practice of blood typing and cross matching blood products should prevent adverse transfusion reactions caused by ABO antibodies [12].

Blood grouping has improved with the advent of monoclonal antibodies and the automation of tests. Although different advanced techniques, such as micro plate method, PCR based, FMC based typing, mini sequencing analysis, fluorescent immuno microplate technique, sandwich ELISA method for ABO genotyping are available, but manual method has its own significance not only in blood typing but also measuring its genotypic frequency by Hardy-Weinberg Law, with no additional costs in the areas with limited access to advance/automated techniques [1].

However clerical error can result in transfusion reaction that can be fatal. Apart from this, the knowledge of distribution of ABO blood group is most important as certain diseases/malignancies have predilection for certain blood groups, like it was found that carcinoma of cervix had higher frequency in blood group A. A significant association was identified for cholera in which cholera patients were twice as likely to have blood group O and one ninth as likely to have blood group AB as community controls. Some interesting facts are also related to blood groups. An association has been found between distribution of finger print (dermatographic) pattern and blood groups. The correlation is more consistent for blood group A and loops, arches are more common in blood group AB [12].

It is interesting to note that the distribution of ABO and Rh blood groups varies from race to race therefore, the distribution of the blood groups A, B, O, and AB varies across the world according to the population and within human subpopulations, example in United Kingdom, the distribution of blood type frequencies in the population still shows some correlation to the distribution of place names and to the successive invasions and migrations, including Vikings, Danes, Saxons, Celts, and Normans, who contributed the morphemes to the place names and the genes to the population. When the rate of Rh positive is considered, varying percentages were reported in various races and populations. Caucasians (85%), African blacks (94%), Asians (99%), Arabians (91%), and Europeans with their descents (84%) [13].

2. Material and methods

1414 randomly chosen health sciences students from ASIA Metropolitan University were screened for their blood group systems. Out of these subjects, 259 were males and 1155 were females. A 1.0-2.0 ml sample of blood was drawn from the antecubital vein of each subject in a disposable syringe, and transferred immediately to a tube containing ethylene diamine

tetra acetic acid (EDTA). Blood grouping (ABO) and Rhesus factors (Rh), was done by the antigen antibody agglutination test. The anti sera used were obtained from Plasmatec Laboratory, Great Britain [1].

3. Results

From the table 1, it is a clear evident that out of 1414 subjects that were randomly selected, 259 (18.32%) were males and 1155 (81.68%) were females. From the total number of males subjects, 257 (99.23%) and from the total number of females subjects, 1134 (98.18%) were found to be Rh positive. Overall 1391 (98.37%) subjects were found of having the Rh positive and 23 (1.63%) subjects were having Rh negative.

The overall distribution of blood group in the studied population with gender distribution was 38.26%, 30.20%, 24.89%, 6.65% for blood group O, B, A and AB, respectively.

Table 1: ABO and rhesus blood grouping

Blood group	Total donors	Percentage (%)
ABO blood grouping		
A	352	24.89
B	427	30.20
O	541	38.26
AB	94	6.65
Rhesus (rh) blood grouping		
Rh +ve	1391	98.37
Rh -ve	23	1.63

From the table 2, it is clearly mentioned that O group was dominant in both group (males and females) followed by B and A. Group AB was rare in both males and the females. Among the Rh positive male, O blood group was found to be most prevalent group (7.07%) followed by group B (6.01) than followed by blood group A (4.17%) and finally group AB (0.92%).

In comparison with Rh positive for female, also blood group O was found to be most prevalent (30.69%) followed by group B (23.55%), group A (20.37%) and the least prevalent was group AB with 5.59%.

Among Rh negative male subjects, group O and B sharing the same percentage of 0.07% respectively and neither group A nor AB were found of having Rh negative.

Among Rh negative female subjects, blood group B is commonest with 0.57% followed by group O (0.42%), group A (0.35%) and the least common was AB (0.14%).

Table 2: Frequency distribution of ABO and Rh blood groups among study population

Blood group	Male	Female	Total donors	Percentage (%)
A +ve	59	288	347	24.54
B +ve	85	333	418	29.56
O +ve	100	434	534	37.77
AB +ve	13	79	92	6.51
A -ve	0	5	5	0.35
B -ve	1	8	9	0.64
O -ve	1	6	7	0.50
AB -ve	0	2	2	0.14

Table 3: Comparison of frequency percentage of ABO and rhesus blood group in the present study and the other countries

Population	A	B	O	AB	Rh +ve	Rh -ve
Britain [6]	42.00	8.00	47.00	3.00	83.00	17.00
USA [6]	41.00	9.00	46.00	4.00	85.00	15.00
Turkey [9]	43.80	16.20	30.80	9.20	86.00	14.00
Iran [9]	33.1	23.3	34.7	8.9	88.7	11.3
India [5]	18.85	32.50	38.75	9.90	94.45	5.55
Nigeria [5]	24.43	23.88	48.94	2.75	95.67	4.33
Present study						
(Malaysia)	24.89	30.20	38.26	6.65	98.37	1.63

4. Discussion

The need for blood group prevalence study is not only important for transfusion medicine but also for organ transplantation and genetic research [12]. Populations of the United States, Asian, Syrian Arabs and Palestinians, group O is dominant, with AB being the rarest, while in Saudi Arabia the prevalence of blood group A is higher as compared to the Pakistani population, where the blood group B is more prevalent. This sharp difference among the blood groups distribution may be due to geographical variations, external environment and genetic factors involved [1].

In present study, blood group O > B > A > AB. The same scenario is experienced by India where blood group O is the highest followed by B, A and AB. In many Asian populations, there is an increase in the prevalence of group B, example in India and Malaysia [13]. From the table 3, except Turkey, other countries like Britain (47.00%), USA (46.00%), Iran (34.70%), India (38.75%), Nigeria (48.94%) having blood group O as the most prevalent blood group. The same scenario experienced in our present study where O (38.26%) is the most prevalent blood group.

From the same table, none of the countries having blood group B as the most prevalent blood group system. Only in Turkey the blood group A (43.80%) is most prevalent followed by blood group O (30.80%), group B (16.20%) and AB (9.20%). Compare to the other countries, Britain is having lowest prevalent of blood group B (8.00%).

In our study, rhesus positive was recorded as 98.37% and only 1.67% was rhesus negative. The similar situation was observed in the countries in table 3. Present study was recorded highest prevalent of rhesus positive followed by Nigeria (95.67%), India (94.45%), Iran (88.7%), Turkey (86.00%), USA (85.00%) and Britain (83.00%). Rhesus negative was recorded in highest prevalent by Britain (17.00%) and the lowest in present study (1.63%).

Blood group O is a risk factor for duodenal ulcer. Blood group B has highest frequency of Diabetes Type II, since diabetes is common in our population, persons with blood group B who are at high risk should have screening for diabetes earlier than normal population [12].

5. Conclusion

The study has a significant insinuation regarding the need for blood group prevalence study which is not only important for transfusion medicine but also for organ transplantation and genetic research. Familiarity of blood group distribution is also essential for reliable geographical information, for clinical studies, external environment and genetic factors in the population. Whereas the rhesus positive (Rh +) was recorded as 98.37% and only 1.67% was rhesus negative (Rh-) of the study that has been conducted. Besides that, this studies will help a lot in dipping the maternal mortality rate, as access to safe and adequate supply of blood will help significantly in reducing the preventable deaths. Such studies need to be carried out at all the regional levels of Malaysia.

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