

Association between different blood groups and blood hemoglobin levels of medical undergraduates: an analytical study

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Abstract

Background: Blood is a specialized connective tissue with complete and unchangeable identity. Although almost 400 blood grouping antigens have been reported, the ABO and Rh is recognized as the major clinically significant blood group antigens which are also known to vary from one population to another. This study therefore sought to study the frequency of these indices and hemoglobin concentration. **Material and Methods:** This cross-sectional analytical, laboratory based study for the association of ABO blood group, Rh factor and hemoglobin concentration in MBBS students was carried out in the Department of Physiology, Patna Medical College, Patna, Bihar, India from November 2018 to October 2019, after taking the approval of the protocol review committee and institutional ethics committee. A total of 200 students aged 16-25 years, were include in this study. The ABO and Rhesus blood grouping were done using the slide method and Hemoglobin concentration was estimated by Acid Haematin method. **Results:** Out of 200, 80 males and 120 females between the ages 16 and 25. The highest percentage of students are of Blood group O (36%), followed by A (34%), B (22%) respectively. The percentage of student having blood group AB are only 8%. There is no significant relationship between male and female students in their blood group. p-value = 0.200 which is greater than 0.05. There was no significant difference between Rhesus positive and Rhesus negative students with ABO blood group system p value is 0.77. This table shows that 56% female students are Rh positive and 4% female students are Rh negative. **Conclusion:** We conclude that individuals with blood group B are more prone to anaemia followed by blood group O, A and least is with blood group AB. Based on their blood groups, we can advice regular intake of diet rich in iron and vitamins or also their supplements to the individual who are more susceptible to anaemia.

Keywords: hemoglobin, Rhesus, ABO and Rh.

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Introduction

Blood is a specialized connective tissue with complete and unchangeable identity. It provides one of the means of connection between the cells of different parts of the body and external environment.[1] In modern medicine blood transfusion is an important measure for replacing blood loss.[2] At least 30 commonly occurring antigens and hundreds of other rare antigen have been found in human blood cells, especially on the surfaces of the cell membranes. Most of the antigens are weak and therefore are of

importance principally for studying the inheritance of genes to establish parentage. Two particular types of antigens are much more likely than the others to cause blood transfusion reactions. They are the A B O system of antigens and the Rh system.[3] ABO and Rh are recognized as the major clinically significant blood group antigens. The rhesus blood group system was the fourth system to be discovered.[1] The ABO blood group individuals are divided into four major blood groups, namely, A, B, AB and O, according to the presence of antigens and agglutinins. Blood group A blood has type A antigens, blood group B has type B antigens and blood group O has neither A nor B antigens. The Rhesus antigen (name because a related antigen was first discovered in Rhesus monkeys), is found in the red blood cells of approximately 85%-

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90% of the people. This is the second most important blood group system due to its immunogenicity in Rh negative individuals in blood transfusion or pregnancy. Rh positive individuals have RhD antigen on the surface of their red blood cells and Rh negative individuals do not have this antigen. Blood group antigens are not only important in relation to blood transfusion and organ transplantation, but also have some association with diseases like duodenal ulcer, diabetes mellitus, urinary tract infection and Rh incompatibility of the newborn.[1] As per the World Health Organization (WHO) database on anemia globally, anemia affects 1.62 billion people (95%), which corresponds to 24.8% of the population. WHO also estimates that anemia contributes to about 20% of maternal and perinatal death in developing countries.[4,5] Anaemia can be defined by a condition in which the total haemoglobin (Hb) level or number of red blood cells (RBCs) is poorly lowered. The World Health Organisation (WHO) defines anaemia as Hb < 130 g/L in men older than 15 years, 110 g/L in pregnant women, and < 120 g/L in non-pregnant women older than age 15.[6, 7] Anemia is defined as a clinical condition which is characterized by reduction in hemoglobin concentration of the blood below the normal for the age.[2] It is a global problem, mainly affecting poor people in developing countries.[2,3] Anemia during adolescence severely impairs the physical and mental development; weakens behavioral & cognitive development; reduces physical fitness; decreases the work performance and even contributes to the adverse pregnancy outcome.[1] Though, the oral iron supplements are given commonly to correct anemia, but should be used only when dietary measures have failed. Moreover, iron supplement can correct anemia which is due to iron deficiency.[4] Besides this, oral iron supplements can cause gastrointestinal problems like nausea, vomiting, diarrhea and constipation and can even aggravate pre-existing ulcers and ulcerative colitis. Long term iron supplements also can cause heart disease. Anaemia even can have a negative impact on physical performance, due to reduced oxygen transport the reduced cellular oxidative capacity.[6,8] Therefore, the present study has been carried out to record the frequency of various blood groups and hemoglobin concentration in the MBBS students of Patna Medical College, Patna, Bihar, India.

Material and methods

This cross-sectional analytical, laboratory based study for the association of ABO blood group, Rh factor and hemoglobin concentration of MBBS students was carried out in the Department of Physiology, Patna

Medical College, Patna, Bihar, India from November 2018 to October 2019, after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the participant.

Methodology

A total of 200 students aged 16-25 years, were included in this study. The blood was transferred into prepared Ethylene-diamine Tetra-acetic Acid (EDTA) anticoagulant vial. The ABO and Rhesus blood grouping were done using the slide method. A drop of blood from each student was placed on a clean dry glass slide in three places. A drop of each of the antisera, anti A, and anti B and anti D was added and mixed with each blood sample with the aid of plastic stick. Blood groups were determined on the basis of agglutination reaction. Hemoglobin concentration was estimated by Acid Haematin method. This method is based on the principle that haemoglobin present in a sample of blood is converted into acid haematin by addition of N/10 HCl to the blood and its haemoglobin content is determined by matching the brown colour of the solution against a non-fading coloured glass.

Statistical Analysis

The data were entered in Microsoft Excel and then Statistical Package SPSS version 16.0 was used for data analysis. Chi square test was used and a p value < 0.05 was regarded as statistically significant

Results

A total of 200 students were included in this study. This consisted of 80 males and 120 females between the ages 16 and 25. The distribution of the blood groups A, B, and O is shown on Table 1. The Highest percentage of students are of Blood group O (36%), followed by A (34%), B (22%) respectively. The percentage of student having blood group AB are only 8%. There is no significant relationship between male and female students in their blood group. P-value = 0.200 which is greater than 0.05. The distribution of RhD positive and Rh negative varies among the ABO blood groups. There are significant differences in the distribution of Rh positive and negative among the groups as shown in Table 2. There is no significant difference between Rhesus positive and Rhesus negative students with ABO blood group system. P value is 0.77. This table shows that 56% female students are Rh positive and 4% female students are Rh negative. The percentage of male students having Rh negative is 3.5% and Rh positive is 36.5%. The distribution of hemoglobin concentration obtained in this study is shown in Table 3 and 4. There is no significant difference in the distribution of hemoglobin

concentration among ABO and Rh blood groups. Table-3 shows that 2% students having Rh negative blood group has low Hb concentration while percentage of students with Rh positive blood group having low Hb concentration is 7%. 91% students were Rh positive having normal Hb concentration. Table 4 shows that 6.5 % female students have low haemoglobin

concentration and 53.5% female has normal Haemoglobin concentration. In case of male, percentage of male students having low Hb is 2.5% and having normal Hb concentration is 37.5% of total. In our study we found that students with blood group B (4%) are more prone for anemia, followed by O (5%), AB (2%) and blood group A (2%). Table 5.

Table 1: Sex wise distribution of ABO blood groups among MBBS students

Blood group	Female =120	%	Male =80	%	Total=200	%
A	40	20	28	14	68	34
B	26	13	18	9	44	22
AB	6	3	10	5	16	8
O	48	24	24	12	72	36
	120	60	80	40	200	100

Table 2: Sex wise distribution of Rh blood groups among MBBS students

	Rh group	Rh group	Rh group	Rh group	Rh group	Total Rh group	Total=200	%
	Negative	Positive	Negative	Positive	Total Negative	Total Positive		
Blood group	Female	Female	Male	Male				
A	3	37	2	26	5	63	68	34
B	1	25	1	17	2	42	44	22
AB	0	6	2	8	2	14	16	8
O	4	44	2	22	6	66	72	36
	8	112	7	73	15	185	200	100

Table 3: Distribution of Hemoglobin concentration on the basis of Rh blood groups

Rh group	Hb concentration		Total		%
	<12gm/dl (low)	%	>12 gm/dl (Normal)	%	
Negative	4	2	11	5.5	15
Positive	14	7	171	85.5	185

Table 4: Sex wise distribution of Hemoglobin Concentration among MBBS students

	Hb concentration				Total
	<12gm/dl (low)	%	>12gm/dl (Normal)	%	Total
Female	13	6.5	107	53.5	120
Male	5	2.5	75	37.5	80
	18	9	182	91	200

Table 5: Blood group wise distribution of Hemoglobin Concentration among MBBS students

Blood group	Hb concentration		Total
	<12gm/dl (low)	>12gm/dl (Normal)	
A	3	63	68
B	8	36	44
AB	2	14	16
O	5	67	72
Total	18	182	200

Discussion

From our study, the distribution of blood group O was the highest with percentage frequency of 36%, followed by blood group A and B with percentage frequency of 34% and 22% respectively and the least percentage frequency is that of blood group AB which is 8%. Normally, the distribution of ABO blood group varies from one population to another. In many other studies, blood group O has been found to be the most common blood group. The frequencies of ABO and rhesus blood groups vary from one population to another. The study conducted among 120 Nepalese medical students of Nepal Medical college, Jorpati, Kathmandu has found that 34% are blood group A, 29% group B, 4% group AB and 32.5% group O. The frequency of Rh-negative blood are 3.33% and Rh-positive 96.66%.[9] In the Caucasians in the United States, the distribution is group O, 47%, group A, 41%, group B, 9% and group AB, 3%.[10] Among Western Europeans 42% are group A, 9% group B, 3% group AB and the remaining 46% group O. For blacks in United States, the distribution is group O, 46%, group A, 27%, group B, 2%, and group AB, 7%.[10] Similarly, in Pakistan, blood group O is the most common (35%), blood group A is 24%, blood group B is 33% and blood group AB is 8%. In Lagos Nigeria, blood group O is 55.3%, blood group A, 25.3%, blood group B, 16.7% and blood group AB, 2.7%.[11] Thus, the segregation of the genes responsible for the ABO blood groups has always taken a particular pattern for its distribution. In this study, it can be seen that blood group AB has the least percentage; which is most of the time very rare and also the case in other previous studies.

Rhesus blood group distribution also varies within any group of human population to others. In this study, it was observed that blood group O Rh positive is the highest with a percentage frequency of 33%, which is followed by group A Rh positive with the percentage frequency of 31.5%, blood groups B Rh positive is 21% and AB RhD positive 7%. This study showed a total percentage of Rh positive distribution of 92.5% and Rh negative distribution to be 7.5%. Similar pattern of distribution was also observed in other studies. Rh negative blood groups is documented as 5.5% in south India, 5% in Nairobi Kenya, 4.5% in Nigeria, 7.5% in Lahore, 7.7% in Ralwalpindi studies.[12-15] Further analysis of study population results revealed that the majority of the female students (6.5%) were observed low hemoglobin concentration i.e. anemic whereas 2.5% of male students were only anemic. This result also shows conformity with the result of Sinha AK, et al.[16] in which the female anemic patients are

dominant. In many studies, it was found that anemia is a common problem in school children of rural area due to low family income so they are unable to take dietary food, lack of awareness is also a main cause of anemia. Iron deficiency is the most common cause of low hemoglobin concentration worldwide. It frequently occurs due to inadequate iron intake, chronic blood loss or disease, mal-absorption, or a combination of all these factors. Similarly data from NNMB Surveys showed that iron and folic acid intake in all the age groups was very low. It affects one's development, growth and resistance to infections and is also associated with mortality among children younger than two years old. Iron deficiency usually develops in a sequential manner over a period of negative iron balance such as period of blood loss and / or prolonged iron-deficiency diet, accelerated growth in children and adolescents as well as during pregnancy and lactation.[17] Further research is recommended to identify the specific risk factors for low hemoglobin concentration; it may be helpful to implement measures to improve nutritional knowledge and awareness among mothers and health workers. Finally, nutritional education and intervention programs should address anemia with a focus on the dietary quantity. All of these interventions must be monitored for effectiveness of the program.

Conclusion

We conclude that individuals with blood group B are more prone to anaemia followed by blood group O, A and least is with blood group AB. Based on their blood groups, we can advise regular intake of diet rich in iron and vitamins or also their supplements to the individual who are more susceptible to anaemia.

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