International Journal of Research in Medical Sciences
Pardeshi A. Int J Res Med Sci. 2024 Jan;12(1):99-102
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20233981

Original Research Article

Study of correlation between blood haemoglobin levels and blood groups in the age group 18-25 years

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Received: 26 September 2023
Revised: 01 November 2023
Accepted: 08 December 2023

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ABSTRACT

Background: Anemia is worldwide health problem. Medical students come from different geographical regions, socio-economic status and cultural backgrounds. Pernicious anemia occurred more frequently in A blood group males and females. This study was undertaken to find out correlation of hemoglobin with blood group in medical students.
Methods: A total of 150 healthy students were finally recruited for the study consisted of 79 males and 71 females. In this study, blood group was determined using glass slide method while hemoglobin concentration was estimated using Sahli's method.
Results: Blood group O+ was the most common, followed by B+ blood group in our study. In this study 132 healthy students tested Rh+, whereas the remaining 18 tested Rh-. In this study, students with hemoglobin concentration less than 10 gm/dl were taken as anemic. Total 40 students are anemic, out of 40, 28 females were anemic whereas only 12 males were found to be anemic. 36 students with Hb less than 10 gm/dl were Rh positive and 4 students Rh negative.
Conclusions: In this study, students with blood group B are more prone to anemia followed by blood group O; A and least is with blood group AB.

Keywords: ABO blood groups, Anaemia, Hemoglobin, Young adults

INTRODUCTION

Blood is a specialized connective tissue which provides connection between the cells of different parts of the body and external environment.[1] Blood transfusion is an important measure to replace blood loss in modern medicine.[2] At least 30 common antigens and hundreds of other rare antigens have been discovered in human blood cells, especially on the cell membrane surface. Most antigens are weak and are therefore important primarily in studying gene transmission to establish origin.

"Blood group" refers to the overall blood group system, which includes red blood cell (RBC) antigens whose specificity is determined by a number of genes that can be allelic or extremely closely spaced on the same chromosome. There are 44 blood groups recognized by the International Society of Blood Transfusion.[3] The main two blood groups are called ABO and Rh. Based on the inherited properties of red blood cells (erythrocytes), which are identified by the presence or absence of antigens A and B that are carried on their surface, blood types A, B, O and AB can exist in individuals. While blood group O lacks the A/B antigen but does contain both of their antibodies in serum, blood group A contains an antibody against blood group B in serum, and vice versa.[4] The Rhesus (Rh) system is the second most significant blood group system, following ABO.[5] Rh factor and immunogenic D-antigen may or may not be present on a person's RBC surface. Therefore, either Rh-positive or Rh-negative status is indicated.

Blood group antigens are not only important in blood transfusions and organ transplantation, but are also

associated with diseases such as duodenal ulcers, diabetes, urinary tract infections, ABO and Rh incompatibility in newborns and anaemia.[1]

Hemoglobin (Hb), a protein that delivers oxygen to the body's tissues, is found in red blood cells (RBC). The amount of hemoglobin in whole blood is expressed in grams per deciliter (gm/dl). Males should have a Hb level of 14 to 18 gm/dl, while females should have 12 to 16 gm/dl. When the haemoglobin level is low, the patient has anaemia.[6] According to the World Health Organization criteria, anemia as Hb<130 gm/l in men older than 15 years, 110 g/L in pregnant women, and <120 gm/l in non-pregnant women older than age 15 years.[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.[8] As per the World Health Organization (WHO) database on anemia globally; anemia affects 1.62 billion people (95%), which correspond to 24.8% of the population. WHO also estimates that anemia contributes to about 20% of maternal and perinatal death in developing countries.[9,10]

Anemia is widespread nutritional problem. Iron deficiency is the most common among all. Although the disease is common in all countries, it is a major concern in developing countries like India because the most common cause is malnutrition, which is treatable. Anemia of adolescence severely impairs physical and mental development; weakens behavioral and cognitive development; reduces physical fitness; decreases the work performance and even contributes to the adverse pregnancy outcome.[11] Iron supplement can correct anemia which is due to iron deficiency, but they can also cause gastrointestinal issues like nausea, vomiting, diarrhea, and constipation as well as aggravate preexisting ulcers and ulcerative colitis.[9]

Anemia even can have a negative impact on physical performance, due to reduced oxygen transport the reduced cellular oxidative capacity.[6,12] Some study showed, blood groups have relation with anemia, hence the present study was conducted to prevent and treat anemia.

Therefore, the present study was undertaken to find out the existence of any correlation between blood group and anemia.

METHODS

This prospective study was done after obtaining approval from the Institutional Human Ethics Committee. The present study was conducted in the department of physiology, Rajshree Medical Research Institute, Bareilly, and Uttar Pradesh, India from January 2022 to December 2022. A total number of 150 subjects were recruited for the study. The study participants were undergraduate medical students between the ages of 18 and 25. Subjects with chronic illness and drug intake were excluded from the study. Non-consenting students were also not allowed to participate.

Blood group estimation

Blood was collected by aseptic finger prick method. The blood groups of the subjects were determined using the slide method and the antisera A, B, and D. For control, a few drops of blood were combined with sodium chloride (NaCl) in test tube. Three slides with the names A, B, and D each received a drop of each antisera: A, B, and D. Then, three different plastic sticks were used to thoroughly mix a drop of blood that had been combined with NaCl into each of the three slides. To rule out any self-agglutination, a control slide containing a drop of blood and NaCl is also retained. For 10 minutes, the slides were kept covered with a petri dish to stop any antisera from evaporating. The blood groups were identified, and the slides were examined for agglutination after 10 minutes.

Hemoglobin estimation

The hemoglobin concentration of the study participants was measured by Sahli's method. N/10 HCl were taken in the Hb tube up to the lowest mark of "2". 20 µl of the blood sample was collected with a single-marking pipette. After 10 minutes of waiting for it to convert to acid hematin, distilled water was poured into it until the colour of the solution in the Hb tube coincided with the glass plates of the comparator. The percentage of Hb was calculated from the reading. The values were recorded. Data were transferred to Microsoft Excel sheet. Statistical analysis was done using non-parametric tests. Statistical significance was taken as $p<0.05$.

RESULTS

There were 79 males and 71 females. The mean age of the students was 19.61±1.14 years (ranges 18 to 25 years). The mean age of the male students was 20.1±1.0 years compared to females' students of 19.91±1.10 years. The age differences between the male and female students were not statistically significant ($p>0.05$).

Table 1: The distribution of male and female students among the ABO blood groups (n=150).

ABO blood group	Total number (%)	Male number (%)	Female number (%)
A	18 (12)	8 (44.44)	10 (55.56)
B	60 (40)	39 (65)	21 (35)
AB	10 (6.67)	06 (60)	04 (40)
O	62 (41.33)	26 (41.93)	36 (58.06)

$\chi^2=7.229$; $p=0.06494$

150 healthy students who underwent ABO blood group testing revealed 8 males (44.44%) and 10 females

(55.56%) with the A blood group, 26 males (41.94%) and 36 females (58.06%) with the O blood group, 39 males (65%) and 21 females (35%) with the B blood group, and 6 males (60.0%) and 4 females (40.0%) with the AB blood group. The O blood group was the most common, followed by the B blood group. The distribution of ABO blood groups among male and female students is shown in Table 1.

Table 2: The distribution of ABO and Rh D blood groups type among the study participants (n=150).

Rh blood group	ABO blood type	Number tested	Percentage
Rh D positive students (132)	A	15	11.36
	B	56	42.42
	AB	7	5.30
	O	54	40.90
Rh D negative students (18)	A	3	16.67
	B	4	22.22
	AB	3	16.67
	O	8	44.44

In this study, 132 healthy students tested positive for RhD, whereas the remaining 18 tested negative. Table 2 shows the distribution of students according to their Rh blood group and ABO blood group type.

Table 3: Distribution of anemic and non-anemic students.

Hb	Frequency	Percentage
<10	40	26.67
≥10	110	73.33
Total	150	100

Table 4: Anemic status in males and females.

Sex	Hb		Total
	<10	**≥10**	
Female	28	43	71
Male	12	67	79
Total	40	150	150

χ^2=11.2417, p<0.0008

In this study, students with hemoglobin concentration less than 10 gm/dl were taken as anemic. Total 40 students are anemic, while remaining 110 students are non anemic. 28 female students are anemic whereas only 12 males were found to be anemic. 36 students with Hb less than 10 gm/dl were Rh positive and 4 students were Rh negative. 96 students and 14 students were Rh positive and Rh negative respectively with Hb more than 10 gm/dl. Among the A blood group, 4 students were anemic, among blood group B, 20 were anemic, among blood group AB, 2 were anemic and 14 students with O blood group were anemic. In our study we found that students with blood group B (13.33%) are more prone for anemia, followed by O (9.33%), A (2.67%) and blood group AB (1.33%).

Table 5: Different blood group status in anemic and non-anemic adults.

Blood group	Hb		Total
	<10	**≥10**	
A +ve	4	11	15
A -ve	0	3	3
AB +ve	1	6	7
AB -ve	1	2	3
B -ve	1	3	4
B +ve	19	37	56
O +ve	12	42	54
O -ve	2	6	8
Total	40	110	100

DISCUSSION

In this study, the distribution of blood group O was the highest with a percentage frequency of 41.33%, followed by blood group B and A with a percentage frequency of 40 and 12% respectively and the least percentage frequency is that of blood group AB which was 6.67%. The prevalence of anemia in our study was found in blood group B, followed by O, A and AB. The same trend of prevalence of blood groups (B>O>A>AB) was observed and reported by study conducted by Kaur et al.[13]

Blood group B has been shown to be the most common blood type in many other studies. The frequency of Rh +ve was about 88%, while 12% were Rh -ve in this study. In this study, anemia was more frequent in blood group B (33.33%) followed by blood group O (22.58%), A (22.22%) and least in the blood group AB (20%), but it was not statistically significant (p=0.8046).

Similar findings were seen in the study conducted by Kumar et al, in which individuals having blood group B, A or AB were prone to anemia compared to blood group O but was statistically significant.[9]

The effects of anemia during adolescence can be severe in terms of physical and mental health, behavioral and cognitive health, physical fitness, work performance, and even the adverse effects of pregnancy. Mild anemia can adversely affect the productivity and is also known to reduce the immune competence.

The average prevalence of anemia was 25-80% seen in several studies across the Indian subcontinent in a study conducted by ICMR in sixteen districts in eleven different states reporting a prevalence rate of anemia 90.1% among the adolescent girls of 11-18 years age groups. In their study, 35% anemia was seen in the 300 adults studied.[14] The similar higher prevalence of anemia

was found in the rural girls (98%) and boys (56%) of Punjab.[15]

This study reveals that there is a relationship between blood group and anemia, though not statistically significant which could be due to small sample size. Similar finding was found in this study where girls are more prone to anemia. The individuals with blood group antigen alpha and beta are comparatively more prone to be anemia, whereas the individuals devoid of these anti gens are resistant to anemia. So, the regular intake of iron and vitamin rich diet in individuals having blood groups A, B, and AB can prevent the occurrence of anemia.

Due to the limited sample size, the results of this study cannot be generalized to the population. In our study, there was no A negative blood group, so the results cannot be applied to A negative blood groups.

CONCLUSION

We conclude that individuals with blood group B are more prone to anemia followed by blood group O, A and least is with blood group AB. Based on blood groups, people prone to anemia may be advised to take iron- and vitamin-rich foods or their supplements regularly.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Pardeshi A. Study of correlation between blood hemoglobin levels and blood groups in the age group 18-25 years. Int J Res Med Sci 2024;12:99-102.