

Original Research Article

A comparative analysis of total haemoglobin level and red blood cells count in ABO blood groups of healthy adults

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ABSTRACT

Background: The haemoglobin content and red blood cells counts in four different ABO blood groups in healthy adults remain conflicting with different results. The present study was undertaken to analyse the possible differences in the haemoglobin content and red blood cell counts in health adults in four ABO blood groups.

Methods: This prospective study was undertaken in a tertiary health care facility. A total of 227 healthy students were finally included in this study for analysis. The study subjects were belonging to 18-22 years old of both genders. The haemoglobin content was measured by Sahli's method and ABO blood group typing along with Rh D typing was carried out in all the students. The statistical analyses were carried out by using Graph-Pad Instat.

Results: The mean age of the students was 19.91 years with 59.9% being males. Both haemoglobin level and red blood cells counts were significantly high in males compared to females. Blood groups A, B, AB and O was reported in 41(18.06%), 63(27.75%), 15(6.60%) and 108(47.58%) healthy students respectively.

conclusion: There was no significant difference was observed in the mean haemoglobin level and red blood cells counts among the four ABO blood groups.

Keywords: ABO blood group, Haemoglobin, Red blood cells, Rh D typing

INTRODUCTION

ABO blood groups are an inherited blood character. The ABO blood groups are characterized by the presence of various blood group antigens on the membrane of the human red blood cells and are determined in part by the oligosaccharide head groups of the glycosphingolipids. The most important antigens are A and B antigens which differs only in their terminal sugar moieties. In A antigen, N-acetyl galactosamine represents as the terminal sugar unit whereas in B antigen galactose is the terminal sugar unit. The antibodies against these red cell antigens are called agglutinins and individually they are divided into four major blood groups, that is, A, B, AB and O blood groups according to the presence of these antigens and agglutinins.^{1,2} Other than these blood

antigens, human red cells that contain antigen D are known as Rhesus antigen D positive while those without antigen D are treated as Rhesus antigen D negative.³⁻⁵ The total hemoglobin content and total red blood cells level in respective blood groups has been studied worldwide with conflicting results.^{1,6,7} Due to paucity of literatures, the present study was undertaken to find out the possible differences in the total hemoglobin content and total red blood cells level in health subjects in four ABO blood groups.

METHODS

This prospective observational study was carried out in the Department of Physiology, Maharaja Krishna Chandra Gajapati Medical College, Berhampur, Odisha, India from

August 2018 to February 2019. The study subjects were undergraduate medical students of 18-22 years old.

Exclusion criteria

- Students with known chronic or acute diseases and
- Students refused to be a part of the study.

Laboratory analysis

The hemoglobin content of the study participants was measured by Sahli's method.⁸ ABO blood grouping was done by agglutination reaction.⁵ Rhesus D typing (Rh D) was carried out in all the study participants. Briefly, a drop of anti-D serum was taken in a clean labeled test tube and a drop of control placed in a second cleaned test tube.

One drop of 5% red blood cells suspension in saline was added and incubated at 37°C. After the incubation period, the contents of the tube were mixed thoroughly and centrifuged at 1000g for 30 seconds. Agglutination was read macroscopically and microscopically in doubtful cases. All negative results were confirmed using the indirect antiglobulin test (IAT) procedure (also for confirmation of weak D).⁵ The red blood cells count was measured by Neubauer hemocytometer slide method.

Statistical analysis

The generated data was entered in a predesigned excel Microsoft window sheet for further analysis. The categorical data were compared by using chi-square test. The comparison of mean among the two groups was analyzed by using Mann-Whitney test whereas comparison of means among more than two groups was analyzed by Kruskal-Wallis test.

A p value of <0.05 was considered for statistically significant. Graph Pad InStat version 3 for window was used for all statistical data analysis.

RESULTS

During the study period, 227 healthy students have participated in this study. The mean age of the students was 19.91±1.34 years (ranges 18 to 22 years) and 136(59.9%) students being males. The mean age of the male students was 20.3±1.3 years compared to females' students of 20.0±1.12 years. There was no statistically significant difference was observed in the age of male and female students (p >0.05).

ABO blood group typing in 227 health students revealed 41(18.06%) healthy students with blood group A, 63(27.75%) healthy students with blood group B, 15(6.60%) healthy students with blood group AB and 108(47.58%) healthy students with blood group O. The distribution of male and female students among the four ABO blood groups was shown in Table 1. In blood groups A and B, approximately 75.0% of the students

were males whereas in blood groups AB and O, approximately 50% of students were males. However, these differences did not reach to statistically significant when compared among the four ABO blood groups ($\chi^2=5.582$; $p=0.1338$).

Table 1: The distribution of male and female students among the four ABO blood groups (n=227).

ABO Blood group	Total Number (%)	Male Number (%)	Female Number (%)	Statistics
A	41(18.06)	30(73.17)	11(26.83)	$\chi^2=5.582$; $p=0.1338$
B	63(27.75)	36(57.14)	27(42.86)	
AB	15(6.60)	11(73.33)	04(26.27)	
O	108(47.58)	59(54.63)	49(45.37)	

Further, out of the 227 healthy students, Rh D was found to be positive in 219(96.48%) healthy students whereas rest 8(3.52%) healthy students were found to have Rh D negative. Out of the 8 Rh D negative students, 3, 3, 0 and 2 students had A, B AB and O blood group respectively. The distribution of study cases (healthy students) on the basis of their ABO blood group typing and Rh blood groups has been depicted in Table 2.

Table 2: The distribution of ABO and Rh D blood groups type among the study participants (n=227).

Rh blood group	ABO blood group	Number tested	Percentage
Rh D positive (N=219)	A	38	17.35
	B	60	27.39
	AB	15	6.85
	O	106	48.4
Rh D negative (N=8)	A	3	37.5
	B	3	37.5
	AB	0	0
	O	2	25.0

The total hemoglobin content in all the students have measured by Sahli's method. Both the mean hemoglobin content and total red blood cells level was high in males compared to females. This significant differences in the mean hemoglobin content were also reflects in respective blood groups except AB blood group.

For red blood cells level, only students with B blood group showed statistical difference. The comparison of total hemoglobin level and red blood cells count among males and females' students in four ABO blood groups were illustrated in Table 3.

The total hemoglobin content in different blood group was 15.6±1.7 g/dL, 14.6±2.0 g/dL, 15.5±1.1 g/dL and 14.9±2.2 g/dL in A, B, AB and O blood groups respectively. The mean hemoglobin content in different blood groups were comparable when analyzed for statistical significance (p=0.0909).

Table 3: The comparison of total haemoglobin level and red blood cells count among males and females students in four ABO blood groups.

ABO Blood group	Hemoglobin content (g/dL) (Mean±SD)			Red blood cell count (x10 ⁶ /µl) (Mean±SD)		
	Male	Female	p value	Male	Female	p value
A	16.2±0.9	14.1±2.5	0.0045	5.0±0.4	5.21±0.2	0.054
B	15.9±0.9	13.0±1.5	<0.0001	5.2±0.5	4.74±0.4	<0.0001
AB	15.3±1.1	15.4±0.9	0.2667	5.2±0.3	5.4±0.9	0.5714
O	16.4±1.3	13.1±1.6	<0.0001	5.0±0.8	5.0±1.5	0.236
Total	16.1±1.1	13.2±1.8	<0.0001	5.1±0.6	4.9±1.1	<0.0001

Similarly, the total red blood cells count in different blood group were 5.06±0.34 (x10⁶/µL), 5.02±0.48(x10⁶/µL), 5.54±0.54(x10⁶/µL) and 4.98±1.16(x10⁶/µL) in A, B, AB and O blood groups respectively. The mean difference in the total red blood cells level among the four blood groups was found to be statistically significant (p=0.0081). The comparison of total hemoglobin level and total red blood cells count in four ABO blood groups was illustrated in Table 4.

Table 4: The comparison of total haemoglobin level and total red blood cells count in four ABO blood groups.

ABO Blood groups	Hemoglobin content (g/dl)		Red blood cell counts (x10 ⁶ /µl)	
	Mean ±Sd	Median	Mean ±Sd	Median
A	15.6±1.7	15.8	5.06±0.34	5.09
B	14.6±2.0	15.1	5.02±0.48	5.01
AB	15.5±1.1	15.4	5.54±0.54	5.47
O	14.9±2.2	15.2	4.98±1.16	4.76
Statistics	p=0.0909		p=0.0081	

DISCUSSION

Two hundred twenty-seven healthy students were included in this study. The median age of the students was 19.8 year with 59.9% being males. There was no difference in the age of males and females' students. ABO blood group typing revealed majorities students with blood group O with 38(47.58%) students followed by B blood groups with 22(27.75%), A blood groups with (18.06%) and AB blood groups with 15(6.6%) of health students. In a study undertaken in Nepalese students, the highest number of students had blood group A followed by blood group O, B and AB.¹ The distribution of ABO blood groups was found to be different in different geographical regions belonging to different races.¹ The gender wise distribution in the four ABO blood groups was found to be comparable. Authors have detected 8(3.52%) healthy students with Rh D negative. This data is in accordance with 3.3% reported by Ukaejiofor, 3.23% reported by Jeremiah in Nigeria and 3.34% reported in Nepalese students, whereas slightly low from the study by Jeremiah et al., (2003) in Port Harcourt, in which 5% of their study participants had Rh D negative.⁵⁻⁷

The comparison of total hemoglobin level in four ABO blood groups was found to be comparable. However, the total hemoglobin content in male students was found to be significantly higher compared to female students in different blood groups except AB blood groups. This is due to because females usually have low hemoglobin content than males. Similarly, the red blood cells content also found to be high in males compared to females. This difference may be due to hormone estrogen in females, which has an inhibitory effect on erythropoietin and which is a stimulator of red blood cells production, and in males, hormone testosterone has a stimulating effect on erythropoietin, thus increasing the red blood cells production.⁹⁻¹⁰ However, why this difference was found to be different in four ABO blood groups is debatable.

In conclusion, both total hemoglobin level and total red blood cells count were found to be comparable in four ABO blood groups in our study participants. To the best of our knowledge this is the first study in southern Odisha, India to elucidate the comparative analysis of total hemoglobin level and total red blood cells count of ABO blood groups with Rh D typing in healthy adult students.

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