

Blood Group and Haemoglobin Levels in Rural Populations: A Hospital-Based Correlation StudySuchita Kumari¹, Rohan Kumar², Mritunjay Kumar Azad³, Abha Prasad⁴¹Tutor, Department of Physiology, JNKTMCH, Madhepura, Bihar, India²Tutor, Department of Forensic Medicine and Toxicology, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India³Assistant Professor, Department of Physiology, JNKTMCH, Madhepura, Bihar, India⁴Tutor, Department of Physiology, JNKTMCH, Madhepura, Bihar, India

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Conflict of interest: Nil

Abstract**Aim:** The aim of the present study was to assess the association between blood groups and blood hemoglobin levels in rural population of Bihar region.**Methods:** The study was done after obtaining in the Department of Physiology. A total number of 100 subjects were recruited for the study. The subjects were recruited from the common rural population in and around in the Bihar region. Apparently healthy males and females of the age group 18–45 years were included in the study.**Results:** In the present study, there were 65 male and 35 females. B +ve was the most common followed by O +ve blood group. O –ve was the least of all blood groups and we did not have any AB–ve blood group subjects in our study population. The mean value of all the blood groups in our selected population falls in the normal range, except for O–ve blood group. There were no significant differences in the hemoglobin values among the blood groups except between A+ve and O+ve blood groups. Total 32 adults are anemic, while remaining 68 adults are non-anaemic. In the present study, 19 female and 13 male were found to be anemic. In our study we found that adults with blood group B (15%) are more prone for anemia, followed by O (10%), blood group A (5%) and AB (2%). There was a significantly high value of hemoglobin occurring in the O+ve individuals (hemoglobin values of 15–16.5 g/dL) as compared to the A+ve individuals though the absolute values and mean values of the hemoglobin fall in the normal range only.**Conclusion:** Through this study, quantitative information regarding the mean values and differences in blood hemoglobin levels among the ABO blood groups obtained, the blood groups prone to anemia could be determined.**Keywords:** Hemoglobin, Anaemia, Blood Group.

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Introduction

According to the World Health Organization criteria, anemia is defined as blood hemoglobin concentration <13 g/dl or hematocrit <39% in adult males; hemoglobin <12g/dl or hematocrit <37% in adult females. Anemia can be caused by many factors; nutritional deficiency is the commonest among all. Though it is prevalent in all the countries but it is a major concern in developing countries like India as the commonest cause is nutritional deficiency which is a treatable cause. Children < 5 years and pregnant females are the most affected groups suffering from nutritional deficiency anemia and their complications. There are 33 blood groups recognized by the International Society of Blood Transfusion. [1] The major blood groups are A, B, AB, and O with either Rh positive or negative. These blood groups of individuals are

determined genetically by coding for specific antigens on the surface of the red cell membrane. There are many studies reported the association of ABO blood groups with disease etiology. The risk of ovarian cancer is 40–60% higher in females with non-O blood groups. [2] It is a well-known fact that A blood group is associated with increased risk of gastric cancer. [3]

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. [4] Genes encoding RBC enzymes and membranes can also cause genetic

variations in hemoglobin concentrations. [5] However, there are very few studies which have reported the difference in blood hemoglobin levels among individuals of different blood groups. There are few older studies which have reported the higher incidence of hemolytic anemia in certain blood groups. Pernicious anemia is commoner in A blood groups males and females. [6] In a study done among the Bengalee families in Calcutta, low hemoglobin levels were observed in A1 and O blood groups. [7] B blood group individuals have higher mean hemoglobin levels than other blood groups among Dhimals at Naxalbari of the Darjeeling district of West Bengal, India. [8]

Likewise, blood hemoglobin values also differ among individuals. These variations are due to age, sex, race, occupation, socioeconomic status, and various diseased conditions. Women have 12% less Hb levels when compared with age-matched men. [9] Genes encoding RBC enzymes and membranes can also cause genetic variations in hemoglobin concentrations. [10] There are several studies reported on the association between blood groups and hemoglobin phenotypes. However, there are very few studies which have reported the difference in blood hemoglobin levels among individuals of different blood groups. There are few older studies which have reported the higher incidence of hemolytic anemia in certain blood groups. Pernicious anemia is commoner in A blood groups males and females. [11]

The aim of the present study was to assess the association between blood groups and blood hemoglobin levels in rural Population of Bihar region.

Materials and Methods

The study was done after obtaining in the Department of Physiology, JNKTMCH, Madhepura, Bihar, India for one year. A total number of 100 subjects were recruited for the study. The subjects were recruited from the common rural population in and around in the Bihar region. Apparently healthy males and

females of the age group 18–45 years were included in the study.

Subjects with a history of anemia, bleeding disorders, and malignancies were not included in the study. Furthermore, subjects with chronic cardiovascular, respiratory or renal diseases, or with a history of chronic drug intake were excluded from the study. Subjects who are chronic smokers or alcoholics were also excluded from the study.

Blood was collected by finger prick method. The procedure was done under strict aseptic precautions. Blood group of the individuals was checked by slide method using antisera A, B, and D (Spanclone, Arkray). Few drops of blood were mixed with NaCl in a test tube. A drop of each antisera A, B, and D was added in three slides and slides were named as A, B, and D. Then, a drop of blood admixed with NaCl was added to all three slides and mixed well with three different wooden sticks. A control slide with a drop of blood with NaCl is also kept to rule out any self-agglutination. The slides were kept covered with Petri dish to prevent any evaporation of antisera for 10 min. After 10 min, the slides were observed for agglutination and the blood groups were determined accordingly. Blood hemoglobin levels were estimated using the instrument hemo control (EKF diagnostics). The finger pricked blood was collected into a hemoglobin microcuvette and this was fed into hemo control. The hemoglobin levels were displayed digitally. The values were recorded.

Data were transferred to Microsoft Excel sheet. The blood hemoglobin values of different blood groups were tabulated. Statistical analysis was done using non-parametric tests with SPSS software version 23. Box plots and graphs were done for comparison using SPSS version 23, Igor Pro software version 6, and Microsoft Excel 2007. P values were checked for any statistically significant differences in the hemoglobin values between each blood group using the SPSS software.

Results

Table 1: Patient details

Gender	N	%
Male	65	65
Female	35	35
Blood groups		
A -ve	1	1
A+ve	27	27
B-ve	3	3
B+ve	35	35
AB-ve	0	1
AB+ve	7	6
O-ve	1	1
O+ve	26	26

In the present study, there were 65 male and 35 females. B +ve was the most common followed by O +ve blood group. O –ve was the least of all blood groups and we did not have any AB–ve blood group subjects in our study population.

Table 2: Mean hemoglobin values with standard deviation of different blood groups observed in the selected population

Blood groups	Hb±SD (g/dL)
A –ve	12.06±0.04
A+ve	13.07±1.16
B-ve	11.6±0.94
B+ve	13.32±1.58
AB-ve	-
AB+ve	14.8±1.82
O-ve	10.5
O+ve	13.67±1.87

The mean value of all the blood groups in our selected population falls in the normal range, except for O–ve blood group.

Table 3: Distribution of anaemic and non-anaemic adults

Hb	Frequency	Percentage
<10	32	32
>=10	68	68
Total	100	100

Total 32 adults are anaemic, while remaining 68 adults are non anaemic.

Table 4: Anaemic status in males and females

Sex	Hb		Total
	<10	>=10	
Female	19	16	35
Male	13	52	65
Total	32	68	100

In the present study, 19 female and 13 male were found to be anaemic.

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

Blood group	Hb		Total
	<10	>=10	
A –ve	0	1	1
A+ve	5	22	27
B-ve	0	3	3
B+ve	15	20	35
AB-ve	0	1	1
AB+ve	2	4	6
O-ve	0	1	1
O+ve	10	16	26
Total	32	68	100

Among the A blood group, 5 adults were anaemic, among blood group B, 15 were anaemic, among blood group AB, 2 were anaemic and 10 adults with O blood group were anaemic. In our study we found that adults with blood group B (15%) are more prone for anemia, followed by O (10%), blood group A (5%) and AB (2%). Blood group A almost resistant to anemia.

Table 6: Comparison of hemoglobin values between the predominant blood groups found in the population

Blood groups	P value
A+ve versus B+ve	0.260
A+ve versus O+ve	0.036
B+ve versus O+ve	0.244

There were no significant differences in the hemoglobin values among the blood groups except between A+ve and O+ve blood groups. There was a significantly high value of hemoglobin occurring

in the O+ve individuals (hemoglobin values of 15–16.5 g/dL) as compared to the A+ve individuals though the absolute values and mean values of the hemoglobin fall in the normal range only.

Discussion

The blood groups of individuals are determined genetically by coding for specific antigens on the surface of the red cell membrane. There are many studies reported the association of ABO blood groups with disease etiology. The risk of ovarian cancer is 40–60% higher in females with non-O blood groups. [12] It is a well-known fact that A blood group is associated with increased risk of gastric cancer. [13] Severe malaria is more common among children with B blood group in southwest Nigeria. [14] It is far better to take the preventive measure to combat anemia by taking iron or vitamin rich diet, especially to those who are more prone to anemia; though the type of such population is not known to us. On the other hand, blood group is one of the important and comparatively known parameter to the large number of present population which exhibits a strong correlation with some common diseases like cardiovascular diseases, gastric cancer and even HIV infection. [15,16]

In the present study, there were 65 male and 35 females. B +ve was the most common followed by O +ve blood group. O –ve was the least of all blood groups and we did not have any AB–ve blood group subjects in our study population. The prevalence of anaemia in our study was found in blood group B, followed by O, AB and then A. The same trend of prevalence of blood groups (B>O>A>AB) was observed and reported by study conducted by Kaur M. [17] In many other studies, blood group O has been found to be the most common blood group. The mean value of all the blood groups in our selected population falls in the normal range, except for O–ve blood group. There were no significant differences in the hemoglobin values among the blood groups except between A+ve and O+ve blood groups. Total 32 adults are anemic, while remaining 68 adults are non-anemic. In the present study, 19 female and 13 male were found to be anemic. Similar findings were seen in the study conducted by Basak Asim Kumar [18] in which individuals having blood group B, A or AB were prone to anemia compared to blood group O but was statistically significant. On the other hand, there was no such relationship between Rh factor and the occurrence of anemia between the above mentioned populations. Anemia during adolescence severely impairs the physical and mental development; weakens behavioral and cognitive development; reduces physical fitness; decreases the work performance and even contributes to the adverse pregnancy outcome Mild anemia can adversely affect the productivity and is also known to reduce the immune-competence.

Mahapatra et al. also have found comparable differences in blood hemoglobin values in different types of ABO blood groups. [19] Similar study was

also done by Ramalingam et al. [20] In our study we found that adults with blood group B (15%) are more prone for anemia, followed by O (10%), blood group A (5%) and AB (2%). There was a significantly high value of hemoglobin occurring in the O+ve individuals (hemoglobin values of 15–16.5 g/dL) as compared to the A+ve individuals though the absolute values and mean values of the hemoglobin fall in the normal range only.

Conclusion

Through this study, quantitative information regarding the mean values and differences in blood hemoglobin levels among the ABO blood groups obtained, the blood groups prone to anemia could be determined. Preventive measures can be adopted and nutritional advises can be given to such individuals. Future studies can be done among larger population to support the information and also to find out what type of anemia the particular blood group individuals are prone to.

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