

## Assessment of Mean Hemoglobin Values for Various Blood Groups and Association of Hemoglobin Values Between the Predominant Blood Groups

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Received: 22-10-2021 / Revised: 28-11-2021 / Accepted: 23-12-2021

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Conflict of interest: Nil

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### Abstract

**Aim:** The aim is to find the mean hemoglobin values for various blood groups and to find out if there are any significant differences in the values in different blood groups.

**Materials and Methods:** The present study was conducted in the Department of Physiology, Patna Medical College & Hospital, Patna, Bihar, India for the duration of 1 year. A total number of 350 subjects were recruited for the study. The randomly selected population consisted of 158 males and 111 females. The randomly selected population consisted of 211 males and 139 females. Blood hemoglobin levels were estimated using the instrument hemo control. Blood hemoglobin levels were estimated using the instrument hemo control.

**Results:** A+ve was the most common followed by B+ve blood group. A-ve, with around 5.70% prevalence, was the least of all blood groups and we did not have any AB-ve and O-ve blood group subjects in our study population. There was a significantly high value of hemoglobin occurring in the O+ve individuals (hemoglobin values of  $15.22 \pm 1.91$  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:** The rural population of Bihar showed significantly higher hemoglobin values in O blood group than the A and B blood groups. Rh-negative blood groups had low hemoglobin values when compared with Rh+ve blood groups.

**Key words:** ABO Blood Groups; Hemoglobin; Rural Population

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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]

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.[4] It is a well-known fact that blood group A is associated with increased risk of gastric cancer.[5] Severe malaria is more common among children with B blood group in southwest Nigeria. [6] 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.[7] Genes encoding RBC enzymes and membranes can also cause genetic variations in hemoglobin concentrations.[8]

### **Materials and methods:**

The present study was conducted in the Department of Physiology, Patna Medical College & Hospital, Patna, Bihar, India for the duration of 1 year. A total number of 350 subjects were recruited for the study.

### **Inclusion and exclusion criteria:**

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.

### **Methodology:**

The subjects were recruited from the common rural population of Bihar. Apparently healthy males and females of the age group 18–45 years were included in the study. The randomly selected population consisted of 211 males and 139 females. 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 micro cuvette 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:**

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

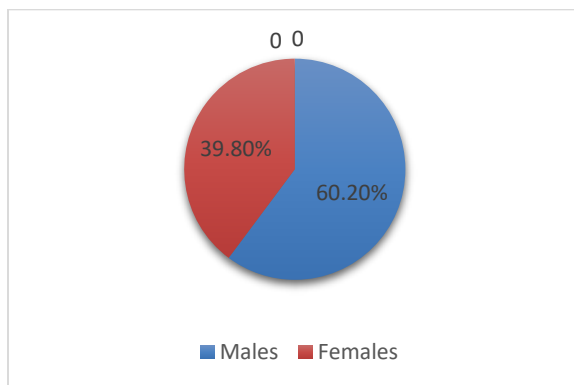
2007. *P* values were checked for any statistically significant differences in the hemoglobin values between each blood group using the SPSS software.

**Results:**

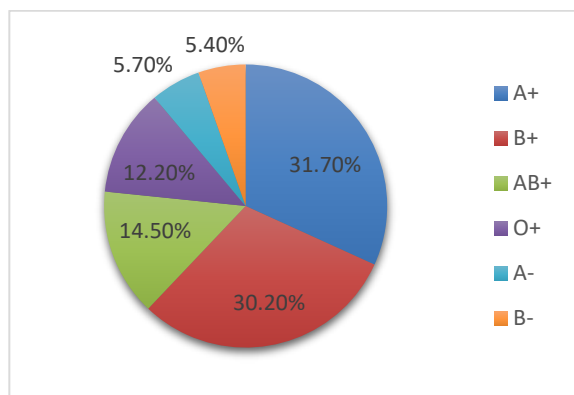
The males and females among selected population are represented in Figure 1. Since the study involved fairly equal distribution among males and females including the distribution of blood groups as represented in Figure 2, analysis was done as a whole population. A+ve was the most common followed by B+ve blood group. A-ve, with around 5.70% prevalence, was the least of all blood groups and we did not have any AB-ve and O-ve blood group subjects in our study population [Figure 2].

Table 1 shows the mean value of all the blood groups in our selected population falls in the normal range, except for AB-ve & O-ve blood group. Among the largely prevalent blood groups in our population, B-ve had the lowest mean hemoglobin value of about  $11.9 \pm 0.62$  g/dL.

Table 2 indicates there 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  $15.22 \pm 1.91$  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.



**Figure 1: Percentage distribution of males and females among the randomly selected population (n = 350)**



**Figure 2: Percentage distribution of various blood groups among the selected population (n = 350)**

**Table 1: Mean hemoglobin values with standard deviation of different blood groups observed in the selected population. (n=350)**

Blood groups	Hb±SD (g/dL)
A+ve	13.48±1.91
A-ve	14.25±0.71
B+ve	15.21±2.01
B-ve	11.9±0.62
O+ve	15.22±1.91
O-ve	----
AB+ ve	14.1±1.92
AB-ve	----

**Table 2: Comparison of hemoglobin values between the predominant blood groups found in the population. There is a significant difference in the hemoglobin values in the A+ve blood group subjects as compared to O+ ve**

Blood groups	P value
A+ve versus B+ve	0.212
A+ve versus O+ve	0.031*

**Discussion:**

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]

There were very few studies done in limited population which have compared the values of hemoglobin in different ABO blood groups. Agrawal et al., in 2014, reported that the most common blood group in our country was O (37.12%), followed by B (32.26%), then A (22.28%) and AB (7.74%) being the least prevalent. [11] A study done by Hoque et al. showed lower hemoglobin, serum iron, serum ferritin, and percentage transferrin saturation levels in subjects with O blood group though they did not find any significant difference among the blood groups, but in our

study, the mean hemoglobin values were higher in O group though there were no significant differences. Blood group A had the highest TIBC. [12]

There are studies in the past which suggest that certain blood groups are more prone for anemia. Pernicious anemia is more common in blood group A. [13] In a study done among the Bengalee family, low hemoglobin levels were observed in A+ and O+ blood groups. [14] Mahapatra et al. also have found comparable differences in blood hemoglobin values in different types of ABO blood groups. [15] Similar study was also done by Ramalingam et al. [16]

A study done in the suburb of Calcutta region showed lower levels of hemoglobin in A1 and O blood groups. There could be regional, racial, and regional differences in the hemoglobin values in the individuals and this could be the reason why we have different results of mean hemoglobin values in different blood groups in our selected population. Fluctuations in Hb levels and its

association with comorbid conditions overtime are also observed with different type of blood groups.[17] Similar to our study, Mahapatra et al. also have found comparable differences in blood hemoglobin values in different types of ABO blood groups.[18]

### Conclusion:

Based on the blood groups, regular intake of diet rich in iron and vitamins or also their supplements to the individual who are more susceptible to anemia. 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.

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