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Original research article

Study of 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: A Retrospective Study

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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: Total 300 subjects were recruited from the common rural population in and around of Telangana. Apparently healthy males and females of the age group 18–45 years were included in the study. 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.

Results: The randomly selected population consisted of 173 males and 127 females There was a significantly high value of hemoglobin occurring in the O+ve individuals (hemoglobin values of 15.1–16.3 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: Our study done on the rural population 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.

Keywords: ABO Blood Groups; Hemoglobin; Rural Population

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 ofimportance 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.

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There are many studies reported the associationof 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 a blood group 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]

Serum iron and total iron-binding capacity (TIBC) were significantly lower in both males and females with O blood group than other blood groups in Southeastern Nigerian population.[9] Knowing that information, this study aims at arriving at mean hemoglobin values for various blood groups and to find out if there are any significant differences in the values in different blood groups.

Material & Methods:

The study was done at Department of Physiology, Chalmeda Anand Rao Institute of Medical Sciences , Karimnagar, Telangana, India. A total number of 300 subjects were recruited for the study. The subjects were recruited from the common rural population in and around of Telangana. Apparently healthy males and females of the age group 18–45 years were included in the study.

The randomly selected population consisted of 173 males and 127 females. 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

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

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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. B^{+ve} was the most common followed by O^{+ve} blood group. $O^{-ve,}$ with around 0.4% prevalence, was the least of all blood groups and we did not have any AB^{-ve} blood group subjects in our study population [Figure 2].

The mean hemoglobin value of each blood group is shown in Table 1. The mean value of all the blood groups in our selected population falls in the normal range, except for O−ve blood group.

The comparison between hemoglobin values of the predominant blood groups in our group of population was done [Table 2]. Among them, 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 15.1–16.3 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 = 300)

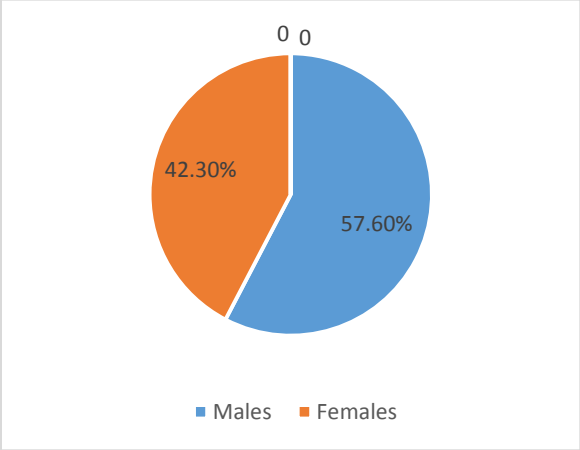

Figure 2: Percentage distribution of various blood groups among the selected population (n = 300)

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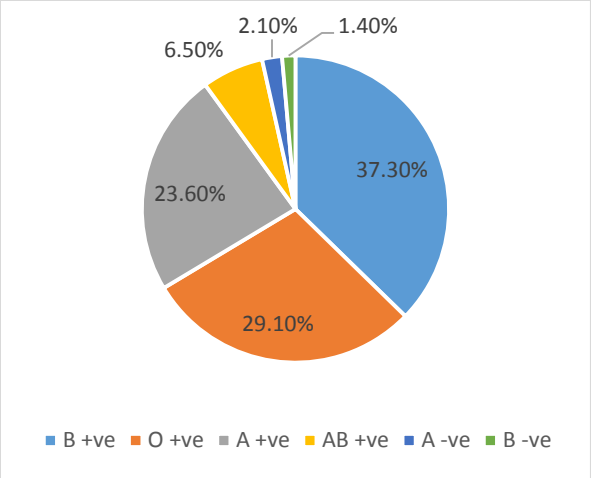

Table 1: Mean hemoglobin values with standard deviation of different blood groups observed in the selected population (n=300)

Blood groups	Hb±SD (g/dL)
A+ve	13.12 ± 1.10
A−ve	12.71 ± 0.08
B+ve	13.42 ± 1.71
B−ve	11.8 ± 0.80
O+ve	13.88 ± 1.85
O−ve	10.5
AB+ ve	14.6 ± 1.90
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	0.681
A+ve versus O+ve	0.001*

Discussion:

Anemia is common in pregnancy due to hemodilution which worsen the condition and makes a pregnant female severely anemic if the hemoglobin levels are low before conception itself. There are studies in the past which suggest that certain blood groups are more prone for anemia. Pernicious anemia is more common in A blood group. [10] In a study done among the Bengalee family, low hemoglobin levels were observed in A1 and O blood groups.[11] Mahapatra et al. also have found comparable differences in blood hemoglobin values in different types of ABO blood groups.[12] Similar study was also done by Ramalingam et al. [13]

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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%.[14] In the Caucasians in the United States, the distribution is groupO, 47%, group A, 41%, group B, 9% and group AB, 3%.[15] 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%.[16] Thus, the segregation of the genes responsible for the ABO blood groups has always taken a particular pattern for its distribution.

Rh-negative blood groups had low hemoglobin. 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.[17] 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 wereno significant differences. Blood group A had the highest TIBC.[18] 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 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.[19] Similar to our study, Mahapatra et al. also have found comparable differences in blood hemoglobin values in different types of ABO blood groups.[20]

Conclusion:

Our study done on the rural population 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.

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