

RESEARCH ARTICLE

Association between blood groups and blood hemoglobin levels in rural population of Kanchipuram district of Tamil Nadu

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ABSTRACT

Background: There are several studies reported on the association between blood groups and hemoglobin phenotypes. 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 group males and females. **Aim and Objective:** 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:** A total number of 269 subjects were recruited for the study. The randomly selected population consisted of 158 males and 111 females. The randomly selected population consisted of 158 males and 111 females. Blood hemoglobin levels were estimated using the instrument hemo control. Blood hemoglobin levels were estimated using the instrument hemo control. **Results:** 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. 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. 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. **Conclusion:** Our study done on the rural population of Kancheepuram district 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

INTRODUCTION

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] Severe malaria is more common among children with B blood group in southwest Nigeria.^[4] 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.^[5] Genes encoding RBC enzymes and membranes can also cause genetic variations in hemoglobin concentrations.^[6]

There are several studies reported on the association between blood groups and hemoglobin phenotypes. For example,

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HbAS pattern was observed in about 27% of the population in a Nigerian study.^[7] 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.^[8] In a study done among the Bengalee families in Calcutta, low hemoglobin levels were observed in A₁ and O blood groups.^[9] 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.^[10] 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.^[11] 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.

MATERIALS AND METHODS

The study was done after obtaining approval from the Institutional Human Ethics Committee. A total number of 269 subjects were recruited for the study. The subjects were recruited from the common rural population in and around Ammapettai village of Kanchipuram district, Tamil Nadu. Apparently healthy males and females of the age group 18–45 years were included in the study. The randomly selected population consisted of 158 males and 111 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.

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

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].

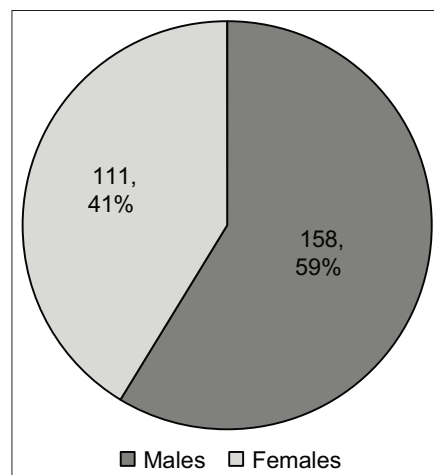


Figure 1: Percentage distribution of males and females among the randomly selected population (n = 269)

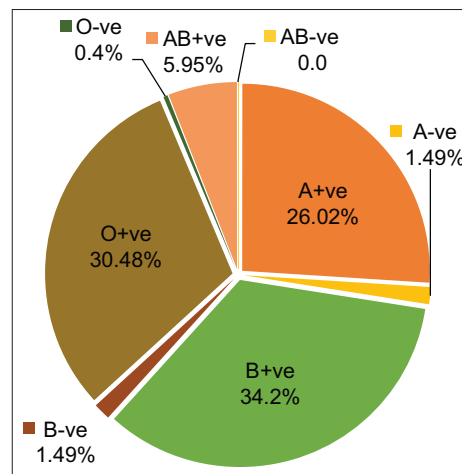


Figure 2: Percentage distribution of various blood groups among the selected population (n = 269)

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. Since the prevalence was only 0.4% ($n = 1$ out of total $n = 269$), as shown in Figure 3a, the value cannot be standardized to the general population. Among the largely prevalent blood groups in our population, B^{-ve} had the lowest mean hemoglobin value of about 11.6 ± 0.85 g/dL. The standard error of mean hemoglobin values of blood groups A^{+ve}, B^{+ve}, O^{+ve} and AB^{+ve} are shown in Figure 3b. Among the selected population the variation was higher in AB^{+ve} individuals.

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 15–16.5 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 study was done on 269 individuals including males (158) and females (111). The B-positive blood group was the most common with 34.2% prevalence followed by O-positive group (30.48%) and A-positive blood group (26.02%). There was 4% difference in the predominance of B blood group in our selected population. Our study done on the rural population of Kanchipuram district showed significantly higher hemoglobin values in O blood group than the A and B blood groups though B blood group was dominant among the population compared to O blood group, but the mean hemoglobin value was higher in O blood group (13.79 g/dL \pm 1.86 g/dL), whereas the mean hemoglobin value in B blood group was 13.35 g/dL \pm 1.67 g/dL, though there were no significant differences in the hemoglobin values between the groups. Rh-negative blood groups had low hemoglobin values when compared with Rh^{+ve} blood groups.

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.^[12] 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.^[13] 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

Table 1: Mean hemoglobin values with standard deviation of different blood groups observed in the selected population ($n=269$)

Blood groups	Hb \pm SD (g/dL)
A ^{+ve}	13.07 \pm 1.13
A ^{-ve}	12.05 \pm 0.07
B ^{+ve}	13.39 \pm 1.69
B ^{-ve}	11.6 \pm 0.85
O ^{+ve}	13.79 \pm 1.86
O ^{-ve}	10.2
AB ^{+ve}	14.1 \pm 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}	0.275
A ^{+ve} versus O ^{+ve}	0.037*
B ^{+ve} versus O ^{+ve}	0.267

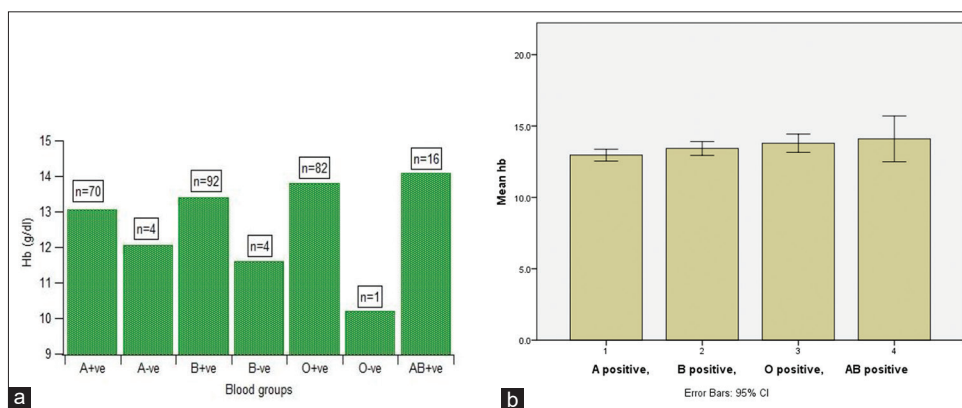


Figure 3: (a) Number distribution of different blood groups with representation of mean hemoglobin values, (b) standard error of mean hemoglobin values represented

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.^[14] Similar to our study, Mahapatra *et al.* also have found comparable differences in blood hemoglobin values in different types of ABO blood groups.^[15]

Few of the limitations of the study are that the comparison was not done between males and females separately, which requires a still larger sample size. Blood groups like AB^{-ve} were not observed in our population; hence, results could not be applied to that particular group.

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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