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IJPBS |Volume 3| Issue 4 |OCT-DEC|2013|10-16

Research Article
Biological Sciences

DISTRIBUTION OF ABO, RHESUS BLOOD GROUPS AND HEMOGLOBIN CONCENTRATION AMONG THE SCHOOL STUDENTS OF DEURALI V.D.C., KASKI, NEPAL

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ABSTRACT

Background: *Blood is a specialized connective tissue with complete and unchangeable identity. Although almost 400 blood grouping antigens have been reported, the ABO and Rh is recognized as the major clinically significant blood group antigens which are also known to vary from one population to another. This study therefore sought to study the frequency of these indices and hemoglobin concentration.* ***Objective:*** *A community-based study was carried out on blood groups representing a random population sample from Bishwoshanti Higher Secondary School, Deurali V.D.C., Kaski, Nepal. The objective was to determine the frequency of different blood groups and distribution of hemoglobin concentration in this region, which would not only help in blood transfusion services but also eliminate the diagnosis of anemia.* ***Method:*** *A cross sectional, analytical study was carried out at Pokhara University, Lekhnath-12 Kaski, Nepal and encompassed 359 subjects, in which 47.6% were male and 52.4% female. These were categorized by their groups, A, B, AB, O and Rh; and their hemoglobin concentration was measured.* ***Results:*** *The average percentage of ABO groups were found as O (34.8%), A (34.3%), B (27.0%) and AB (3.9%). The Rh positive and negative distribution in the studied population was 98.6% and 1.4% respectively. The hemoglobin concentration was found to be greater than12 gm/dl in 85.8 percent students and only 14.2 % students had low Hb concentration than 12 gm/dl. 0.3% students having Rh negative blood group was found to be low hemoglobin concentration. And Hb concentration of 84.7% students having Rh positive blood group was normal.* ***Conclusion:*** *The studied population exhibited a predominance of group O, in the order of O>A>B>and AB, as well as Rh positive antigen for 98.6% subjects within the population, with Rh negative being 1.4%. Percentage of students with Rh negative blood group having low Hb concentration is 0.3%.*

KEY WORDS

ABO, Rhesus blood groups, Hemoglobin Concentration

INTRODUCTION

Blood is a specialized connective tissue with complete and unchangeable identity. Although almost 400 blood grouping antigens have been reported, the ABO and Rh is recognized as the major clinically significant blood group antigens. This system derives its importance from the fact that A and B are strongly antigenic and anti A and anti B occur naturally in the serum of persons lacking the corresponding antigen, these antibodies being capable of producing hemolysis in vivo. Rhesus blood group system was the fourth system to be discovered and yet it is second most important blood group from the point of view of transfusion **(Adeyemo OA, *et al*, 2006).**

Karl Landsteiner was the first person to put forward the ABO blood group system in 1900. Even after

100years, the single most important test performed in blood banking services is determination of ABO blood groups to avoid transfusion reaction and death (**Honig and Bore, 1980**). Also, the presence of Rhesus blood group was recognized in 1939 and it was confirmed within few years (**Landsteiner and Weiner, 1940**). With the ABO blood group individuals are divided into four major blood groups namely, A, B, AB and O, according to the presence of antigens and agglutinins. Group A blood has type A antigens, group B blood has type B antigens and group O blood has neither A nor B antigens. Also plasma from blood group A contains Anti-B antibodies which act against type B antigens, whereas plasma from type B blood contains Anti-A antibodies, which act against type A antigens. Type AB has neither type of antibody and type O blood has both A and B antibodies (**Seeley *et al*, 1998**). It is a well known fact that the ABO blood groups are not found in equal numbers. In Caucasians in the United States, the distribution is group O, 47%, group A, 41%, group B, 9%, and AB, 3%. Among the African Americans the distribution is group O, 46%, group A, 27%, group B, 20% and group AB, 7%. In the Orientals the distribution is group O, 36%, group A, 28%, group B, 23%, and group AB, 13% (**Pramanik and Pramanik, 2000**). One of the antigens on the surface of red blood cells, the Rhesus antigen (named because a related antigen was first discovered in Rhesus monkeys), is found on the red cells of approximately 85% of the people of United States. This is the second most important blood group system due to its immunogenicity in Rh negative individuals in blood transfusion or pregnancy (**Dennis *et al*, 1998)**. People are positive if they have RhD antigen on the surface of their red cells and are Rh negative if they do not have this antigen.

RhD antigen distribution varies from one population to the other. RhD negative blood group is documented as 5.5% in South India, 5% in Nairobi, 4.8% in Nigeria, 7.3% in Lahore, 7.7% in Rawalpindi (**Bhatti and Amin, 1996**). About 95% of African Americans are RhD positive.

The need for distribution of blood group studies is multipurpose, as besides their importance in evolution; their relation to disease and environment is being increasingly sought in modern medicine. Blood group antigens are not only important in relation to blood transfusion and organ transplantation, but also have been utilized in genetic research, anthropology and training ancestral relation of humans (**Omotade OO, *et al*, 1999**).

Nepal is a developing country and literacy rate is low as compared to many other developing countries. People are still ignorant about the specific dietary requirement. This results in inability of the erythropoietic tissue to maintain a normal hemoglobin concentration on account of an inadequate supply of one or more nutrients. Anemia is a very common problem in Nepal. It affects almost all ages and both sexes. It is especially common in female and lower socio-economic group (**Sinha AK, et al, 2012**). Therefore, the present study has been carried out to record the frequency of various blood groups and hemoglobin concentration in the students of rural population, Deurali VDC, Kaski, Nepal, with a view to diagnose anemia, to study social and economical status as a sole factor for low hemoglobin concentration, and also generate the data with multipurpose future utilities for the health planners.

MATERIALS AND METHOD

A cross sectional, analytical, laboratory based study for the distribution of ABO blood group, Rh factor and hemoglobin concentration in the school students of 8-18 years old was conducted in the eve of one day free health check up program conducted by Pokhara University, Lekhnath-12 Kaski, Nepal in the date 23rd august, 2013 at Bishwoshanti Higher Secondary School, Deurali, Kaski, Nepal.

Blood Sample collection

A total of 259 school students aged 8 – 18 years, were randomly selected from among registered students of the Deurali Higher Secondary School, Deurali, Kaski, Nepal. Blood samples were collected by venepuncture from the antecubital vein. The blood was transferred into prepared Ethylene-diamine Tetra-acetic Acid (EDTA) anticoagulant Vial.

Determination of ABO and Rh Blood Groups

The ABO and Rhesus blood grouping were done using the slide method. A drop of blood from each student was placed on a clean dry glass slide in three places. A drop of each of the antisera, anti A, and anti B and anti D was added and mixed with each blood sample

with the aid of plastic stick. Blood groups were determined on the basis of agglutination reaction.

Estimation of Hemoglobin Concentration:

Hemoglobin concentration was estimated by Cyanmethaemoglobin method. This method is based on the principle that blood is diluted in Drabkin's reagent i.e. the solution of Potassium ferricyanide and Potassium Cyanide. The ferricyanide oxidizes Hemoglobin to Hemiglobin or Methaemoglobin. Potassium Cyanide provides cyanide ions to form Hemiglobin cyanide or Cyanmethaemoglobin. The intensity of color produced is directly proportional to concentration of Hemoglobin present in blood sample which is measured at 540 nm.

Statistical Analysis-

The data were entered in Microsoft Excel and then Statistical Package SPSS version 16.0 was used for data analysis. Chi square test was used and a p value < 0.05 was regarded as statistically significant.

RESULTS

A total of 259 school students were randomly selected from registered students of Deurali Higher Secondary School, Deurali, Kaski, Nepal. This consisted of 171 males and 188 females between the ages 8 and 18. The distribution of the blood groups A, B, and O is shown on **Table 1**. There is no significant relationship in the distribution of blood groups between the male and female students. The distribution of RhD positive and Rh negative varies among the ABO blood groups. There are significant differences in the distribution of Rh positive and negative among the groups as shown in **Table 2**. The distribution of hemoglobin concentration obtained in this study are shown in **Table 4 and 5**. There is no significant difference in the distribution of hemoglobin concentration among ABO and Rh blood groups.

Table 1: Sex wise distribution of ABO blood groups among school students

ABO	Count	Sex		Total
		F	M	
A	Count	68	55	123
	% within sex	36.2%	32.2%	34.3%
	% of Total	18.9%	15.3%	34.3%
AB	Count	5	9	14
	% within sex	2.7%	5.3%	3.9%
	% of Total	1.4%	2.5%	3.9%
B	Count	55	42	97
	% within sex	29.3%	24.6%	27.0%
	% of Total	15.3%	11.7%	27.0%
O	Count	60	65	125
	% within sex	31.9%	38.0%	34.8%
	% of Total	16.7%	18.1%	34.8%
Total	Count	188	171	359
	% of Total	52.4%	47.6%	100.0%

Table 1 shows that Highest percentage of students are of Blood group O (34.8%), followed by A (34.3%), B (27.0%) respectively. The percentage of student having blood group AB are only 3.9%. There is no significant relationship between male and female students in their blood group. P-value = 0.300 which is greater than 0.05.

Table 2: Correlation between Rh and ABO blood groups of school students

ABO	Count	Rh group		Total
		Negative	Positive	
A	Count	2	121	123
	% within Rh	40.0%	34.2%	34.3%
	% of Total	0.6%	33.7%	34.3%
AB	Count	0	14	14
	% within Rh	0.0%	4.0%	3.9%
	% of Total	0.0%	3.9%	3.9%
B	Count	2	95	97
	% within Rh	40.0%	26.8%	27.0%
	% of Total	0.6%	26.5%	27.0%
O	Count	1	124	125
	% within Rh	20.0%	35.0%	34.8%
	% of Total	0.3%	34.5%	34.8%
Total	Count	5	354	359
	% of Total	1.4%	98.6%	100.0%

This **Table-2** shows that there is no significant difference between Rhesus positive and Rhesus negative students with ABO blood group system. P value is 0.89

Table 3: Sex wise distribution of Rh blood group in school students

Sex	Count	Rh group		Total
		Negative	Positive	
F	Count	2	186	188
	% within sex	40.0%	52.5%	52.4%
	% of Total	0.6%	51.8%	52.4%
M	Count	3	168	171
	% within sex	60.0%	47.5%	47.6%
	% of Total	0.8%	46.8%	47.6%
Total	Count	5	354	359
	% of Total	1.4%	98.6%	100.0%

This table shows that 51.8% female students are Rh positive and 0.6% female students are Rh negative. The percentage of male students having Rh negative is 0.8% and Rh positive is 46.8%.

Table-4: Distribution of Hemoglobin concentration on the basis of Rh blood groups

Rh group	Count	Hb concentration		Total
		<12gm/dl (low)	>12 gm/dl (Normal)	
Negative	Count	1	4	5
	% within Rh	2.0%	1.3%	1.4%
	% of Total	0.3%	1.1%	1.4%
Positive	Count	50	304	354
	% within Rh	98.0%	98.7%	98.6%
	% of Total	13.9%	84.7%	98.6%
Total	Count	51	308	359
	% of Total	14.2%	85.8%	100.0%

The **Table-5** shows that 0.3% students having Rh negative blood group has low Hb concentration while percentage of students with Rh positive blood group having low Hb concentration is 13.9%. 84.7% students were Rh positive having normal Hb concentration.

Table-5: Sex wise distribution of Hemoglobin Concentration among school students

Sex	Count	Hb concentration		Total
		< 12 gm/dl (low)	>12 gm/dl (Normal)	
F	Count	40	148	188
	% within sex	78.4%	48.1%	52.4%
	% of Total	11.1%	41.2%	52.4%
M	Count	11	160	171
	% within sex	21.6%	51.9%	47.6%
	% of Total	3.1%	44.6%	47.6%
Total	Count	51	308	359
	% of Total	14.2%	85.8%	100.0%

The **Table 5** shows that 11.1% female students have low haemoglobin concentration and 41.2% female has normal Haemoglobin concentration. In case of male, percentage of male students having low Hb is 3.1% and having normal Hb concentration is 44.6% of total.

DISCUSSION

It was cross sectional, analytical study in which we included the students of Bishwoshanti higher secondary school, Deurali VDC, Kaski, Nepal. And their age was between 8 to 18 years old. This is because of being unavailability of small children in higher secondary school.

From our study, the distribution of blood group O was the highest with percentage frequency of 34.8%, followed by blood group A and B with percentage frequency of 34.3% and 27.0% respectively and the least percentage frequency is that of blood group AB which is 3.9%. 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. In the Nepalese people, 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% (Parmanik **T et al, 2010).** In the Caucasians in the United States, the distribution is group O, 47%, group A, 41%, group B, 9% and group AB, 3% (**Seeley et al, 1998**). 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%. (**Seeley et al, 1998**). 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% (**Adeyemo et al, 2006**). Thus, the segregation of the genes responsible for the ABO blood groups has always taken a particular pattern for its distribution. In this study, it can be seen that blood group AB has the least percentage; which is most of the time very rare and also the case in other previous studies**.**

Rhesus blood group distribution also varies within any group of human population to others. In this study, it was observed that blood group O Rh positive is the highest with a percentage frequency of 34.5%, which is followed by group A Rh positive with the percentage frequency of 33.7%, blood groups B Rh positive is 26.5% and AB RhD positive 3.6%. This study showed a total percentage of Rh positive distribution of 98.6% and Rh negative distribution to be 1.4%. Similar pattern of distribution was also observed in

other studies. Rh negative blood group is documented as 5.5% in south India, 5% in Nairobi Kenya, 4.5% in Nigeria, 7.5% in Lahore, 7.7% in Ralwalpindi studies (**Khan MN, *et al*, 2009; Mawuagi, 1999; Omatade *et al*, 1999; Bhatti and Amin, 1996**).

Further analysis of study population results revealed that the majority of the female students (11.1%) were observed low hemoglobin concentration i.e. anemic whereas 3.1% of male students were only anemic. This result also shows conformity with the result of **(Sinha AK, et al, 2012)** in which the female anemic patients are dominant.

In many studies, it was found that anemia is a common problem in school children of rural area due to low family income so they are unable to take dietary food, lack of awareness is also a main cause of anemia. Iron deficiency is the most common cause of low hemoglobin concentration worldwide. It frequently occurs due to inadequate iron intake, chronic blood loss or disease, mal- absorption, or a combination of all these factors. Similarly data from NNMB Surveys (**Adams WH, et al, 1974**) showed that iron and folic acid intake in all the age groups was very low. It affects one's development, growth and resistance to infections and is also associated with mortality among children younger than two years old. Iron deficiency usually develops in a sequential manner over a period of negative iron balance such as period of blood loss and / or prolonged iron-deficiency diet, accelerated growth in children and adolescents as well as during pregnancy and lactation (**WHO, 2002**). Further research is recommended to identify the specific risk factors for low hemoglobin concentration; it may be helpful to implement measures to improve nutritional knowledge and awareness among mothers and health workers. Finally, nutritional education and intervention programs should address anemia with a focus on the dietary quantity. All of these interventions must be monitored for effectiveness of the program **(WHO, 2001).**

CONCLUSION

The frequency of ABO and Rhesus blood groups appeared to be stable and consistent with reports from previous studies in Kaski, Nepal. Blood group O was the most prevalent. This also means there is a large pool of universal blood donors in this population.

Knowledge of the distribution of ABO, Rh blood groups and hemoglobin concentration in any population is useful in health care planning, medical diagnosis of anemia, allocation of resources and targeting the population that need counseling. If such information is well managed it can make a difference in the quality of decisions that individuals will make especially as it concerns marriage, blood transfusion and other medical demands. Anemia and iron deficiency increased strongly with age and low-caste status among the study children.

ACKNOWLEDGEMENTS

The authors express their sincere thanks to head teacher of Bishwoshanti Higher Secondary School , Deurali, Kaski, Nepal for providing the sample collection place, arranging peaceful and fragile environment during sample collection and conveying the students to participate in the research. We also acknowledge our dearest students of BMLT third year, whose tremendous, valuable effort made the research successful to complete. Our special thanks also go to Pokhara University for providing financial supports to do the research. And we never forget all participants involved formally and informally in this study. We are also grateful to Mr. Ishwor Sharma for his contribution in analysis of data.

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