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Research Article

Blood Group Distribution in a Study Population and their Associated Rhesus Factor (Uganda)

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Abstract: Whole blood transfusions have continuously been done in medical hospitals as the major line of emergency recovery on the African continent as a result of limited infrastructure despite of the fact that the general blood group status is poorly understood. The aim of the study was to determine the prevalent blood groups and their associated rhesus factor. This was a cross sectional study conducted for a period of two months at Kampala International University Teaching Hospital involving a total of 47 undergraduate students, blood was picked by pricking the index finger and placed on a white tile from which the antigens were added to it. The study revealed that majority (53.2%) of the population had blood group O with the greatest prevalence being in the male population and blood group B was the second prevalent blood group in this study. This would probably be due to the establishment of endemic stability with malaria infections in the community. This would be due to genetic selection thus favoring the proliferation of the B and O blood groups as they appear to offer a mutuality protective advantage against plasmodium parasites. The major associated Rhesus factor were of O^+ (53.2%) and B^+ (21.3%) which showed that there was a significant downward shift in the levels of the Rhesus antigen. Blood group O was the most prevalent probably due to its evolutionary advantage in the region. Phenotypic expression need to be investigated further for the development of a strong hematological team in various rural communities.

Keywords: Blood groups, Uganda, O prevalence

INTRODUCTION

In sub Saharan countries like Uganda, majority of blood transfusions are carried out using the routine blood typing protocols [1]. Blood transfusions have been shown to be associated with enormous health risks and these have been shown to either be immediate or delayed thus making clinical diagnosis and reporting of cases different to monitor [2]. Epidemiological information on the hematological status of sub Saharan patients is important for a full scale management of hematological related cases in the communities. This requires the establishment of reliable hematological reports that offer fundamental knowledge to policy makers in the region in preparation for future projects. The major internationally recognized blood group systems in operation are the ABO, Rhesus (Rhesus) systems [3, 4]. Recent funding in various regional hospitals through the World Health Organization (WHO) has led to an improvement of blood handling leading to a reduction in unnecessary transfusion accidents [5].The increasing prevalence of infectious and non-infectious diseases ranging from HIV/AIDS, hepatitis, malaria to the hemolytic disease of the new born, as well as chronic cardio-pulmonary challenges has led to increased research in the field of molecular hematology [3, 6-10]. Studies have shown the distribution of the ABO phenotypes to vary among different populations [3, 4]. The A phenotype is the most prevalent in North Central Europe while the B phenotype is most frequent in Central Asia [3, 11]. Blood group O is the most prevalent phenotype globally, with majority of Africa and Australia showing highest frequencies [12]. It's thought to be due to evolutionary selection based on pathogen-driven blood group antigen changes. The current status of the prevalent blood groups in sub Saharan Uganda is poorly known, thus the study was conducted to determine the recent blood frequencies in Western Uganda.

MATERIALS AND METHODS

This was a cross sectional study conducted for a period of two months (October – November 2014) at Kampala International University Teaching Hospital involving a total of 47 undergraduate students. These were randomly chosen, grouped into two groups basing on sex and their blood groups were determined using commercial anti-sera. Briefly, 2 ml of venous blood were collected into a sterile vacutainer containing EDTA. 2 drops of the blood were applied on a clean white tile and an equal value of anti-serum added to determine the blood group and Rhesus factors.

Statistical analysis

Data was recorded as frequencies and expressed as percentages. Group comparisons on gender were carried out using SPSS Version 21 and $p < 0.05$ was considered statistically significant.

Ethical Considerations

All authors hereby declare that all experiments have been examined and approved by then appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

Consent

Informed consent was obtained from participants before they were enrolled for this study.

RESULTS

The study revealed that majority (53.2%) of the population had blood group O with the greatest prevalence being in the male population. Blood group B was also found to be highly prevalent (23.4%) and second to blood group O in which the male population were also most prevalent (14.9%). The positive Rhesus factor was shown to be the most prevalent (89.4%) antigen in the population and it was most prevalent in the male population (61.7%) as shown in Table 1. No statistical significance ($p= 0.486$) was shown to exist between gender and the different blood groups. The Rhesus factor prevalence in the participants was also found to be independent ($p = 0.613$) of sex.

Table 1: Showing frequencies of blood groups among participants

Parameter	Variable	Frequency of gender of participants (%)		
		Female	Male	Total
Blood group	A	0 (0)	5 (10.6)	5 (10.6)
	B	4 (8.5)	7 (14.9)	11 (23.4)
	AB	2 (4.3)	4 (8.5)	6 (12.8)
	O	8 (17)	17 (36.2)	25 (53.2)
Rhesus factor	Positive	13 (27.7)	29 (61.7)	42 (89.4)
	Negative	1 (2.1)	4 (8.5)	5 (10.6)

The Rhesus factor was found to be most prevalent (53.2%) in blood group O with the positive (O^+) Rhesus factor being most prevalent (48.9%). This was followed by blood group B (23.4%) and the most prevalent genotype was of the positive factor (B^+) at 21.3% as shown in Table 2. No statistical significance ($p= 0.825$) was shown between Rhesus factor and blood group in the population.

Table 2: Showing distribution of Rhesus factor amongst blood groups

Blood group	Rhesus factor frequency (%)		
	Positive	Negative	Total
A	4 (8.5)	1 (2.1)	5 (10.6)
B	10 (21.3)	1 (2.1)	11 (23.4)
AB	5 (10.6)	1 (2.1)	6 (12.8)
O	23 (48.9)	2 (4.3)	25 (53.2)

DISCUSSION

The study revealed that majority (53.2%) of the population had blood group O with the greatest prevalence being in the male population as shown in Table 1. This would probably be due to the small sample size which had a male to female ratio of 3:1. Blood group O has been shown to be the most prevalent in the black population in previous study [13, 14] and blacks of American decent have been shown to be associated with a sickle cell trait (SCT) thus showing that genotypic expression are major factors in the determination of pathological outcomes of disease [15]. Since the Rhesus factor is located on the surface of the RBCs, presence or absence of the factor depends on the genetic distribution of the genes during meiosis and since the entire process is random, one's sex doesn't necessary have any association ($p= 0.613$) with the type of Rhesus factor which will be expressed. Blood group B was the second prevalent blood group in this study which would probably due to the establishment of endemic stability with malaria infections in the community. This would be due to genetic selection thus favoring the proliferation of the B and O blood groups as they appear to offer a protective advantage against plasmodium parasites and this has been shown to have

serious implications for blood donation campaigns [4, 16, 17].

The study further revealed that the Rhesus factor was most prevalent (53.2%) in blood group O i.e. O^+ followed by B^+ (21.3%) as shown in Table 2. These findings show a significant downward shift in the levels of the Rhesus antigen compared to a recent study in West Africa [1]. This would probably be due to differences in study area, populations size, genotypic variation, and environmental evolutionary changes [1, 4, 11]. No statistical significance (p = 0.825) was shown between Rhesus factor and blood group in the population. This is due to the fact that Rhesus factor is determined by genetic factors which are in built within the DNA of the RBCs [4].

CONCLUSION AND RECOMMENDATIONS

In conclusion, the most prevalent blood group types were O^+ followed by B^+ which is thought to be due to the evolutionary advantage the groups have against the endemic plasmodium parasites in the region. Further studies would be carried out to determine the phenotypic expression and genetic predisposition to plasmodium parasites in the study community for the development of a strong hematological team in various rural communities. This would help to provide precise and accurate knowledge on the management of patients of East sub Sahara African origin, especially in the rural communities which struggle with minimal infrastructure.

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