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Haemoglobin Genotype, ABO and Rhesus Blood Group Distribution in Briggs Family of Abonnema, Rivers State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: The aim of this study was to assess the distribution of haemoglobin genotype, ABO and Rhesus blood groups amongst members of the Briggs family in Akulga Local Government Area of Rivers State.
Study Design: This was a cross-sectional, field-based study carried out in Abonnema, Akuku-Toru Local Government Area in Rivers State. All samples were analyzed at the Haematology Laboratory, Department of Medical Laboratory Science, Rivers State University, Port Harcourt, Nigeria, between June and August, 2018.
Methodology: Haemoglobin genotype was done through electrophoresis using the cellulose acetate method and ABO and Rhesus blood groups using the tube method. Blood samples were collected from a total of 100 members of Briggs family (59 males and 41 females (age 6 to 60 years).
Results: The data collated revealed that the ABO blood group frequencies were O Rhesus D positive 56%; A Rhesus D positive 24%; B Rhesus D positive 17% and AB Rhesus D positive 3%

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among members of the Briggs family with no Rhesus D negative subject. HbAA was the commonest haemoglobin genotype, possessed by 80% of the subjects, followed by HbAS with a prevalence of 20%. There was no subject with HbSS.
Conclusion: Greater percentage of members of the Briggs family was of blood group O Rhesus D positive and haemoglobin genotype AA. There was no Rhesus D negative and haemoglobin SS genotype, in the sampled population and considering the fact that Briggs compound or family is like a village in Abonnema, this finding is so unique in that there are social and medical advantages it offers in health (sickle cell disease) and selection of spouses.

Keywords: Haemoglobin genotype; ABO and Rhesus blood group; Briggs family; Abonnema.

1. INTRODUCTION

The Briggs family is one of the four major family compounds that makeup the Abonnema Town, a tribe in Kalabari kingdom in Rivers State. The Briggs family was formerly called Oruwari and its members are well known in all works of life as far as Rivers State is concerned, they are typically known to speak the Ijaw dialect as primary means of communication. Abonnema (originally known as Nyemoni, which means "covet your own" in the Kalabari dialect of the Ijaw languages group) is a larger town in the Kalabari kingdom that was founded in 1882. Four major family compounds makes up Abonnema, namely: Manuel (Owukori), Briggs (Oruwari), Georgewill (Otagi) and Jack (Iju) [1].

The inherited disorders of haemoglobin are the most common single-gene disorders with 7% of the world's population being carriers according to World Health Organisation [2]. Inheritance pattern of the different types of haemoglobin variants is the basis for which sickle cell disease is established. Haemoglobin A (HbA), haemoglobin S (HbS), haemoglobin C (HbC) are some of the genes that are inherited. Haemozygous sickle cell anaemia (HbSS) is a disease condition in which a person inherits a haemoglobin S (HbS) from both parents and it is common in Africa. Also, sickle cell haemoglobin C (HbSC) is a disease condition in which an individual inherits HbC gene from one of the parent and HbS gene from the other and it is found in West Africa [3].

The ABO and Rhesus blood grouping system are among the most important blood groups in human, and in the ABO blood group, individuals are classified into four major blood groups, A, B, AB and O, based on the presence of the antigens and antibodies in them. Blood type A has A antigens and B antibody, type B blood has B antigens and A antibodies, type AB blood has both types of antigens (A and B) but no antibodies, and O blood type has neither A nor B antigens but A and B antibodies [4].

The Rhesus blood group system is the second most important blood group system due to the haemolytic disease of newborn and its importance in Rhesus D negative individuals in subsequent transfusions once they develop Rhesus antibodies. Rhesus incompatibilities have the potential of causing a major problem in some pregnancies when the mother is Rhesus negative and the foetus is Rhesus positive [5].

Haemoglobin which is the oxygen carrying molecule of the erythrocyte has been found to vary at the molecular level. Sickle cell haemoglobin (HbS) differs from normal haemoglobin (HbA) because it has a valine in place of a glutamic acid in position six of the beta chain of globin molecule. When oxygen is reduced, erythrocytes containing sickle cell haemoglobin change from round biconcave disc shape to sickle-shaped cells. The sickle cell homozygote (HbS/HbS) almost always suffers anaemia. The sickle cell heterozygote (HbA/HbS) is only slightly anaemic and has resistance to malaria parasitaemia [6]. The normal homozygote (HbA/HbA) is not anaemic and has no resistance to malaria. Thus, in areas where malaria is common, the fit genotype of the three appears to be the sickle cell heterozygote, which has resistance to malaria and only a minor anaemia.

The haemoglobin variants contained in an individuals blood which by implication affects the concentration of haemoglobin that will be present in such an individual, is critical in accurately predicting the functional competence of the blood to supply oxygen to the various body tissues and in predicting the possibility of having anaemia (sickle cell disease). Also, the ABO and Rhesus blood type in individuals is a key determining factor in predicting the occurrence of haemolytic

disease of the newborn in couples who are of different Rhesus blood type, and in the availability of compatible blood in cases of emergencies where family related blood donation is required; hence the need for carrying out this research in Briggs family.

The aim of this study was to assess the distribution of haemoglobin genotype, ABO and Rhesus blood groups amongst members of the Briggs family in Abonnema, Akuku-Toru Local Government Area of Rivers State, Nigeria. The objectives of the study were to (i) determine the haemoglobin genotype, ABO and Rhesus blood groups amongst the members of the Briggs family, (ii) evaluate the distribution of haemoglobin genotype, ABO and Rhesus blood groups amongst male and female in Briggs family, (iii) determine the distribution of haemoglobin genotype, ABO and Rhesus blood groups in different age groups of Briggs family.

2. MATERIALS AND METHODS

2.1 Research Design

This is a cross-sectional, field-based study carried out in Abonnema, Akuku-Toru Local Government Area, in Rivers State, specifically to determine the haemoglobin genotype, ABO and Rhesus blood groups of members of the Briggs family in Abonnema, Akuku-Toru Local Government Area and determine the distribution of the aforementioned inherited red blood cell components.

2.2 Study Area

The study was carried out amongst the Briggs family in Abonnema Town, Akuku-Toru LGA of Rivers State. Abonnema is a larger town in the Kalabari kingdom that was founded in 1882. Abonnema is located at latitude 4° 43′ 23.22″ N and longitude 6° 46′ 43.85″ E. According to the 2006 census, there was 68, 591 people in Abonnema town.

2.3 Study Population

Whole blood samples were collected from a total of 100 members of the Briggs family, Abonnema was collected and analysed for their haemoglobin genotype, ABO and Rhesus blood groups.

2.4 Eligibility of Subjects, Ethical Clearance and Informed Consent

Non-members of the Briggs family were excluded from the study and only willing members of the Briggs family were enrolled. Informed consent was obtained from apparently healthy subjects prior to enrolment upon ethical clearance by the Ethics Committee of the Department of Medical Laboratory Science, Rivers State University.

2.5 Sample Collection

4 ml of blood was collected by venipuncture into a K_3EDTA anticoagulated (at a concentration of 1.2 mg/ml), with sample container already labelled with patient's name, sex and age. Analysis was carried out within two hours of sample collection.

2.6 Sample Analysis

Haemoglobin electrophoresis was carried out with method as described by Brown [7]. A small quantity of haemolysate of venous blood from each of the subjects was placed on the cellulose acetate membrane and carefully introduced into the electrophoretic tank containing Tris/EDTA/Borate buffer at a pH of 8.9. The electrophoresis was then allowed to run for 15 to 20 minutes at an electromotive force (emf) of 160V. The results were read immediately. Haemolysates from blood samples of known haemoglobin (i.e. AA, AS, AC) were run as controls at the same time.

Red cell phenotyping was carried out with standard tube techniques as described by Judd [8] and Brecher [9]. For ABO blood phenotyping, a drop of anti-A, anti-B, and anti AB (Biotec, Ipswich, UK) each was placed in clean test tubes labelled 1, 2, 3. To each tube was added a drop of 5% red blood cell suspension in saline. The contents were gently mixed together and centrifuged for 30 seconds at 1000 g. The cell buttons were re-suspended and observed for agglutination. Agglutination of tested red cells constituted positive results. A smooth cell suspension after re-suspension followed by a microscopic confirmation constituted negative test results.

2.7 Statistical Analysis

Statistical analysis was done using Microsoft Excel to defining the percentage frequency of the

various blood groups and the genotype in Briggs family. Data are represented in Tables.

3. RESULTS

3.1 Demographic Details of Participants

A total of 100 persons all from the Briggs family were recruited for this study. Ranging from: children (6 years), adolescents, to adults (60 years), as well as males and females. Details are shown in Table 1.

3.2 Percentage Distribution of ABO and Rhesus Blood Groups among Members of Briggs Family

The percentage distribution of ABO and Rh blood groups among members of Briggs family were 24%, 3%, 17%, and 56% for A Rhesus D positive, AB Rhesus D positive, B Rhesus D positive and O Rhesus D positive respectively, there was no member of the Briggs family with Rhesus D Negative as shown in Table 2.

3.3 Haemoglobin Genotype Distribution among Members of Briggs Family

The percentage distribution of haemoglobin genotype among members of the Briggs family was 80% and 20% for AA and AS respectively as shown in Table 3.

3.4 Percentage Distribution of ABO and Rhesus Blood Groups among Members of Briggs Family Based on Gender

The percentage distribution of ABO and Rh blood groups among the male members of Briggs family are 15%, 1%, 8% and 35% for A+, AB+, B+ and O+ respectively; among female members are 9%, 2%, 9%, and 21% for A+, AB+, B+ and O+ respectively as shown in Table 4.

3.5 Percentage Distribution of Haemoglobin Genotypes among Members of Briggs Family Based on Gender

The percentage distribution of haemoglobin genotypes among the male members of Briggs family are 46% and 13% for AA and AS respectively; among female members are 34 and 7% respectively as shown in Table 5.

3.6 Percentage Distribution of ABO and Rhesus Blood Groups among Members of Briggs Family Based on Age Category

The percentage distribution of ABO and Rh blood groups among the members of Briggs family that are children are 4%, 1% and 6% for A+, B+ and O+ respectively; adolescent members are 3%, 3% and 9% for A+, B+ and O+ respectively; for adult members are 17%, 3%, 13% and 41% for A+, AB+, B+ and O+ as shown in Table 6.

3.7 Percentage Distribution of Haemoglobin Genotypes among Members of Briggs Family Based on Age Category

The percentage distribution of haemoglobin genotypes among the members of Briggs family that are children are 8% and 3% for AA and AS respectively; adolescent members are 12% and 3% for AA and AS respectively; for adult members are 60% and 14% for AA and AS respectively as shown in Table 7.

Table 1. Demographic details of participants

Subjects	Frequency (%)
Males	59 (59)
Females	41 (41)
Total	**100 (100)**
Children	11 (11)
Adolescent	15 (15)
Adults	74 (74)
Total	**100 (100)**

Table 2. Percentage distribution of ABO and Rh blood groups among members of Briggs family

Parameters		Frequency (%)
ABO and Rh blood group	A+	24 (24)
	AB+	3 (3)
	B+	17 (17)
	O+	56 (56)
	Total	**100 (100)**

Key: A+ = Group A Rh "D" Positive; AB+ = Group AB Rh "D" Positive; B+ = Group B Rh "D" positive; O+ = Group O Rh "D" positive

4. DISCUSSION

Haemoglobin variants and blood groups are all inherited blood characters and are known to play

critical roles in diseases, blood transfusion and selection of spouses. The data collated revealed that the ABO blood group frequencies were found in the order O > A > B > AB (56%, 24%, 17% and 3%) respectively among members of Briggs family. The data is in agreement with other reports in Nigeria where the same trend was also observed (O Rhesus D positive; 52.93%, A Rhesus D positive; 22.77%, B Rhesus D positive; 20.64% and AB Rhesus D positive 3.66%) [10] [11] [12], as well as in agreement with other reports from most parts of the world as reported from a study on 3,086,215 individuals belonging to different race/ethnic groups in USA (O;46.6%, A;37.1%, B;12.2% and AB;4.1%) [13].

The distribution of ABO and Rhesus blood groups in this study revealed a greater percentage of the subjects having O Rhesus D positive (56%), this is in consonance with a study in Port Harcourt, Rivers State which revealed that the frequency of group O Rhesus D positive was 55.16% [14]. This goes to confirm that group O appears to show predominance over the other blood groups in Rivers State. The high frequency of group O in Port Harcourt, Rivers State as also observed amongst the Briggs family provides an advantage in terms of availability of blood for blood transfusion especially in emergencies.

Table 3. Percentage distribution of haemoglobin genotype among members of Briggs family

		Frequency (Percentage)
Haemoglobin genotype	AA	80 (80)
	AS	20 (20)
	SS	0
	Total	**100 (100)**

Table 4. Percentage distribution of ABO and Rhesus blood groups among members of Briggs family based on gender

	Gender		Frequency (Percentage)
ABO and Rh Blood group	**Males**	A+	15 (15)
		AB+	1 (1)
		B+	8 (8)
		O+	35 (35)
		Total	**59 (59)**
	Females	A+	9 (9)
		AB+	2 (2)
		B+	9 (9)
		O+	21 (21)
		Total	**41 (41)**
		Grand Total	**100 (100)**

Key: A+ = Group A Rh "D" Positive, AB+ = Group AB Rh "D" Positive, B+ = Group B Rh "D" positive, O+ = Group O Rh "D" positive

Table 5. Percentage distribution of haemoglobin genotypes among male and female members of Briggs family based on gender

	Gender		Frequency (Percentage)
Haemoglobin genotype	**Males**	AA	46 (46)
		AS	13 (13)
		SS	0
		Total	**59 (59)**
	Female	AA	34 (34)
		AS	7 (7)
		SS	0 (0)
		Total	**41 (41)**
		Grand Total	**100 (100)**

Table 6. Percentage distribution of ABO and Rhesus blood groups among members of Briggs family based on age category

	Age group (Male and female)		Frequency (Percentage)
ABO and Rh blood group	**Children**	A+	4 (4)
		AB+	0
		B+	1 (1)
		O+	6 (6)
		Total	**11 (11)**
	Adolescence	A+	3 (3)
		AB+	0
		B+	3 (3)
		O+	9 (9)
		Total	**15 (15)**
	Adults	A+	17 (17)
		AB+	3 (3)
		B+	13 (13)
		O+	41 (41)
		Total	**74 (74)**
		Grand Total	**100 (100)**

Key: A+ = Group A Rh "D" Positive, AB+ = Group AB Rh "D" Positive, B+ = Group B Rh "D" positive, O+ = Group O Rh "D" positive

Table 7. Percentage distribution of haemoglobin genotypes among members of Briggs family based on age category

	Age group Male and female		Frequency (Percentage)
Haemoglobin genotype	**Children**	AA	8 (8)
		AS	3 (3)
		SS	0
		Total	**11 (11)**
	Adolescence	AA	12 (12)
		AS	3 (3)
		SS	0
		Total	**15 (15)**
	Adults	AA	60 (60)
		AS	14 (14)
		SS	0
		Total	**74 (74)**
		Grand Total	**100 (100)**

The frequency of Rhesus D antigen in this study was 100% since none of the subjects were Rhesus D negative. A similarly high percentage of 96.7% recorded for the Igbos [15], and similar to 95% found in Port Harcourt [16,14], this can be said to be of an advantage in the study area especially in women as the likelihood for the development of anti–D which can cause both moderate and severe form of haemolytic disease of newborn is at a very low minimum or unlikely.

The result of the study shows that the HbAA was the commonest haemoglobin genotype, possessed by 80% of the subjects, followed by HbAS with a prevalence of 20%. There were no subjects with HbSS. This in agreement with Jeremiah [14], who recorded the frequency of HbAA as 80.32%, HbAS was found to be 19.68%, whereas, HbSS did not occur among the 620 participants in his study. This trend was similarly recorded by Umoh and colleagues [17], where the result of their study showed that the HbAA was the commonest haemoglobin genotype with a percentage distribution of 78.7%, followed by HbAS, 19.6% and HbSS with a prevalence of 1.5%.

In this study, sex and age were not considered critical; rather the results depended on the genetic constitution of the subjects. However, the distribution of the blood groups and haemoglobin genotypes among different age groups and sex were analyzed. In this study majority of the members of the Briggs family that participated were adults and the inherited characters were better distributed amongst them than in children and adolescence. The same trend observed in the general percentage distribution was observed amongst the male and female subjects.

5. CONCLUSION

In conclusion the greater percentage of members of the Briggs family was of blood group O Rhesus D positive and haemoglobin genotype AA (HbAA), there were no Rhesus D negative and haemoglobin genotype SS (HbSS) amongst the members of Briggs family in Abonnema, Rivers State and considering the fact that Briggs compound or family is like a village, this finding is so unique in that there are social and medical advantages it offers in health (sickle cell disease) and selection of spouses.

Though there were no Rhesus D negative cases and haemoglobin SS genotype amongst some members of the Briggs family in Abonnema, it is necessary to ensure that regular screening for these inherited red cell components is encouraged and maintained as well as the sensitization and education of the populace on the significance of haemoglobin genotype, ABO and Rhesus blood groups in blood transfusion as well as choice of spouses.

CONSENT AND ETHICAL CLEARANCE

Informed consent was obtained from apparently healthy subjects prior to enrolment upon ethical clearance by the Ethics Committee of the Department of Medical Laboratory Science, Rivers State University.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Revolvy. Abonnema. Available:https://www.revolvy.com/page/Abonnema Accessed 28 September 2018
2. Weatherall DJ. Haemoglobin and inherited disorders of globin sythesis. In: Hoffbrand AV, Lewis SM, and Tuddenham EGD. (eds). Postgraduate Haematology. 5th ed., USA: Blackwell Publishers. 2005;85-103.
3. Cheesbrough M. District laboratory practice in tropical countries. 2nd ed., Part 2. Cambridge; Cambridge University Press; 2010.
4. Seeley RR, Stephens TD, Tate P. Anatomy and physiology. 4th ed., USA: McGraw Hill Companies, Inc; 1998.
5. Advert ND. The Rhesus blood group system: Insight from recent advances in molecular biology. Transfusion Medicine Review. 1999;13:245–66.
6. Tamarin RH. Principles of genetics. 7th ed., USA: The McGraw Hall Companies, Inc.; 2002.
7. Brown BA. Haematology: Principles and procedures. 6th ed., Philadelphia, USA: Lea and Febiger; 1993.
8. Judd JW. Methods in immunohematology. 2nd ed., Durham, USA: Montogomery Scientific Publications; 1994.
9. Brecher M. Technical manual. 14th ed., Bethesda, USA: American Association of Blood Banks; 2002.
10. Anifowoshe AT, Owolodun OA, Akinseye KM, Oyeyemi BF. Gene frequencies of ABO and Rh blood groups in Nigeria: A review. The Egyptian Journal of Medical Human Genetics. 2016;18(2017): 205–10.
11. Egesie UG, Egesie OJ, Usar I, Johnbull TO. Distribution of ABO, Rhesus blood groups and haemoglobin electrophoresis among the undergraduate students of Niger Delta University Nigeria. Nigerian Journal of Physiological Sciences. 2008; 23(1-2):5–8.
12. Okoroiwu IL, Obeagu EI, Christian SG, Elemchukwu Q, Ochei KC. Determination of the haemoglobin, genotype and ABO blood group pattern of some students of Imo State University, Owerri, Nigeria. International Journal of Current Research and Academic Review. 2015;3(1):20-7.
13. Garratty G, Glynn SA, McEntire R. ABO and Rh (D) phenotype frequencies of different racial/ethnic groups in the United States. Transfusion. 2004;44(5):703–6.
14. Jeremiah ZA. Abnormal haemoglobin variants, ABO and Rh blood groups among student of African descent in Port Harcourt, Nigeria. African Health Sciences. 2006; 6(3):177-81.

15. Ukaejiofor EO, Okonkwo WC, Tagbar EN, Emeribe AO. ABO and Rhesus in a Nigerian population. In: Ukaejiofor, E. O. Blood Transfusion in the Tropics. Nigeria: Salem Press; 1996.
16. Jeremiah ZA, Buseri FI. Rh antigens and phenotype frequencies and probable genotypes for the four main ethnic groups in Port Harcourt Nigeria. Immunohematology. 2003;19(3): 86–8.
17. Umoh AM, Abah G, Ekanem T, Essien E. Haemoglobin genotypes: A prevalence study and implications for reproductive health in Uyo, Nigeria. Nigerian Journal of Medicine: Journal of the National Association of Resident Doctors of Nigeria. 2010;19:36-41.

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