ORIGINAL ARTICLE

Kidd Phenotypes in Multiple Ethnicities in Hospital Umum Sarawak, Malaysia

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ABSTRACT

Introduction: Kidd blood group system is distributed differently within populations. In Malaysia, the prevalence of Kidd phenotypes have been reported but not in Hospital Umum Sarawak (HUS).We characterised Kidd phenotypes among regular blood donors in HUS. **Methods:** A cross-sectional study was done from 1st September 2015 to 10th September 2015. Blood samples were collected from 250 regular blood donors of different ethnicities in HUS. Samples were then investigated for Kidd blood group phenotypes by utilising Seraclon anti-Jka and anti-Jkb reagents employing the Diamed-ID gel card system. **Results:** Phenotype Jk(a+b+) was found in 110 out of 250 (44.0%) and phenotype Jk (a-b-) phenotype in seven out of 250 (2.8%) blood donors. Jk(a+b-) was detected in 60 out of 250 (24.0%) and Jk(a-b+) in 73 out of 250 (29.2%) donors. Kidd phenotype was detected in four ethnics; Chinese 50.8%, Malays 38.4%, Bidayuh 10.0% and Iban 0.8%. Jk(a-b-) phenotype was present only in the Malays; seven out of 250 (2.8%) but not found in other ethnicities. **Conclusion:** Jk(a+b+) is the most common Kidd phenotype found in regular blood donors in HUS in the four ethnicities studied. Only Malays exhibit the Jk(a-b-) phenotype which is a rare phenotype. The results of this study may serve as a preliminary database for Kidd blood group profile of regular blood donors in HUS.

Keywords: Kidd blood group system, Kidd phenotype, Multiple Ethnicities, Hospital Umum Sarawak (HUS)

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INTRODUCTION

In 1951, Kidd blood group system was discovered in a woman who delivered a baby with haemolytic disease but this woman had no history of transfusion (1). Since then, many reports about Kidd blood group system have been published and recently it was noted Kidd antigens (Jka and Jkb) play major roles in urea transport via the membrane of red blood cells (RBC) [2]. Subsequently in 1953, the first case of alloimmunization during pregnancy by anti-Jkb was reported (3).

The Kidd antigen comprised of two (2) antithetical antigens, Jka and Jkb and four Kidd phenotypes are thus possible which are: Jk(a+b-), Jk(a-b+), Jk(a+b+), and Jk(a-b-) (4). It has been noted that Kidd antibodies can create several difficult transfusion scenarios; typical acute haemolytic transfusion reactions. However, Kidd antigens are also known for causing delayed haemolytic transfusion reactions (DHTR) which is due to the strong anamnestic response manifested by antibodies directed against Kidd antigens (5). Many cases of DHTR are unnoticed due to the slow destruction of RBC (6). As mentioned, antibodies against any of the Kidd antigens can also be a cause of haemolytic disease of the fetus and new born (HDFN), although it is generally not severe.

Prevalence of red cell phenotype including Kidd antigen has been published in many countries including India, Thailand and Japan (7, 8, 9). In the Malaysian population, the Kidd blood group system has been described where the most common Kidd phenotype is Jk(a+b+) followed by other Kidd phenotypes which are Jk(a+b-), Jk(a-b+) and Jk(a-b-) (10). Additionally, it was reported the low prevalence of Jk(a-b-) phenotype in blood donors in National Blood Centre (NBC), Malaysia (11).

Knowledge of the frequency of RBC antigen phenotype in a population with different ethnics groups is useful in

efforts to create a database on the distribution of blood groups for the purpose of providing compatible blood especially for patients with multiple alloantibodies (10). Database may also be useful for blood banks to record a rare blood type for future development of cryopreservation facilities (11). Furthermore, a matched phenotype blood is also useful for prevention of risks from transfusion therapy (12). In Malaysia, Kidd phenotyped blood is needed for patients with chronic anaemia or oncology patients and in NBC, there is very limited frozen blood and Kidd phenotype blood is kept in the freezer for many years pending requests for transfusion.

Sarawak is one of the 13 states in Malaysia and is the largest state, located in northwest Borneo Island. The population of Sarawak totaled 2,636,000 based on the 2015 census. There are six major ethnic groups in Sarawak namely Iban, Chinese, Malay, Bidayuh, Melanau, and Orang Ulu (13). There are also other smaller but substantial populations, such as the Kedayan, Javanese, Bugis, Murut, and Indians (14). Ibans make up the largest ethnic group and they usually reside in interior or remote areas of Sarawak whereas Chinese and Malays usually stay in towns. Thus, there are multi ethic groups and tribes in Sarawak and maintaining a blood registry is a challenge and for a start having a database of blood group system is an advantage.

In Hospital Umum Sarawak (HUS), random regular RBC phenotyping for blood donors is not practiced. Therefore, if blood is required for clinical transfusion, blood has to be requested from the NBC. Hence, database of rare blood donor RBC phenotypes is relevant to meet the needs of patients requiring blood transfusion especially those with chronic diseases. Therefore the main objective of this study was to determine the prevalence of Kidd phenotype in different ethnic groups of regular blood donors in HUS.

MATERIALS AND METHODS

A cross sectional study was conducted, where samples collected from regular blood donors who donated in the duration of 1stSeptember 2015 until 10th September 2015 was analysed. This study was conducted in Blood Bank of HUS, the largest hospital in Sarawak. It is the main referral hospital in Sarawak. There are about 1000 beds in HUS and this hospital offers various specialist and sub specialist services in Medicine and Surgery. The inclusion criteria for blood donors are regular blood donors; defined as blood donors who have donated their blood annually with negative results for all markers of virology screening. Secondly, eligible blood donors who fulfilled the criteria for blood donors as stated in National Guidelines for blood donation. (Transfusion Practice Guidelines for Clinical and Laboratory Personnel 3rd edition 2008 (15). The exclusion criteria for blood donors are first time blood donors, foreigners and non-eligible blood donors.

Regular blood donors who donated in Transfusion Unit of HUS were recruited. They were voluntary non-remunerated blood donors. In HUS, regular donors are from the Chinese and Malay donors, and Ibans which form the largest ethnic group, may not be representative because of their usually remote area of habitants.

Informed consent was taken after detailed study explanation where participation is voluntary. All subjects were required to fill Donor History Questionnaire and examined by the medical officer. Each subject was anonymised and assigned a number to ensure confidentiality.

Then the donors underwent normal process of blood donation. Blood segment from donated blood bag was cut and transferred to tubes. No extra blood sample was taken from the blood donors. All samples were labelled with barcode and blood group of donor. The blood samples then underwent Kidd phenotyping using reagents containing of anti-Jka (JK1) Seraclone® Human Monoclonal (MS15) and anti-Jkb (JK2) Seraclone® Human Monoclonal (MS8) from Biorad, USA. The antisera used were for the determination of the Kidd antigens Jka and Jkb of RBC using the micro-column ID-NaCl/enzyme from Biorad, USA (16).

Results were recorded and the remaining blood samples were discarded after the study was completed. Relevant data such as ABO and Rh blood group, ethnicity, barcode number were also determined from the donor records.

For the statistical analysis, SPSS version 23.0 for window-software (SPSS, Chicago Illinois, USA) was used to present the descriptive statistics and association statistics. There were multiple independent variables to be evaluated. Therefore, Chi square test or Fisher exact test was utilised to investigate the relationship among these different variables. A p-value of 0.05 was considered statistically significant.

This study was approved by National Medical Research Regisry and National Health Ministry (NMRR) and Human Research Committee of Universiti Sains Malaysia (JePEM).

RESULTS

There were a total of 250 regular blood donors in HUS who participated in this research and the ethnicities of the donors were 50.8% (127) Chinese, 38.4% (96) Malays, 10.0% (25) Bidayuh and 0.8% (2) Iban as shown in Table I. Results of ABO and Kidd phenotyping are shown in Table II. Blood group O was the most common 40.8% (102) followed by B; 34.4% (86), A; 22.0% (55) and blood group AB; 2.8% (7). Results for Kidd

Table I: Different ethnicities of blood donors, n = 250

Characteristics	Number (percentage) n (%)
Number of donors, N	250
Ethnicity	
Malay	96 (38.4)
Chinese	127 (50.8)
Bidayuh	25 (10.0)
Iban	2 (0.8)

Table II: 2 ABO blood group and Kidd phenotyping results of donors, n=250

Characteristics	Number (percentage) n(%)
Blood group	
O	102 (40.8)
A	55 (22.0)
B	86 (34.4)
AB	7 (2.8)
Kidd phenotypes	
Jk(a+b+)	110 (44.0)
Jk(a+b-)	60 (24.0)
Jk(a-b+)	73 (29.2)
Jk(a-b-)	7 (2.8)

phenotypes showed Jk (a+b+) 44.0% (110) followed by Jk (a-b+) 29.2% (73), Jk (a+b-) 24.0% (60) and Jk (a-b-) 2.8% (7). There were 2.8 (7) donors who were Jk (a-b-). ABO blood group and Kidd phenotypes according to different ethnicities are shown in Table III. Jk(a+b+) has the highest percentage of Chinese ethnicity 45.5% (50), followed by Malays 42.7% (47), Bidayuh 10.0% (11) and Iban 1.8% (2). For Jk(a+b-) and Jk(a-b+), the highest is in Chinese (66.7%, 50.7%), followed by Malays (28.3%, 34.2%), Bidayuh (5.0%, 15.1%) and non in Iban. The Kidd phenotype, Jk(a-b-) was found in only the Malay blood donors (7).

Table III: ABO Blood group, Kidd phenotype and different ethnicities of donors, n=250

Characteristics	Ethnicity			
	Malay n (%)	Chinese n (%)	Bidayuh n(%)	Iban n (%)
Blood group				
O	39 (38.2)	51 (50.0)	10 (9.8)	2 (2.0)
A	22 (40.0)	26 (47.3)	7 (12.7)	0 (0.0)
B	30 (34.9)	48 (55.8)	8 (9.3)	0 (0.0)
AB	5 (71.4)	2 (28.6)	0 (0.0)	0 (0.0)
Kidd phenotypes				
Jk(a+b+)	47 (42.7)	50 (45.5)	11 (10.0)	2 (1.8)
Jk(a+b-)	17 (28.3)	40 (66.7)	3 (5.0)	0 (0.0)
Jk(a-b+)	25 (34.2)	37 (50.7)	11 (15.1)	0 (0.0)
Jk(a-b-)	7 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)

Pertaining to the ABO blood group system, O blood group has the highest percentage in all ethnicities: Malays 38.2% (39), Chinese 50% (51), Bidayuh 9.8% (10) and Iban 2.0% (2). With regards to A and B blood groups, the highest percentage was found in Chinese (47.3%, 55.8%), followed by Malays (40.0%, 34.9%) and Bidayuh (12.7%, 9.3%). AB blood group is the lowest among all ethnics: Malays 71.4% (5) and Chinese 28.6% (2).

Blood group distributions based on Kidd phenotypes are shown in Table IV. In O blood group, the highest Kidd phenotype was Jk(a+b+) 51% (52), followed by Jk(a+b-) and Jk(a-b+) with same percentage 23.5% (24) and Jk(a-b-) 2.0% (2). In A blood group donors, Jk(a+b+) was 67.3% (37), Jk(a+b-) 16.4% (9), Jk(a-b+) 14.5% and Jk(a-b-) 1.8% (1). In B blood group, the highest percentage of Kidd phenotype was Jk(a-b+) 46.5% (40), followed by Jk(a+b-) 27.9% (24), Jk(a+b+) 20.9% (18) and Jk(a-b-) 4.7% (4). In AB blood group, Jk(a+b+) and Jk(a+b-) each was 42.9% (3) and Jk(a-b+) 14.3% (1).

Table IV: Blood group distributions of the blood donors based on Kidd Phenotype, n=250

Blood group	Kidd Phenotype			
	Jk(a+b+) n(%)	Jk(a+b-) n(%)	Jk(a-b+) n(%)	Jk(a-b-) n(%)
O	52 (51.0)	24 (23.5)	24 (23.5)	2 (2.0)
A	37 (67.3)	9 (16.4)	8 (14.5)	1 (1.8)
B	18 (20.9)	24 (27.9)	40 (46.5)	4 (4.7)
AB	3 (42.9)	3 (42.9)	1 (14.3)	0 (0.0)

The association between ABO blood group and Kidd phenotypes in different ethnicities are shown in Table V and Table VI. Chi- square and Fisher exact test were used to investigate the association between blood donors ' ethnicity and the different Kidd phenotypes. The

Table V: Association ABO blood group of donors and ethnicity, n=250

Characteristics	Ethnicity				p-value
	Malay n(%)	Chinese n(%)	Bidayuh n(%)	Iban n(%)	
[a]**Blood group**					
O	39 (38.2)	51 (50.0)	10 (9.8)	2 (2.0)	0.573
A	22 (40.0)	26 (47.3)	7 (12.7)	0 (0.0)	
B	30 (34.9)	48 (55.8)	8 (9.3)	0 (0.0)	
AB	5 (71.4)	2 (28.6)	0 (0.0)	0 (0.0)	
[a]**Kidd phenotypes**					
Jk(a+b+)	47 (42.7)	50 (45.5)	11 (10.0)	2 (1.8)	0.006*
Jk(a+b-)	17 (28.3)	40 (66.7)	3 (5.0)	0 (0.0)	
Jk(a-b+)	25 (34.2)	37 (50.7)	11 (15.1)	0 (0.0)	
Jk(a-b-)	7 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	

[a]Chi-square test/Fisher's exact test *Significant if p-value < 0.05
Enumerating sample-space combinations:
Stage 4: enumerations = 1
Stage 3: enumerations = 33
Stage 2: enumerations = 7903
Stage 1: enumerations = 0

Table VI: Association between clinical characteristics and ethnicity using STATA, n=250

Row (ethnic)	Col (types of Kidd phenotype)				Total
	1	2	3	4	
1	47	17	25	7	96
2	50	40	37	0	127
3	13	3	11	0	27
Total	110	60	73	7	250

The result using Fisher Exact test, P value =0.003.

association for blood donors' ethnicity and the different Kidd phenotypes were tested using Chi-square test. P-value of less than 0.05 was taken as significant. There is significant association for blood donors' ethnicity and different Kidd phenotypes (p= 0.006). Table V shows significant association for blood donors' ethnicity and different Kidd phenotypes (p= 0.006). The association for blood donors' ethnicity and the different Kidd phenotypes were analysed using Fisher Exact test. A P-value of less than 0.05 was taken as significant. There is significant association for blood donors' ethnicity and the different Kidd phenotypes (p= 0.003). Table VI shows significant association for blood donors' ethnicity and the different Kidd phenotypes (p= 0.003).

The association between ABO blood group and Kidd Phenotypes shown in Table VII. Chi- square was used to investigate the association between ABO blood group and the different Kidd phenotypes. The association between ABO blood group and the different Kidd phenotypes was investigated using Chi-square test where a P-value of less than 0.05 was considered significant. There is significant association between ABO blood group and the different Kidd phenotypes (p< 0.001). Table VII shows there is a significant association between ABO blood group and the different Kidd phenotypes (p< 0.001).

Table VII: Association between ABO blood group and Kidd Phenotype, n=250

Blood group	Kidd Phenotype				p-value
	Jk(a+b+) n(%)	Jk(a+b-) n(%)	Jk(a-b+) n(%)	Jk(a-b-) n(%)	
O	52 (51.0)	24 (23.5)	24 (23.5)	2 (2.0)	<0.001*
A	37 (67.3)	9 (16.4)	8 (14.5)	1 (1.8)	
B	18 (20.9)	24 (27.9)	40 (46.5)	4 (4.7)	
AB	3 (42.9)	3 (42.9)	1 (14.3)	0 (0.0)	

[a]Chi-square test

*Significant if p-value < 0.05

DISCUSSION

The objective of this study was to determine the prevalence of ABO and Kidd phenotypes in different ethnic groups of regular blood donors in HUS. This was a cross-sectional study undertaken to determine the frequency and association of Kidd phenotypes and ethnicity in regular blood donors in HUS. Regular blood donors (total of 250) in HUS participated in this study and the ethnicities of the donors were 50.8% (127) Chinese, 38.4% (96) Malays, 10.0% (25) Bidayuh and 0.8% (2) Iban.

From the records obtained, the blood group O was the most common among donors in all ethnics and blood AB group was the least common. This is consistent with previous findings where (11), blood group O was also highest among Malaysian population. This similar finding was also described among blood donors in Thailand where blood group O was the most common whilst group AB was least common (8).

Regarding the Kidd blood group, results showed Jk(a+b+) was the commonest Kidd phenotype in all the four ethnic groups and this similar findings have been reported populations elsewhere (17,18,19). It was also noted that there is low prevalence of Jk(a-b-) and discovered only in the Malays (7.3%) but not in other ethnic groups. This findings befits previous reports that the phenotype Jk(a-b-) has been rarely found rendering it an uncommon phenotype.

Kidd phenotypes and ethnicity showed significant association in this study where there is significant association between ethnicity of blood donors and the different Kidd phenotypes (p= 0.003). Jk(a+b+) phenotype was highest in the Chinese population (39.4%) and this finding is comparable to other study on Asian subjects (8). The Jk(a+b-) was also most common phenotype in the Chinese population when compared to Malays, Bidayuh, and Iban (17.7%, 12.0% and 0%) respectively. The Jk(a-b+) is also considered a rare phenotype and it is usually found in people from Asian countries (20).

It is worthwhile to note that results from this study captured more Chinese and Malays blood donors than donors from the Ibans. This is because HUS is located in the middle of Kuching city center where there are more Chinese and Malay blood donors as opposed to Iban blood donors who usually reside in the inner part of Sarawak.

The present study results contribute to increasing knowledge of the differences in the ethnicity and expression of Kidd antigens among diverse world populations. These differences have clinical implications for transfusion medicine services serving the Malaysian population, since population frequencies of Kidd antigen may differ from others.

The results gathered in this present study may serve as a database for Kidd phenotypes of regular blood donors in major ethnic groups in HUS. Indirectly, it will increase the rare blood donor registry in HUS to meet the patients

demand if blood which is phenotypically matched is requested.

Several limitations were noted namely, this study only involved 250 blood donors which is a small size, one of the reasons being time constraints. This study was only done in one hospital in Sarawak, ideally the study should have included more blood donors from different zones since Sarawak is a large state in its geographical settings.

CONCLUSION

Among regular blood donors of four different ethnics in HUS, the most common Kidd phenotype is Jk(a+b+). The Jk(a-b-) phenotype is present only in the Malays compared to other ethnic groups. This study may serve as a database for Kidd blood group profile of regular blood donors of different ethnic groups in HUS.

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