



## Phenotypic Profile of Kell Blood Group System among Saudi Donors at King Abdulaziz Medical City-Riyadh

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### Abstract

**Background:** The Kell blood group system (KBGS) is complex and contains many blood group antigens; these antigens are considered highly immunogenic. KBGS antigens are the third most potent, after the ABO and Rh blood group antigens.

**Aims:** The aim of this study is to provide essential data about the distribution of the major Kell antigens and the most common phenotype among the Saudi population.

**Methodology:** This is a retrospective study to evaluate the Kell antigens grouping performed among some donors who donated blood or blood products at department of donation center in King Abdulaziz Medical City, Riyadh, Saudi Arabia from 1<sup>st</sup> January 2015 to 31<sup>th</sup> December 2015. Sample size included four hundred donors. All donors are males and their ages were above 18 years.

**Results:** The Incidence of other kell antigens i.e. K, k, Kp<sup>a</sup> and Kp<sup>b</sup> were 18.2%, 97.0%, 11.7% and 96.0% respectively The most common kell phenotype according to K and k antigens among Saudi donors was K-k+ (81.5%) followed by K+k+ (15.5%) followed by K+k- (3%) and the K-k- phenotype was (0%) , while the most common kell phenotype according to Kp<sup>a</sup> and Kp<sup>b</sup> antigens among Saudi donors was Kp<sup>a</sup> - Kp<sup>b</sup>+ (88.0%) followed by Kp<sup>a</sup> +Kp<sup>b</sup> + (7.8%) followed by Kp<sup>a</sup> +Kp<sup>b</sup> -(4.2%) and the Kp<sup>a</sup> -Kp<sup>b</sup>- phenotype was (0%).

**Conclusion:** This study showed that there is a wide racial and geographical variation in the distribution of Kell antigens and phenotypes among study participants. The Kell blood group system has vital role in population genetic study and in resolving medical-legal issues and more importantly in transfusion medicine practice.

**Keywords:** Kell blood group system, Kell antigens and Kell phenotypes.

### Introduction

Human red blood cells (RBCs) contain on their surface many glycoproteins and glycolipids which constitute the blood group antigens. These blood group antigens are developed under genetic

control and appear early during fetal life and remain stable until the end of life. <sup>[1]</sup>

The Kell blood group system (KBGS) is complex and contains many blood group antigens; these antigens are considered highly immunogenic.

KBGS antigens are the third most potent, after the ABO and Rh blood group antigens. [2, 3, 4]

KBGS was discovered by Coomb's, et al in 1946 from a child of Mrs. Kelleher who was suffering from hemolytic disease of newborn, and the antibody coated RBC of the newborn gave positive direct coomb's test, the reason was unexplained and search for antigen lead to discovery of new antigen, named Kell blood group. [5, 6] The blood group antigens of KBGS were named after the individuals in whom the antibodies were first found. [5] The blood group antigens of KBGS are about more than twenty two antigens. [7]

The blood group antigens have been the theme of research due to the importance of blood transfusion in many conditions. [8, 9] Blood group antigens issues related to blood transfusion medicine are very interesting and their investigations have much to offer to blood banking, thus making role of workers in transfusion medicine more important in clinical medicine. [10, 11, 12]

This study is to provide enough data on the distribution and frequency of KBGS antigens among donors who donated blood or blood products at King Abdulaziz Medical City-Riyadh that would assist in planning and coordinating blood transfusion services in Kingdom of Saudi Arabia.

**Material and Methods**

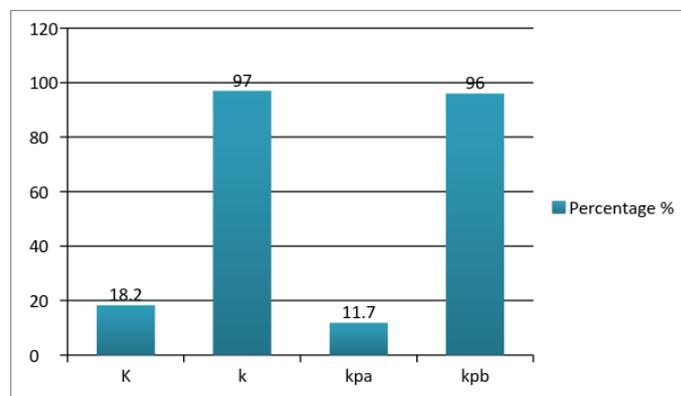
This is a retrospective chart review study conducted to determine the frequency of Kell antigens and Kell phenotypes among donors donating blood or blood products at King Abdulaziz Medical City-Riyadh in the year 2015. Participants in this study included four hundred donors. All donors are males and their ages are above 18 years. The selection criteria was based on donating blood or blood products. Donors who did not donate blood or blood products were excluded. Finally the raw data of Kell antigens and Kell phenotypes obtained were analyzed using SPSS computer program.

**Results**

Participants in this study included four hundred donors. All donors are males and their ages are above 18 years, the Incidence of other kell antigens i.e. K, k, Kp<sup>a</sup> and Kp<sup>b</sup> were 18.2%, 97.0%, 11.7% and 96.0% respectively (Table 1 and Figure 1). The most common kell phenotype according to K and k antigens among Saudi donors was K-k+ (81.5%) followed by K+k+ (15.5%) followed by K+k- (3%) and the K-k- phenotype was (0%) , and the most common kell phenotype according to Kp<sup>a</sup> and Kp<sup>b</sup> antigens among Saudi donors was Kp<sup>a</sup> - Kp<sup>b</sup>+ (88.0%) followed by Kp<sup>a</sup>+ Kp<sup>b</sup>+ (7.8%) followed by Kp<sup>a</sup> + Kp<sup>b</sup>- (4.2%) and the Kp<sup>a</sup> - Kp<sup>b</sup>- phenotype was (0%) (Table 2 and Figure 2).

**Table (1):** Incidence of kell antigens in present study

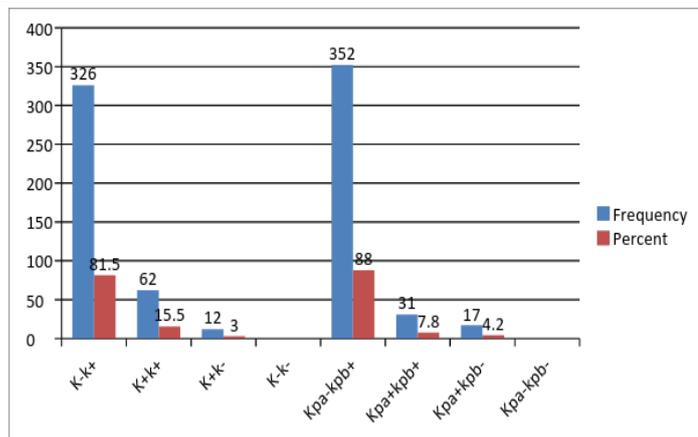
Percentage %	Kell antigen
18.2	K
97.0	k
11.7	Kp <sup>a</sup>
96.0	Kp <sup>b</sup>



**Figure (1):** Incidence of kell antigens in present study.

**Table (2):** Frequency and percentage of kell phenotypes

Percentage %	Frequency	Phenotype
81.5	326	K-k+
15.5	62	K+k+
3.0	12	K+k-
0.0	0	K-k-
88	352	Kp <sup>a</sup> -kp <sup>b</sup> +
7.8	31	Kp <sup>a</sup> +kp <sup>b</sup> +
4.2	17	Kp <sup>a</sup> +kp <sup>b</sup> -
0.0	0	Kp <sup>a</sup> -kp <sup>b</sup> -



**Figure (2):** Frequency and percentage of kell phenotypes.

### Discussion

This study shows the distribution of Kell antigens and phenotypes among Saudi donors who donated blood or blood products in the blood transfusion services center located at King Abdulaziz Medical City (KAMC)-Riyadh in Saudi Arabia, and compared it with other populations. The Kell antigen group system is very important in blood transfusion, paternity and in some criminal cases.

In 1946 the kell blood group was discovered by Mrs. Kelleher. [7,9,11] Kell antigens and kell phenotypes are constant over human life. [9, 11] The kell antigens are located on the surface of the RBCs. The frequency of kell blood group antigens and phenotypes are most important among population, in hemolytic disease of newborn child. [7,9,11] The kell blood group system plays important rule in blood transfusion, paternity, and race studies.

The frequency of Kell (K) antigen among donors donated blood or blood products in the blood transfusion services center located at King Abdulaziz Medical City (KAMC)-Riyadh in Saudi Arabia was 18.2% as compared to the findings in Sudanese, Japanese and Indians where the respective prevalence is found 5.6%, 0.0001% and 1.97%. [13,14] The frequency of Cellano (k) antigen among the donors was 97% as compared to the findings in Sudanese and Indians where the respective prevalence is shown to be 99.6% and 100%. [13,14]

The frequency of K-k+ phenotype (81.5%) is

found significantly lower among the Saudi donors, as compared to Indians, which was 98.03%. [14] The frequency of Kp<sup>a</sup> antigen among donors in the blood transfusion services center located in KAMC was 11.7%. It is near frequent to American population (4%), while it is not compatible with Sudanese population (99.8%). [1]

The frequency of Kp<sup>b</sup> antigen among Saudi donors in the blood transfusion services center located in KAMC was 96%, which is 100 per cent nearest to Sudanese and American populations. [6]

The frequency of Kpa-kp<sup>b</sup>+ phenotype showed significantly lower among the Saudi donors (88%) compared to Sudanese, white American and black American populations, which were 93%, 98% and 99% respectively. [1]

This study revealed that Kell antigenic profile, phenotype and genotype along with antibody screening and their identification are very important factors before undertaking blood transfusions especially in patients with history of massive transfusion and multi-parity females.

### Conclusion

In conclusion, our study shows that there is a wide range of racial and geographical variation in the distribution of Kell antigens and phenotypes. The Kell blood group system has vital role in population genetic study in resolving medical-legal issues and more importantly in transfusion practice.

### References

1. Daniels G, Hadley A, Green CA. Cause of fetal anemia in hemolytic disease due to anti-K. Transfusion. 2003; 43: 115-116.
2. Reid ME, Lomas-Francis C (2004). The blood group antigen facts book. (2nd edition). 2004, New York: Elsevier Academic Press.
3. Shakila A, Moinuddin .Kell blood group, a population based study. PK J Med Sci. (2001); 17: 211-214.
4. Mohandas N1, Narla A. Blood group antigens in health and disease. Curr Opin

- Hematol. 2005; 12:135-40.
5. Neville JB. An introduction to immunohematology. 3rd edition, Toronto: Congress L; 1994.
  6. Ahaded A, Brossard Y, Debbia M, Lambin P. Quantitative determination of anti-K (KEL1) IgG and IgG subclasses in the serum of severely alloimmunized pregnant women by ELISA. *Transfusion* 2000; 40:1239-45.
  7. Hoffbrand AV, Pettit AE .Post graduate hematology. 4th edition, British library, London; 2001.
  8. Mohieldin Elsayid, Younes Yahya Aseeri, Faisal Al Saqri, Abdullah Alanazi, Shoeb Qureshi. A Study of Prevalence of Blood Group of Saudi Patients in King Abdulaziz Medical City-Riyadh. *Science Journal of Public Health*. 2015;3:559-562.
  9. K. S. N. Reddy and G. Sudha , ABO and Rh (D) Blood Groups among the Desuri Reddis of Chiuttoor District, Andhra Pradesh .*Anthropologist*, 2009; 11:237-238.
  10. Mollison, PL., Engelfriet CP & Marcelac. Blood transfusion in clinical medicine. 10th edition, United Kingdom: Oxford Blackwell scientific publications. (1997).
  11. Brown, TA .Genetics: A Molecular Approach. Singapore: Fong & sons printers; pp: 309-327. (1992).
  12. Dacie JV, Lewis SM. Practical hematology. In: Lewis SM, Bain BJ, Bates I, editors. 9th ed. London: Churchill Livingstone, Harcourt Publishers Limited; 2001. pp. 444–51.
  13. Ahmed Siddig Akasha, The frequency of kell red cell antigens (K,k) among the major Sudanese tribes, *Recent Research in Science and Technology*, 2012; 4:44-45.
  14. Nitin Agarwal, Rakesh Mohan Thapliyal, and Kabita Chatterjee, Blood group phenotype frequencies in blood donors from a tertiary care hospital in north India, *Blood Research*, 2013;48: 51–54.