

Research Article

A COMPARISON OF RARE ALLELES OF ABO BLOOD GROUP SYSTEM IN THREE ASIAN POPULATION

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ABSTRACT

Genotyping of the ABO blood group system has been carried out on the Chinese population and compared with the other two Asian populations the Japanese and Korean populations. We performed the PCR-RFLP, PCR-SSP, and PCR direct sequencing approach for the analysis of the nucleotide at 11 positions, nts 261, 297, 467, 526, 646, 681, 703, 796, 802, 803, and 1060. Apart from the common alleles, we detected three rare alleles in our study: A1(Pro) (=A101), A2(Leu) (=A201), B (=B101), O(T) (=O01), O(A) (=O02), and O2 (=O03), A1(Leu) (=A102). Names for the rare alleles of the ABO gene were used according to the dbRBC; Ov1, Bv2, Bv in the Chinese population. The comparison of these rare alleles with the other two Asian populations showed that based on these rare alleles the frequency is similar in the Chinese and Japanese populations but this frequency in Korean population is different from the Chinese population. According to our results, the Chinese population is similar to the Japanese as compare to the Korean population.

Keywords: Blood Group Genotyping, Rare Alleles, ABO Gene.

INTRODUCTION

Clinical and transfusion medicine, forensics research, as well as transfusion medicine rely on the ABO as the most comprehensive and clinically essential blood group system. In fact, over 300 different ABO alleles have already been found, according to the International Society of Blood Transfusion (ISBT). In the population throughout the world, ABO weak phenotypes can be determined by the pattern of A or B antigens appearing on the membrane surface of red blood cells in a multitude of populations. However, the ABO weak phenotypes are infrequent in the Chinese population, with a prevalence rate of roughly 0.015 % [1-4]. The ABO cDNA cloning molecular genetics basis dates back to 1990, it was the first instance when Yamamoto performed it [5]. Although numerous ABO polymorphisms produced by variations in the gene's coding domain have been found, however, the molecular mechanisms behind some of these variants are still unknown, necessitating more research. This article presents the alleles of Chinese populations and compare them to the Japanese and Korean populations.

MATERIAL AND METHOD

According to the present study, we investigated 200 samples of the Chinese population from Yunnan province of China.

The most common methods widely used for ABO blood group genotyping in forensic case work, PCR-RFLP and PCR-SSP analysis were used to examine nucleotide at 11 positions i.e., nt 261, 297, 467, 526, 646, 681, 703, 796, 802, 803 and 1060 [6-8]. We compare our findings in this study with Japanese and Korean populations [9-11]. The ABO alleles distribution data for Japanese and Korean populations were taken from the available literature. Google Scholar, PubMed, Scihub were searched for the retrieval of literature. A direct PCR sequencing approach was used for the confirmation of the rare ABO alleles sequence. Primers of different lengths previously used; GA19, GA20, and GA22 were applied the sequence analysis stretched between nt804 and nt1106. The detail of primers is given in (Table 1).

RESULTS AND DISCUSSION

In addition to the commonly available allele in the Asian population i.e. *A1(Pro) (=A101), *A2(Leu) (=A201), B (=B101), *O(T) (=O01), *O(A) (=O02), and *O2 (=O03), *A1(Leu) (=A102) (Table 2), we detected three rare alleles in our study: Names for the rare alleles of the ABO gene were used according to the dbRBC; *Ov1, *Bv2, *Bv. *Ov1 showed a single nucleotide deletion at position nt261, while the nucleotides at the remaining 10 sites were similar observed in *A1 (Lue). *Bv2 samples were identified as belonging to the B blood group in

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the serological methods however, the nucleotide sequence of the blood group at 10 position were identical with the exception of nt297A>G, to (A1Pro). Likewise in the case of the Bv, the nucleotide was Adenine at nt297 but the rest of the sequence was same as the B allele. The distribution of the genotype's frequency of the ABO blood groups are given in (Table 3).

In comparison to the Japanese and Korean populations the common genotypes of the ABO gene were found in all the three Asian population which have nearly the same genotypic frequencies as can be seen in table 3 however, the rare alleles showed some differences in these three populations. The most

prevalent rare allele Bv showed increased frequency of 1.57% in Korean population, while this frequency was 0.50% and 0.39% in Chinese and Japanese populations respectively. Bv2 were similar in Chinese and Japanese population however, in Korean population the frequency for this rare blood type allele has very low with 0.26%. Ov1 type showed increased frequency compared to the Chinese 0.50% and Korean 0.39% table no.3. Our results showed that the frequency of the rare allele was similar in Chinese and Japanese population however, it is different Korean population. In our study, the finding is consistent with studies conducted in Asian populations [12-16].

Table 1. Primers used for sequence analysis from nt804 to nt1106.

Name	Sequence (5'-3')	Direction/Specificity	Location	Ref.
GA19	GATTCTACTACCTGGGGAG	(Sense primer) A-and-O-allele specific	nt784-803	[12]
GA20	GATTCTACTACCTGGGGGG	(Sense primer) B-allele Specific	nt784-803	[12]
GA22	CTAAAACCAAGGGCGGGAGG	(Anti sense primer)	nt1126-nt1107	[13]

Table 2. Nucleotide at 11 positions in ABO gene.

Allele	nt	261	297	467	526	646	681	703	796	802	803	1060
1(Pro)		G	A	C	C	T	G	G	C	G	G	C
*A1(Leu)		-	-	T	-	-	-	-	-	-	-	-
A2(Leu)		-	-	T	-	-	-	-	-	-	-	d
O(T)		d	-	-	-	-	-	-	-	-	-	-
'O(A)		d	G	-	-	A	A	-	-	-	-	-
O2		-	-	-	G	-	-	-	-	A	-	-
Ov1		d	-	T	-	-	-	-	-	-	-	-
*B		-	G	-	G	-	-	A	A	-	C	-
Bv2		-	-	-	-	-	-	-	-	-	-	-
Bv		-	-	-	G	-	-	A	A	-	C	-

Note: (nt=nucleotide), (-=same as reference sequence), (d=deletion).

Table 3. Genotype occurrence in three Asian populations.

Genotype	Population					
	Chinese. No.	(%)	Japanese. No.	(%)	Korean. No.	(%)
*A1(Pro)/ *A1(Pro)	03	01.50	06	02.37	09	02.35
*A1(Pro)/ *A2(Leu)	24	12.00	26	10.40	31	08.12
*A2(Leu)/ *A2(Leu)	08	04.00	04	01.58	14	03.66
*A1(Pro)/ *O(T)	02	01.00	28	11.06	27	07.06
*A1(Pro)/ *O(A)	16	08.00	03	01.18	26	06.80
*A2(Leu)/ *O(T)	20	10.00	18	07.11	32	08.37
*A2(Leu)/ *O(A)	01	00.50	02	00.79	07	01.83
*A1(Pro)/ *O2	13	06.50	1901	07.50	27	07.06
*A1(Pro)/ *Ov1	01	00.50	02	00.79	02	00.52
*A1(Pro)/ *B	07	03.50	14	05.53	08	02.09
*A2(Pro)/ *B	03	01.50	03	01.18	10	02.62
*B/*B	18	09.00	21	08.30	26	06.80
*B/*Bv	01	00.50	01	00.39	06	01.57
*B/*O(T)	25	12.50	28	11.06	26	06.80
*B/*O(A)	04	02.00	08	03.16	10	02.62
*B/*O2	04	02.00	07	02.76	28	07.32
*B/Bv2	01	00.50	01	00.39	01	00.26
*O(T)/Ov1	01	00.50	01	00.39	02	00.52
*O(T)/ *O(T)	26	13.00	21	08.30	30	07.85
*O(A)/ *O(A)	06	03.00	06	02.37	20	05.23
*O(T)/ *O(A)	16	08.00	13	05.13	40	10.47

Note: Total number of samples: Chinese=200, Japanese=253, Korean=382. No=numbers. %=Percentage. References Japanese: [6,11] Korean: [9,10].

CONCLUSION

In our study, we found that *A1(Pro) (=A101), *A2(Leu) (=A201), *B (=B101), *O(T) (=O01), *O(A) (=O02), and *O2 (=O03), *A1(Leu) (=A102) alleles are commonly available in Asian population. We also find three rare alleles, which we compared in these populations which showed varied frequencies. On the basis of these ABO rare alleles, we concluded that the Chinese and Japanese population are similarities in their genetic makeup of the ABO gene as compare to the Korean population which showed slightly different allele frequency.

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