

Original Research Article

Distribution of ABO and Rh (D) Allele Frequencies in the Type 1 Diabetes Mellitus Patients and Healthy Individuals

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ABSTRACT

Aim: To compare the distribution of serological traits like ABO and Rh (D) blood groups among type 1 diabetes mellitus (T1DM) patients and control subjects.

Objective: Comparative analysis of ABO & Rh blood group phenotype and allele frequencies in T1DM and healthy individuals.

Materials & Methods: A total of 98 individuals (40 T1DM and 58 controls) were evaluated. Blood samples were analyzed for ABO and Rh (D) blood groups and allele frequencies were calculated using chi-square test.

Result: Data of the present study revealed that frequency of O allele (0.500) was highest among T1DM patients followed by B allele (0.311) and A allele (0.109). Chi-square value for ABO blood group was found to be significant ($p < 0.05$) in controls while it was non-significant ($p > 0.05$) in T1DM patients. D allele was more frequent in controls (0.679) than T1DM patients (0.644).

Conclusion: The findings of the present study suggest that there is no association between distributions of ABO blood types in T1DM.

Keywords: Type 1 diabetes mellitus, ABO blood group, Rh (D) blood group, allele frequency.

INTRODUCTION

Type 1 diabetes mellitus (T1DM) is an autoimmune disorder, where the body's defense system attacks the insulin-producing β -cells in the pancreas. As a result, body can no longer produce insulin it needs. ^[1] T1DM accounts for 5-10% of all diabetes cases. T1DM is usually characterized by the presence of anti-GAD₆₅, islet cell or insulin antibodies. Auto-antibodies to the tyrosine phosphatases IA-2 and IA-2 β are also markers of immune destruction of β -cells of

pancreas. T1DM develops suddenly and symptoms are abnormal thirst, dry mouth, frequent urination, lack of energy, sudden weight loss, recurrent infections, blurred vision and ketoacidosis. ^[2] Risk factors of T1DM are still being researched. However, family history, environmental factors and exposure to viral infections have been linked to the risk of developing T1DM. ^[1]

The major human blood group system is ABO and Rh is the second most significant blood group system in humans.

ABO blood group distribution varies in different geographical and ethnic groups, and socio-economic group. [3] In India, the ABO blood group frequency is variable, the frequency of B ranges from 6% in Negritos of Andamans to 48% in Birjas of Bihar while group A is 20-30% in Western and Eastern Himalayas. [4] The blood group frequency in North India is B>O>A>AB. [5] About 95% of Indian population are Rh (D)⁺ and 5% are Rh (D)⁻. [6]

Many researchers have made attempts to determine the significance of particular ABO phenotypes for susceptibility of disease. Certain diseases like peptic ulcer and gastric cancer show strong association with the ABO/Rh blood groups. [7] Gastric cancer is more common in blood group A individuals whereas gastric and duodenal ulcers occur more frequently among blood group O individuals. [8] Significant association between blood group O and type 2 diabetes mellitus has been reported by Jaggi and Yadav. [9] ABO blood group is significantly associated with the risk of pancreatic cancer. [10] In the present study, an attempt has been made to investigate any relationship of ABO and Rh blood groups with T1DM.

MATERIALS AND METHODS

Subjects

For the present study, 40 T1DM patients were chosen randomly for ABO and Rh (D) blood typing. Along with that, 58 age, sex and socio-economic status matched healthy controls were selected from the same area. Informed consent was taken from all the participants and the study was approved by institutional ethics committee (vide letter no. IEC/13/330 dated 27/4/2013). Procedures followed were in accordance with Helsinki Declaration.

Methods

Blood samples were taken from vein with the help of registered medical practitioner. The samples were collected in K₂EDTA vacutainers, labeled and transported to laboratory for ABO and Rh (D) blood grouping simultaneously. Red blood cell agglutination method was followed for blood group analysis. On a clean, labeled glass slide a drop of antisera-A, antisera-B and antisera-D was placed and a drop of blood was added to each and mixed immediately. Agglutination with antisera-A showed A blood group, with antisera-B showed B blood group and with both A and B showed AB and with neither of these showed O blood group. Agglutination with D showed positive test for D antigen.

Statistical analysis

Chi-square test was applied to estimate the probability of difference distributions occurring by chance. $p < 0.05$ was considered to be statistically significant. The allele frequencies of A, B and O alleles were calculated according to Yasuda. [11] Square root method was used to evaluate d allele frequency.

RESULTS

The phenotype and allele frequencies of ABO blood group of T1DM patients and control subjects have been illustrated in table 1. Blood group B is more common in T1DM patients (42.50%) than controls (41.38%). Blood group O is also found oftener in T1DM patients (25.00%) than controls (20.69%). But in blood group AB, the controls (12.07%) are more numerous than T1DM patients (10.00%). In blood group A also, the controls (25.86%) outnumber the T1DM patients (22.50%). The allele frequency of O allele (0.500) was highest in T1DM patients followed by B allele (0.311) and A allele (0.189). Whereas the allele frequencies in controls were in order A (0.477) > O (0.454) > B (0.317).

Table 1: Phenotype and allele frequencies of ABO blood group among the type 1 diabetes (T1DM) patients and control subjects.

Group	N		Phenotype frequency				Allele frequency		
			A	B	AB	O	A	B	O
T1DM	40	Obs.	9 (22.50)	17 (42.50)	4 (10.00)	10 (25.00)	0.189	0.311	0.500
		Exp.	9.00	16.32	4.70	10.00			
Controls	58	Obs.	15 (25.86)	24 (41.38)	7 (12.07)	12 (20.69)	0.477	0.317	0.454
		Exp.	38.34	22.50	17.54	11.95			

The values in parenthesis show the percent frequency.

Table 2 depicts the chi-square values for ABO blood group among T1DM patients and control subjects. The chi-square value was observed to be non-significant in T1DM patients showing homogenous distribution while the chi-square value was found to be significant ($p < 0.05$) in control subjects representing heterogenous distribution.

Table 2: Chi-square values for ABO blood group in type 1 diabetes (T1DM) patients and control subjects.

Group	Df	χ^2	Probability	Remarks
T1DM	3	0.133	$p > 0.05$	Non-significant
Controls	3	20.640	$P < 0.05$	Significant

Table 3 represents the phenotype and allele frequency of Rh (D) blood group among T1DM patients and control subjects. Control subjects (89.66%) have numerous Rh (D)⁺ individuals than T1DM patients (87.50%). While Rh (D)⁻ blood group is more frequent in T1DM patients (12.50%) than controls (10.34%). The frequency of D allele was slightly higher in control subjects (0.679) than in T1DM patients (0.644). While d allele frequency was found to be higher in T1DM (0.356) than control subjects (0.321).

Table 3: Phenotype and allele frequencies of Rh (D) blood group among the type 1 diabetes (T1DM) patients and control subjects.

Group	Phenotype frequency		Allele frequency	
	Rh (D) ⁺	Rh (D) ⁻	D	d
T1DM	35 (87.50)	5 (12.50)	0.644	0.356
Controls	52 (89.66)	6 (10.34)	0.679	0.321

The values in parenthesis show the percent frequency.

DISCUSSION AND CONCLUSION

The study of distribution of blood groups is important as it plays an important role in genetics, blood transfusion, organ

transplantation, genetic research, human evolution and forensic pathology. [12] Some blood groups have been found to be associated with diseases like peptic ulcer, [13] type 2 diabetes mellitus, [14] urinary tract infection [15] and Rh and ABO incompatibility of newborn. [16] Many researchers have tried to study the association between ABO and Rh (D) blood groups and diabetes mellitus. The results have been unsteady and varied from region to region. Tedeschi & Cavazzuti [17] and Henry & Poon-King [18] reported increased frequency of B blood group among diabetic patients. In Copenhagen, an excess of blood group O was found in male diabetics. [19] In the present study, T1DM patients showed homogenous distribution. Findings of the present study are in agreement with Sidhu *et al.* [20] and Koley. [21] They also found non-association of ABO blood groups and diabetes mellitus. [22-25] There are several other studies which do not found any apparent association of blood group with diabetes. 190 patients with diabetes mellitus were tested for several genetic erythrocyte and serum protein markers, and compared with healthy controls by Berg *et al.* [26] and did not find an association between diabetes mellitus and ABO system. We have found increased frequency of Rh (D)⁻ blood group in T1DM patients than controls. Same observation was made by Sidhu *et al.* [20] To conclude, the findings of the present study suggest that there is no association between distribution of ABO blood types in T1DM.

Conflict Of Interest: There are no conflicts of interest.

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