

Possible Linkage between ABO Blood Groups and Type 2 Diabetes; An Observational Study from Karachi, Pakistan

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Abstract

Objective: To explore the relationship of type 2 diabetes (T2DM) with different blood groups (A, B, AB and O) and Rhesus factor (positive or negative).

Settings and duration: The study was conducted at the Biochemistry Department of Baqai Medical University from January 2015 to December 2015.

Subjects and Methods: A total of 400 individuals were enrolled with 200 known type 2 diabetic patients and 200 healthy controls. Written informed consent was obtained from each study participant. Convenient sampling technique was adopted. Blood grouping procedure was based on Agglutination principle. The quantitative determination of hemoglobin A1C was done in hemosylate derived from whole blood on Roche automated clinical chemistry analyzer.

Results: It was observed that blood group B was significantly more common among diabetic subjects (p -value <0.05), whereas blood group A was significantly less common in diabetic subjects as compared to non-diabetic subjects (p -value <0.05). No significant difference was found in terms of Rhesus factor among diabetic and non-diabetic subjects.

Conclusion: The outcomes suggest that frequency of blood group B is significantly higher in type 2 diabetes while frequency of blood group A is significantly lower in type 2 diabetes as compared to non-diabetes. Further larger scale community based studies are needed to ascertain the findings of this study.

Key words: ABO blood groups, type 2 DM, rhesus factor.

Introduction

International Society of Blood Transfusion has defined almost 700 erythrocyte antigens and organized 30 blood group systems, of which ABO and Rh are most significant¹. The blood type of a subject characterized by tiny carbohydrate epitopes

depending on the presence or absence of two genes, A and B. The relevant gene is present on chromosome 9q34 having 7 exons extend over 18 kb known as ABO groups². The ABO blood group comprises of four basic phenotypes i.e. A, B, O and AB, while Rhesus system have two phenotypes Rh+ve and Rh-ve^{1,3}. The prevalence of ABO and Rh blood group systems vary widely across different countries, races and ethnic groups^{1,4}. Different blood groups appeared to be related with various diseases such as gastric and duodenal ulcer, abdominal aortic aneurism, vascular diseases, several malignant tumors (esophageal cancer, pancreatic cancer, hepatocellular carcinoma), Hepatitis-B, and diabetes mellitus^{2,4}.

Diabetes Mellitus (DM) is an uprising global threat to humanity⁵. According to National Diabetes Survey of Pakistan (NDSP 2016-17), prevalence of type 2 diabetes (T2DM) is 26.3%. Hence, Pakistan has around 27.4 million people suffering from

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Received: 21 July 2018, **Accepted:** 30 January 2019,

Published: 29 March 2019

Authors Contribution

RA, IAS & AF conceptualized the project. Statistical analysis & Literature search was done by NM. RA, IAS, FA, NM, SA & AF did the drafting, revision and writing of manuscript.

diabetes above 20 years of age⁶. DM has a complex etiology and seems to include factors like genetic, environmental, dietary, obesity, lack of exercise and immunological factors^{2,7}. Uncontrolled plasma glucose levels lead to life threatening micro vascular and macro vascular complications⁸.

Corresponding to several kinds of inherited traits, blood groups are also genetically pre-determined and thus have a strong relationship with certain diseases including diabetes. Association of ABO blood group and diabetes has been studied in past. Among diabetic subjects, high frequency of blood group A was observed in Nepal⁹ and Taiwan¹⁰ and blood group B in India¹¹, Qatar¹² and Italy¹³. Whereas it was noted that in Pakistani diabetic subjects, blood group AB & Rh-negative blood groups were more common¹⁴.

Determination of such association may be helpful to identify those subjects who are more prone to develop future diabetes, as aggressive preventive measures are required in these subjects to ultimately reduce overall disease prevalence. Therefore, this study was aimed to explore the relationship of type 2 diabetes (T2DM) with different blood groups (A, B, AB and O) and Rhesus factor (positive or negative).

Subjects and Methods

Total four hundred patients and subjects participated in this study which were categorized into two groups diabetic and non-diabetic groups. Out of them, 200 participants were already known patients with type 2 diabetes who attended outpatient department of diabetes at Baqai Medical University hospital for their routine follow-up, while 200 participants were placed in non-diabetic group, (after taking history of diabetes by research officer who was appointed to enroll study participants) who attended outpatient department of medicine at Baqai Medical University hospital for other illnesses. As per the standard ADA diagnostic criteria, fasting or random plasma glucose was tested for the confirmation of the non-diabetic status of the control subjects¹⁵.

The study was conducted from January 2015 to December 2015. The study was approved by ethical review committee of Baqai Medical University. Written informed consent was obtained from each study participant. Convenient sampling technique was used to recruit both groups. The inclusion criteria included all known patients with type 2 diabetes and non-diabetic individuals irrespective of age and gender who were willing to participate and gave informed consent. While exclusion criteria included subjects with type 1

diabetes, pregnant and lactating women. All recruitment process done under the supervision of Biochemistry Department of Baqai Medical University.

All information was gathered through one-to-one interview by a trained research officer. Blood was collected by using EDTA K2 (for haemoglobinA1c; HbA1c), sterilized disposable vacutainer tubes containing sodium fluoride (for glucose). Within 15 minutes of blood collection, the samples were sent to the laboratory department. Blood grouping procedure was based on Agglutination principle. The quantitative determination of hemoglobin A1C was done in hemosylate derived from whole blood on Roche automated clinical chemistry analyzer. Fasting plasma glucose was done after enzymatic oxidation by Glucose Oxidase.

Statistical Package for Social Sciences (SPSS) 22.0 was used for statistical analysis of the data. Student's t- test, chi-square test and two sample proportion test were performed. *p* value of < 0.05 was considered as significant. Mean and standard deviation were used to represent continuous variables like age, age at onset of DM, body mass index, fasting plasma glucose, and HbA1c whereas blood groups were described in frequency and percentages.

Results

Both diabetic and non-diabetic groups have equal gender ratio with mean age of 44.32±7.55 years and 30.24±8.74 years respectively. Mean onset age of diabetes was 38.52±7.42 years. Mean hbA1c level of patients with diabetes and non-diabetic subjects was 8.42±1.51% and 5.26±1.09%, respectively.

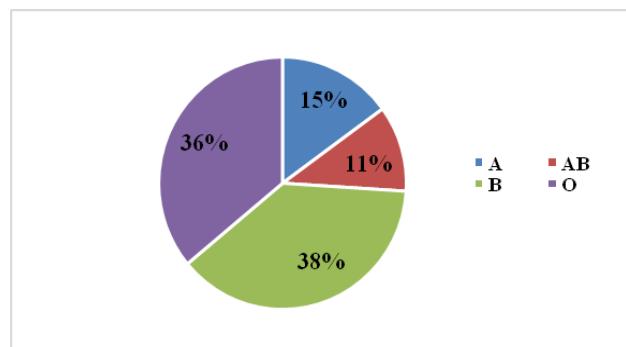


Figure 1: Distribution of ABO blood groups in studied subjects.

Blood group B was the most prevalent (38%) followed by O (36%) and A (15%). Whereas,

AB was the least prevalent blood group (11%) among studied subjects (Figure-1).

It was observed that blood group O and AB had similar distribution among diabetic and non-diabetic subjects (p -value >0.05). Blood group B was significantly more common among diabetic subjects (p -value <0.05), whereas blood group A was significantly less common in diabetic subjects as compared to non-diabetic subjects (p -value <0.05) (Table-1).

Table 1: ABO blood groups among diabetic and non-diabetic subjects. (n=200)

Blood group	Diabetic n (%)	Non-Diabetic n (%)	p-value
A	17 (8.5)	43 (21.5)	0.0002
B	86 (43)	66 (33)	0.03
AB	24 (12)	20 (10)	0.63
O	73 (36.5)	71 (35.5)	0.83

p -value <0.05 was considered statistically significant.

When compared ABO Blood Group Systems with Rh factor in diabetic and non-diabetic subjects. It was found that blood group A+ve was significantly more often in non-diabetic subjects than diabetic subjects (Table-2).

Table 2: ABO blood group systems with Rh factor in diabetic and non-diabetic subjects.

Blood Group	Diabetic n (%)	Non-Diabetic n (%)	p-value	Overall n (%)
n	200	200	-	400
A-VE	3 (1.5)	5 (2.5)	0.47	8 (2)
A+VE	14 (7)	38 (19)	0.0003	52 (13)
AB-VE	1 (0.5)	2 (1)	0.561	3 (0.8)
AB+VE	23 (11.5)	18 (9)	0.412	41 (10.2)
B-VE	6 (3)	4 (2)	0.522	10 (2.5)
B+VE	80 (40)	62 (31)	0.061	142 (35.5)
O-VE	2 (1)	5 (2.5)	0.254	7 (1.8)
O+VE	71 (35.5)	66 (33)	0.596	137 (34.2)

p -value <0.05 was considered statistically significant.

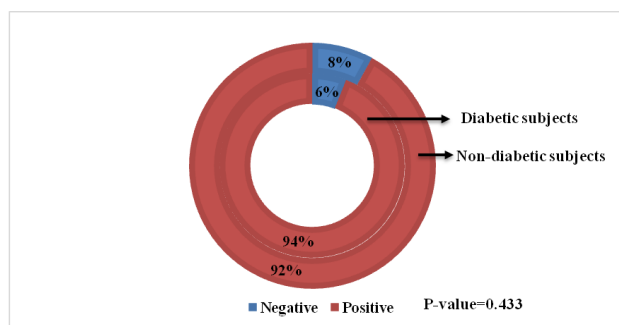


Figure 2: Distribution of Rh+ve & Rh-ve.

As shown in Figure-2, it has been observed that only 6% of the diabetic subjects were Rh-ve

while 94% were Rh+ve. Similarly, among non-diabetic subjects, 8% were found to be Rh-ve and 92% were Rh+ve. No significant difference was observed between the groups.

Discussion

The blood groups have different ethnic and racial differences. Various researches in the Indo-Pak sub-continent revealed that there have been an equal supremacy of blood group B and O in general population¹⁶. Research study in India, Bangladesh and Pakistan have revealed the same distribution pattern of blood groups as B>O>A>AB and Rh+ve>Rh-ve^{1,17-18}. The results of present study were strongly in favor of these past studies expressing the similar order of frequency of ABO blood groups. Whereas, several studies from North West Nigeria, Kenya and Ethiopia have shown that blood group O was most prevalent blood group in their population which is different from our findings¹⁹⁻²¹.

Many researches had done to explore the association between ABO blood groups and diabetes mellitus in different regions of the world²²⁻²⁶. Nevertheless, available data is still conflicting. Several studies had proved the relationship of ABO blood group with diabetes whereas some studies observed no association between them²²⁻²⁶.

The present study revealed that blood group B was most prevalent among type 2 diabetic subjects (43%). A study from the same region demonstrated similar findings that frequency of blood group B was significantly higher in type 2 diabetic subjects as compared to the general population²². This finding was also consistent to a study from Malaysia²³.

The present study provided the evidence of inverse association and low incidence of blood group A in type 2 DM which is similar to a past research that blood group A was less prevalent among subjects with type 2 DM²³. The same results were also highlighted in another research²⁴. However, some past researches provide evidence of equal distribution of ABO blood groups among diabetic and non-diabetic subjects²⁵.

Moreover, we found high percentage of Rhesus positive in type 2 DM subjects than healthy persons (94% vs 92%) but this finding was not statistically significant. Hence, an association of DM with Rhesus system was not proven. The outcomes were consistent with previous study conducted in India and western Algeria^{26,27}. Likewise, there have been various studies which do not observed any apparent association between diabetes and rhesus system^{23,28}.

Outcomes of the present study may have influenced by certain limitations of this study which includes relatively small sample size with the absence of community based randomized sampling technique were among the major limitations of this study. Hence, multicenter studies based on larger sample size and age matched participants in both groups are further needed to ascertain the verdicts of this study.

In conclusion, blood group B was significantly most prevalent and blood group A was significantly least prevalent among subjects with type 2 diabetes as compared to subjects without diabetes. This study did not find any significant association between type 2 diabetes and Rhesus system. As the prevalence rate of type 2 diabetes is high in Pakistan, the screening of high risk individuals is recommended and the blood group factor can also be considered to prioritize the screening individuals.

Acknowledgement

We acknowledge the support of Research department of Baqai Institute of Diabetology and Endocrinology and the OPD department of Baqai Medical University. We are also thankful to our study participants for their cooperation.

Conflict of interest: None declared.

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