

# The distribution of the ABO blood groups among the diabetes mellitus patients

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## Abstract

**Background:** There is strong evidence in the literature that there is an association between ABO blood group and certain diseases.

**Aim:** The aim of this study was to investigate any association between the ABO blood groups and diabetes mellitus (DM) in Qatar.

**Design:** This was a sex-matched case-control study.

**Setting:** This study was carried out in the diabetic outpatient clinics and blood bank of the Hamad Medical Corporation (HMC) from April 2011 to December 2012.

**Subjects and Methods:** The study included 1633 diabetic patients and 1650 nondiabetic apparently healthy controls. A total of 2148 adult patients above 18 years of age were selected consecutively from the diabetic clinics of the hospitals and 1633 patients gave consent to take part in this study, thus giving a response rate of 76%. A total of 2150 nondiabetic healthy adults above 18 years of age were recruited from the blood bank and 1650 individuals agreed to take part in this study, giving a response rate of 76.7%. Blood group of the recruited subjects was taken from the database of the Blood Bank, Central laboratory, HMC.

**Results:** The data revealed that the blood group B was significantly more common in diabetic patients as compared with healthy population (25.7% vs. 20.4%;  $P < 0.001$ ). Blood group O was significantly less common in diabetic patients compared with nondiabetics (38.5% vs. 45.4%;  $P < 0.001$ ). Among diabetic men, the frequency of only blood group B was significantly higher, while on the contrary among diabetic women the frequency of both A and B (29.7% vs. 24.8%;  $P = 0.03$  and 25.5% vs. 20%;  $P < 0.009$ , respectively) were significantly higher as compared with nondiabetic healthy population.

**Conclusion:** The findings in this study suggest that ABO antigens are associated with DM. DM is more common in individuals with blood group B.

**Key words:** ABO blood groups, case-control, diabetes mellitus, prevalence

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## Introduction

Diabetes Mellitus (DM) is recognized as a global major public health problem and diabetes is one of the main contributors to ill health and premature mortality worldwide.<sup>[1]</sup> The DM is a common medical problem having

significant morbidity and mortality. The total number of people with DM is projected to 366 million in 2030.<sup>[2]</sup> DM has been described as a modern epidemic which is emerging rapidly in developing countries. The etiology of

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DM is complex, but factors such as genetic, immunological, and environmental are involved.

Diabetes has a genetic predisposition, although environmental factors do play their role in its genetic expression. The major human blood group system is ABO and the incidence of ABO groups varies markedly in different races, ethnic groups, and socioeconomic groups in different parts of the world.<sup>[3]</sup> All human populations share the same blood group systems, although they differ in the frequency of specific types. Blood group antigens are hereditary determined and plays a vital role in transfusion safety, understanding genetics, inheritance pattern, and disease susceptibility. The absence and presence of blood group antigens has been associated with various diseases. It was reported that there are various associations between particular ABO phenotypes and an increased susceptibility to disease.<sup>[4]</sup>

DM and blood groups are interrelated because of the broad genetic immunologic basis in both.<sup>[5]</sup> Identification of a positive association between DM and blood groups might reflect increased susceptibility to and a negative association protection against diabetes. Studies by Bener *et al.*,<sup>[6-8]</sup> reported a high prevalence of DM and its complications in Qatari population. Also, it was reported that the presence of a family history of diabetes resulted in an early onset of the disease to the offspring. These study findings and hypothesis have highlighted the importance of identifying the susceptibility to DM and adopt possible preventive measures to decrease the prevalence in Qatari population. Recently, the relationship between ABO blood groups and disease susceptibility has generated a lot of interest.<sup>[9]</sup> Hence, we have taken the effort to discover the association between DM and ABO blood groups in general population.

## Subjects and Methods

This was a sex-matched case-control study. Patients with established DM were recruited from the diabetic outpatient clinics and donors visiting blood bank of the Hamad Medical Corporation (HMC), Doha Qatar from April 2011 to December 2012. The study included 1633 diabetic patients as cases and 1,650 nondiabetic healthy subjects as controls. The study was approved by the HMC prior to commencing data collection.

During the study period, we screened the nurse log book to identify eligible participants for this study. The purpose and procedure of the study was explained to all recruited patients. A total of 2148 adult patients above 18 years of age were selected consecutively from the diabetic clinics of the hospitals and 1633 patients gave consent to take part in this study, thus giving a response rate of 76%. These patients were already diagnosed with diabetes and under treatment. They were coming to hospitals for follow-up on diabetes management. These patients were classified as diabetes if their venous blood glucose values were higher than or equal

to 7 mmol/L or if they were taking medication for diabetes at the time of the study.

The controls were taken from healthy people who visited blood bank of the HMC for blood donation during the study period. A total of 2150 nondiabetic healthy adults above 18 years of age were approached and 1650 individuals agreed to take part in this study, giving a response rate of 76.7%. They were identified as healthy subjects if their venous blood glucose values were less than 6.1 mmol/L and they were not taking any medication for diabetes at the time of the study. Exclusion criteria for controls were patients with psychiatric illness, acute diseases, medical history of diabetes, and age below 18 years old.

In the State of Qatar, it is a must to identify the blood group of the people residing in Qatar while completing their immigration formalities. The blood group of every resident is in the database of the blood bank, Central Laboratory of the HMC. Also, it is mentioned in their identity card. Hence, it was easy to collect the blood group of the cases and controls from the database. The gender of the subject was also recorded from the database. Medical records of the subjects were reviewed in the event of any missing information.

Data were expressed in frequencies and percentage. Chi-square test for trend was used to compare frequencies between two or more than two categories. The level  $P < 0.05$  was considered as the cut-off value for significance.

## Results

Table 1 shows the distribution of blood groups among diabetic patients and healthy population. The blood group B was significantly more common in diabetic patients as compared to healthy population (25.7% vs. 20.4%;  $P < 0.001$ ), whereas blood group O was significantly more common in healthy population (45.4% vs. 38.5%;  $P < 0.001$ ). Blood group AB has similar distribution in both groups (6.8% and 6.5%).

Table 2 reveals the distribution of ABO blood groups among male and female diabetic patients and healthy control. Blood group B was more common in male diabetic patients (25.8%) as compared with nondiabetic males (20.5%;  $P < 0.001$ ). Blood group O was significantly less common in male

**Table 1: Distribution of ABO blood groups among diabetic patients and healthy population**

Blood group	Diabetes (n=1,633(%))	Healthy population (n=1,650(%))	P value
A	474 (29)	456 (27.6)	0.214
B	419 (25.7)	337 (20.4)	<0.001
AB	111 (6.8)	107 (6.5)	0.636
O	629 (38.5)	750 (45.4)	<0.001

diabetic patients than in healthy nondiabetic men (38.2% vs. 45.3%;  $P < 0.001$ ). The frequency of blood group A, followed by group B was significantly higher among diabetic women as compared with healthy women (29.7% vs. 24.8%;  $P = 0.030$  and 25.5% vs. 20%;  $P < 0.009$ , respectively).

Table 3 compares the distribution of ABO blood groups in diabetic population globally. Similar to Qatar (29%), blood group A was higher in diabetic population of Iraq (35.98%), Japan (33.7%). But blood group B was higher in Malaysia (35.7%) and India (38.6%). Blood group O was more common in diabetic population Iraq (43.6%), and Algeria (52.9%).

## Discussion

In this study, comparison of blood groups frequency between diabetic and healthy population was carried out. The present study has supported the hypothesis that DM and blood groups are interrelated. We found that the frequency of blood group B was significantly higher among diabetic patients as compared with nondiabetic population (25.7% vs. 20.4%). Two studies from Malaysia<sup>[10]</sup> and India<sup>[11]</sup> also reported similar findings of higher frequency of blood group B among diabetic patients. In addition, Quershi and Bhatti from Pakistan also demonstrated an interrelationship between diabetes and ABO blood group with highest distribution

of blood group B in diabetes.<sup>[5]</sup> On the contrary, a study conducted among Algerian population reported that the frequencies of blood groups A and B were lower among diabetic patients as compared with healthy population.<sup>[12]</sup> Another study by Okon *et al.*, from Nigeria reported a strong association between blood group A and diabetes.<sup>[13]</sup>

Blood group O was significantly less common in diabetic patients (38.5%), while it was higher in nondiabetics (45.4%) showing a negative association between diabetes and blood group O in the study population. But in the population of Pakistan,<sup>[14]</sup> Algeria<sup>[12]</sup>, Iraq<sup>[15]</sup> and Japan<sup>[16]</sup>, it was reported that blood group O has the highest distribution among diabetics.

The current study indicated that individuals with blood group B are more likely to have DM, whereas a blood group O is less likely to have DM. Blood group A and AB did not show any significant difference between diabetic and healthy population. On the contrary, a study conducted in Pakistan<sup>[14]</sup> revealed that blood group AB was more frequent in diabetes than blood group A and B. Studies regarding the association between ABO blood groups and DM are inconclusive. While some of the studies reported an association,<sup>[12,17]</sup> there is some evidence against the presence of any association existing between ABO and DM.<sup>[5,18]</sup>

The possible explanation of conflicting results regarding the association between ABO blood groups and DM could be racial and geographical variations playing role in the genetic expression of the disease. Previous study has reported that the frequency of ABO blood group vary across different populations.<sup>[14,17]</sup>

With respect to gender, this study found that among men the frequency of blood group B was significantly higher among diabetics, while among women the frequency of both blood groups A and B were significantly higher as compared to healthy men and women, respectively. The frequency of blood group O was significantly lower among both men and women with DM than controls. Other population studies did not show significant differences in men and women between both groups except a study from Algeria,<sup>[12]</sup> which found that blood groups O and AB were significantly higher in the diabetic group among men compared with healthy controls.

## Conclusion

The study findings revealed that blood groups and DM are interrelated in Qatar. It was found that blood group B was more dominant and blood group O was less common among diabetic group as compared with nondiabetic healthy population. ABO blood group also varied according to ethnicity. Blood group B was more common in diabetic

**Table 2: Distribution of ABO blood groups among male and female diabetic patients and healthy population**

Blood group	Male (%)		P value	Female (%)		P value
	Diabetic men (n=842)	Healthy nondiabetic men (n=850)		Diabetic women (n=791)	Healthy non-diabetic women (n=800)	
A	239 (28.4)	235 (27.7)	0.662	235 (29.7)	199 (24.8)	0.031
B	217 (25.8)	174 (20.5)	<0.001	202 (25.5)	160 (20)	<0.009
AB	64 (7.6)	56 (6.5)	0.206	47 (5.9)	41 (5.1)	0.397
O	322 (38.2)	385 (45.3)	<0.001	307 (38.8)	400 (50)	<0.001

**Table 3: Global comparison of distribution of ABO blood groups among diabetic population**

Country	Total sample size	ABO blood groups (%)				Year
		A	B	AB	O	
Malaysia <sup>[10]</sup>	70	15.17	35.71	14.29	34.29	2009
India <sup>[11]</sup>	511	27.98	38.55	9.00	24.46	2008
Algeria <sup>[12]</sup>	280	28.28	13.92	3.92	52.85	2011
Nigeria <sup>[13]</sup>	224	33.03	11.60	5.35	52.67	2008
Pakistan <sup>[14]</sup>	201	20.37	28.86	14.92	30.85	2011
Iraq <sup>[15]</sup>	920	35.98	16.30	4.13	43.58	2012
Japan <sup>[16]</sup>	114	33.70	26.90	6.70	32.70	2013
Qatar (current study)	1,633	29	25.7	6.8	38.5	2013

men, whereas blood groups A and B were higher in diabetic women compared with nondiabetic healthy population.

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