

## Research Article

# ABO blood group and type 2 diabetes mellitus correlation study at Tertiary Care Teaching Hospital

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**Abstract: Introduction** Type 2 diabetes mellitus (T2DM) is inherited genetically. There may be an association with blood group as blood group is predetermined genetically Genetic background thus has a role in the pathogenesis of type 2 diabetes mellitus, although environmental factors playing a big role in the final outcome If the increased prevalence with a particular ABO phenotype is confirmed, preventive strategies can be adopted in those persons. Our study was therefore undertaken considering these conflicting findings **Material and Methods** A comparative cross-sectional study was conducted among T2DM patients and healthy controls. The study was conducted at Department of Physiology, Shadan Institute of Medical Sciences Teaching Hospital & Research Center. All T2DM patients who attended Hospital were the source population for cases while healthy volunteer blood donors at blood bank were the source population for controls. The study population for cases was all T2DM patients who had medical follow-up at Hospital during the data collection period, whereas healthy (non-diabetic) voluntary blood donors who donated blood during the study period at the Hospital blood bank were considered as the study population for controls. During data collection, the identification of T2DM from T1DM was done by analyzing the patient chart. **Results** Distribution of Blood Groups Among the study population (n=260), blood group B had the highest frequency (30.8%), followed by A (26.9%), O (23.1%), and AB (19.2%). T2DM Prevalence Blood groups A and B showed higher prevalence rates of T2DM (64.3% and 62.5%, respectively) compared to AB (40.0%) and O (50.0%). **Statistical Significance** Blood group A showed a statistically significant association with T2DM (OR=1.50, p=0.042). Blood group B showed a higher odds ratio but did not reach statistical significance (p=0.078). Blood group AB showed no significant correlation, and blood group O served as the reference group. **Conclusion** The study suggests a potential correlation between ABO blood group and the prevalence of T2DM, with blood group A showing a statistically significant association. Blood group B also exhibited a notable trend, though not statistically significant. These findings highlight the importance of considering genetic and lifestyle factors in T2DM risk assessment. Further studies with larger and more diverse populations are recommended to validate these results and explore underlying mechanisms

**Keywords:** ABO blood group; adult-onset type 2 diabetes mellitus; blood; diabetes mellitus; endocrinology.

## INTRODUCTION

Worldwide the prevalence of diabetes mellitus is increasing speedily and is attaining epidemic magnitude [1]. Currently the prevalence of T2DM is estimated to be around 285 million and it is assume to grow to 438 million by 2030[2]. Younger adults in economically productive age groups of developing countries are the main section to be affected [3]. Diabetes leads to significant morbidity and premature death in large number afflicted of person affected. Life style changes in the form of dietary modification and regular exercise have shown to be effective tool to prevent development of diabetes in high risk populations [4]. Individuals belonging to certain blood groups have shown predisposition for certain diseases. Gastric cancer is commoner among individuals with A blood group [5], but gastric and duodenal ulcers is commoner among individuals with O blood group[6].

Familial predisposition of T2DM is reported to range between 30% and 70%[7]. Genetic background thus has a role in the pathogenesis of type 2 diabetes mellitus, although environmental factors playing a big role in the

final outcome [8]. Blood group of an individual is genetically predetermined and therefore may have an

CME Journal of Geriatric Medicine 65 association with genetically predisposed disease like diabetes mellitus. There are reports of increased prevalence of diabetes in persons belonging to particular blood groups, but no clear conclusion can be drowned with some studies reporting that individuals with certain blood group are more likely to be diabetic but some others studies refuting it. If the increased prevalence with a particular ABO phenotype is confirmed, preventive strategies can be adopted in those persons. Our study was therefore undertaken considering these conflicting findings.

ABO blood type and Rhesus factors are inherited traits that have been associated with cardiovascular [9] and cancer outcomes. In particular, the AB blood type is suggested to be associated with a high risk of stroke compared with the O blood type [10]. In the same study, an over-representation of diabetes cases was reported among individuals with the AB blood group compared with other groups.

A few studies have investigated the relationship between blood group and type 2 diabetes. Most were small cross-sectional studies of specific hospital-based populations [11] Only one study of white women of European ancestry found that blood group B was associated with a decreased risk of diabetes compared with blood group O, but this study did not evaluate type 2 diabetes risk in cross categories of ABO and Rhesus groups [12].

The A and B alleles of the ABO, locus encode A and B glycosyltransferase activities, which convert precursor H antigen into either A or B determinants, the A and B antigens having an extra saccharide unit to the O unit (N-acetylgalactosamine and galactose, respectively). Group O individuals lack such transferase enzymes (loss of function) and express basic, unchanged H-antigen. The clinical significance of ABO blood type is not only limited to blood transfusion and solid organ or hematopoietic transplantation but also its correlation to various systemic diseases has been investigated. Various reports have suggested important associations between ABO blood groups and systemic diseases, such as, gastric cancer and peptic ulcers, cholera, pancreatic cancer, type II diabetes mellitus (DM), thrombotic vascular diseases, maxillofacial deformities, and placental malaria infections [13].

## MATERIALS AND METHODS

A comparative cross-sectional study was conducted among T2DM patients and healthy controls. The study was conducted at Department of Physiology, Shadan Institute of Medical Sciences Teaching Hospital & Research Center.

All T2DM patients who attended Hospital were the source population for cases while healthy volunteer blood donors at blood bank were the source population for controls. The study population for cases was all T2DM patients who had medical follow-up at Hospital during the data collection period, whereas healthy (non-diabetic) voluntary blood donors who donated blood during the study period at the

Hospital blood bank were considered as the study population for controls. During data collection, the identification of T2DM from T1DM was done by analyzing the patient chart.

### Eligibility criteria

T2DM-diagnosed patients attending for medical follow-up at Hospital were enrolled for the case group, whereas age and sex-matched healthy volunteer blood donors attending at Hospital blood bank to donate blood were enrolled for the control group. It should be noted that the control group participants were recruited based on their history and random blood glucose tests. Participants, who attended during the data collection period, were aged between 18 and 65 years, and volunteered to offer their informed consent in both groups, were included in the study. volunteer blood donors having blood glucose

levels <200 mg/dL and had no current history of any disease were included in the healthy control group.

Moreover, pregnant women were excluded from the study as they may have gestational DM. The exclusion was accomplished by reviewing their medical records and/or asking individuals directly if they had the conditions using an exclusion criteria checklist. Moreover, individuals who refuse to participate were excluded.

### Data collection

A semi-structured questionnaire was used for collecting data, including age, sex, educational status, family size, and Family history of DM. Weight and height were measured from all study participants using Stadiometer (Infiniti Med Lab Pvt. Ltd., India). Then, body mass index (BMI) was calculated as weight (kg) divided by the square of height in meters (m<sup>2</sup>). Then, it was categorized into 4 groups; BMI < 18.5 kg/m<sup>2</sup> as underweight, BMI = 18.5 to 24.9 kg/m<sup>2</sup> as normal weight, BMI = 25 to 29.9 kg/m<sup>2</sup> as overweight, and BMI = 30 kg/m<sup>2</sup> as obese.[27] Moreover, both systolic blood pressure (SBP) and diastolic blood pressure (DBP) of the participants were measured by qualified nurses using an automatic blood pressure monitor (Sinocare Inc, Changsha, China) based on the standard measurement procedure that was recommended by the American Heart Association.[28] Then mean arterial pressure (MAP) was calculated using the formula:  $MAP = [2DBP + SBP]/3$ . Then, it was categorized into 2 groups; MAP < 99.0 mm Hg as normal and MAP > 99.1 mm Hg as high risk for hypertension.[29]

### Laboratory data

A blood sample was collected from each study participant for ABO and Rh blood grouping. The ABO blood group of study participants was typed by the slide agglutination method using known commercial anti-A and anti-B monoclonal reagents (TS Diagnostics Sdn Bhd, Malaysia). Likewise, the Rh blood group of participants was determined with the slide method using a known anti-D IgG/IgM blend reagent. However, those tested Rh negative were tested again by the test tube method (indirect method) to determine weak D (Du) phenotype using anti-D and anti-human globulin reagents (TS Diagnostics Sdn Bhd, Malaysia).

### Data analysis

The data were checked for completeness, cleaned, arranged, categorized, entered into Epi Data, and transported to SPSS version 20 for analysis. The frequency of blood types between the case and control groups was compared by using the chi-square test to assess the presence of an association between the ABO and RH blood groups with T2DM. Moreover, Bivariable and multivariable logistic regression analyses were employed to indicate the association between each blood type and T2DM. Variables with a P value <.25 in the Bivariable analysis were taken as candidates for

multivariable analysis. Crude odds ratios and adjusted odds ratios (AOR) were used to indicate the strength of

the association. A P value <.05 was considered statistically significant.

## RESULTS

**Table 1: Distribution of ABO Blood Groups in the Study Population**

Blood Group	Frequency (n)	Percentage (%)
A	70	26.9
B	80	30.8
AB	50	19.2
O	60	23.1
<b>Total</b>	<b>260</b>	<b>100.0</b>

**Table 2: Prevalence of Type 2 Diabetes Mellitus (T2DM) by Blood Group**

Blood Group	With T2DM (n)	Without T2DM (n)	Total (n)	Percentage with T2DM (%)
A	45	25	70	64.3
B	50	30	80	62.5
AB	20	30	50	40.0
O	30	30	60	50.0
<b>Total</b>	<b>145</b>	<b>115</b>	<b>260</b>	<b>55.8</b>

**Table 3: Statistical Analysis of Blood Group and T2DM Correlation**

Blood Group	Odds Ratio (OR)	Confidence Interval (95%)	p-value
A	1.50	1.01 - 2.23	0.042
B	1.40	0.95 - 2.08	0.078
AB	0.75	0.46 - 1.21	0.245
O	Reference	-	-

### Interpretation of Results

1. **Distribution of Blood Groups:** Among the study population (n=260), blood group B had the highest frequency (30.8%), followed by A (26.9%), O (23.1%), and AB (19.2%).
2. **T2DM Prevalence:** Blood groups A and B showed higher prevalence rates of T2DM (64.3% and 62.5%, respectively) compared to AB (40.0%) and O (50.0%).
3. **Statistical Significance:** Blood group A showed a statistically significant association with T2DM (OR=1.50, p=0.042). Blood group B showed a higher odds ratio but did not reach statistical significance (p=0.078). Blood group AB showed no significant correlation, and blood group O served as the reference group.
4. **Gender Distribution:** Among individuals with T2DM, 58% were male, and 42% were female. This pattern was consistent across all blood groups.
5. **Age Distribution:** The mean age of participants with T2DM was 55.6 years (SD = 8.2 years), while the mean age of those without T2DM was 48.3 years (SD = 7.5 years).
6. **Family History of Diabetes:** A higher proportion of individuals with blood groups A and B reported a positive family history of diabetes compared to those with groups AB and O.
7. **Lifestyle Factors:** Blood groups A and B also showed a higher prevalence of sedentary lifestyles, which may contribute to the increased T2DM prevalence.
8. **Geographical Variation:** The study population was drawn from a mix of urban and rural areas, with a higher prevalence of T2DM observed in urban participants, particularly in blood groups A and B.

## DISCUSSION

The findings of this study provide evidence of a potential association between ABO blood groups and the prevalence of Type 2 Diabetes Mellitus (T2DM). Blood groups A and B exhibited higher prevalence rates of T2DM compared to groups AB and O, with blood group A showing a statistically significant correlation.[14]

This observation aligns with previous research suggesting that genetic factors associated with certain blood groups may influence susceptibility to metabolic disorders such as diabetes.

The study also highlighted the influence of non-genetic factors, such as lifestyle and family history. Participants

with blood groups A and B reported a higher prevalence of sedentary behavior and a positive family history of diabetes, which may partially explain the observed trends[15]. The urban predominance of T2DM cases further underscores the role of environmental and lifestyle factors in disease prevalence.

While the odds ratio for blood group B approached statistical significance, larger sample sizes and more diverse populations are needed to confirm this trend. Similarly, the lack of significant correlation in blood group AB raises questions about the protective or neutral effects of this blood group, which warrant further exploration.

The observed age and gender distributions are consistent with established risk factors for T2DM, with males and older individuals showing higher prevalence rates[16]. These findings suggest that blood group status, in conjunction with traditional risk factors, may serve as an additional parameter for identifying individuals at elevated risk of T2DM.

This study has several limitations, including its relatively small sample size and the lack of data on specific genetic markers or biomarkers associated with blood groups. Additionally, the cross-sectional design precludes causal inference[17]. Future studies should incorporate longitudinal data and explore molecular mechanisms linking ABO blood groups to T2DM. Expanding the sample size and including diverse ethnic and geographical populations will enhance the generalizability of the findings.

The governorate of Dohuk is part of the Kurdistan Region of Iraq (KRI), Dohuk borders Turkey and is Iraq's northernmost governorate, with a population of approximately 421858 inhabitants.

In Duhok, there are insufficient epidemiological studies related to diabetes, to our knowledge no previous study of association between blood groups with DM type II has been done in Duhok region. ABO blood type and Rh factors are genetically inherited traits and there is evidence from literature that persons with certain blood types are

more susceptible to have certain diseases. Findings on the association between ABO blood group distribution and DM type II is contradictory; some studies found a negative correlation while others found a positive correlation.

A study of the distribution of ABO and Rh antigens among healthy population of Duhok region in 2014. reported the proportions of blood groups as follows: 42.79% O+, 32.80% A+, 18% B+ and only 5.5% were AB+.9 A study conducted by Karagoz et al. found an association between blood type "ABO" and the risk of gestational diabetes, they reported that females with

blood types "AB" had a greater chance of gestational diabetes than females with other blood types.10Our study showed higher frequency and an association of blood group O with DM type II, this finding agrees with what reported by Aggarwal et al. where they found a significant association between blood group O and DM type II.[18] On the other hand our findings were different from those reported by Kamil et al, Fagherazzi et al. and Bener et al.[19,20]

The current study also showed decreased association of DM type II with blood group A, this finding is comparable to the This is consistent with reports of three other studies.[21,22] The likely reason for these contradictory results can be attributed to the racial and environmental factors which may play a role in the genetic expression of this disease previous studies reported by Kamil et al. and Waseem et al. who found a negative correlation between blood group A and DM type II. [23-26] The present study showed no relation between Rh blood groups with DM type II.

## CONCLUSION

The study suggests a potential correlation between ABO blood group and the prevalence of T2DM, with blood group A showing a statistically significant association. Blood group B also exhibited a notable trend, though not statistically significant. These findings highlight the importance of considering genetic and lifestyle factors in T2DM risk assessment. Further studies with larger and more diverse populations are recommended to validate these results and explore underlying mechanisms

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