

Comparative study of ABO blood grouping system with Type 2 Diabetes Mellitus.

¹Dr.M.Srujana Devi

¹PG Resident,

¹Department of Anesthesia,

Sree Mookambika Institute of Medical Sciences (SMIMS), Padanilam, Kulasekharam, Tamil Nadu

Abstract:

Background:

To determine the relationship between ABO/ Rhesus (Rh) blood groups and type 2 diabetes mellitus (DM) in East Godavari Population.

Method:

This Retrospective cross-sectional study was conducted in East Godavari district, involving 150 patients with type 2 diabetes mellitus and 150 healthy controls. After obtaining consent, the hospital provided the results of the blood sample. The samples underwent ABO and Rh blood group testing.

Results:

From a total of 300 participants included for this study, blood group B was found higher in frequency with 143(47.6%) cases and healthy controls. ABO blood groups showed significant association with T2DM, a chi-square value of 15.064. The one-way Anova test revealed f-ratio value is 1652.15884 and p-value is < .00001. The result is significant at p < .05. However, the Rh blood group was not associated with T2DM. Binary logistic regression analysis revealed that blood group B had a higher risk (OR: 0.64, M = 7.1, 95% CI [6.766, 7.434].) and blood group AB had decreased risk (OR: 0.48, M = 6.97, 95% CI [6.2896, 7.6504].) of T2DM as compared to other blood groups.

Conclusion:

ABO blood group antigens showed significant association with type 2 diabetes mellitus. Blood group B was associated with an increased risk and O blood group with decreased risk of type 2 diabetes mellitus.

Keywords: Blood grouping, Hypertension, Diabetes Mellitus, Hereditary, Compatible, Rh typing.

INTRODUCTION

Over the years, the prevalence of DM has increased rapidly on a global scale and has emerged as one of the major causes of mortality. A complicated interplay of genetic and environmental variables results in the development of several unique forms of DM. Type 2 DM develops as a result of aberrant insulin secretion and insulin resistance. There is a significant hereditary component to type 2 DM.

A metabolic illness with numerous aetiologies, diabetes mellitus (DM) is defined by persistent hyperglycaemia and changes in the metabolism of carbohydrates, fats, and proteins as a result of deficiencies in insulin production, insulin action, or both [1, 2]. The development of DM is influenced by a number of pathological events, from defects that lead to resistance to insulin action to autoimmune death of the pancreatic beta cells with subsequent insulin shortage [3].

Blood group antigens are thought to be heritable determinants that help us understand genetics and disease susceptibility [4]. Since the discovery of blood groups in 1900, there has been a growing interest in determining a possible link between ABO and Rh blood groups and various diseases [5]. ABO antigens are expressed on the surface of many human cells and tissues, including the epithelium, sensory neurons, platelets, and the vascular endothelium, in addition to red blood cells [6]. Thus, the clinical significance of the ABO and Rh blood group systems extends beyond transfusion medicine, and several studies have suggested that the ABO and Rh blood group antigens play an important role in the development of various diseases [7, 8].

Diabetes mellitus is the most common metabolic disorder affecting people worldwide both in developing and developed countries. People living with DM were estimated to be 451 million in the world by 2017. These figures were expected to increase to 693 million in 2045 [9]. Asia is a major area of the rapidly emerging T2DM global epidemic, with China and India being the top two epicentres [10]. In the African region, the average prevalence was 4.9% in 2013, having Reunion (15.4%), Seychelles (12.1%), and Gabon (10.7%) as the top three countries with higher prevalence [11]. In Ethiopia in 2016, the prevalence of DM was found to be 6.5% [12]. ABO and Rh blood groups are among the genetic factors that contribute to the occurrence of T2DM [13]. The major human blood group systems are ABO and Rh. The frequency distribution of these blood groups varies markedly in different races and ethnic and socioeconomic groups.

Learning objectives:

- To understand the trends of contribution of blood group antigens for maintaining blood glucose levels.
- To inter-relate whether blood group antigens act as a causative factor for an individual prone to diabetes mellitus.
- To determine if there is any relation between the gene producing blood group antigens and the complications that are produced due to diabetes mellitus.
- To understand the frequency of risk associated with blood group susceptible to diabetes mellitus.

METHODOLOGIES

Type of study: A cross sectional retrospective study which involves clinical investigations and correlative study among individuals and graphical analysis to deduce the relationship among blood grouping antigens and diabetic mellitus.

Subjects for study:

Subject 1: people with blood group A

Subject 2: people with blood group B

Subject 3: people with blood group AB

Subject 4: people with blood group O

Criteria for selection of subjects: Subjects with type 2 diabetic mellitus showing no signs/ symptoms of haematological disorders and cardiovascular disorders are chosen for the study to avoid setback that occur due to presence of other factors that may cause the disease.

Sample size: 150, Type 2 diabetic mellitus patients and 150 healthy control subjects among the relative of patients and volunteers were selected for this study to compare the distribution of ABO blood groups.

Data collection and procedure: Hospital based Retrospective comparative cross-sectional study was carried out. sociodemographic and clinical data was collected with a semi structured pretested questionnaire. The subjects with type 2 diabetes mellitus were tested for their blood groups and be categorized into above mentioned groups. The ABO blood group of Study participants was determined by the slide method using known Anti-A and Anti-B sera. All the subjects were cross verified for the type 2 diabetes mellitus by performing random blood sugar test. Ethical clearance certificate and consent was obtained from the hospital during the course of study.

Test for DIABETES: Random blood Sugar Test is done to detect the diabetes in a patient. This test can be done alone at any time and you don't need to fast. A blood sugar level of 200 mg/dL or higher indicates that the patient is having diabetes. A small a device called glucometer or glucose meter is used.

STATISTICAL ANALYSIS

The data collected shall be tallied and the chances of susceptibility to diabetes mellitus with respect to particular blood group is noted. Also, the range of variation with the change of blood group antigen must be considered to assess the extent of contribution of the blood group antigens in causing diabetes mellitus.

DEMOGRAPHIC CHARACTERISTICS:

In this study Males (216) comprised 50.9% of the study participants. The average age of the study participants was 35.35 years (range: 04-65 years). (Table 1)

Table 1: Demographic characteristics

AGE		GENDER		BLOOD GLUCOSE		GLUCOSE CONTROL		BLOOD GROUP			
< 40	> 40	MALE	FEMALE	RBS < 200	RBS > 200	HBA1C < 7	HBA1C > 7	A	B	O	AB
210	90	208	82	239	61	179	221	111	143	12	34

Findings of the current study revealed that study participants with blood group B were more affected by T2DM as compared with healthy controls. (Table 2)

Table 2: Correlation of blood groups with Blood glucose

BGT	BLOOD GLUCOSE				GLUCOSE CONTROL		
	RBS < 200	%	RBS > 200	%	HBA1C < 7	HBA1C > 7	Mean
A	94	31.33	17	5.67	62	49	7.18
B	115	38.33	28	9.33	87	56	7.17
O	9	3	3	1	7	5	7.43
AB	19	6.33	15	5	23	11	6.97

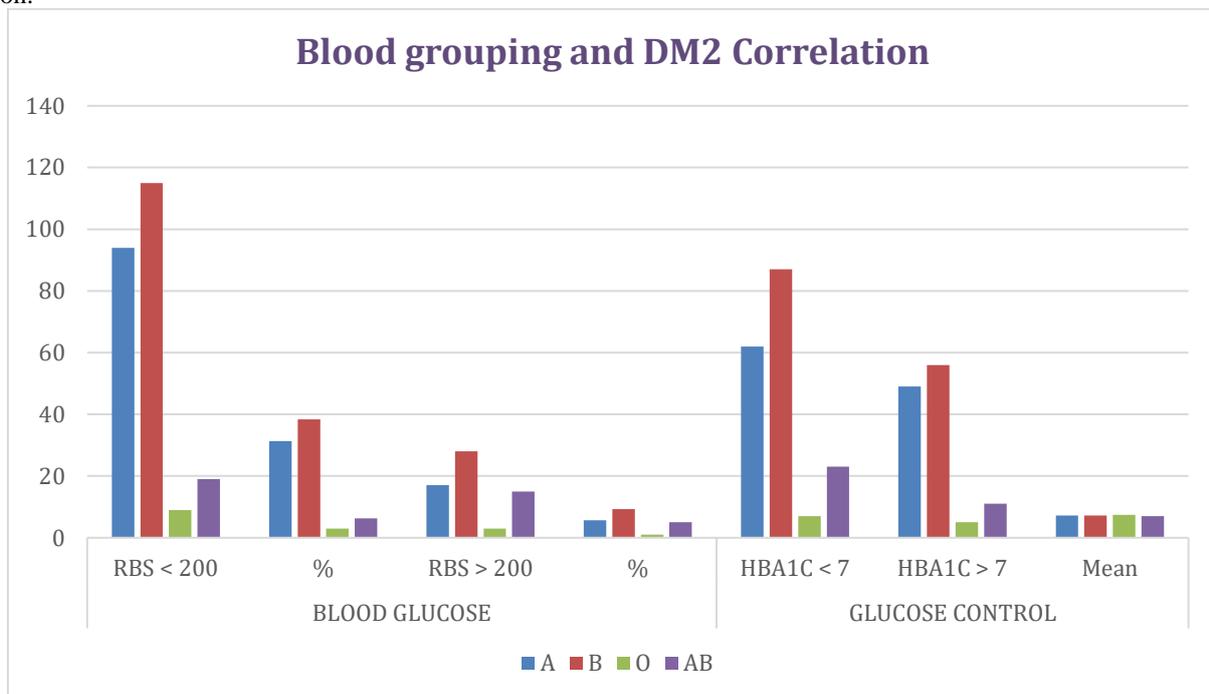
From a total of 300 participants included for this study, blood group B was found higher in frequency with 143(47.6%) cases and healthy controls. ABO blood groups showed significant association with T2DM, a chi-square value of 15.064. The one-way Anova test revealed f-ratio value is 1652.15884 and p-value is < .00001. The result is significant at $p < .05$. However, the Rh blood group was not associated with T2DM. Binary logistic regression analysis revealed that blood group B had a higher risk (OR: 0.64, M = 7.1, 95% CI [6.766, 7.434].) and blood group AB had decreased risk (OR: 0.48, M = 6.97, 95% CI [6.2896, 7.6504].) of T2DM as compared to other blood groups.

DISCUSSION

Many studies have been conducted in order to investigate the possible relationship between the ABO and Rh blood group phenotypes with T2DM and its associated factors. The results have been proved to be inconsistent and differed from one study to another [14–17]. The results of the present study supported the assumption that ABO blood group phenotypes are associated with the risk of developing T2DM. Our finding was similar with studies done in Saudi Arabia [18] and Malaysia [14, 19]. Contrary to the current findings, studies conducted in India [20], Iran [17], and Algeria [16] reported non statistically significant association between DM and any of ABO blood group phenotypes. The possible reason for this contradiction might be sample size, age and gender distribution, and a difference in racial and environmental factors which may affect the distribution of ABO blood group phenotypes and disease occurrence [13].

From this study (Graph 1), blood group AB was not associated with T2DM. However, a study done in Egypt [23] showed that blood group AB was protective against T2DM, and another study in India [24] showed that the AB blood group was higher among T2DM patients as compared to healthy controls. The reasons for this variation might be the geographical, genetic, and environmental difference in the study area.

The result of the present study showed that the Rh factor was not associated with T2DM. Similar results were reported by studies in India [25] and Algeria [16]. However, a study conducted in Pakistan [5] indicated that Rh-negative blood groups and T2DM had a significant association. On the other side, research done in Iran [26] showed that Rh-positive blood groups are positively associated with T2DM. In our study, A+ and B+ blood groups were significantly associated with the risk of T2DM. In support of the present study, a study in France [13] reported that blood group B+ showed a higher risk for DM; another study from Nigeria [27] conducted on both types of diabetes types reported that O+ blood group was significantly lower in diabetics patients than in the control population.



Graph 1: Correlation between Blood group and Type 2 Diabetes

The mechanisms for the observed association between ABO blood group phenotypes with T2DM are still unknown. There are some possible suggested assumptions. The first suggestion was that the human ABO antigen locus might influence inflammatory mediators, such as factor VIII-von Willebrand factor (VWF) complex, which is present in higher levels in non-O individuals [21]. In addition, ABO blood group antigens have been linked with plasma-soluble ICAM-1 and TNF-R levels. These both markers have been associated with an increased type 2 diabetes risk thus providing a potential explanation for the observed relationships [22].

IMPLICATIONS

From the study we would like to note the role of ABO blood group antigens in affecting the individual with diabetes. Whether the presence or absence of blood group antigen has an effect on maintaining the glucose levels in the blood. Deduce conclusions as to which blood group people are at higher risk of encountering diabetes. The research being done on small scale, when extrapolated to a large sample size, it can establish a new path for mitigating the chances of attacking the people with diabetes. The results of research if extended in fields of medicine is of value.

LIMITATIONS OF THE STUDY

The limitation of this study was the inability to determine the association of ethnic backgrounds with blood groups for the study participants with T2DM.

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