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ORIGINAL ARTICLE

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Revealing the Physiological Relationship Between Different Blood Groupings And Type II Diabetes

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ABSTRACT

OBJECTIVE: To evaluate the association of ABO classification of blood grouping with Type II Diabetes Mellitus.

METHODOLOGY: This cross-sectional study was conducted from July to September 2022, in the Department of Physiology of Sindh University Jamshoro Sindh. in collaboration with Diabetic OPD and department of emergency medicine of Liaquat University Hospital Hyderabad. A total of 360 participants, comprising 220 males and 140 females between 40-60 years participated in this study. Blood group were tested by glass slide agglutination method using anti-sera A, B and D. Random blood sugar levels were measured using a Care Sense N Glucometer Model no GM 505 Pad. Data analysis was performed using Graph Pad Prism5, with a significance threshold set at $p < 0.05$.

RESULTS: This study indicates greater chances of developing Diabetes Mellitus in individuals with Type B group of blood, showing statistical significance in both males ($p = 0.02$) and females ($p = 0.04$). In contrast, individuals with blood type A, AB, and O shows some degree of protection against the onset of Type II Diabetes Mellitus.

CONCLUSION: This study concludes that individuals with blood group B are quite susceptible to emergence of Diabetes.

KEY WORDS: Blood Grouping, Hyperglycemia, Blood Agglutination method, type II Diabetes Mellitus

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INTRODUCTION

Diabetes Mellitus (DM) is a disease that involves multiple systems of the human body. Etiologically, it evolves either because of the destruction of beta cells of Langerhans (Type 1) leading to decreased insulin secretion, or reduced action of insulin on the target tissues. An estimated 140 million people are suffering from this multisystem syndrome at present, which will rise to 300 million patients in 2040. [1] It is estimated that 90% of diabetic patients are in the type II Diabetes Mellitus (type II DM) group. With 19 million people affected by diabetes, Pakistan ranks third in the world for the highest number of diabetes cases. In 2022, the International Diabetes Federation reported a drastic rise in cases of DM about 330 million and shows the fear that many individuals are pre-diabetics and undiagnosed. This may lead to a greater increase in the number of possible case.[2] Diabetes causes the development of both micro and macrovascular diseases. Macrovascular issues include strokes and coronary heart disease, while microvascular complications encompass diabetic retinopathy, peripheral neuropathy, and nephropathy. [3] Recent population-based studies reveal a notable shift in mortality factors for individuals with diabetes mellitus. While vascular disease was historically the primary cause of death, the landscape has changed, with cancer now emerging as a significant contributor to mortality rates. In England, a survey spanning from 2003 to 2018 showed a decline in hospitalizations related to vascular complications among those with diabetes; from 50% to 30%. This shift underscores the evolving dynamics of complications, with a noteworthy move from vascular issues to a heightened impact of cancer-related concerns.[4] Blood, a crucial body fluid, serves as a transport medium for respiratory gases and nutrients. Comprising plasma and cellular components, red blood cells (RBCs), white blood cells (WBCs), and platelets. [5] RBCs have important sugars called glycans on their surface, such as ABO and Rh antigens. These

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glycans are key antigens, affecting how RBCs behave and function in the body.[6] The ABO system is the most important way of classifying human blood types, which is based on the presence of two glycoproteins, namely Antigen A and Antigen B, on the outer cell membrane of the RBCs. These antigens are inherited from parents and determine the compatibility of blood transfusions. ABO classification system comprised of 4 blood groups (A, B, AB, O).[7] These blood group antigens are present on the surface of all body tissues and different fluid systems, including salivary fluid, amniotic fluid, etc. These specific antigens have an important role during the transfusion of blood, transplantation of donated organs, and finding suspects of executed crimes.[8] There are many researchers conducted in different countries about the impact and association of different blood groups and type II DM, such as a study conducted in Turkey that found that individuals with type A blood groups are more susceptible to developing diabetes as compared to the remaining types of blood groups.[9] The study conducted on residents of Libya showed surprisingly very different results; they concluded that individuals in the A and O blood groups were relatively less prone to developing diabetes than individuals in the type B blood group.[10] These are the patterns and characteristics of inherited genes, which decide the type of blood group and Rh factor the individual will acquire. Thus, it can be assumed that diseases are associated with the polymorphism of genes like DM.[11] Genes that influence DM have specific locations on the long arm of chromosome 1 (1q21-q23), while genes responsible for giving different blood groups are placed on the long arm of chromosome 9 (9q34.2).[12] In the continent of Asia, much research was done to explore the impact of different types of blood groups on diabetes development. They have found that under the ABO system of blood grouping, each group type has its own level of susceptibility to acquiring the disease of diabetes. In that group, O has the least chances of becoming diabetic. In Qatar, Bener et al. in 2023 conducted their research on local populations and found that type B blood group individuals had a very high risk of diabetes compared to others.[13] the rational of this study is to uncover the physiological link between different blood groupings and development of Type II DM.

METHODOLOGY

This was a cross-sectional study that was conducted in the Department of Physiology of Sindh University, Jamshoro, Sindh, in collaboration with diabetic OPD and the Department of Emergency Medicine of Liaquat University Hospital, Hyderabad, with approval from the ethical and review committees of the Department of Physiology of Sindh University from July 2022 to September 2022. This study was conducted to investigate any relationship between different blood groups and diabetes using data from patients who visited the diabetic outpatient department (OPD) and the emergency department of Liaquat University Hospital. Written consent was taken from all participants after explaining the aims and methods of our study. A total of 360 participants, comprising 220 males and 140 females, participated in this study. The age limit was 40–60 years of age. Both male and female participants were included in this study. Two groups were constructed: a control group comprising 203 participants (male = 125 and female = 78) and a study group (Type II DM) comprising 157 participants (male = 95 and female = 62). Participants were selected using a convenience sampling technique for this study. The control group included those participants who were not diagnosed with type 2 diabetes and were normal and came for minor problems. In the study group, only those patients were included who were suffering from type II DM. All those patients who were suffering from any other disease except Type II DM were excluded from the study. All those patients who were below 40 and above 60 years of age had psychiatric illnesses or had any other metabolic or endocrine disorder that could affect blood glucose levels temporarily or permanently. Blood groups were tested by glass slide agglutination method using anti-sera A, anti-sera B and anti-sera D. Random blood sugar levels were measured using a Care Sense N Glucometer Model no GM 505 Pad was used. Data collected was incorporated in a specific questionnaire Performa. Data analysis was performed using Graph Pad Prism5, with a significance threshold set at $p < 0.05$. The statistical analysis was done by applying chi square and Fischer exact test.

RESULTS

Table 1 describes the demographic characteristics of participants. The mean age in control group was 50.92±6.9 while in study group it was 53.46±6.1. HbA1C in non DM group was 5.34±0.64 while it was 7.2± 0.69. BMI in Diabetic was 22.7±2.1 while it was 18.8±1.7.

Table 2 shows the association between diabetes and specific blood types. The analysis reveals a significant association between different blood groups and diabetes in both males and

Demographic characteristics	Mean	Standard error of mean
Age in Non DM	50.92±6.9	0.97
Age in DM	53.46±6.1	0.86
HbA1C non DM	5.34±0.64	0.09
HbA1C DM	7.2± 0.69	0.09
BMI DM	22.7±2.1	0.29
BMI non DM	18.8±1.7	0.24

Table 1: states demographic characteristics of participants

Gender	Blood Group	Normal	Diabetic	Total	X2	D.f	p-VALUE
Male	A	25(6.9%)	35(9.7%)	60(16.7%)	9.1	3	0.02
	B	40(11.1%)	30(8.3%)	70(19.4%)			
	AB	20(5.5%)	10(2.7%)	30(8.3%)			
	O	40(11.1%)	20(5.5%)	60(16.7%)			
	Total	125(34.7%)	95(26.8%)	220(61.1%)			
Female	A	20(5.5%)	10(2.8%)	30(5.5%)	7.9	3	0.04
	B	20(5.5%)	30(8.3%)	50(13.9%)			
	AB	13(3.6%)	7(1.9%)	20(8.0%)			
	O	25(6.9%)	15(4.2%)	40(11.1%)			
	Total	78(21.7%)	62(17.2%)	140(38.9%)			

Table 2: Association of blood groups and Diabetes mellitus. Values are number (%)

Gender	Blood Group	Normal	Diabetic	Total	p-value	ODD Ratio	95%CI	Sensitivity/specifity	Like hood ratio
Male	Rh +	150(41.7%)	148(41.1%)	298(82.8%)	0.006	0.2	0.07 to 0.68	0.8/0.02	0.9
	RH -	18(5%)	4(1.1%)	22(6.1%)					
	Total	168(46.7%)	152(42.2%)	320(88.9%)					
Female	Rh +	62(17.2%)	58(16.1%)	120(33.3%)	0.02	0.2	0.01 to 0.15	0.7/0.06	0.8
	Rh -	16(4.4%)	4(1.1%)	20(5.5%)					
	Total	78(21.7%)	62(17.2%)	140(38.9%)					

Table 3: Association between Rhesus group and Diabetes mellitus. Values are number (%)

females (p-value = 0.02 and 0.04 respectively). Notably, individuals with blood type B have a higher chance of developing Type II diabetes as compared to blood types A, AB, and O, which appear to act as protective factors. The higher number of B blood group patients shows the natural distribution within the population, which plays a pivotal role in maintaining the study's external validity. Adjusting the sample size to equalize blood groups could artificially distort the findings, which would add another confounding factor for this study.

Table 3 reveals a significant link between Rh factor and Type II Diabetes in men and women (p-values 0.006 and 0.02, respectively). Rh-positive individuals have a higher diabetes risk (odds ratio = 0.2, 95% CI: 0.07 to 0.68). This suggests that Rh-positive individual is more susceptible than other blood types to Type II Diabetes.

DISCUSSION

The study results show a significant association between Rh factor, blood group, and type II diabetes mellitus. Rh-positive men (P=0.006, OR=0.2, 95% CI: 0.07-0.68) and women (P=0.02, OR=0.2, 95% CI: 0.01-0.15) show increased diabetes risk. Among blood groups, men with blood group B (P = 0.02) and women with blood group B (P = 0.04) were specifically having higher diabetes incidence. These findings suggest that both Rh-positive status and blood group B elevate the risk of type II diabetes. Our research indicates that people with blood type B are more prone to diabetes emergence than people with blood types O, A, and AB; this shows varying degrees of protection against the disease. Our findings were similar to a study conducted by Khalil. S et al. Who showed that there is a significant relationship between blood type B and Rh-positive status with diabetes mellitus, further supporting this relation with a statistically significant p-value of less than 0.05.[14] Sharjeel S et al. found that participants who have blood group B are having a higher incidence of developing diabetes mellitus than the normal population, with a p-value of less than 0.05.[15] Ali et al. also demonstrate that blood group B was an independent risk factor for type 2 diabetes with an odds ratio (OR) of 2.07, while blood group O had a protective effect with an OR of 0.71.[16] Legese et al. also showed that blood group B has comparatively higher incidences of developing diabetes mellitus than blood group O, with an OR of 2.12 and a 95% CI of 1.33-3.32.[17] but there is another group of studies that doesn't show this same relation. Abdullah et al., Shehzadi et al., and Bunajimah et al. showed in their studies that there is no significant relation between blood group, Rh factor, and development of diabetes mellitus, with a P-value greater than 0.005, showing that this correlation is statistically non-significant.[18,19,20]

This study suggested that the prevalence of diabetes among different blood types is not the same across the globe but is under the influence of the socioeconomic status of populations. Therefore, a large-scale study is required to explore the possible genetic association between these two factors and to formulate effective strategies for prevention and treatment of this disease.

Limitations and Recommendations: There are certain limitations to this study. First, it was a cross sectional study, Secondly, the sample size was small, Thirdly, this study was conducted in one hospital, so the results cannot be applied to the whole population and Fourthly, the presence of confounding variables. More new researches are required in different regions on different ethnic groups throughout the globe for the validation of the results.

CONCLUSION

This study concludes that there is a significant association between blood grouping and Type II Diabetes whereas blood type B found to be quite susceptible to diabetes than other blood type.

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CONFLICT OF INTEREST

Author declared no conflict of interest

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AUTHORS CONTRIBUTIONS

SF: Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable.

KW: Conception, Design of the work, Acquistion, Data Analysis, and Drafting, Reviewed, Final approval, Agreement to be accountable.

SA: Conception, Design of the work, Interpretation of data for the work, and Drafting, Reviewed, Final approval, Agreement to be accountable.

HC: Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable .

DATA SHARING POLICY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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