DISTRIBUTION OF ABO AND RH BLOOD GROUPS AMONG TYPE-II DIABETIC PATIENTS IN POPULATION OF LAHORE, PAKISTAN

Muhammad Luqman[1*], Usman Wajid[2], Farhan Ikhtiar[3], Rehmana Rashid[4], Amina Arif[5], Fatima Naseem[6], Tehmina Kausar[7], Ayesha Zahid[8]

Abstract

Background: Many epidemiological studies discuss the relation between the ABO blood group and the risk of developing diabetes mellitus. ABO is the major blood group system. Diabetes mellitus is a metabolic disorder characterized by hyperglycemia. It is firmly considered that like other congenital characters and qualities blood types probably relate to diabetes mellitus.

Materials and Methods: The study duration was 3 months from June to August 2021 study design was a comparative cross - sectional study. In our study, 400 participants were included: 200 were confirmed diabetics and 200 were non - diabetic as control. This study was conducted in the department of Pathology at Rehman Medical Institute, Peshawar. After obtaining informed consent from every patient 3ml of Blood samples in the EDTA tube were collected, labeled and sent to the laboratory for identification of blood group. Slide agglutination test for the determination of ABO and Rh blood groups was used.

Results: It was observed that blood group B was significantly more common among diabetic subjects (p- value < 0.05). Our study shows a higher percentage of blood group B in the diabetic group (46.5 %) compared to controls (27 %).

Conclusion: We conclude that there was an association between blood groups and Diabetes Mellitus. The outcomes suggest that the frequency of blood group B is significantly ($P < 0.05$) higher in type 2 diabetes as compared to non - diabetes.

Keywords: ABO Blood Group, Type 2 Diabetes Mellitus.

[1*,2,3,5,7]Department of Basic and Applied Chemistry, Faculty of Science and Technology, University of Central Punjab, Lahore.
[4]Deaprtment of Pharmacy, The Women University Multan, Pakistan
[6]Clinical Pharmacist at Goulburn Velly Health, Shepparton, Victoria 3630. Australia
[8]Armed Forces Post Graduate Medical Institute Rawalpindi.

***Corresponding Author:** Muhammad Luqman
*Department of Basic and Applied Chemistry, Faculty of Science and Technology, University of Central Punjab, Lahore. m.Luqman.4784@gmail.com

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INTRODUCTION

ABO blood groups

The division of ABO and Rh blood categories differ from race to race in the human population and subpopulation throughout the globe. Variances in blood groups unexpectedly exist in Pakistan because of ethnic and racial variances (2).

The exploration of ABO blood categories passes from misconception and misbelief to the Nobel award. Karl Landsteiner, a Viennese pathologist assembled an examination that when his serum and fellow co - workers were merged one by one with saline draped RBCs, clumping was examined in few compositions, not with others. He announced this examination in the publicized report as a marginal note in 1900 and more detail in 1901. In initial academic work, he revealed that two of six sera distinguished in 3 blood types: A, B, and C. Later on, C was renamed O from ohne, a German word, means without. Hence, Landsteiner showed that one's serum has antibodies against antigens that are not possessed by their red blood cells. After one year, another group AB was explained in four persons by sturli and decastello in wide - ranging academic work of 34 fine persons and 121 ill persons (3).

Serology of ABO Blood Group System:

The ABO blood category is set on by the existence of antibodies anti - A and anti B in the serum and of A and B antigens on RBCs. Hence, the blood type A contains antigen A on RBCs and antibody anti B in serum. In the same way, blood group B has antigen B on RBCs and an anti - A antibody in serum. O blood group has both antibodies A and B but owns no antigen. Blood group AB has A and B antigens and has no antibodies. Normally, antibodies are absent in neonates and come into view in the initial year of life. They of generally IgM class. The antibodies made against surrounding and food antigens (infection agent, pathogen or antigen of plants) are identical in form to antigens A and B (4) (1).

At the beginning of 1901, academic works initiated on the association between human being health and blood groups. Blood groups have been linked with the happening of many disorders, consisting of circulatory diseases, Neural diseases, malignancy, and infections (5) (6). Several diseases announced, revealed a firm relation with ABO blood types of system. Many initial research works have been completed to relate various infectious diseases, cancerous diseases, and clotting, measures by using mathematical and statistical processes to describe them (7). Studies conducted on the Relation of diseases and ABO blood types includes: various diseases, cardiovascular diseases (8), coronary artery disease (9), such as ischemic heart disease (10), malignancy of pancreas (11) , and stomach (12) .To test achievable contact between the ABO and Rhesus blood types with type 2 diabetes and its related factors, many academic works have been handled. Results have been verified to be conflicting and incompatible in various study designs (13). Hence, it is firmly considered that like other congenital characters and qualities blood types probably have relation with DM (14)

Diabetes Mellitus

Diabetes Mellitus is a class of metabolic disorder marked by high glucose levels in the blood (hyperglycemia) developing from flaws in the production of insulin, action of insulin, or both. The persistent high glucose level in the blood (hyperglycemia) is linked to prolonged harm and failure of different organs, mainly includes kidney, heart, eyes and blood vessels (15) . Because of this persistent DM, several signs appear, recurrent discharge of urine, grown and increased thirstiness, starvation, the buildup of an acid in the blood, high level of salt, glucose in the blood, and unconsciousness. Diabetes mellitus is because of 2 reasons; (16).

- Not enough buildup of insulin by the cell of pancreas and
- Not accurate response by cells of the body to the insulin made.

Mechanism

Diabetes mellitus is a group of linked, associated disorders and pathosis due to which a person's body cells are not able to manage the quantity of glucose, especially in the blood. Glucose is conveyed to body cells by blood to make the body able to make energy for carrying out everyday deeds. Food eaten by an individual is changed to glucose by the liver after conversion it is delivered to the blood. Glucose amount in the blood is adjusted by many hormones but mainly insulin is fine and fit. Insulin is made by the pancreas located in the middle of the liver and stomach. In type 1 DM, the body has insufficient insulin and in type 2 diabetes mellitus there is no accurate usage of insulin. In a diabetic patient, the glucose amount in the blood is not able to move to the cells, therefore the quantity of glucose in blood increases. Because of this reason, cells are hungered for this needing energy and destroy different other parts of the body uncovered to increase the amount of glucose (17).

Type 1 Diabetes

In insulin - dependent diabetes mellitus patients, body cells are not able to make sufficient insulin. It is also called " Juvenile Diabetes " (16). Type 1 diabetes belongs to autoimmune disorder when pancreatic β - cells are not able to make enough insulin than type 1 diabetes mellitus or juvenile diabetes occurs. The amount of glucose in the blood becomes high and cells have no energy to perform well because of lacking delivery of glucose from the body to cells due to this body goes toward life harmful situation of high and low sugar in the blood. When the body has hypoglycemia condition, then cells have less amount of glucose. As a result, a person has a condition of confusion and unconsciousness, sometimes when the brain has a prolonged deficiency of glucose then death happens. Prolonged body deprivation of insulin causes hyperglycemia due to hyperglycemia; blood became saturated with ketones and instead of glucose, fat is utilized as a source of fuel by cells. So, therefore, the blood becomes more acidic because of the assembling of the ketone. In this condition, the body goes toward an unconscious state and coma followed by death (17).

Pathophysiology

In type 1 there is demolition of cells that produce insulin in the pancreas by CD4 + and CD8 + and islets of Langerhans are invaded by macrophages (18).

Before going through insulin therapy, most diabetes mellitus type 1 patients have a measurable or detectable amount of insulin antibodies and about 85 percent of type 1 DM patients have flowing islets cells antibodies. Inside pancreatic B - cells, the majority of antibodies of islet cells are managed in opposition to glutamic acid decarboxylase. Defiance of insulin production is due to the demolition of B-cells in the pancreas. Due to these disorders of metabolism occurs related to T1DM. Adding to the loss of insulin production, the role of a cell in the pancreas also become anomalous and result in too much production of glucagon patient of T1DM. Usually, glucagon production is turned down in increased levels of glucose in the blood, but hyperglycemia can't repress glucagon production in T1DM patients. Because of insulin defiance, the final unsuitably raised glucagon's amount to intensify flaws in metabolism. Even though defiance of insulin is the fault of patients of T1DM, the fault also occurs in the management of insulin. In the plasma, the amount of unbounded fatty acid becomes high due to unrestrained breakdown of lipids because of defiance in insulin quantity results in repression of metabolism of glucose in marginal or peripheral tissues like bony muscles. This harms the usage of glucose and defiance in insulin amount this also turns down many gene expressions that are essential for selected tissues to show a response in a normal manner to insulin - like GLUT4 class of glucose transporters in adipose tissues and glucokinase in the liver (18).

Type 2 Diabetes

When cells don't show an accurate response to insulin then type 2 diabetes starts with the progression of this disease, the shortage of insulin occurs. Type 2 diabetes is also called adult - onset diabetes. The main reason for this pathosis is insufficient bodywork and more individual body mass (16). NIDDM is a metabolic and complicated endocrinal pathosis. The association and relation between inherited and surrounding environment elements bring diversified and developmental disease which has varying levels of opposition to insulin and dysfunction of B - cell in the pancreas. The main role in the growth of insulin resistance and damaged glucose toleration are obesity and increase body weight. Damaged glucose toleration proceeds to type 2 diabetes when B - cell in the pancreas has no extended ability to make enough insulin to control resistance to insulin. In type 2 diabetes, insulin resistance decreased insulin production and a high amount of glucose in the blood is caused by irregularities and abnormalities in other hormones such as GLP - 1, increased glucagon amount in the blood, etc. obesity and increase of body weight play role in insulin resistance through various ways, include No balance in the number of hormones (e.g. high leptin , low adiponectin , and high glucagon), high quantity of cytokine , repressors of cytokine , signal , other signals of inflammation and could be protein attached to retina 4.1. glucose intolerance develops into NIDDM when the production of insulin is not enough to controls insulin resistance. The amyloid formation, oxidative tension, stress, inflammation, lipotoxicity, glucotoxicity happen when the B - cell role is decreased. Type 2 diabetic patients commonly have a - cell inhibited mean don't play a role. Due to this, glucagon amount is increased and may have decreased prandial glucagon - like peptide I production (17). Pathophysiology

In type 2 diabetes Mellitus patients, these processes fail and as a result, damaged production of insulin by B - cell in the pancreas and damaged insulin action by the resistance of insulin occurs . In circumstances where insulin resistance dominates, then B cells go through alteration and become able

to make the production of insulin high and remunerating for abnormal and uncontrolled demand. Absolutely, the amount of insulin in plasma generally becomes high (Meal and fasting both concentrations). Comparatively to the intensity of insulin resistance, the amount of insulin in plasma is not enough to keep the homeostasis of glucose balanced. In practical, it is not possible to isolate and separate the role of each one or to type 2 diabetes. Raised amount of insulin in blood and resistance to insulin progress to damage toleration of glucose or glucose tolerance. The inheritance way of type 2 DM is indistinct and not clear except MODY (maturity - onset diabetes of the young). The mutation and defect in the gene of glucokinase located on chromosome 7p might be the reason for MODY which is a dominant autosomal feature or trait. Hyperglycemia detected before 25 years of age and curable without insulin in the case for more than 5 years where antibodies of islet cells (ICA) are negative is called MODY (18).

Epidemiology

Because of population aging, urbanization and related lifestyle changes, the global occurrence of diabetes mellitus is rapidly growing (19). Diabetes mellitus is a frequently developing medical condition with high morbidity and fatality rates over the world. (20) In 2002, DM was responsible for 988,000 deaths globally, or 1.7 percent of all deaths (21). Over the last three decades, the number of persons diagnosed with diabetes has more than doubled. Diabetes mellitus affected an expected 285 million individuals globally in 2010, with 90 % of those suffering from type 2 diabetes. Diabetes mellitus will affect 439 million people worldwide by 2030, accounting for 7.7 % of the globally adult people elderly 20 up to 79 years. (19). According to global diabetes mellitus figures from 2013, over 382 million individuals worldwide have the disease, by type 2 diabetes accounting for approximately 90 % of cases. DM was the eighth greatest cause of mortality globally recorded in 2012 and 2013, killing 1.5-5.1 million persons per year. Diabetes is expected to kill 592 million persons by 2035, according to projections. (16). In 2004, World Health Report, according to them the yearly DALYS (disability - adjusted life years) lost due to Diabetes mellitus was 16.2 million in 2002 (women 8.6 million men 7.6 million) . That were 1.1 % of the entire disease load and the other were non communicable disease 2.3 % of the burden worldwide According to (WHO) World Health Organization, the problem of Diabetes mellitus is different in different areas ; Africa 0.5 up to 0.6 million DALYs lost ranged, in the Americas 0.2 up to 1.8 million, in Europe 0.5 up to 1.1 million and in the region of Eastern Mediterranean 0.4 to 0.8 million. In Southeast Asia which contains Bangladesh and India (1.1-3.6 million), further in Western Pacific areas, which contains China (0.2-1.3 million) (21). Type 2 diabetes mellitus was quite uncommon in developing nations some decades previously; for example, the disease occurrence in 1980 in China was < 1 %. But high rate detected in Chinese peoples in Mauritius and in Asian Indian as well as in western countries Asian immigrants strongly established the possible epidemic of type 2 Diabetes mellitus that how occurred in main land in India and China. The major burden of diabetes mellitus is now taking place in developing rather than in developed countries. 80 % cases of diabetes mellitus worldwide live in less developed countries and areas Globally Asia has appeared as diabetes epicenter as a consequence of quick economic expansion, development and diet change over a quite small period of time. In the list of 10 countries presumed to have more DM patient in the year 2030, five countries (Pakistan, China, India, Indonesia and Bangladesh) belong to Asia. India is overwhelmed by China and China has become the universal core of DM. Out of the total population, 92 million adults are suffering from DM. A remarkable rise in people with DM has been revealed from a study in India in both citizens (from 13.9 % in the year 2000 to 18.2 % in the year 2006) and rural (from 6.4 % in the year 2000 to 9.2 % in the year 2006) (19). In Pakistan, 26.3 % of DM prevalence has been announced by the National Diabetes Survey of Pakistan from 2016-2017. Out of 207.77 million population, 27.4 million are suffering from DM. Along with this pre - diabetic people became 14.47 % (22).

1. MATERIALS AND METHODS

It was a cross - sectional study. All laboratory work was performed at the pathology department of Rehman Medical Institute, Peshawar. The study duration was 3 months from June, 2021 to August, 2021. Sample size was 400. It was non-probability sampling. Patients with the age above 25 years having type 2 Diabetes Mellitus were enrolled in this study regardless of their sex, socioeconomic status or duration of the disease and the patients with type 1 Diabetes Mellitus as well as patients unwilling to give data were excluded.

In our study 400 participants were included, 200 of them were confirmed type 2 diabetic patients and 200 were normal healthy individuals as a control for comparison. The diabetic patients in this study are already diagnosed to have diabetes (type 2),

were under treatment and coming for the follow - up to hospital for their management. Furthermore, Individuals were considered to be diabetic if they fulfilled the American Diabetes Association cut - off or those patients already on glucose takedown medication. Taking written informed consent, the purpose and process of the study were described to all diabetic patients. After sign, the consent Two ml of blood sample was collected in EDTA tube from patients by a phlebotomist aseptically, labeled and conveyed to the laboratory for blood groups. Blood groups were done by simple technique drop of blood was placed on a clear glass slide at three different sites. Then anti - sera were added to each drop, the anti - sera were anti - A, B and D. The antisera were mixed to each blood drop with the help of match sticks. Blood groups were determined based on clumping all information was recorded on a datasheet and saved for record and analysis of the findings after the study. For statistical analysis, we used MS Excel, Graph Pad, and SPSS software version 22.

2. RESULTS

A total number of 400 (200 diabetics and 200 non-diabetic) individuals were included in this study. Among 200 diabetic individuals, 115 (57.5 %) were female and 85 (42.5 %) were males individuals, mean ±SD was calculated as 56.75±10.81 (Figure 4.1, 4.2). Among non-diabetic individuals 125 (62.5%) were male and 75 (37.5 %) were females, mean ±SD was calculated as 33.07±6.29. (Figure 4.1, 4.2)

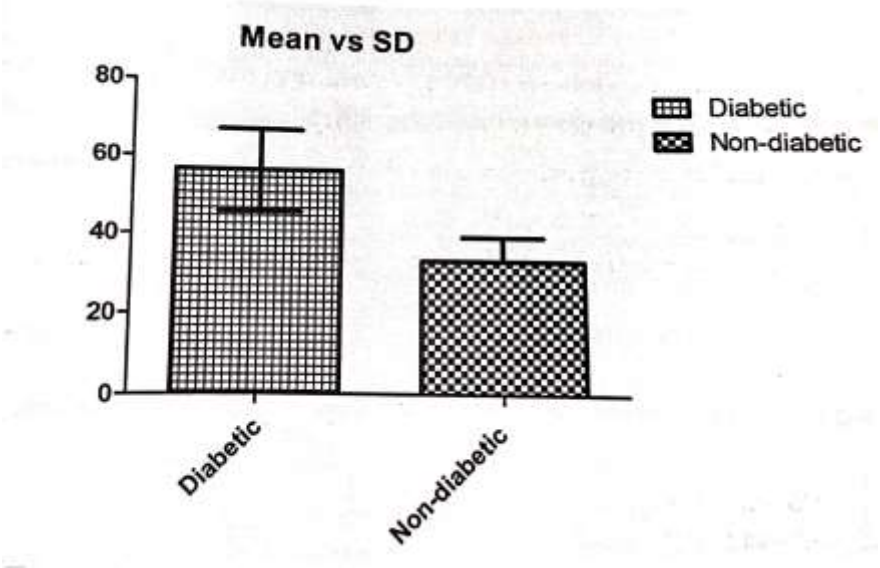

Figure 4.1 Mean ±Standard deviation of diabetic and non - diabetic groups

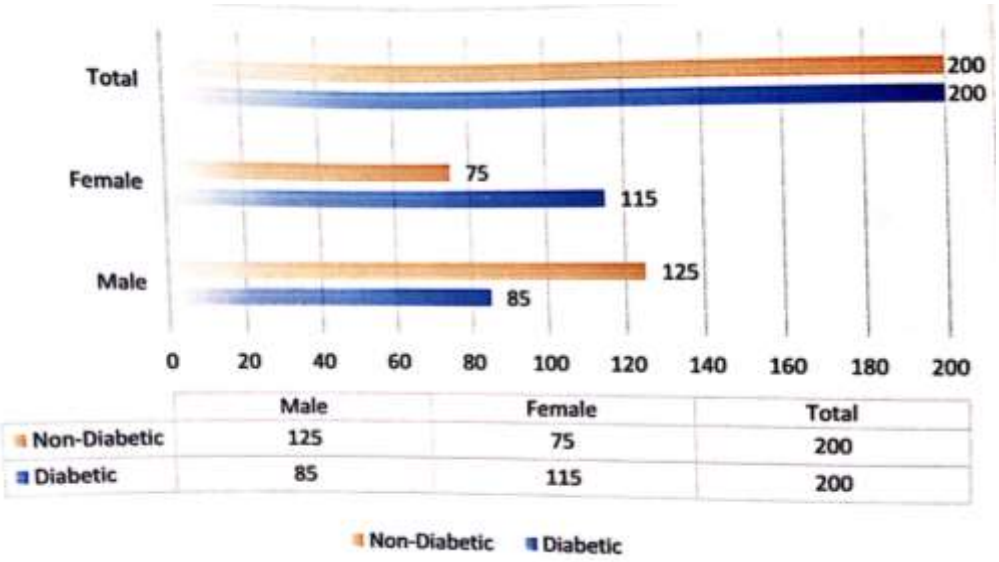

Figure 4.2 Distribution of male and female population of diabetic and non-diabetic group

Frequency of the ABO and Rh blood groups in diabetic group was recorded as 47 (23.5) in A+, 87 (43.5%) in B+, 41 (20.5 %) in O +, 15 (7.5 %) in AB +, 3 (1.5 %) in A-, 6 (3 %) in B- , 1 (0.5 %) in O- and 0 in AB - blood groups. (Table 4.1).

Table 4.1 Distribution of ABO and Rh blood groups among diabetic group

Rh	Blood Groups				
	A	B	O	AB	TOTAL
POSITIVE	47	87	41	15	190
NEGATIVE	3	6	1	0	10
TOTAL	50	93	42	15	200

Frequency of the ABO and Rh blood groups in non - diabetic group was recorded as 62 (31 %) in A+, 45 (22.5 %) in B+ , 44 (22 %) in O+ , 20 (10 %) in AB + , 13 (6.5 %) in A- , 9 (4.5 %) in B- , 7 (3.5 %) in O- , and 0 in AB - blood groups. (Table 4.2).

Table 4.2 Distribution of Rh blood groups among non - diabetic group Rh Blood

Rh	Blood Groups				
	A	B	O	AB	TOTAL
POSITIVE	62	45	44	20	171
NEGATIVE	13	9	7	0	29
TOTAL	75	54	51	20	200

Among the diabetic group out of a total of 200 individuals 50 (17 males and 33 females) were with blood group A , 93 (45 males and 48 females) with B , 42 (16 males and 26 females) and 15 (7 males and 8 females) were with AB blood group . Blood group B was found more prevalent in the diabetic group in both male and female populations as compared to the other blood groups (Table 4.3).

Table 4.3 Gender wise distribution of ABO blood groups in diabetic population

Gender	Blood Groups				
	A	B	O	AB	TOTAL
Female	33	48	26	8	115
Male	17	45	16	7	85
TOTAL	50 (25%)	93 (46.5%)	42 (21%)	15 (7.5%)	200

Among the non - diabetic group out of a total of 200 individuals 75 (50 males and 25 females) were with blood group A , 54 (34 males and 20 females) with B , 51 (31 males and 20 females) with O and 20 (10 males and 10 females) were with blood group AB. (Table 4.4)

Table 4.4 Gender wise distribution of ABO blood groups in non - diabetic population

Gender	Blood Groups				
	A	B	O	AB	TOTAL
Female	25	20	20	10	75
Male	50	34	31	10	125
TOTAL	75 (37.5%)	54 (27%)	51 (25.5%)	20 (10%)	200

In the non - diabetic group, the most prevalent blood group was A and the least frequent was AB, while in the diabetic group, blood group B was found more prevalent. In the diabetic blood group, B was found most prevalent with a high frequency of 93(46.5%) which showed an association with diabetes mellitus. (Figure 4.3).

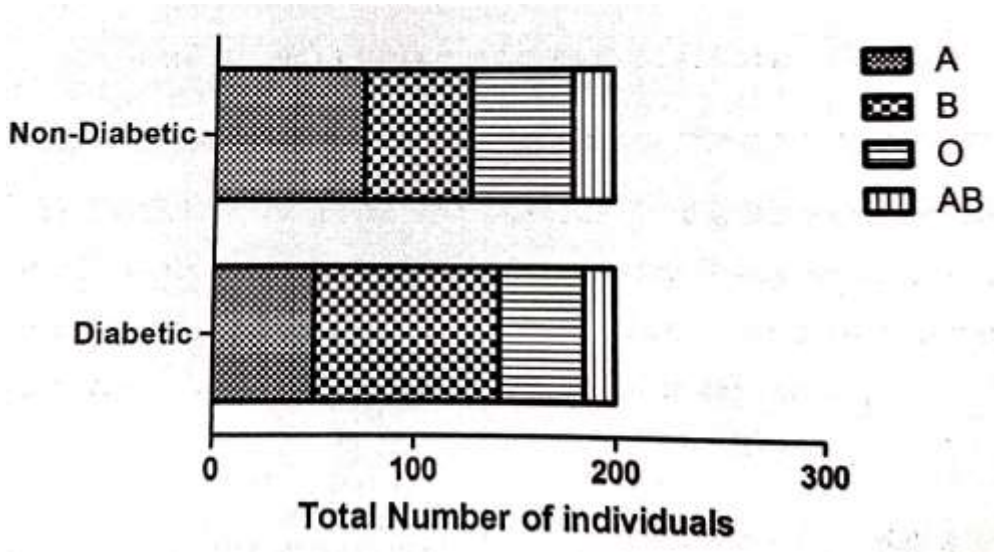

Figure 4.3 Distribution of blood groups A, B, O and AB among diabetic and non-diabetic population

	Value	Df	Exact sig. (2- sided)	Exact sig. (1- sided)
Pearson Chi-square	10.256	1		
			0.002	0.001
N of Valid Cases	400	1		

5. DISCUSSION

Numerous studies have been accompanied to explore the possible relationship between the blood group ABO and Rh phenotypes with Type 2 diabetes mellitus and its related factors. The outcomes of studies have been showing to be varying and fluctuated from one to another. Our study was deliberate with the opinion to conclude the frequency of blood groups ABO and Rh in patients with diabetes mellitus.

The results of our study were that in diabetic patients blood group B was significantly more prevalent as compared to non - diabetic healthy control which was (46.5 % VS 27 %), And blood group A in non - diabetic healthy control were (37.7 % VS 25 %) respectively. The order of blood groups in diabetic were B > A > O > AB and the order in non - diabetic healthy control were A > B > 0 > AB. Blood group O and AB are nearly the same distribution in both groups. Blood groups with Rh - positive were in Higher percentage and blood groups with Rh - Negative were less in diabetics patients but no significant association was found.

Our results were similar to shams et al According to their study that B blood group have high sugar levels they applied chi - squared test among different blood groups and there were P value less than 0.05 and statistically significant (14). Another study by Anwar et al showed that B blood group were significantly (p - value < 0.05), more common in diabetic as compared to non - diabetic No significant difference were initiated in terms of Rh factor between diabetic and non-diabetic individuals (32). According to a study conducted by (A Bener and MT Yousafzai), the occurrence of B blood group was significantly higher between diabetic as compared with a non - diabetic population (30).

Various contrasting relations among blood groups ABO & Rh with diabetes mellitus have been reported According to (Abdul Ghani Waseem et al) in their study more common blood group in diabetes were AB as compared to controls , A and B blood groups in diabetes were less common whereas O blood group has similar distribution between both groups. There is a positive association among Diabetes and Rh negative groups (28) and our outcomes are different from these results, in our study we found that the B blood group is more prevalent and when we compared diabetic and control groups , we discovered that diabetics have a higher frequency of Rh Positive blood groups. A study conducted by (Munaza Javed et al) showed that there were more Rh + blood groups in diabetes, similar to our study. But in contrast, their study showed Frequency of blood groups ABO observed in patients with diabetes group were different from our study and recorded as 97 (38.8 %) in O + , 55 (22 %) in B + , 52(20.8 %) in A + , 23 (9.2 %) in AB + , 10 (4 %) in O - , 8 (3.2 %) in B- , 2 (0.8 %) in A and 3 (1.2 %) in AB- blood groups. Their study limitation was

that they do not take the control group for comparison. (29) Similar Results showed by Kumar Ganesan and Sharmila that individuals with O and B blood groups are more probable to have Diabetes. There was a significant difference ($p < 0.05$) of the B blood group among diabetic and non - diabetic and also significant difference among Rh group. Rh - positive groups were highly common in diabetics. (33) Another study conducted by (Muhammad Kamil et al) results indicated a negative association between type 2 diabetes mellitus and ABO. Blood groups A and O showed a negative relationship with DM, which implicit that blood group A and O patients have fewer probabilities of type 2 diabetes mellitus. But, no significant relation was found among blood groups B and DM type 2 the value of is ($P = 0.423$). (25) According to a study conducted by (Dali Sahi M et al) A, B and AB Blood groups were more mutual in controls as compared to diabetic patients. O blood group were more numerous diabetics than non - diabetics but these difference is statistically not significant. (34).

The disagreement still occurs as different blood groups ABO / Rh have been described to be mutual in diabetic populations in numerous national and international studies. The likely explanation of these inconsistent findings is that maybe racial and geographical features have a character in the genetic appearance of the disease.

CONCLUSION

The study outcomes suggest that in type 2 diabetes blood group B frequency is significantly higher as compared to non - diabetic. Additional larger - scale studies are required to determine the results of this study. Based on the present study, it was determined that people with B blood group would take care of their health, diet and exercise to avoid the probability of diabetes. Therefore, it is extremely suggested for all smokers, obese and old age peoples and particularly for those having B blood groups to avoid smoking, alcohol, eat fresh fruits and vegetables, take consistent exercise and check blood glucose, blood pressure and cholesterol levels frequently to decreases the risk and the probabilities of diabetes.

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