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Significant Effect of Blood Sugar Level in Diverse Blood Groups

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ABSTRACT

Many epidemiological studies discussed the linkage between ABO blood group and the risk of developing diabetes mellitus.“Diabetes mellitus”, is one of the most common non-communicabledisorderat global level. India faces numerous challenges in the management of diabetes mellitus, including a rising occurrence in urban and rural zones, lack of disease awareness among the public, limited health care facilities, high cost of treatment, suboptimal glycaemic control and rising prevalence of diabetic complications. Insulin therapy for diabetes is most commonly delivered via subcutaneous injections, up to four times a day. Long-term insulin therapy, compounded by the invasive nature of its administration, has caused problems with patient compliance, ultimately influencing patient outcomes. There is an increase in the prevalence of type 1diabetes also, but main cause of diabetic epidemic is type2 diabetes mellitus, which accounts for more than 90 percent of all diabetes cases. Type2 diabetes is a serious and common chronic disease resulting from a complex inheritance-environment interaction along with other risk factors such as obesity and sedentary lifestyle

Key words: ABO blood group; Diabetes mellitus; T2DM, T1DM

Aim
This study aimed to evaluate the association between ABO blood group and diabetes mellitus. Methods: This study was a comparative cross-sectional study, conducted at Lab of microbiology at Saaii College of Medical Science And Technology, Kanpur Participants were randomly selected and assigned to either healthy group or to patients with diabetes group. The study was carried out from July28 until August 2 2019; The collected data were analysed .Results: 60 participants were included in the study, none of them were diabetic patients and 60 subjects were diabetic. Non -significant association between ABO blood group and type 2 diabetes .However, significant differences between blood groups in terms of Fasting Blood Sugar were found; and participants with blood groupB have strong relation. Conclusion: B blood group was found to be positively associated with T2DM, while O blood group has negative association with (T2DM).

INTRODUCTION

Several pathological processes are involved in the development of DM that range from autoimmune destruction of the β cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action .

Diabetes mellitus is generally divided as insulin-dependent diabetes mellitus (T1DM) characterized by an absolute deficiency of circulating insulin and non-insulin-dependent diabetes mellitus (T1DMor T2DM), characterized by elevated insulin levels that are ineffective in normalizing blood sugar levels or by impaired insulin secretion 1 It was reported that DM type 2 is the most common type, accounting for 90% of

ABO blood types may also be associated with gut bacteria composition, which may be linked to T2DM. In T2DM, gut dysbiosis contributes to the onset and maintenance of insulin resistance. Different strategies that reduce dysbiosis can improve glycemic control. Evidence in animals and humans reveals the differences between the gut microbial composition in healthy individuals and those with T2DM. Changes in the intestinal ecosystem could cause inflammation, alter intestinal permeability, and modulate metabolism of bile acids, short-chain fatty acids, and metabolites that act synergistically on

TYPE 1 DIABETES MELLITUS (T1DM)

Type 1 diabetes mellitus (T1DM), also known as autoimmune diabetes, is a chronic disease characterized by insulin deficiency due to pancreatic β-cell loss and leads to hyperglycemia. Although the age of symptomatic onset is usually during childhoodor adolescence, symptoms can sometimes develop much later. Although the etiology of T1DM is not completely understood, the pathogenesis of the disease is thought to involve T cell-mediated destruction of β-cells. Islet-targetingautoantibodies that target insulin, 65 kDa glutamic acid decarboxylase, insulinoma-associated protein 2 and zinc transporter 8 — all of which are proteins associated with secretory granules in β-cells — are biomarkers of T1DM-associated autoimmunity that are found months to years before symptom onset, and can be used to identify and study individuals who are at risk of developing T1DM. The type of autoantibody that appears first depends on the environmental trigger and on genetic factors. The pathogenesis of T1DM can be divided into three stages depending on the absence or presence of hyperglycemia and hyperglycemia- associated symptoms (such as polyuria and thirst). A cure is not available, and patients depend on lifelong insulin injections; novel approaches to insulin treatment,such as insulin pumps, continuous glucose monitoring and hybrid closed.

TYPE 2 DIABETES MELLITUS (T2DM)

Type 2 diabetes mellitus (T2DM) is an expanding global health problem, closely linked to the epidemic of obesity. Individuals with T2DM are at high risk for bothmicrovascular complications (including retinopathy, nephropathy and neuropathy) and macrovascular complications (such as cardiovascular comorbidities), owing to hyperglycaemia and individual components of the insulin resistance (metabolic)syndrome. Environmental factors (for example, obesity, an unhealthy diet and physical inactivity) and genetic factors contribute to the multiple pathophysiologicaldisturbances that are responsible for impaired glucose homeostasis in T2DM. Insulin resistance and impaired insulin secretion remain the core defects in T2DM, but atleast six other pathophysiological abnormalities contribute to the dysregulation of glucose metabolism. The multiple pathogenetic disturbances present in T2DMdictate that multiple antidiabetic agents, used in combination, will be required to maintain normoglycaemia. The treatment must not only be effective and safe but also improve the quality of life[1 2].

Metabolic regulation systems contributing to insulin resistance [3]’ Diabetes mellitus is the most common metabolic disorder affecting people worldwide both in developing and developed countries.There have been efforts to discover a possible association between ABO and Rh blood groups and different diseases. Certain diseases show strong association with the ABO blood groups, notably, peptic ulcer is much higher in blood group O whereas stomach cancer, tumors of salivary glands are more frequent in blood group A individuals.

Many reports have appeared in recent years suggesting an association between blood groups and diabetes mellitus [4].The etiology of diabetes mellitus is complex and appears to involve interactions of genetic, immunological and environmental factors. Blood group antigens are thought to be among hereditary determinants and play a vital role to understand genetics and disease susceptibility. Since the discovery of blood groups in 1900, there have been interests to discover a possible association between ABO and Rh blood groups and different diseases. Along with their expression on red blood cells, ABO antigens are also expressed on the surface of many human cells and tissues, including the epithelium, sensory neurons, platelets, and the vascular endothelium. M. Francine and G. Lippi, “The intriguingRelationship between the ABO blood group,Cardiovascular disease, and cancer[3]’

Diabetes is a major lifestyle disease which affects several million people worldwide every year. According to reports, 415 million people worldwide were diabetic in 2015, most of them suffering from Type II diabetes (IDF Diabetes Atlas, 2015).

CAUSES OF TYPE 2 DIABETES MELLITUS

Your Pancreas makes a hormone called insulin. It helps your cells turn glucose, a type of sugar, from the food you eat into energy. People with type 2 diabetes make insulin, but their cells don't use it as well as they should.

At first, your pancreas makes more insulin to try to get glucose into your cells. But eventually, it can't keep up, and the glucose builds up in your Blood instead.

Usually, a combination of thing causes type 2diabetes they might include:

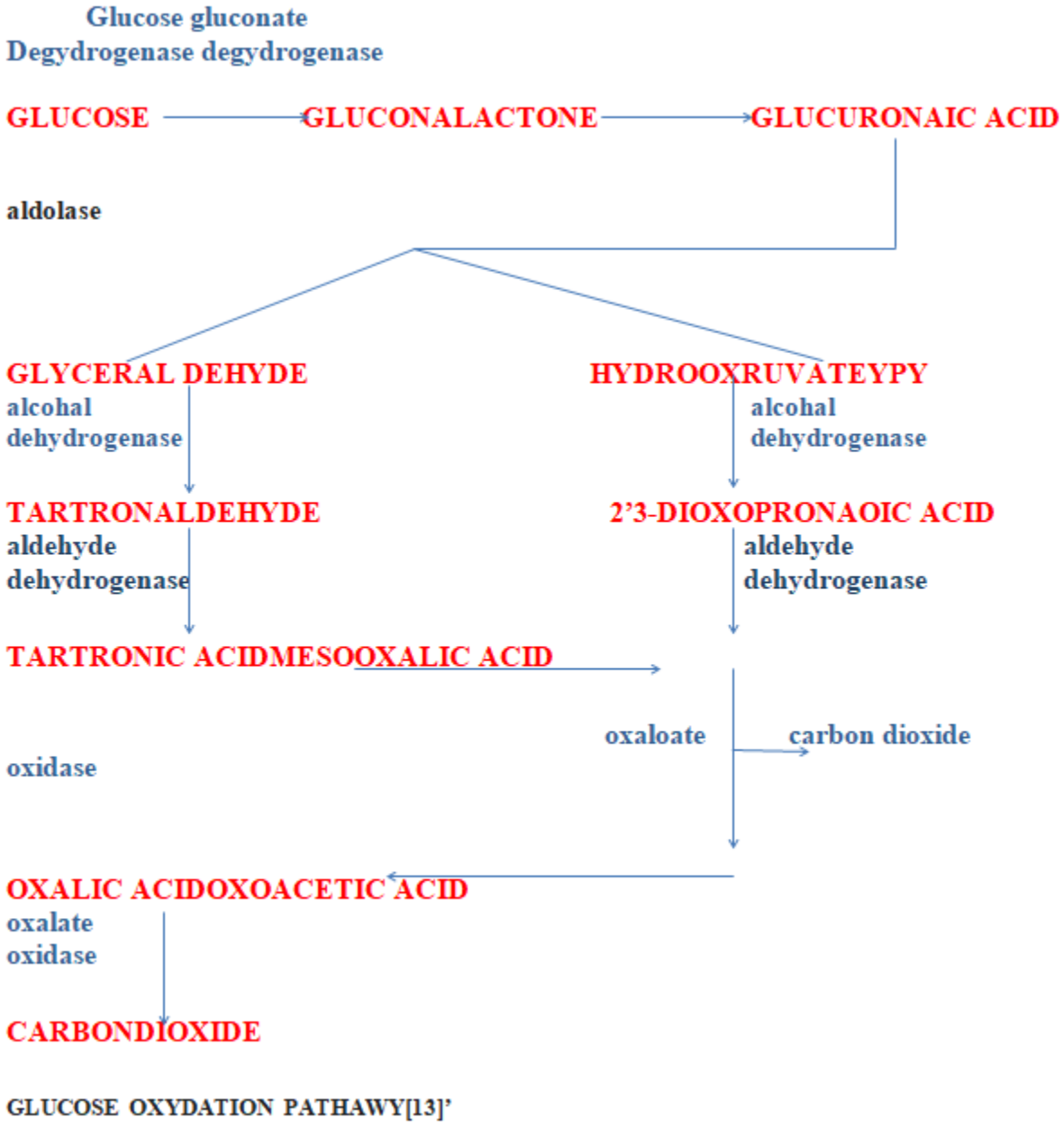
Type 2 diabetes mellitus is also known as adult-onset diabetes. The progressive insulin secretary defect on the background of insulin resistance (American Diabetes Association, 2014) [20]. People with this type of diabetes frequently are resistant to the action of insulin [21]. The long-term complications in blood vessels, kidneys, eyes and

nerves occur in both types and are the major causes of morbidity and death from diabetes [1]. The causes are multifunctional and predisposing factor includes: Obesity, Sedentary lifestyle, increasing age (affecting middle-aged and older people), Genetic factor (Ross and Wilson 2010), such patients are at increased risk of developing macro vascular and micro vascular complications [22, 23]

TYPE 2 DM GLUCOSE OXYDATION PATHAWY

It is highly essential for glucose to be oxidized in body cells. The initial process by which this occurs is termed glycolysis. It is a ten-step enzyme catalyzed pathway,

the first among other reaction pathways (Kreb cycle and electron transport chain) collectively involved in ATP (energy) generation from glucose.[12]'



GLUCOSE OXYDATION PATHAWY[13]'

GESTATIONAL DIABETES

Gestational diabetes is a type of diabetes that is first seen in a pregnant woman

who did not have diabetes before she was pregnant. Some women have more than one pregnancy affected by gestational diabetes. Gestational diabetes usually shows up in the middle of pregnancy. Doctors most often test for it between 24 and 28 weeks of pregnancy.

Often gestational diabetes can be managed through eating healthy foods and regular exercise. Sometimes a woman with gestational diabetes must also take insulin.[9]'

Gestational diabetes is diabetes that a woman can develop during pregnancy. When you have diabetes, your body cannot use the sugars and starches (carbohydrates) it takes in as food to make energy. As a result, your body collects extra sugar in your blood. We don't know all the causes of gestational diabetes. Some—but not all—women with gestational diabetes are overweight before getting pregnant or have diabetes in the family.

From 1 in 50 to 1 in 20 pregnant women has gestational diabetes. It is more common in Native American, Alaskan Native, Hispanic, Asian, and Black women, but it is found in White women, too.[10]'

BLOOD GROUP TABLE

BLOOD GROUPS	**ANTIGENS PRESENT ON THE RED BLOOD CELLS**	**ANTIBODIES PRESENT IN THE SERUM**	**GENOTYPES**
A	**A antigen**	**Anti B**	**AA or AO**
B	**B antigens**	**Anti A**	**BB or BO**
AB	**(A,B) antigens**	**None**	**AB**
O	**None**	**Anti A and Anti B**	**OO**

[8]'https://www.ncbi.nlm.nih.gov/

MATERIALS AND METHODS

Place of study:-
The study was conducted in the Department of Medical Microbiology,Saaii College of Medical Science And Technology,Kanpur.

Study periods:-
Study was conducted from July28 to August 24, 2021.

Study Population:-
60 Type 2 diabetic patients and 60 healthy control subjects among the relative of patients and volunteers were selected for this study

Sample design:-
All the subjects were selected by random sampling technique.

Study design:-
Hospital based cross-sectional study.

Study Tool:-
For blood grouping- Glass slides, Pastuer pipettes, Applicator sticks and centrifuge,

(1) Antigens.Anti A.Anti B. Anti C
(2)Blood Mixing Sticks.
(3)Glass slid
(4) Blood
(5) Cotton
(5) Surgical spirit

(6) Lancet needle
(8) Centrifuge
(7) Glucometer machine

 The reagents are:ANTIGENS; Anti A .Anti B Anti C

- Anti-A sera (blue color): Human polyclonal or murine monoclonal.
- Anti-B sera (yellow color): Human polyclonal or murine monoclonal.
- Normal saline: 0.9 g/dl sodium chloride in distilled water.

 For blood sugar- glucometer comp.(DR.MORPEN)

Blood sampling:-
One to two ml of blood sample for grouping was collected from patients. ABO blood group was determined using the ABO gel card test. ABO blood group determination by using ID-Card gel method.
ABO typing:-

 Specimen: Clotted blood is generally used, the clotted blood is centrifuged at 1500rpm for (three) minutes to separate serum.

 The red cells are then separated from the clot using a Pastuer pipette and suspended in saline.
 Anti-coagulated blood with proper anticoagulants like ethylene demine tetra acetic acid EDTA can also be used.

 The specimen should be stored at 2-8C if there is any delay in examination.

 Blood obtained by finger puncture may be tested directly by the slide method and mixed quickly with antisera to avoid clotting.

(3)PROCEDURE

1.Place one drop of anti-D serum on a pre-warmed glass slide.
2. Add one drop of 10% suspension of red blood cells (in case of anemic patients, use one drop of sedimented red cells) using a Pasture pipette.
3. With an applicator stick, mix cell-serum mixture well.
4. Tilt the slide back and forth and observe for agglutination.
5. Tests that show no agglutination within three to five minutes are considered negative.

1. Prepare a 10% suspension of red blood cells in normal saline
(i) Mix 0.05 ml (5 drops) of sedimented red cells with 2 ml of normal saline
(ii) Centrifuge at 1,500 rpm for 1 to 2 min and discard supernatant
(iii) Add 2 ml of normal saline to the sedimented red cells, mix well to give a 10% suspension of red cells.
2. Place 1 drop of anti-A sera on one-half of a glass slide.
3. Place 1 drop of anti-B sera on the other-half slide.
4. Add a drop of the red cell suspension to each half of the slide using a clean Pasteur pipette.
5. Mix each cell-serum mixture well using separate applicator sticks.
6. Tilt the slide back and forth and observe for agglutination.
Study was conducted from July28 to August 24, 2021.

Study Population:-
60 Type-2 diabetic patients and 60 healthy control subjects among the relative of patients and volunteers were selected for this study

Sample design:-
All the subjects were selected by random sampling technique.

Study design:-
Hospital based cross-sectional study.

Study Tool:-
For blood grouping- Glass slides, Pastuer pipettes, Applicator sticks and centrifuge.

 The reagents are:

- Anti-A sera (blue color): Human polyclonal or murine monoclonal.
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 For blood sugar- glucometer

Blood sampling:-
One to two ml of blood sample for grouping was collected from patients. ABO blood group was determined using the ABO gel card test. ABO blood group determination by using ID-Card gel method.
ABO typing:-

 Specimen: Clotted blood is generally used, the clotted blood is centrifuged at 1500rpm for few minutes to separate serum.

 The red cells are then separated from the clot using a Pastuer pipette and suspended in saline.
Anti-coagulated blood with proper anticoagulants like EDTA can also be used.

 The specimen should be stored at 2-8C if there is any delay in examination.

 Blood obtained by finger puncture may be tested directly by the slide method and mixed quickly with antisera to avoid clotting.

Blood sugar Test
Specimen:

 Alcohol prep pad (or soap and water if you have access to a sink)

 Lancet

 Test strip

 Glucometer

 A notebook to record results

Procedure:

 First, set out your glucometer, a test strip, a lancet, and an alcohol prep pad.

 Wash your hands to prevent infection. If you are not by a sink, it's okay to just use the alcohol swab. If you are by a sink and wash your hands thoroughly, you do not have to use an alcohol swab.

 Sometimes it helps to warm your hands first to make the blood flow easier. You can rub your hands together briskly or run them under warm water—just be sure to dry them well as wet hands can dilute the blood sample, resulting in a lower number.

 Turn on the glucometer and place a test strip in the machine when the machine is ready. Watch the indicator for placing the blood on the strip.

 Make sure your hand is dry and wipe the area you've selected with an alcohol prep pad and wait until the alcohol evaporates.

 Pierce your fingertip on the side of your finger, between the bottom of your fingernail to the tip of your nail (avoid the pads as this can pinch more). The type of drop of blood required is determined by the type of strip you are using (some use a "hanging drop" of blood versus a small drop for strips that draw blood in with a capillary action).

 Place the drop of blood on or at the side of the strip.

 The glucometer will take a few moments to calculate the blood sugar reading. Follow your healthcare provider's orders for whatever blood sugar reading you get.

 You may use the alcohol prep pad to blot the site where youdrew the blood if it is still bleeding.

 Write down your results. Keeping a record makes it easier for you and your healthcare provider to establish a good treatment plan. Some glucometers can store your results in a memory, for easier record keeping.

RESULT

Sociodemographic Characteristics'
Males (34) comprised 50.4% of the study participants. The median age of the study participants was 30 years (range: 18-30 years). Most of T2DM study participants were unmarried157 (74.1%).

Clinical Data of Study Participants
18person(30.7%) of T2DM cases had a family history of DM. Out of 60 T2DM cases, 4.2%, 26.9%, 62.7%, 63.7%, and 55.7% were cigarette smokers, alcohol drinkers, eat fruits and vegetables sometimes, and did not perform physical exercise, and have normal BMI, respectively.

Among DM patients, blood group O (34.9%) was the most frequent followed by B (33.0%), A (27.8%), and AB (4.2%), and (90.1%) were Rh 'D' positive Among healthy controls blood group O (45.8%) was most frequent followed by A (32.1%), B (18.9%), and AB(3.3%), and (92%) were Rh 'D' positive

DISCUSSION

Many studies have been conducted in order to investigate the possible relationship between the ABO and Rh blood group phenotypes with T2DM and itsfactors. The results have been proved to be associated inconsistent and differed from one study to another. The results of thepresent study supported the assumption that ABO blood group phenotypes are associated with the risk ofdeveloping T2DM. Our finding was similar withstudies done in SaudiArabia andMalaysia . Contrary to the current findings, studiesconducted in India, Iran , andAlgeriareported 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

Findings of the current study revealed that study participants with blood group B were more affected by T2DM as compared with healthy controls. The rationale behind this observed association might be the existence of higher levels of inflammatory mediators like factor VIII-VWF complex, ICAM-1, and TNF-2 in

blood group B individuals. It is well stated that systemic inflammation is the main cause of insulinresistance and ultimately plays a role in the development of T2DM . Similar results were reported by studies in Qatar , Saudi Arabia , India , Malaysia and France . However, a study conducted indicated that blood groups B and A were less likely to develop p to T2DM as compared to other blood groups. The possible justifications for the observed difference may be geographical and racial differences which may affect the genetic expression of disease and the frequency of ABO blood group antigens .

Blood group 'O' individuals were less likely to develop T2DM compared to other ABO blood types. The reason for this protective effect of the O blood group might be the low level of inflammatory mediators like factor VIII-VWF complex, intercellular adhesion molecule-1 (ICAM-1), and TNF-2. Inconsistent to the current result, a study in India reported that

blood group O had increased risk of developing DM as compared to other blood groups. The reasons for the observed difference might be the geographical, environmental, and genetic differences in which these studies were conducted. [7]'

CONCLUSIONSand 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.

CONCLUSION

From the findings of this study, ABO blood group phenotypes are significantly associated with T2DM. In this study, B blood group was found to be positively associated with T2DM, while O blood group has negative association with T2DM. However, blood groups A, AB, and Rh were not associated with T2DM. This study also sought to determine the relationship between ABO and Rh blood group phenotypes with DM-associated factors.

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