INTERACTION OF RED CELL INDICES AND BLOOD GROUP IN DIABETIC PATIENTS ABOVE 50 YEARS OF AGE

ABSTRACT

Introduction: A group of metabolic diseases with a hyperglycemic phenotype known as diabetes mellitus impact both industrialized and developing nations. It is brought on by deviations in insulin synthesis, action, or both.

Research objective: This study seeks to associate the interaction of red cell indices and blood group in diabetic patients above 50 years of age. This is a case control study in which a convenient sample size of 100 individuals were recruited from a consenting population at a private hospital in Port Harcourt, Rivers State, 50 of whom were diabetic, and the remaining 50 were not.

Method: Using the automated 3-part differential hematology analyzer Sysmex KX-21N, a Full blood count (FBC) and differential was obtained using (Sysmex Corporation Kobe, Japan) Standardization, instrument calibration, and analysis of sample was achieved in line with accordance with the manufacturer's manual to determine the red cell indices and grouping of cells using the tile approach to determine the ABO Blood Groups. Blood samples were taken from the veins using a vacutainer tube and needle according to Chesbrough's instructions, and then put in EDTA anticoagulated bottles with clear labelling. These samples were transported right away using the triple packing procedure to the lab and stored until testing at 4°C. Inferential statistics utilizing the students' statistical t-test were employed to compare the results.

Results: Blood group O, with a total of 25 (50%), had the highest prevalence of diabetes mellitus, followed by blood group A with a total of 12 subjects (24%) and blood group B with a total of 8 subjects (16%) and blood group AB came in last with a total of 5 participants (10%), respectively. In this study, blood group O predominated over blood groups A and B (47% against 25% versus 17%, respectively). The least common blood type in this study was AB (11%). When the Packed Cell Volume, Haemoglobin, Red Blood Cell, Mean Cell volume, Mean Cell Haemoglobin, Mean Cell Haemoglobin Concentration, and Red cell Distribution Width were examined between diabetic and non-diabetic participants, no statistically significant ($p<0.05$) difference was found.

Conclusion: The findings of this study suggest that blood types O and AB are more prevalent in diabetics. We can deduce that a person's blood type may be a risk factor for developing this condition and may be useful in diagnosing it.

Key Words: Interaction, Diabetes, Red cell indices, ABO Blood Groups

1. Introduction

Both industrialized and developing nations experience diabetes mellitus (WHO, 2014), a hyperglycemic phenotypic group of metabolic diseases, brought on by abnormalities in insulin synthesis, action, or both. The complex interaction between inherited and environmental factors

causes these errors (Sarwar, 2014). In 2013, there were 382 million cases of diabetes globally, up from an estimated 30 million cases in 1985, according to the World Health Organization (WHO).
The World Health Organization (WHO) describes diabetes mellitus as a chronic metabolic disorder characterized by elevated blood glucose levels that, over time, have an impact on the heart, blood vessels, kidneys, eyes, and nerves (WHO, 2014). 1.7% of the people in Nigeria and the rest of the world suffer from diabetes mellitus, which is a serious concern (Wokoma *et al.*, 2002). According to estimates made by Wild *et al*., (2004), there would be 366,212 million diabetics worldwide by the year 2030. In Rivers State, the prevalence of diabetes mellitus has climbed to roughly 42.7%. However, according to the International Diabetes Federation (IDF), by 2045, adults aged 40 and older are expected to have a diabetes rate of about 10.9%, up roughly 9.3% from 2019. (Saeeid *et al.*, 2019).

Families pass down blood type antigens, which are crucial for comprehending genetics, inheritance patterns, disease susceptibility, and the security of blood transfusions. Blood group antigens have been connected to a number of disorders, both in their absence and presence. Due to the fact that diabetes mellitus and blood type share the same genetic and immunological foundations (Desisto *et al*., 2014). The relationship between the ABO blood group and disease risk has recently become the subject of extensive research.

Thankfully, new research from authors like Anifowoshe *et al*. (2017) and Oladele *et al*. (2020) indicates that ABO blood types affect disease susceptibility, which can be used as a management strategy. Studies by Qureshi and Bhatti (2003) and Bener and Yousafzai (2014), among others, also demonstrate that ABO blood groups affect diabetes susceptibility. ABO blood groups are hereditary and are controlled by a gene on chromosome nine known as the ABO gene or immunoglobulin (Zahid *et al*., 2016). Thus, some cases of diabetes may be genetic (Abdel-Gaffar *et al*., 2020; Yahaya *et al*., 2020).

Additionally, there is evidence supporting the notion that demographic and environmental factors have an impact on illness susceptibility (Yahaya *et al*., 2017). Shittu *et al*. (2017) advised that high prevalence of diabetes and pre-diabetes among women and those younger than 61 in Oyo State, Nigeria, is noteworthy. In all, these revealed that the association of ABO blood groups and red cell

indices can offer basic information for controlling a person's health as well as figure out how diseases are distributed among diabetics.

Consequently, it is necessary to ascertain the distribution of the ABO blood group and among diabetics in a given population so as to effectively employ ABO blood types as well as red cell indices to anticipate and manage a disease. In Port Harcourt, Rivers State, Nigeria, as in other underdeveloped countries, there are few such studies among the diabetic community. Hence, this study aims at ascertaining the relationship between ABO blood groups and red cell indices in diabetics visiting a private hospital in Port Harcourt Rivers State, Nigeria.

RBC parameters are part of the Complete Blood Cell Count (CBC), a panel of analytical assays typically used to distinguish between various kinds of anemia (Doig and Zhang, 2017). Red Blood Cell Count (RBC), Hematocrit (HCT), Hemoglobin (HGB), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), and Red cell Distribution Width (RDW) are RBC parameters (Vinupritha *et al*., 2017). Continuously exposing RBCs to hyperglycemia causes hemoglobin protein to be permanently glycated, which alters the hemoglobin molecule's structural and functional properties (Turpin *et al*., 2020). In addition to changing the mechanical properties and internal viscosity of RBCs, hyperglycemia also promotes aggregation and osmotic fragility. It also causes proteins to become glycated. The structure and hemodynamic properties of the erythrocyte are affected by these processes (Juhi, 2015; Li and Yang, 2018). These changes could be reflected in any or all of the red blood cell analytical measures, such as RBC count, HGB, HCT, MCV, MCH, and RDW.

A measurement of the size diversity of circulating erythrocytes is the red cell distribution width (RDW). In the differential diagnosis of macrocytic anemia, it is mostly utilized as an auxiliary index. A high RDW is linked to anemia caused by iron deficiency. According to a study, whether their RDW is higher or even within the normal reference range, middle-aged and older persons have a noticeably elevated risk of cardiovascular disease (CVD) events. (Anderson *et al*., 2007; Ani and Ovbiagele, 2009; Patel *et al*., 2009; Perlstein *et al*., 2007)

Materials and methods

2.1 Study Design

Patients who sought treatment at a private hospital participated in this cross-sectional study.

2.2 Study Area

At Port Harcourt, the state capital of Rivers State, a private hospital hosted this facility-based cross-sectional study. With a population of 1,865,000 and a location along the Bonny River, Port Harcourt is a metropolis in Nigeria's South-South geopolitical zone that is sometimes frequently referred to as the Niger Delta.

2.3 Study Population

In total, 100 male and female participants who were 50 years of age or older were included in this study. The other 50 test subjects, who functioned as controls and did not have diabetes mellitus, whereas the 50 others were diabetic patients.

2.4 Collection of Blood Samples, Storage and Transportation

Following the directions of Chesbrough's (Cheesbrough, 2010) blood samples were drawn from the veins using a vacutainer tube and needle and placed in EDTA anticoagulated bottles with clear labels. Following their immediate transfer to the lab, these samples were kept at 4°C until testing using a triple packing method.

2.5 Methodology

2.5.1 ABO Blood Grouping

Method: Grouping Cells Using Tiles

A white, flawless tile was divided into sections. In compartments 1, 2, and 3, one drop of anti-A serum, one drop each of anti-B and anti-AB serums, and one drop of the patient's serum was added (auto control). A single drop of 20% patient red blood cells that had been properly blended with an applicator stick was injected into each of the 4 compartments. After gently moving the tile, it was permitted to stand for three to five minutes. Within five minutes, the agglutination on

the tile was studied macroscopically and microscopically, with the results being read and recorded.

3 RESULTS

3.1 Demographic Details of Study Participants

The study included 100 individuals in total. Those with diabetes were 50, subjects without diabetes were 50. Males without diabetes were 25, while those with diabetes were 27. Females without diabetes were 28, while those with diabetes were 23. Details are shown in Table.1.

3.2 Frequency Distribution of on ABO Blood Group in Diabetic and Non Diabetic Subjects.

Table.2 revealed that blood group O had the greatest incidence of diabetes mellitus 25(50), followed in descending order by blood groups A 12(24), B 8(16), and AB 5 (10).

Table.1 Demographic Details of Study Participants

Parameters	Number
Total Number of Subjects	100
Total Number of Diabetic Subjects	50
Total Number of Non-Diabetic Subjects	50
Total Number of Diabetic Males	27
Total Number of Diabetic Females	23
Total Number of Diabetics with Blood Group A	25
Total Number of Diabetics with Blood Group B	17
Total Number of Diabetics with Blood Group AB	11
Total Number of Diabetics with Blood Group O	47

	Diabetic		Non-Diabetic			
Blood Group	Frequency	Percentage (%)	Frequency	Percentage (%)	Total Frequency	Total Percent (%)
A	12	12	13	13	25	25
B	8	8	9	9	17	17
AB	5	5	6	6	11	11
O	25	25	22	22	47	47

Table.2: Frequency Distribution of on ABO Blood Group in Diabetic and Non Diabetic Subjects.

DISCUSSION

Numerous researchers have attempted to find evidence of a connection between diabetics and specific ABO groupings. Variable, inconsistent, and regionally distinct outcomes have been obtained. Although some researchers have shown a link between blood types and diabetes, other studies have not been able to confirm this. (Sukalingam and Ganesan, 2015; Bener and Yousafzai, 2014; Dali and Aour, 2014; Moinzadeh *et al*., 2014).

This study's findings showed that blood group O, of which there was a total of 25 (50%), had the highest prevalence of diabetes mellitus. Blood group AB came in last with a total of 5 participants (10%), followed by blood group A with a total of 12 subjects (24%) and blood group B with a total of 8 subjects (16%) respectively. In this study, blood group O predominated over blood groups A and B (47% against 25% versus 17%, respectively). The least common blood type in this study was AB (11%). The findings of this study are at odds with a study by Waseem AG *et al*. (2012) that discovered diabetics had a higher likelihood of having blood type AB than non-diabetics. Blood types B (32%) and O (18%) showed the strongest and weakest links, respectively, with diabetes mellitus, according to a study by Zabida *et al*. (2021). There is a lot of

evidence connecting certain blood types, particularly the A, AB, and Rh-positive blood groups, to the condition of diabetes mellitus, according to Sidhu *et al*'s inquiry on the subject in 2018.

In their investigation on the relationship between ABO blood groups and diabetes mellitus, Muhammad *et al*. (2010) discovered a negative correlation between ABO blood groups A and O and diabetes, with A and O group having decreased risks of diabetes.

When ABO blood groups are compared to diabetic populations around the world, different blood groups are distributed in different ways.

This study found that blood types O and A were the most prevalent among diabetics, and these results were in line with those of studies conducted in Japan and other Sub-Saharan African nations. Other nations including Nigeria, Algeria, Qatar, and Iraq have the highest prevalence of blood group O. While the B blood group was the most prevalent blood group in nations like Malaysia, Italy, and Trinidad (Jayawardena et al., 2012).

Racial and geographic differences may have an impact on how the disease is expressed genetically could be one explanation for the contradictory findings about the link between ABO blood types and diabetes.

5. CONCLUSION

According to the results of our study, diabetics are more likely to have the blood types O and AB. We can infer that blood type might be a risk factor and might be helpful in determining the condition.

CONSENT AND ETHICAL APPROVAL

After receiving approval from the Department of Medical Laboratory Science at Rivers State University, Port Harcourt, informed consent was obtained from patients who appeared to be in good health prior to enrollment.

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