# Association between ABO, Rhesus Blood Groups, and Type II Diabetes Mellitus among the Urhobos

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*Authors' contributions*

*This work was carried out in collaboration between all authors. Author MOE carried out the bench work. Authors AAA and PRCE managed the Literature searches. Author REU performed the statistical analysis. Author MOO wrote and monitored the first draft of the manuscript, while author JCI designed and supervised the study. All authors read and approved the final manuscript.*

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## ABSTRACT

Typing of red blood cells is a prerequisite for blood transfusion. Blood types (A, B, AB and O) may be respectively distributed and transmitted by Ethnicity and Mendelian heredity. The goal of this study was to determine amongst the Urhobos, the possible association between the ABO/Rhesus blood groups and type II diabetes mellitus. To achieve this, a total of 410 (200 diabetic and 210 non-diabetic) subjects were randomly recruited within the Urhobos; ethnic nationalities in south-south geopolitical zone of Nigeria. Using syringe and EDTA, Blood samples were obtained from each subject for specific anti-sera test (anti-A, anti-B and anti-D). Using the chi-square test, statistical measure of association was performed on obtained data, with p-value < 0.05 adjudged

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as statistically significant. Upon careful observation, Study found no significant difference in the distribution of ABO blood group between Diabetics and Non-Diabetics (control) at p<0.05. Apparently, while diabetics had less distribution of blood group A (as against control), Blood group AB was commoner in non-diabetics. These observations were however, not statistically significant at p<0.05, as Blood groups B and O showed similar distribution in both groups respectively.

## 1. INTRODUCTION

There is now a formidable body of evidence to support the hypothesis that humans originated from Africa, and to inform the timescale of various migrations that have led to the world's population of today [1]. Simply by overlaying the known distribution of blood group frequencies on the world map of human migrations, the potential significance of genetic drift and founder effects is apparent [1]. Blood types do not just exist to create conversation between people; they actually have vital immunological functions. They help us fight diseases. A blood type (also called blood group) is a classification of blood based on the presence or absence of inherited antigenic substances on the surface of the red blood cells (RBCs). These antigens may be proteins, carbohydrates, glycoproteins, or glycolipids, depending on the blood group system [2].

In recent times, strong evidences exist to suggest an association between ABO blood group and certain diseases [3,4]. In peptic ulcer and gastric cancer for instance, Doll et al. had reported an uneven distribution of the ABO blood groups between respective sufferers [5]. Similarly, the intricacies in the aetiology of Diabetes mellitus (DM), especially secondary DM, has prompted recent investigations and findings that links it with such conditions as chronic pancreatitis, total pancreatectomy, Cushing syndrome and Acromegaly [6].

Diabetes Mellitus is old with man. Globally, there are different prevalent levels from country to country, race and ethnic groups. The International Diabetes Federation in its recent publication came up with prevalence and incidence values around different regions and countries of the world; with Nigeria showing 3.9% in its current database atlas.

This study aimed at determining the association between type II diabetes mellitus and ABO/Rhesus blood groups among the Urhobos. Specifically, study attempted to determine:

i. Blood groups of diabetic patients using ABO and Rhesus grouping systems.

ii. Blood groups of normal subjects using ABO and Rhesus grouping systems.
iii. The effect of gender on the relationship between type II diabetes mellitus and blood group (ABO and Rhesus).

## 2. MATERIALS AND METHODS

### 2.1 Study Area

Study was conducted at the Eku Baptist Government Hospital, Eku and Central Hospital, Ughelli, both in Delta State, Nigeria. Delta State is a 16,842 /km$^2$ area of land that lies approximately between Longitude $5^0$ 00 and $6^0$ 45′ East and Latitude $5^0$ 00 and $6^0$ 30′ North (National gazette, 2007). Within the state, the selected hospitals (aforementioned) are located in Ethiope East and Ughelli North Local government areas; each with an estimated population size as 202,712 and 309, 484 respectively [7].

### 2.2 Study Population

Study population was target at the Urhobos, an indigenous ethnic group of over 3 million + who are major residents of the study area.

### 2.3 Study Design

Study design was of the case study type, where subjects' ABO blood group patterns (Type II Diabetics) were determined and compared with those of normal healthy (control) group.

### 2.4 Selection Criteria

Non-type II diabetics (DM) patients were excluded from the study. Selection also excluded non- Urhobos, as well as subjects whose age were below 25 years.

### 2.5 Resources and Sources

#### 2.5.1 Humans

Using the simple random sampling technique, a total of four hundred and ten humans (410) were

recruited from selected hospitals within the Study areas.

The decision to sample 410 humans was informed by the Slovin's statistical relation:

$$SS = \frac{Z^2P \times (1 - P)}{C^2}$$

Where,

 SS = Sample Size
 Z  = confidence level as z-score (95% = 1.96 from z-table)
 P  = Population proportion variance. (Maximal at 0.5 from binomial distribution table)
 C  = Confidence interval or margin of error (0.05).

Above relation [8] returned a minimum of 384 samples for a minimal population size as 202,712, the towns under study.

### 2.5.2 Other resources

Syringes, EDTAs, white tiles, and antisera (anti-A, anti-B and anti-D) reagents were used to obtain blood samples and conduct agglutination tests for sampled subjects. In each case, new syringe and/or EDTA were applied for each subject.

## 2.6 Ethical Considerations

Ethical Approval was sourced from the Research and Ethics Committee of the Faculty of Basic Medical Sciences, College of Health Sciences, Delta State University, Abraka, Delta State. Prior to actual investigation (test), formal consent for eligible subjects was obtained.

## 2.7 Procedure

Using the simple random sampling technique, a total of 410 subjects were drawn (from the population) for the study. They comprised of 200 diabetics (male and female) and 210 non-diabetics (control); with non-diabetics accounting for 63 males and 147 females. For each subject, a syringe and needle were used to collect blood sample. Collected samples where then kept in an EDTA container to avoid quick coagulation. A white tile was then demarcated in to four (4) with each quadrant containing a drop of the sampled blood. ABO blood grouping was done by agglutination test, using anti-A, anti-B, and anti-D human sera. Since gender differences have not been known to exist in the ABO blood group type, obtained samples (from both males and females) were pooled for the analysis.

## 2.8 Statistical Analysis

Using Microsoft's Excel (version 14.0.4760.1000), Evaluation of collected data for statistical significance was made. Obtained data was for chi-square tests of independent variables, with P-values less than 0.05 adjudged as statistically significant.

## 3. RESULTS AND DISCUSSION

## 3.1 Results

Tables 1 through 6 (below) neatly presents obtained data for measured parameters, following careful sorting and analysis.

## 3.2 Discussion

This work associated the ABO/Rhesus blood group patterns and type II Diabetes Mellitus among the Urhobos. The Study found blood group O (54.63%) as most prevalent, followed by groups B (23.17%), A (19.51%), and lastly, AB (2.68%). Apparently, this is similar to the findings of Odokuma *et al[*9], who found corresponding predominance in similar order (O, B and AB). Current study also conforms to recent work in the Niger Delta, amongst the Benin ethnic group of Nigeria [10].

**Table 1. Distribution of ABO blood group amongst diabetics and non-diabetics (control)**

|  | A | B | AB | O | N | $X^2$ |
|---|---|---|---|---|---|---|
| Diabetics % (n) | 15.50 (31) | 24.00 (48) | 4.00 (08) | 56.0 (113) | 200 | 7.140 |
| Control % (n) | 23.33 (49) | 22.38 (47) | 1.42 (03) | 52.85 (111) | 210 | p > 0.05 |
| Total subjects | 19.51 (80) | 23.17 (95) | 2.68 (11) | 54.63 (224) | 410 | |

*Values are expressed as Mean of Percentage Distribution for Blood Groups. N = 410 = 200 Diabetics and 210 non-diabetics. Chi-square returned 7.140. Above table shows that Distribution of blood groups between diabetics and control was statistically insignificant at p>0.05*

**Table 2. Distribution of rhesus blood group in diabetics and non-diabetics (control)**

|  | $Rh^+$ | $Rh^-$ | N | $X^2$ |
|---|---|---|---|---|
| Diabetics % (n) | 96.50 (193) | 3.50 (07) | 200 | 0.000 |
| Control % (n) | 96.60 (203) | 3.33 (07) | 210 | p > 0.05 |
| Total subjects | 396 | 14 | 410 | |

*Values are expressed as Mean of Percentage Distribution for Blood Rhesus. N = 410 = 200 Diabetics and 210 non-diabetics. Chi-square returned 0.000. Above table shows that Distribution of blood Rhesus between diabetics and control was statistically insignificant at p>0.05*

**Table 3. Distribution of combined ABO and Rhesus positive blood group in diabetics and non-diabetics (control)**

|  | $A^+$ | $B^+$ | $AB^+$ | $O^+$ | N | $X^2$ |
|---|---|---|---|---|---|---|
| Diabetics % (n) | 15.00 (30) | 23.50 (47) | 3.50 (7) | 54.50(109) | 193 | 4.518 |
| Control % (n) | 21.62 (46) | 22.09(47) | 1.41(3) | 50.76(108) | 204 | p>0.05 |
| Total subjects | 76 | 14 | 10 | 217 | 397 | |

*Values are expressed as Mean of Percentage Distribution for Blood Group/Rhesus. N = 397 = 193 Diabetics and 204 non-diabetics. From the table, a Lower percentage of Diabetics had $A^+$ than control as data proved insignificant at p>0.05*

**Table 4. Distribution of combined ABO and rhesus negative blood group in diabetics and non-diabetics (control)**

|  | $A^-$ | $B^-$ | $AB^-$ | $O^-$ | N | $X^2$ |
|---|---|---|---|---|---|---|
| Diabetics % (n) | 0.50 (01) | 0.50 (01) | 0.50 (01) | 2.00(4) | 7 | 3.000 |
| Control % (n) | 1.41 (03) | 0.00(0) | 0.00(0) | 1.41(3) | 6 | p>0.05 |
| Total subjects | 76 | 14 | 10 | 217 | 13 | |

*Values are expressed as Mean of Percentage Distribution for Blood Group/Rhesus. N = 13 = 7 Diabetics and 6 non-diabetics. From the table, Chi-square returned 3.00,0 proving insignificant at p>0.05*

**Table 5. Distribution of combined ABO and Rhesus negative blood group in Type II diabetic and non-diabetic (control) male and female**

|  |  | $A^-$ | $B^-$ | $AB^-$ | $O^-$ | N | $X^2$ |
|---|---|---|---|---|---|---|---|
| Diabetics % (n) | Male | 0.50 (01) | 0.00 (0) | 0.00 (0) | 1.00 (2) | 3 | 10.651 |
|  | Female | 0.00 (0) | 0.50 (1) | 0.50 (1) | 0.50 (1) | 3 | |
| Control % (n) | Male | 0.95 (02) | 0.00 (0) | 0.00(0) | 0.48(1) | 3 | p>0.05 |
|  | Female | 1.43 (3) | 0.00 (0) | 0.00(0) | 0.95(2) | 5 | |
| Total Subjects |  | 6 | 1 | 1 | 6 | 14 | |

*Values are expressed as Mean of Percentage Distribution for Blood Group/Rhesus negative. N = 14 = 6 Diabetics and 8 non-diabetics. Chi-square returned 10.651, proving insignificant at p>0.05*

**Table 6. Distribution of combined ABO and rhesus positive blood group in type II diabetic and non-diabetic (control) male and female**

|  |  | $A^+$ | $B^+$ | $AB^+$ | $O^+$ | N | $X^2$ |
|---|---|---|---|---|---|---|---|
| Diabetics % (n) | Male | 5.00 (10) | 8.00 (16) | 1.50 (3) | 22.50 (45) | 74 | 5.333 |
|  | Female | 10.00 (20) | 15.50 (31) | 2.00 (4) | 32.50 (65) | 120 | |
| Control % (n) | Male | 6.67 (14) | 6.67 (14) | 0.48(1) | 14.76(31) | 60 | p>0.05 |
|  | Female | 14.29 (30) | 15.24 (32) | 0.95(2) | 37.14(78) | 142 | |
| Total subjects |  | 74 | 93 | 10 | 219 | 396 | |

*Values are expressed as Mean of Percentage Distribution for Blood Group/Rhesus negative. N = 396 = 194 Diabetics and 202 non-diabetics. Chi-square returned 5.333, proving insignificant at p>0.05*

Although the distribution of ABO blood groups varies from one population to the other, in most studies however, blood group O has also been reported as the predominant group. For

example, amongst the Caucasians and Blacks in the United States, 47.0% and 46.0% prevalence was respectively reported [11].

This study also found that rhesus positive group was predominant in about 96.59% cases. This as well, is in agreement with some previously published works [12,13,14].

For the combined ABO/Rh blood grouping, it was found that the most predominant group was O$^+$, which accounted for 52.93%, B$^+$ (22.93%), A$^+$ (18.54%), AB$^+$ (2.44%), O$^-$ (1.70%), A$^-$ (0.98%), and least being B$^-$ and AB$^-$ (0.24% each). This finding compares with that of Ladoke Akintola University, Ogbomoso [15], which found similar prevalence amongst inhabitants of Ogbomosho.

Diabetes Mellitus was observed to have occurred in all ABO/Rhesus blood groups. Many investigators have tried to identify a possible association between ABO & Rh blood groups and diabetes mellitus. The results have been variable, inconsistent and differed from one region to the other. Some people have identified an association (positive or negative) between blood groups and diabetes. But, there are studies were no association could be established. This study also revealed a lower percentage of blood group A among diabetic population as compared to control. This was however statistically insignificant as the rhesus blood grouping pattern among diabetics and control was found to be of similar distribution.

In this study, it was also observed that there was a gender effect in the distribution of blood group in male and female diabetics as compared to control. This is consistent with the finding of Okon et al. [16], and could be due to hormonal differences in gender as in male and females.

The findings from this study could be due to the fact that blood grouping (ABO or Rhesus) is basically determined. Diabetes is a multi-factorial trait. The aetiology of diabetes mellitus is complex and appears to involve inter-actions of genetic, immunological and environmental factors [17].

## 4. SOCIETAL ADVANTAGE OF STUDY

This study will be helpful to physicians and haematologists in the management of their patients and early diagnosis of diabetes mellitus while able to pre-empt the possibility of occurrence. Study will also add to the plethora of related literatures for which subsequent investigations on the ethnic group studied (Urhobos) may have basis.

## 5. CONCLUSION

This study found no significant difference in the distribution of ABO blood group between Diabetics and Non-Diabetics Urhobos. Apparently, while diabetics had less distribution of blood group A (as against control), Blood group AB was commoner in non-diabetics. These observations were however, insignificant as Blood groups B and O showed similar distribution in both groups respectively.

## 6. RECOMMENDATIONS

With increasing urbanization of our rural communities and the attendant increase incidence of diabetes mellitus, it is recommended that more work be done on the association of diabetes mellitus and other factors so as to raise the index of suspicion and thus early detection and management.

## CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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