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Blood Group O, Rhesus Factor Distribution and Relationship with Blood Pressure Indices

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Abstract:

Background and Aim: Blood group O which is reported as most prevalent of the ABO system has been associated with susceptibilities and levels of relative immunity to some diseases. Perhaps the presence of Antigen D might factor this phenotype. Thus, we investigated the distribution of Antigen D in blood group O subjects and the relationship with some blood pressure indices.

Methods: Palpatory and auscultatory methods were used to record systolic and diastolic blood pressures in 440 subjects aged 19 – 45 years, while blood groupings were with the standard antisera. The relationship between blood group O, Rhesus factor and the blood pressure parameters was analyzed statistically using SPSS Version 17.0

Results: The Student's t-Test analysis comparing the blood pressure parameters (in Mean \pm SD) of blood groups O⁺ and O⁻ subjects shows that both systolic and diastolic blood pressures were significantly ($p < 0.05$) lower in O⁺ subjects than O⁻. The observation was similar for all categories (general, within gender and between genders) of the population studied.

Conclusion: The presence of Antigen D (Rhesus factor) is associated with lower systolic and diastolic blood pressures in blood group O subjects.

Keywords: ABO blood group, Antigen D, Diastolic blood pressure, Systolic blood pressure

1. Introduction

The ABO blood group system has been the most clinically significant diagnostic feature for blood transfusion and tissue transplant in medical and hematological sciences.^[i] They have also been associated with susceptibilities and or some relative immunity to various diseases. For instance, the risk of developing gastric cancer was reported to be much higher for people with blood type A than those of blood group O. But people with blood group O had a greater risk of peptic ulcers.^[ii] Some studies in have shown that women with blood type A may have higher chances of becoming pregnant, while those of blood type O have twice as high chances than blood group A.^[iii] Women with blood type AB reportedly have double or triple risk of developing preeclampsia and those of blood type AB or B were reported to have high risk of developing ovarian cancer, while women with blood group O are vulnerable to norovirus which can cause vomiting and diarrhea. Recently, people with blood group O were reported to have lower risk of heart attacks but more common occurrence of epistaxis than other ABO blood groups.^[iv]

A particular study involving 5,777 members of 1068 Brazilian families reported higher diastolic blood pressure in subjects with blood group O than in their siblings with other ABO blood types.^[v] Meanwhile, blood group O has profoundly been reported as the most prevalent type among the ABO group in many populations' studies like India,^[vi] it is 53.8% in Argentina,^[vii] 58.5% in Mexico^[viii] and 52.9% in Nigeria.^[ix]

Sequel to these, the awareness on vulnerabilities and or relative immunity of this phenotype to diseases requires concentrated and concerted studies which may include exploring genetic investigations. This current study however, is focused on determining whether the presence of Antigen D in the blood group O subject could in any way factor in the eventual predispositions of the phenotype-subjects; specifically, as it relates to two blood pressure parameters, systolic blood pressure (SBP) and diastolic blood pressure (DBP).

2. Materials and Methods

A total of 900 Students aged 19 – 45 years from Niger Delta University, Bayelsa State Nigeria were randomly selected following the students' informed consent and approval of all procedures for the study by ethical committee of the University on experiment involving human subjects. A preliminary determination of ABO blood group of subjects was done and only those (440) who tested blood group O were further investigated.

2.1. Blood Pressure Measurement

The average of two recordings of systolic and diastolic blood pressures was taken from each subject with a mercury sphygmomanometer in the right upper limb and recorded in the resting supine position. Any tendencies for anxiety, fear, stress or activities that may affect the recordings were minimized.

2.2. Blood Grouping Procedure

Blood grouping was done; by collecting blood samples through finger prick under aseptic conditions and mixing the blood and normal saline to prepare red cell suspension. The suspension was then mixed with antisera anti-A, anti-B, Anti-D and covered with petri dish for 8 – 10 minutes. Blood group and Rhesus factor was determined by observing the presence or absence of agglutination under low-power objective microscope.^[ix]

3. Statistical Analysis

The SPSS Version 17.0 was used for statistical analysis and the Student's t-Test was applied to compare separately, the relationship between the blood group O Rhesus D positive (O⁺) and blood group O Rhesus D negative (O⁻) with the blood pressure parameters. This comparison was also done within and between genders.

4. Results

The preliminary determination of prevalence of the ABO blood group in the study population shows that blood group O is the most abundant (48.9%), followed by B > A > AB as shown in Table 1. Generally, among the blood group O subjects, those with Rhesus D antigen were more (84.9%) than Rhesus negative (15.1%), Table 2. The comparison of the Rhesus O phenotypes in relation to diastolic and systolic blood pressures across various categories shows that; in general blood group O⁺ subjects had lower systolic and diastolic blood pressures than O⁻ (Table 2), Gender-wise, within male (Table 5) and within female (Table 6) the trend was similar showing lower systolic and diastolic blood pressures in O⁺ subjects than O⁻. However, between genders male O⁻ had higher systolic and diastolic blood pressures than female O⁻ (Table 4), and male O⁺ had higher systolic blood pressure than female O⁺ but male O⁺ had lower diastolic blood pressure than female O⁺ (Table 3). All observations were significant at $p < 0.05$.

Blood group	A	B	AB	O
Frequency	200	233	27	440
Percentage	22.2%	25.9%	3%	48.9%

Table 1: Prevalence of ABO blood group in the study population

Difference is significant at $p < 0.05$

Blood group O	Percentage %	Mean DBP \pm SD (mmHg)	Mean SBP \pm SD (mmHg)
O ⁺	84.1	83.9 \pm 11.2	120.1 \pm 23.9
O ⁻	15.9	90.0 \pm 14.1	141.4 \pm 25.2

Table 2: Distribution of Rhesus factor in blood group O subjects and relationship with blood pressure parameters

Difference is significant at $p < 0.05$

Blood group O ⁺	Percentage %	Mean DBP \pm SD (mmHg)	Mean SBP \pm SD (mmHg)
Male	29.7	83.7 \pm 11.0	131.2 \pm 23.7
Female	70.3	85.2 \pm 9.7	116.9 \pm 24.8

Table 3: Distribution of blood group O⁺ between gender and relationship with blood pressure parameters

Difference is significant at $p < 0.05$

Blood group O ⁻	Percentage %	Mean DBP \pm SD (mmHg)	Mean SBP \pm SD (mmHg)
Male	42.9	93.3 \pm 20.8	153.0 \pm 19.2
Female	57.1	85.0 \pm 5.77	130.8 \pm 25.7

Table 4: Distribution of blood group O⁻ between gender and relationship with blood pressure parameters

Difference is significant at $p < 0.05$

Male	Percentage %	Mean DBP \pm SD (mmHg)	Mean SBP \pm SD (mmHg)
O ⁺	78.6	83.7 \pm 11.0	131.2 \pm 23.7
O ⁻	21.4	93.3 \pm 20.8	153.0 \pm 19.2

Table 5: Distribution of Rhesus factor within Male gender and relationship with blood pressure parameters
Difference is significant at $p < 0.05$

Female	Percentage %	Mean DBP \pm SD (mmHg)	Mean SBP \pm SD (mmHg)
O ⁺	86.7	84.1 \pm 9.7	116.9 \pm 24.8
O ⁻	13.3	85.0 \pm 5.77	130.8 \pm 25.7

Table 6: Distribution of Rhesus factor within Female gender and relationship with blood pressure parameters
Difference is significant at $p < 0.05$

5. Discussion

A Preliminary ABO blood group investigation was done with 900 subjects aged 19 – 45 years among whom blood group O was most abundant (48.9%), followed by B (25.9%) > A (22.2%) > AB (3%). The predominance of blood group O in this research agrees with the studies of Varghese, Pacheco-ciano, Quiroga, Kulgami and their teams [v,vi,vii,viii] as well as a previous study by our team. [x] Further investigation for Antigen D presence among these blood group O subjects shows that those with Rhesus D antigen (O⁺) were predominant in the general population (84.1%) and within gender; male (78.6%) and female (86.7%).

Systolic blood pressure is a measurement of blood vessel pressure when the heart beats, while diastolic blood pressure measures the pressure between heartbeats, and where the force of blood flowing through the arteries is too high, it results in high blood pressure or hypertension. [xi] When we compared the systolic and diastolic blood pressures in both Rhesus types of the blood group O subjects generally, we observed significantly lower levels of these indices in the O⁺ subjects than O⁻. This trend was similar in the comparison within male and female gender. Although there is no exclusive concerted study on this, a recent report involving only male hypertensive subjects in which researchers observed non-significance in the occurrence of more O⁺ subjects with lower systolic blood pressure than O⁻ [vi] and the observation from this current study may be clue to elucidating a clinically relevant vista of physiological event. Studies have shown that the RH locus has two structural genes the *RHD* gene which encodes the RhD protein with the D antigen (and variants) and the *RHCE* gene which encodes the RhCE protein with the C, E, c and e antigens (and variants); inferring possibility of some genetic interactions in blood pressure levels. [xii, xiii]. Very recently researchers working on genome association analysis have begun to identify novel blood pressure loci offering biological insights into cardiovascular risk. [xiv] Perhaps the Antigen D may have genetic interactions associated with the quantitative outcome of the blood pressure indices measured, in such a way that blood pressure tend to be lower in blood group O subjects that have inherited the Antigen D (rhesus positive) phenotype.

In the comparison between genders, male O⁻ had higher systolic and diastolic blood pressures than female O⁻, and male O⁺ had higher systolic blood pressure than female O⁺; it is possible that some overriding factors (not elucidated) may be associated with masculinity in raising blood pressure, such that in the presence or absence of Antigen D, the systolic blood pressure of male blood group O subject was higher than female.

6. Conclusion

The current study suggests that Antigen D contributes to reducing levels of blood pressure indices (systolic and diastolic) in blood group O subjects; generally, and within gender, but not between genders in which case some overriding factors may be responsible. Further investigation is recommended to elucidate these mechanisms.

7. Limitations of the Study

The current work did not investigate heart rate and or cardiac output alongside possible genetic interaction of antigen D which is also a hereditary phenotype. However, the clinical relevance of the finding is not limited.

8. Acknowledgement

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9. Conflict of Interest

We declare that there is no conflict of interest regarding this work

10. References

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