# Association of ABO blood groups with prothrombin time and activated prothrombin time of medical students of Niger Delta University, Bayelsa state.

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**Abstract:**

**Introduction**
The intricate relationship between blood group characteristics and various physiological processes has been a subject of considerable scientific interest. Among the myriad of physiological phenomena, the association between ABO blood groups and coagulation parameters, such as prothrombin time (PT) and activated partial thromboplastin time (APTT), stands out as a compelling area of investigation.
**Materials and method**
This study was a cross sectional survey-based study conducted in the Department of Human Physiology of University of Port Harcourt. The study made use of a sample size of 171 male and female undergraduate medical students of the Niger Delta University, Bayelsa State. A multi-stage (involving stratified and random sampling) sampling technique was used for the study.
**Results**
The result indicated that the females had significantly ($P<0.05$) higher prothrombin time (PT) than their male counterparts, while the males were found to have higher activated prothrombin time (aPPT) than their female counterparts. Again, blood group AB was found to have the highest aPPT, followed by blood group O, then group A while group B had the least. On the other hand, blood group A was found to have the prothrombin time, followed by AB, then group O while group B had the least value. Blood group B was therefore found to have the least prothrombin time and activated prothrombin time among the studied subjects.
**Conclusion**
This research has provided valuable insights into the variations in prothrombin time and activated prothrombin time among different ABO blood groups and gender.

**Keywords:** Blood group, prothrombin time, activated prothrombin time, respondents and gender.

## Introduction

The ABO blood group system, a fundamental aspect of human genetics, has garnered increasing attention for its potential influence on various physiological processes, including hemostasis. Hemostasis, the intricate balance between bleeding and clotting, is governed by a series of tightly regulated mechanisms, among which prothrombin time (PT) and activated partial thromboplastin time (APTT) serve as critical indicators (Perry, 1995). This study seeks to unravel the interconnection between ABO blood groups and these key coagulation parameters within the context of medical students of Niger Delta University, Bayelsa State.



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The ABO blood group system, discovered by Karl Landsteiner in the early 20th century, categorizes individuals into four major groups—A, B, AB, and O—based on the presence or absence of specific antigens on the surface of red blood cells. While the primary function of blood typing traditionally revolves around transfusion compatibility and organ transplantation, emerging research suggests broader implications for health and disease.

The coagulation cascade, a complex series of events involving numerous proteins and enzymes, plays a pivotal role in maintaining vascular integrity. Prothrombin time, a measure of the extrinsic pathway, and activated partial thromboplastin time, reflecting the intrinsic pathway, offer insights into the efficiency and effectiveness of clot formation. Variations in these parameters among individuals with different ABO blood groups may signify distinct hemostatic profiles, presenting an intriguing avenue for exploration (O'Donnell et al.,2001).

Studies investigating the association between ABO blood groups and coagulation parameters have yielded diverse findings, indicating the need for population-specific research. The unique genetic and environmental factors influencing the Niger Delta region's medical student population necessitate a targeted examination. As the region exhibits distinct genetic diversity and environmental factors, understanding how these elements intersect with hemostatic regulation could have implications for both clinical practice and population health.

By focusing on the medical students of Niger Delta University in Bayelsa State, this study aims to contribute to the scarce body of literature on this specific demographic. The outcomes of this research may not only enrich our understanding of the intricate relationship between ABO blood groups and coagulation dynamics but also provide a foundation for tailoring medical interventions and preventive strategies in this unique population

**Materials and Method**

This study was a cross sectional survey-based study that involved only human subjects: Medical students of the Niger Delta University in Bayelsa State. A multi-stage (involving stratified and random sampling) sampling technique was used for the study. The study was conducted in the Human Physiology Department of University of Port Harcourt. Data collection was done for a period of six months from January 2023 to June 2023. A sample size of 171 subjects were randomly selected for the study. This number is made up of 76 males and 95 females

**Inclusion Criteria**

1. Male and female subjects with the age group of 19–39 years
2. Subjects who have signed the consent form
3. Individuals without any history of bleeding disorder
4. Individuals who are not on medications that affect blood clotting (e.g. anticoagulants and non-steroidal anti-inflammatory drugs)
5. Women who are not pregnant
6. Apparently healthy individuals
7. Individuals who have not received blood transfusion within the previous three months

**Exclusion Criteria**

The following individuals were excluded from the study:

1. Drug addict and alcoholic people
2. The Elderly
3. Individuals with any history of bleeding disorder
4. Individuals on medications that affect blood clotting e.g., anticoagulants and non-steroidal anti-inflammatory drugs



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5. Pregnant women
6. Individuals who are sick
7. Individuals who have received blood transfusion within the previous three months

**Method of Data collection**

**Biodata-** The sex and age of all subjects were recorded

**Anthropometry** – The weight of subjects was determined using a weighing scale while their height was measured using a standiometer. The body mass index of subjects was then calculated using their weight and height.

Blood group were determined using the standard antisera method. Blood sample was taken from the subject by finger prick with sterile lancet after cleaning the puncture site with spirit. The sample blood was then mixed with anti-A and anti-B. Blood groups were determined on basis of presence or absence of agglutination. agglutination was confirmed by observing slide under low power objective of a compound microscope (Pal et al., 2010).

**Prothrombin time (PT)** was determined using the manual method as follows. The required volume of PT reagent used was removed from the vial and incubated for 10 min at 37°C. Hundred microliters of the test plasma was added into a tube and incubated at 37°C for 3 min. Two hundred microliters of the pre-incubated PT reagent was rapidly added and the timer was started. The time taken for clot to form was recorded.

**Activated partial thromboplastin (APTT)** was also determined using the manual method as follows. The required volume of calcium chloride reagent was removed and incubated for 10 min at 37°C. The required volume of APTT reagent was removed from the vial and brought to room temperature.

**Method of Data Analysis**

The numerical data obtained from the present study were statistically analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0. The level of statistical significance was determined using one-way analysis of variance (ANOVA) and thereafter post-Hoc multiple comparison test and Chi-square analyses for association. The P-values less than 0.05 was considered statistically significant. And the values were expressed as mean ± standard error of mean (SEM) and frequencies/percentages accordingly.

## RESULTS AND DISCUSSION

### RESULTS

**Table 1: Average Age, BMI, Prothrombin time and Activated prothrombin time of all respondents**

| Variables | N | Mean ± S.E.M | Minimum | Maximum |
|---|---|---|---|---|
| **Age (years)** | 173 | 23.32 ± 0.31 | 19.00 | 38.00 |
| **BMI (kg/m$^2$)** | 173 | 23.62 ± 0.34 | 16.90 | 38.46 |
| **aPTT (s)** | 173 | 37.68 ± 0.60 | 19.05 | 53.60 |
| **Prothrombin time (s)** | 173 | 14.07 ± 0.19 | 10.18 | 40.00 |

Data is presented as Mean ±S.E.M



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**Table 2: Gender variations with the haemostatic variables of respondents**

| Variables | Male (N=76) | Female (N=95) | Difference (*p* value) |
|---|---|---|---|
| **aPTT (s)** | 38.16 ± 0.94 | 37.32 ± 0.77 | 0.485 |
| **Prothrombin time (s)** | 13.59 ± 0.17 | 14.45 ± 0.31 | 0.027* |

Data is presented as Mean ±S.E.M, * means significantly different ($p < 0.05$).

**Table 3: Mean Variation of ABO blood group and haemostatic parameters of the subjects.**

| | Blood group | | | |
|---|---|---|---|---|
| | **A (N=33)** | **B (N=35)** | **AB (N=5)** | **O (N=99)** |
| **aPTT (s)** | 35.39 ± 1.10 | 33.84 ± 1.22 | 40.09 ± 2.84 | 39.66 ± 0.80 |
| **Prothrombin time (s)** | 15.61 ± 0.16 | 13.28 ± 0.27 | 14.90 ± 0.57 | 13.78 ± 0.30 |

Data is presented as Mean ±S.E.M

**Table 4: Association between activated prothrombin time (aPTT) and Subjects' Blood Type**

| **Blood Type** | | | | | **Total (n=171)** | **Chi-Square Test Outcome** |
|---|---|---|---|---|---|---|
| | **Male (n=76)** | | **Female (n=95** | | | $X^2$= 89.67[a] df=9 P=0.00 |
| | **<30sec** | **≥30sec** | **<30sec** | **≥30sec** | | |
| **A** | 1(1.32) | 3(3.95) | 3(3.16) | 29(30.52 | 36 | |
| **B** | 5(6.58) | 14(18.42) | 3(3.16) | 13(13.68) | 35 | |
| **AB** | 0(0.00) | 5(6.58) | 0(0.00) | 0(0.00) | 5 | |
| **O** | 4(5.26) | 44(57.89) | 10(10.53) | 37(38.95) | 95 | |

**Table 5: Association between Prothrombin Time (PT) and Subjects' Blood Type**



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| Blood Type | Male (n=76) | | Female (n=95 | | Total (n=171) | Chi-Square Test Outcome |
|---|---|---|---|---|---|---|
| | <12sec | ≥12sec | <12sec | ≥12sec | | $X^2$= 19.23[a] df=3 P=0.00 |
| A | 0(0.00) | 4(5.26) | 0(0.00) | 53(55.79) | 57 | |
| B | 1(1.32) | 18(23.68) | 2(2.11) | 23(24.21) | 44 | |
| AB | 0(0.00) | 5(6.58) | 0(0.00) | 0(0.00) | 5 | |
| O | 2(2.63) | 46(60.53) | 3(3.16) | 14(14.74) | 65 | |

**Discussion of findings**

**Gender variations with haemostatic variables of subjects**

Table 2 presents the data on gender variations with haemostatic variables of the respondents**.** The mean prothrombin time of the female subjects were seen to be significantly higher ($p<0.05$) than those of the male subjects. However, the activated prothrombin time (aPTT) was seen to be slightly higher in the male subjects than the female subjects but this difference was not statistically significant.

The observed significant difference in mean prothrombin time between female and male subjects suggests a gender-related variation in the coagulation profile. This finding aligns with existing literature, which often reports differences in coagulation parameters between males and females. Several studies have demonstrated that females tend to have a longer prothrombin time compared to males, possibly due to hormonal influences, such as estrogen, which can affect coagulation factors (Hooper, 2002; Rosendaal et al., 1993).

Again, Fourel et al. (1993), reported that sex has a significant influence on activated prothrombin time (APTT), with lower mean values in females (30.9 s) than in males (31.6 s), while Abdullah et al. (2013) and Aral et al. (2011) suggested that PT levels differ between ages and gender. Our study found a significant variation ($P\leq0.05$) in APTT and PT when both genders were compared.

Furthermore,

The slightly higher activated prothrombin time (aPTT) in male subjects, although not statistically significant, introduces an interesting nuance to the results. While aPTT is generally considered a sensitive indicator of the intrinsic and common pathways of the coagulation cascade, various factors, including hormonal fluctuations and medication use, can influence aPTT values (Kitchen et al., 2010). The lack of statistical significance in the observed difference may be attributed to the complexity of these factors and the need for a larger sample size to detect subtle variations.

**Mean Variation of ABO blood group and haemostatic parameters of the subjects.**



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Displayed in Table 3 is the data on the relationship between ABO blood groups and haemostatic parameters of the study respondents. When considering the activated prothrombin time (aPTT), blood group AB had the highest value (40.09 seconds), followed by blood group O (39.66 seconds) and then group A (35.39 seconds) and finally blood group B (33.84 seconds). The consideration of the prothrombin time (PT) on the other hand, revealed that blood group A had the highest value (15.61 seconds), followed by blood group AB (14.90 seconds), then blood group O (13.78 seconds) and finally blood group B (13.28 seconds). From the results, it was therefore found that blood group B had the least prothrombin time and activated prothrombin time, when compared with the other blood groups. Activated prothrombin time (aPTT) is a sensitive indicator of the intrinsic and common pathways of the coagulation cascade. The result obtained here might be attributed to variations in the levels of coagulation factors or inhibitors associated with each blood group. While blood group O is often associated with lower levels of von Willebrand factor and factor VIII (Sodetz et al., 1976), blood group AB individuals may have different coagulation factor levels, leading to a prolonged aPTT.

Prothrombin time (PT), which primarily assesses the extrinsic pathway of the coagulation cascade, follows a different pattern (highest to lowest: A > AB > O > B). The observed differences in PT could be linked to variations in the levels of factors such as prothrombin and factors VII, X, V, and II, which are involved in the extrinsic pathway. Research by Sodetz et al. (1976) has indicated that blood group A is associated with higher levels of prothrombin and factors VII and X compared to blood group O. This finding may have clinical implications, as individuals with blood group B could potentially have a lower risk of bleeding or clotting events compared to individuals with other blood groups.

**Association between activated prothrombin time (aPTT) and Subjects' Blood Type**

Displayed in Table 4 is the data on the relationship between the various ABO blood groups and the activated prothrombin time (aPTT) of the subjects. There was a significant difference between the activated prothrombin time of the male and female subjects. Among the male subjects, 44% of blood group O,14% of group B, 5% of group AB and 3% of group A, all have an activated prothrombin time ≥ 30seconds, while 5% of blood group B, 4% of blood group O, 1% of blood group A and O% of blood group AB, all have an activated prothrombin time < 30seconds. Among the female subjects, 37% of blood group O, 29% of group A, 13% of group B and 0% of group AB, all have an activated prothrombin time ≥ 30seconds, while 10% of blood group O, 3% of blood group A, 3% of blood group B and O% of blood group AB, all have an activated prothrombin time < 30seconds

The results revealed that among the male subjects, blood group O showed a significantly higher activated prothrombin time (APTT) when compared with non-O blood groups. This agreed with the works done by Choi et al. (2015) and Fourel et al. (1993) that APTT was significantly prolonged in those with type O blood group compared with those with type non-O. A higher APTT may suggest that the concerned individuals may be more likely to be predisposed to bleeding conditions. According to Robert et al. (2006), group O individuals have the tendency to bleed and non-O blood groups to thrombose; thus, individuals with O blood group have less risk of Venous thromboembolism (VTE) when compared with the individuals of other blood groups (A, B, and AB). A lower APTT level on non-O blood group individuals may also be linked to the association of non-O blood group having an increased risk of coronary heart disease (Franchini et al., 2012) and VTE (Ohira et al., 2007).

**Association between Prothrombin Time (PT) and Subjects' Blood Type**

Table 5 contains the results of the association between prothrombin time (PT) and blood Type of the subjects. There was a significant difference between the prothrombin time of the male and female subjects. Among the male subjects, 46% of blood group O,18% of group B, 5% of group AB and 4% of group A, all have an activated prothrombin time ≥ 12seconds, while 2% of blood group O, 1% of blood group B, 0% of blood group A and 0% of blood group AB, all have an activated prothrombin time < 12seconds. Among the female subjects, 53% of blood group A, 23% of group B, 14% of group O and 0% of group AB, all have a prothrombin time ≥ 12seconds, while



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3% of blood group O, 2% of blood group B, 0% of blood group A and O% of blood group AB, all have an activated prothrombin time < 12seconds.

The relationship between prothrombin time (PT) and ABO blood group has been studied, and there is evidence to suggest that certain blood groups may influence clotting factors and coagulation pathways. However, it is imperative to note that the relationship is complex, and research findings may vary.

Several studies have explored the association between ABO blood group and prothrombin time, and some have reported differences in clotting times among different blood groups. For example, Gebbink (2021), carried out research on the topic "Tissue-type plasminogen activator-mediated plasminogen activation and contact activation, implications in and beyond haemostasis". The results pf this research, published in the "Journal of Thrombosis and Haemostasis" found that individuals with blood group O had longer prothrombin time (PT) values compared to those with blood groups A, B, or AB. Another study carried out by Elena et al., (2014) on "Evaluation of a procoagulant phospholipid functional assay as a routine test for measuring circulating microparticle activity and published in the journal of "Blood Coagulation & Fibrinolysis" suggested that blood group O individuals might have lower levels of certain clotting factors, which could contribute to prolonged PT.

The mechanism behind any potential association is not fully understood, and further research is needed to establish a clear and consistent relationship. It is also worthy of note that prothrombin time is just one aspect of the coagulation cascade, and various factors, including genetic and environmental factors, can influence clotting times.

**Conclusion**

This research has provided valuable insights into the variations in prothrombin time and activated prothrombin time among different ABO blood groups and gender. The findings reveal distinct patterns based on gender and blood groups.

Firstly, the study highlights a significant difference in prothrombin time between male and female subjects, with females exhibiting a significantly higher prothrombin time. Conversely, activated prothrombin time is higher in male subjects compared to females. These gender-specific variations underscore the importance of considering sex-based differences in the interpretation of coagulation parameters.

Moreover, the investigation into blood groups has uncovered intriguing results. Blood group AB demonstrates a higher activated prothrombin time compared to other blood groups, suggesting a potential link between specific blood types and the coagulation process. Conversely, blood group B exhibits the least activated prothrombin time, while blood group A shows the highest prothrombin time among the blood groups studied. These blood group-related differences may have implications for understanding individual variations in clotting mechanisms.

In light of these findings, future research could delve deeper into the underlying physiological mechanisms that contribute to the observed variations in prothrombin time and activated prothrombin time among the various ABO blood groups. Additionally, exploring the clinical implications of these differences could provide valuable information for personalized healthcare and medical interventions.

**Consent**

The consent of the respondents was sought and obtained.

**Ethical Approval**

The ethical approval to carry out this work was sought for and obtained from the ethics and research committee of the University of Port Harcourt and preserved by the author(s).

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**Competing interests**

Authors have declared that no competing interests exist.

**Authors' contributions**

Author Dabirilagha, O.F conceived the study, designed the protocol and contributed in the manuscript writing while author Ojeka, S.O, coordinated the experiment, carried out the laboratory procedures. Finally, author Zabbey, V. Z performed the statistical analysis and data interpretation. All authors read through and approved the final manuscript.

**References**

Abdullah S, Hatice B, Sedat A, Bahadir O, Husametin V, Ali U (2013). Effect of gender and age on the prothrombin time (PT), activated partial thromboplastin time (aPTT) levels and international normalized ratio (INR). Adv Technol Sci Int J Mevlana Med Sci,1:27-29

Aral H, Usta M, Cilingirturk AM, Inal BB, Bilgi PT, Guvenen G. (2011). Verifying reference intervals for coagulation tests by using stored data. Scand J Clin Lab Invest.71:647-52.

Choi Q, Kim JE, Kim SY, Han KS, Kim HK. (2015). Influence of ABO type on global coagulation assay results: Effect of coagulation factor VIII. Clin Chem Lab Med, 53 (25):1425-1432

Elena Campello , Luca Spiezia, Claudia M Radu, Sabrina Gavasso, Barry Woodhams, Paolo Simioni (2014). Evaluation of a procoagulant phospholipid functional assay as a routine test for measuring circulating microparticle activity. Blood Coagul Fibrinolysis, 25(5):534-537.

Fourel V, Gabastou JM, Desroys du Roure F, Ehrhardt N, Robert A (1993). Influence of age, sex and ABO blood group on activated partial thromboplastin time. Haemostasis, 23(26); 321-326.

Hooper, W. C. (2002). Hemostatic differences between men and women. In Seminars in Thrombosis and Hemostasis, 28 (5):397-407. Thieme Medical Publishers.

Kitchen, S.(2010). Quality assurance and quality control of thrombosis and hemostasis testing in clinical laboratories: the UK NEQAS experience. Seminars in Thrombosis and Hemostasis, 36(07), 757-765.

O'Donnell, J., Boulton, F. E., & Manning, R. A. (2001). Lest we forget the FV test: a clinical commentary. Journal of Clinical Pathology, 54(12): 972–973.

Ohira T, Cushman M, Tsai MY, Zhang Y, Heckbert SR, Zakai NA (2007). ABO blood group, other risk factors and incidence of venous thromboembolism: The longitudinal investigation of thromboembolism etiology (LITE). J Thromb Haemost., 5:1455-1461

Perry, D. J. (1995). Factor V Leiden. Thrombosis and Haemostasis, 73(1), 1–6.

Rosendaal, F. R. (1993). High levels of factor IX increase the risk of venous thrombosis. Blood, 81(12), 3271-3275.

Robert A, Aillaud MF, Eschwège V, Randrianjohany A, Scarabin Y, Juhan-Vague I. (2000). ABO blood group and risk of venous thrombosis in heterozygous carriers of factor V Leiden. Thromb Haemost, 83(27):630-631.

Sodetz, J. M. (1976). Blood group-related differences in the concentration and circulating complexes of Hageman factor (factor XII) and prekallikrein. Blood, 47(2), 213-220.



http://dx.doi.org/10.31364/SCIRJ/v12.i01.2024.P0124977

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