

INFLUENCE OF ABO BLOOD GROUP ON COAGULATION PROFILE OF DONORS AT SABHA CENTRAL BLOOD BANKNaser M. Alaasswad¹, Buthaina M. Khalfalah² and Albashir M. Yhmed^{2*}¹Department of Medical Laboratory Science, Faculty of Medical Technology, Sebha University, Libya.²Department of Medical Laboratory Science, Faculty of Medical Technology, Wadi Alshatti University, Libya.

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ABSTRACT

Introduction: Due to the effect of ABO blood groups on the level of factor VIII in plasma, it is also likely to effect on fibrinogen levels, thrombin generation time, and partial prothrombin time. **Objectives:** This study aims to evaluate the relationship between ABO blood groups and coagulation profile. **Materials and Methods:** This study was conducted on 152 blood donors who frequented the Sebha Central Blood Bank in the period of time (from February 15 to March 15). Prothrombin Time (PT), partial thromboplastin time (APTT) and fibrinogen were measured as well as determining the blood group for each sample, along with measuring weight, height and blood pressure. **Results:** The results showed that, there were no significant differences in age among the sample of the studied groups, and that none of the donors suffered from underweight. The results showed an increase in the level of APTT and PT in people with blood group AB compared to other blood groups, with a lower concentration of fibrinogen factor. **Conclusions:** The results of this study conclude that, people with blood group AB are less likely to have coagulopathies than other blood groups.

KEYWORDS: ABO blood groups, Prothrombin Time, partial thromboplastin time, fibrinogen and coagulopathies.

INTRODUCTION

The primary role of the hemostatic system is to maintain blood in a fluid state under normal conditions, and reduces blood loss by stopping bleeding at sites of vascular injury. This is done through a complex network of reactions in which dozens of components play different roles. Uncontrolled activation of these organs and components may lead to obstruction of the vascular system, i.e. thrombosis and embolism. On the other hand, serious bleeding occurs if the hemostatic system fails.^[1]

There is a close relationship between ABO blood types and the risk of venous thromboembolism^{[2][3]}, coronary heart disease^{[2][4]} and atherosclerosis.^{[5][6]} Some studies have shown increased bleeding in people with blood type O.^{[7][8]}, as well as in patients with hereditary bleeding disorders, and this is due to the fact that individuals with blood type O have a constant overrepresentation of this disorders.^{[7][9]} ABO blood types may also represent a link between cardiovascular risk and cognitive function, as a recent study showed that AB blood type and high FVIII are associated with an increased incidence of cognitive impairment.^[10]

Many studies have shown the relationship between different blood types (ABO) and bleeding, as it has been proven that some patients who carry certain blood types

are at risk of bleeding from different sites in the body. Partial thromboplastin time (APTT) and prothrombin time (PT) play a role in the clotting process within the body.^[11]

Blood is known as a connective tissue that contains a number of blood cells (red blood cells, white blood cells, and platelets). After studies, it was noted that this tissue contains in its liquid part a number of antibodies that do not have antigens on its blood cells, which was the first step to discovering the types. Blood cells. In 1900, the scientist Karl Landsteiner discovered the ABO blood groups by observing that when substances were placed on the blood cells, they became agglutinated, and by mixing some different bloods, clotting also occurred. The reason for this aggregation was the presence of antigens on the surface of the red blood cells that had antibodies in the sera of different people. The fourth blood group, AB, was discovered by Alfred von DeCastello and Adriano Storli in 1902. After studies followed, it was known that these antigens located on the wall of red cells are a carbohydrate complex that differs in the sugar end and genetic location on the chromosome. They are located on chromosomes 9 and 19 and are inherited. As genetic traits from parents to offspring.^{[12][13]}

The distribution rate of ABO and Rh blood groups varies significantly with geographic and ethnic differences. Among American Caucasians, the predominant blood group is O (45%), followed by group A (41%), then B (10%), and finally AB (4%). Native American Indians belong to Rounding off blood group O, these distributions converge with the distribution of blood groups in Western Europe, where group O represented the highest percentage (46%), followed by group A (42%), then B (9%) and AB (3%). While in Eastern Europe, the predominant blood type was B (40%)^[11], and in Australia and Britain, the most common blood types were O and A, followed by B and AB. In the Indo-Pakistani subcontinent, the greatest prevalence of blood types was B and O groups^[3], while in Bangladesh, the most common blood type is blood group B (34.4%), followed by group O (30.4%), then A (26.7%), and type AB was the least among blood groups(8.6%).^[4]

MATERIALS AND METHODS

This study was conducted on 152 blood donors who visited the Sabha Central Blood Bank during the time period (from February 15 to March 15). They were divided into blood group (O) with 53 samples, blood group (A) with 44 samples, and blood group (B) with 34 samples, and blood type (AB) with 21 samples.

In this study, any donor who had a medical history or genetic factor with bleeding disorders was excluded, as well as any person taking medications. A 5-6 ml of venous blood was drawn from each donor and divided into two tubes, one containing the anticoagulant Tri sodium citrate for the purpose of obtaining plasma containing clotting factor proteins, and the other containing the anticoagulant Ethylene Diamine Tetra

Acetic Acid (EDTA) to determine the types of blood group, Complete Blood Count (CBC). The weight, height, and blood pressure of each donor were attached to the blood samples. After collecting the samples, they were worked on directly.

To measure coagulation factors (fibrinogen, prothrombin time, and activated partial thromboplastin time), ready-reagent from BIOMEDICA were used. As for determining blood types, the reagent used were from DELMA, and the SPSS system was used to conduct statistical analysis.

RESULTS

ABO blood groups

ABO blood groups are important in coagulation studies, and tests are usually performed to determine whether the difference in ABO blood group antigen affects the internal and external pathways of coagulation factors. The results of this study showed that blood group type O was predominant among the individuals in the study sample (53 samples), followed by blood group A (44 samples), then type B (34 samples), while blood group AB was the least group among the study samples (21 samples).

Age

This study was conducted with the aim of studying the relationship between donor blood groups types and some coagulation factors. The results showed that the mean age of the total study group was 47.9±12.8 years. As shown in Table 1, statistical analysis showed that, there were no significant differences in age between the blood group samples studied.

Table 1: Shows the average age of donor samples (152 samples).

Blood group	(O)	(A)	(B)	(AB)
Age(years)±SD	35±8.8	33.5±8.4	36.3±10.6	33.7±8.3

Body Mass Index (BMI)

The results of BMI measurement showed that the average BMI for the total study group was 26.3% ± 4.6. Based on the (BMI) values, the participants were classified into four groups.

- 1.Underweight group.
- 2.Normal-weight group.
- 3.Overweight group.
- 4.Obese group.

The results showed that, there were none of the donors suffered from being underweight, and that 70 (46%) of the donors had a normal healthy weight, and 58 (38%) of the donors were overweight, while the remaining 24 (16%) of the donors were suffering from of obesity as shown in (Table 2. Statistically, the results did not show any significant differences between the different blood type groups.

Table 2: Shows the body mass index of donor samples (152 samples).

	(O)	(A)	(B)	(AB)
Underweight	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Normal weight N=70 (46.0%)	20 (37.7%)	25 (56.8%)	14 (41.2%)	11 (52.5%)
Overweight N=58 (38.0%)	23 (43.4%)	14 (31.8%)	13 (38.2%)	8 (38.0%)
Obese N=24 (16.0%)	10 (18.9%)	5 (11.4%)	7 (20.6%)	2 (9.5%)

Blood Pressure Results

The systolic and diastolic pressures of the study sample were measured before the blood donation process, and the results showed that the average systolic pressure for the study sample was 133.4 ± 16.3 , while the average

diastolic pressure was 79.4 ± 9.4 . Performing statistical analysis showed that there was no significant difference in blood pressure between donors in the different groups. As shown in Table 3.

Table 3: Shows the systolic and diastolic pressures of 152.

	Average systolic pressure 133.4±16.3	Average diastolic pressure 79.4 ± 9.4
O group	134.2±16.1	80.8±12.5
A group	137.5±19.9	80.2±13.4
B group	129.6±14.6	79.4±11.4
AB group	126.4±7.6	75.5±9.1

Haematological profile results for the studied group (152)

Table (4) shows the results of the complete blood count (CBC) for the study sample (152 donors), where the hemoglobin concentration was 13.5 ± 1.5 g/dl, which is

within the normal range of hemoglobin concentration level according to the World Health Organization (WHO) classification (13 g/dl). RBC (5.3 ± 0.5 /mm³) MCV (85.1 ± 3.7 fl), Hematocrit ($44.5 \pm 4.2\%$), MCH (28.3 ± 1.5 pg/cell), and the MCHC ($33.0 \pm 0.8\%$).

Table 4: shows the complete blood count of (152).

PARAMETER	RESULT
Haemoglobin (g/dl)	15.5 ± 1.3
Red blood cells (10 ⁶ cells/mm ³)	5.3 ± 0.5
White blood cells (10 ³ cells/mm ³)	8.8 ± 1.4
Platelets count (10 ³ cells/mm ³)	214.1 ± 69.3
Hematocrit (%)	44.5 ± 4.2
MCV (fl)	85.1 ± 3.7
MCH (pg/cell)	28.3 ± 1.5
MCHC (%)	33.0 ± 0.8

Study of the complete blood count among different study groups

The results showed that the number of platelets in the O blood group was 215.9 ± 53.8 , (A)group 219.9 ± 53.4 , (B) blood group 222.6 ± 56.1 and in the AB blood group was 228.9 ± 87.6 . By conducting statistical analysis, it was

found that, there were no significant differences when comparing the groups to each other, as in Figure No. (5). The results also showed that there were no significant differences for the rest of the blood indicators studied, as shown in Table 5.

Table 5; shows the complete blood count of different blood groups.

	(O) Group	(A) Group	(B) Group	(AB) Group
Hb(g/dl)	15.7 ± 1.4	15.5 ± 1.2	15.3 ± 1.1	15.2 ± 1.1
RBC (10⁶ /mm³)	5.6 ± 0.6	5.0 ± 0.5	5.2 ± 0.3	5.4 ± 0.5
WBC (10³ /mm³)	6.3 ± 1.6	5.3 ± 1.4	6 ± 0.9	5.8 ± 1.2
PLT (10³ /mm³)	215 ± 53.8	219.9 ± 53.4	222.6 ± 565.1	228.9 ± 87.6
Hematocrit (%)	46.5 ± 5.0	42.1 ± 3.7	42.1 ± 3.9	44.1 ± 2.4
MCV (fl)	84.0 ± 3.9	84.4 ± 2.4	86.9 ± 3.2	85.7 ± 2.2
MCH (pg/cell)	27.8 ± 1.7	28.0 ± 1.2	29.0 ± 1.4	27.0 ± 1.7
MCHC (%)	33.0 ± 0.8	32.0 ± 0.7	34.2 ± 0.8	34.6 ± 0.7

Coagulation profile study results

Prothrombin Time (PT)

The results for the studied samples (152) showed that the average (PT) was 15.3 ± 0.8 seconds, and that blood group AB had the highest average time, 16.2 ± 1.2 seconds. The statistical analysis showed that there were significant differences when was compared to blood type O, where the average PT for its group of samples was 15.2 ± 0.8 seconds ($P = 0.002$) and for blood type A, whose average PT was 15.3 ± 0.8 seconds ($P = 0.004$),

and the average PT for blood type B was 15.3 ± 1.1 seconds ($P = 0.02$), as shown in Figure 1, while the results showed there were no significant differences when comparing the rest of the groups to each other.

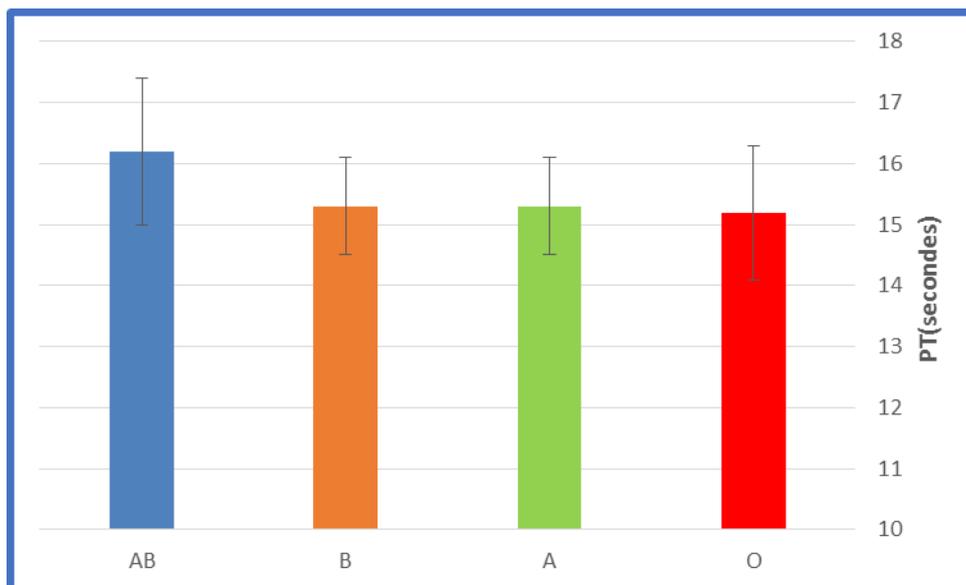


Figure 1: Shows The Average Prothrombin Time (PT) For The Blood Groups Samples.

Partial thromboplastin time (APTT)

The APTT results for the (152) samples showed that, the average APTT was 42.2 ± 5.3 seconds, and that the blood group (AB) had the highest average APTT (44.7 ± 6.3 second). Statistically, there were no significant differences when compared to the other blood types: O

42.9 ± 5.2 ($P=1.00$), for blood type B 41.2 ± 4.5 ($P=0.193$), and for blood type A 40.8 ± 4.8 ($P=0.057$) as shown in Figure 2, while the results showed that there were no significant differences when comparing the rest of the groups to each other.

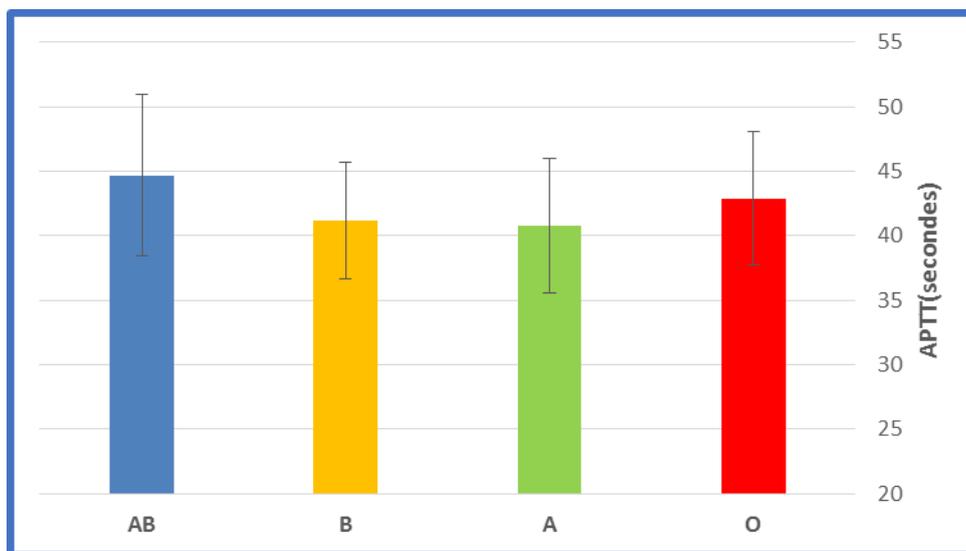


Figure 2: shows the average partial thromboplastin time (APTT) for the blood groups samples.

The results of fibrinogen concentration (Fib)

Fibrinogen (Fib) results for the studied samples (152) showed that its average concentration reached 368.3 ± 101.2 . The result in figure (3) shown that, blood group (AB) had the lowest Fib concentration, 289.5 ± 75.2 . The statistical analysis showed that there was significant decrease when compared with blood type (O) 379.7 ± 111.4 ($P=0.007$), and with blood type (A) 386.0 ± 86.7 ($P=0.004$) and with blood type (B) 366.7 ± 91.8 ($P=0.02$) as is, while the results showed that there were no significant differences when comparing the rest of the groups to each other.

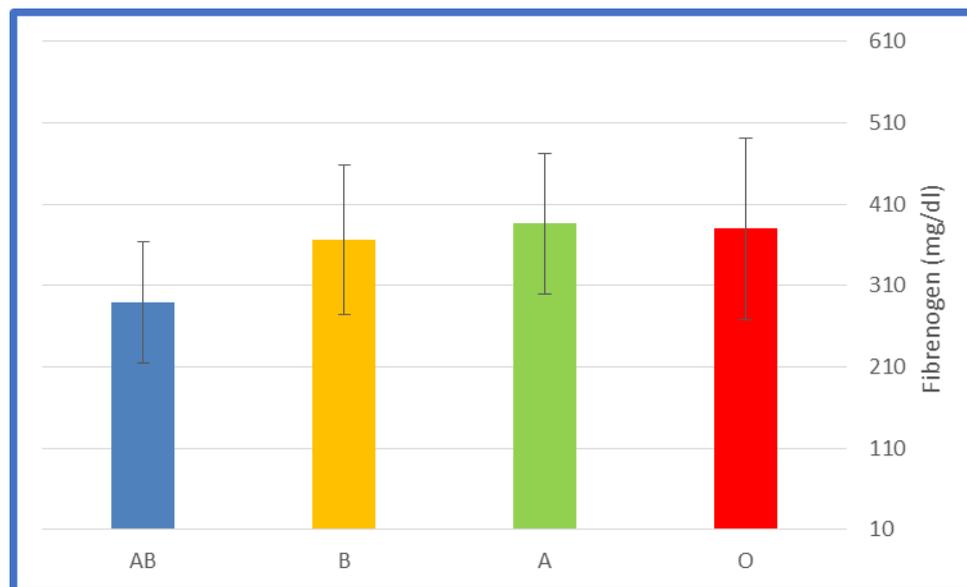


Figure 3: Shows The Fibrinogen Concentration In The Blood Groups.

DISCUSSION

The ABO blood group is considered important in coagulation studies, and the tests are usually performed to determine whether the difference in the type of ABO blood group antigen affects the internal and external pathway of coagulation factors.^[14] This study turned out that, the O blood group was the predominant blood type among the study sample members (53 samples), followed by (A - 44 samples), then (B -34 samples) while blood group AB was the least among the groups (21 samples). This distribution of blood group types matches the results that obtained by other studies.^{[14][15]} However, in Pakistan, there was a slight difference in the results, as the O blood group was the predominant one, but the next in prevalence was the B blood group, then the A blood group, and then the blood group AB.^[16] Moreover, in the study conducted by Azad and his colleagues, the results were completely different, as it was found that blood group B had the highest presence, followed by type O, then type A, followed by type AB.^[17] The frequency of ABO blood groups varies among different populations around the world; the highest frequency of ABO is found mainly in Northern and Central Europe, and B in Central Asia, while blood group O is the most common blood group worldwide, with some parts of Africa and Australia.^[18] This difference and variation in results may be due to genetic or environmental factors.

The effect of age on the blood coagulation profile

The results of this study showed that, there were no significant differences between the average age of the study sample in the different types of blood groups, and therefore there is no effect of age on the blood coagulation profile, and this is consistent with the results obtained from the study conducted by Wang and his colleagues.^[19]

Body mass index and blood groups

BMI is considered a risk factor for many diseases, and therefore it has become important to examine the relationship between ABO blood groups and BMI.^[16]

The results of this study did not find a significant differences between BMI and blood group types, this result is consistent with the results obtained by other studies.^{[16][20][21]}

No association study at the genetic level has proven that the genes that cause high BMI are located in the same chromosomal region that determines the ABO blood group or that the gene encoding the blood group antigens exerts regulatory control over them. Thus, it can be said that the genetic basis for the association of ABO blood groups with BMI is not present enough.^[16]

The prothrombin time and partial thromboplastin on ABO

Measuring the PT and APTT are considered indicators of hemostasis and give insight into the hemostasis state. These tests are usually used to detect whether there is a deficiency in clotting factors.^{[7][22]} This is due to the type of blood ABO affects the level of factor VIII in plasma.^[9] It is known that the PT test is a functional test for blood clotting, and it is a test that evaluates the external and common coagulation pathways. It is normal for there to be an increase in the PT if there is a deficiency of one of the common clotting factors in the external and common coagulation pathways (I, II, V, VII), and it is also known that ABO blood group antigens bind to clotting factor VIII and von Willebrand factor and have no connection or effect on other clotting factors, and therefore it is assumed that the PT time does not differ between ABO blood groups.^{[17][23]}

This study showed a variation between individuals of the blood groups in the study sample, as a higher level of PT

and APTT were observed in people with blood type AB compared to other blood groups, the study conducted by Al-Sayed and Amin in 2015, showed that, the PT was significantly higher in the AB blood group compared to the rest of the other types (ABO).^[24]

In contrast to current study the results obtained by other studies showed that there was an increase in the APTT for blood type O, as for the PT was the highest for blood group A compared to other blood types.^{[9][14]} Another studies showed that, there was a significant increase in the APTT in people with blood type O compared to other groups, while there was no clear difference in the PT between the blood groups.^{[19][25]} This difference may be due to differences in the extrinsic and common pathways of clotting factors in different ethnicities.^[15]

Fibrinogen and blood group types

It became clear from the results obtained in this study that, the AB blood group had the lowest concentration of fibrinogen compared to the concentration of fibrinogen of the rest of blood groups (A, B and O). This result was not agreed with the results obtained by other studies, which proved that, there were no effect of ABO blood groups on the level of fibrinogen concentration between different blood groups.^{[19][25]}

CONCLUSION

The present study revealed a significantly high prothrombin time, and partial thromboplastin and lower fibrinogen concentration in AB blood group participants than in (O, A and AB) blood group individuals, indicating a possible lower risk of developing coagulopathies in individuals with blood type AB compared with the rest of the other blood groups individuals.

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