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Original article

Relation Between Anemia and ABO Blood Group in Pregnant Women: Retrospective Observational Study in Tobruk, Libya

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ABSTRACT

Anemia is one of the most common complications related to pregnancy. Normal physiologic changes in pregnancy affect the hemoglobin (Hb), and there is a relative or absolute reduction in Hb concentration. The purpose of this study was to evaluate the incidence of anemia among pregnant women and its relation to blood group and occurrence of anemia, so that preventive measures can be taken to combat anemia in women who are more susceptible to it. The retrospective study was conducted on 2469 pregnant who are in the age group of 18-45 years in Tobruk Medical Center. Blood samples were determined using tube method using antisera A, B and D and the Hemoglobin concentration analysis was estimated using Sysmex XP-300. In our study we found that women with blood group A+ and O+ (36%) were more prone for anemia, followed by B+ (20%), AB+ (7 %). Chi-square value exhibited 26.538 with a p-value of 0.143 which was showing non-significant (> 0.05) association between anemia and all blood groups. We can conclude that pregnant with blood groups A and O were more prone to anemia followed by blood group B and least with blood group AB. Additional research is required to determine the causes and related factors of anemia among pregnant women. The exact mechanisms behind the relationship between ABO blood group and anemia are not fully understood. However, it is hypothesized that the antibodies produced by different blood groups may interact with red blood cells in ways that impact their lifespan or production. Understanding this relationship is crucial for developing targeted interventions to manage anemia in pregnant women, ensuring better maternal and fetal health outcomes.

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INTRODUCTION

Anaemia during pregnancy is a series of public health and nutrition problems confronting the world nowadays, specifically in middle and low-resource countries (1, 2). It occurs at all ages, especially in children and pregnant women (3). Gestational anaemia can lead to many serious consequences and increase the risk of adverse maternal and perinatal outcomes, Including peripartum transfusion, maternal death, maternal infection, preterm birth and low birth weight, in addition to neurodevelopmental disorders among children (4). According to the World Health Organization (WHO), anaemia in pregnancy is developed when haemoglobin (Hb) levels are reduced to <11g/dL with a haematocrit of <0.33/L (5). Anemia affects 36% of all pregnant women especially those between 15–49 years of age in developed countries

whereas 42.6% in developing countries (6). Several reasons lead to gestational anemia such as multiple pregnancy, shorter intervals period between pregnancy and lack of nutrition, which is the major cause of anaemia specially the most common anemia is iron deficiency anemia (7).

Due to the various effects of anaemia on both mothers and their fetuses (8), it's necessary to know the suitable treatment for anaemia. One of the most common treatments is iron therapy, which is the first line of treatment for iron deficiency anaemia during gestation (9, 10). However, the long use of iron may lead to many side effects. Blood transfusion becomes an appropriate treatment for anemia and avoids many side effects resulting from iron therapy (10). The ABO Blood group system was discovered by Karl Landsteiner in 1900 whereas, Landsteiner and Alexander Wiener discovered the RH system in 1940 (11, 12). These systems play a critical role in hematological, blood transfusion and immunological diseases. Each person has a various blood category, which is determined by the inherited genetic present on the surface of the erythrocyte. These antigens do not alter through life in healthy people (13). The International Society of Blood Transfusion (ISBT) recently found 43 blood group systems containing 345 red cell antigens (14). For instance, studies have shown that women with blood group O are more prone to anemia compared to those with other blood groups (15). This could be due to the presence of specific antibodies in blood group O individuals that affect red blood cell production or survival. The mechanisms behind this association are not entirely clear, but it is hypothesized that the antibodies produced by different blood groups may interact with red blood cells in ways that impact their lifespan or production. Understanding this relationship is crucial as it can help in developing targeted interventions to manage anemia in pregnant women, ensuring better maternal and fetal health outcomes.

The most significant blood groups are A, B, AB, and O with either Rh positive or negative. Each blood groups have a specific antibody present in the plasma: for example, blood group A has A antigens on the red blood corpuscle and has anti-B antibodies against blood group B. Whereas blood group B—has B antigens with anti-A antibodies in the plasma. Blood group O—has no A or B antigens, but both anti-A and anti-B antibodies in the plasma, and blood group AB—has both A and B antigens, but no antibodies (16). The objectives of this study were to determine the prevalence of anaemia among pregnant subjects and to find the relationship of low levels of haemoglobin and ABO blood type in pregnant women.

METHODS

Study setting

This study included all participants admitted to the department of obstetrics and gynecology in Tobruk medical center in 2021. Data was collected by filling out a predesigned Performa with demographic and clinical data.

Sample collection

The blood sample was collected using antecubital vein puncture of blood and drained in EDTA and plain containers. Blood haemoglobin levels were estimated by using Sysmex analysis. The haemoglobin levels were displayed digitally. The values were recorded. ABO typing was determined by (Forward or direct method).

Statistical analysis

The data were included in a database and analysed by SPSS software (version. 20). The Chi-square test was used and a p-value < 0.05 was regarded as statistically significant

RESULTS

This retrospective investigation entailed examining laboratory data of the blood groups and haematological parameters of all pregnant women from January 2021 to December 2021. A total of 6124 pregnant female patients, aged between 18 and 45 years, were admitted to the Department of Obstetrics and Gynecology at Tobruk Medical Center. Among these, 2469 pregnant women were diagnosed with anaemia, with a mean age of 30.42± 6.75 years. The study participants were categorized into three distinct age groups: group 1 (18-30 years), group 2 (31-40 years), and group 3 (over 40 years), with the distribution of age groups being 198 (8%), 923 (37%), and 1348 (55%), respectively (Table 1). The highest prevalence of anaemia was observed in Group 1 (54.6%), followed by Group 2 (37.4%), while Group 3 exhibited the lowest prevalence (8.0%). The overall prevalence of anaemia within the study population was determined to be 40.3%, as illustrated in figure 1.

Table 1. Distribution of the anemic pregnancy according to age (n = 2469)

Age (years)	No.	%
Group A (18 - 30)	1348	54.6
Group B (31 - 40)	923	37.4
Group C (>40)	198	8.0
Min. – Max.	16.0 – 48.0	
Mean ± SD.	30.42 ± 6.75	
Median (IQR)	30.0 (25.0 – 35.0)	

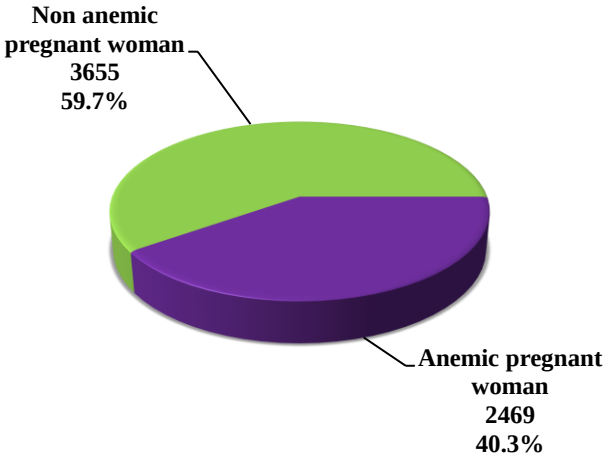

Figure 1. Prevalence of anemia in pregnant woman (n = 6124)

The distribution of the blood groups A, B, O and AB is illustrated in table 2. The most prevalent blood group was O+ (32.1%) followed by A+ (30.5%), B (18.5 %) respectively. Rh+ positive remains dominant (87.4%) and (12 %) had Rh-negative antigen (Table 2).

Table 2. Distribution of the studied cases according to blood groups and Rh D (n = 2469)

Rh blood group	*Blood groups*	*No.*	*%*
Rh D positive 2160 (87.4%)	***O+***	***793***	***32.1***
	O-	***116***	***4.7***
	A+	***753***	***30.5***
	A-	***118***	***4.8***
Rh D positive (309) (12 %)	***B+***	***457***	***18.5***
	B-	***53***	***2.1***
	AB+	***157***	***6.4***
	AB-	***22***	***0.9***

The results indicate that there was no relationship between haemoglobin levels (anaemia) and blood types (p=0.143) (Table 3).

Table 3. Relation between blood groups and Hb (n = 2469)

Blood groups	*Anaemia*								χ^2	^{MC}p
	Normal (≥11) (n = 415)		**Mild (10-10.9) (n = 1190)**		**Moderate (7-9.9) (n = 840)**		**Severe (<7) (n = 24)**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
O+	131	31.6	387	32.5	269	32.0	6	25.0	26.538	0.143
O-	14	3.4	65	5.5	36	4.3	1	4.2		
A+	137	33.0	354	29.7	253	30.1	9	37.5		
A-	27	6.5	45	3.8	46	5.5	0	0.0		
B+	66	15.9	232	19.5	156	18.6	3	12.5		
B-	12	2.9	22	1.8	18	2.1	1	4.2		
AB+	23	5.5	77	6.5	55	6.5	2	8.3		
AB-	5	1.2	8	0.7	7	0.8	2	8.3		

Table 4 show that Mean level and an interquartile range of haemoglobin in all types of blood groups participated in this study; there was insignificant p-value between the blood groups and haemoglobin levels.

Table 4. Relation between blood groups and Hb (n = 2469)

Hb (g/dl)	Blood groups								*H*	*p*
	O+ (n = 793)	O- (n = 116)	A+ (n = 753)	A- (n = 118)	B+ (n = 457)	B- (n = 53)	AB+ (n = 157)	AB- (n = 22)		
Mean ± SD.	9.77±0.9	9.76±0.9	9.77±1.0	9.73±1.0	9.78±0.9	9.82±1.1	9.72±1.0	9.42±1.7	1.877	0.966
Median (Min. – Max.)	10(5–11)	10 (6.40–11)	10(4–11)	10(7–11)	10(6–11)	10 (5.50–11)	10 (5.50–11)	10(4–11)		

DISCUSSION

Anaemia constitutes a significant global public health challenge, impacting nations across both developing and developed spectrums, and it carries profound implications for human health alongside social and economic advancement. According to the World Health Organization (WHO) database, the prevalence of anaemia worldwide affects approximately 1.62 billion individuals (95% of cases), which equates to 24.8% of the overall population (16, 17).

In the current investigation, it was determined that blood groups A and O exhibited heightened susceptibility to the onset of iron deficiency anaemia among pregnant women The most common anaemic women (54.6%) were seen in the age group of (18-30) years. Younger mothers (mean age of 28.4±6.12 years) displayed elevated incidences of both iron deficiency anaemia (IDA) and nutritional deficits in comparison to their older counterparts. A positive correlation was identified between malnutrition and serum ferritin levels, suggesting that as malnutrition escalated, serum ferritin concentrations also tended to rise (18, 19). Anaemia was found to be more prevalent among individuals with blood group B, while it was less frequently observed in those with the AB blood group. The distribution pattern conformed to the North Indian demographic: B > O > A > AB. The AB blood group demonstrated an increased vulnerability to anaemia. Females exhibited a higher likelihood of being anaemic, which may be attributable to diminished red cell mass influenced by elevated estrogen levels (20). It was observed that individuals possessing blood groups B, A, or AB are particularly susceptible to anaemia. Conversely, individuals with blood group O displayed a relative resistance to anaemia, despite the widespread occurrence of O groups within the general population (21). It has been established that anaemia is significantly prevalent during the gestational period, with a prevalence rate ranging from 75% to 95% (22). The average age of the pregnant cohort was 30 years ± 5.8 SD (with ages ranging from 18 to 45 years). Among this group, 48.4% of pregnant women were aged between 21 and 30 years, 40.8% fell within the 31 to 40 year age bracket, 5.8% were over 40 years old, and 5% were under 20 years of age (23). The correlation between the prevalence of anaemia and ABO blood group in pregnant women in developing countries remains underexplored, as existing studies primarily focus on the overall prevalence and associated risk factors rather than specific blood group associations. Anaemia affects a significant proportion of pregnant women in these regions, with prevalence rates ranging from 28.8% to 63% (24). (24, 25). Factors contributing to anaemia include low socioeconomic status, lack of iron and folic acid supplementation, and rural residency (26). Notably, the prevalence of anaemia is higher among women from lower-income backgrounds and those with limited access to healthcare (27).

The findings of this study indicate a correlation between ABO blood group classification and the incidence of anaemia and found that insignificant correlation between blood group and anaemia as well as haemoglobin. Therefore, it can be posited that consistent consumption of a diet rich in iron and vitamins among individuals classified as blood groups A, O, B, and AB may serve as a preventative measure against the onset of anaemia.The timely identification and proficient management of anaemia during gestation can significantly decrease childhood and adolescent undernutrition and enhance adult stature.

CONCLUSION

We find that the pregnant women with blood groups A and O are at high risk of anaemia, followed by those with group B, while group AB shows the lowest risk. Future studies can be done among larger population and more than one year to support the information and to find out what type of anemia the particular blood group individuals are prone to and to measure the attitude and awareness of pregnant about anemia. The relationship between anaemia and ABO blood group in pregnant women is a complex and multifaceted issue. While some studies suggest a higher prevalence of anemia in certain blood groups, the underlying mechanisms remain unclear. Continued research in this area is essential

for developing effective strategies to address anemia in pregnancy and improve health outcomes for both mothers and their babies

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Conflicts of Interest
The authors declare that they have no conflict of interest

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العلاقة بين فقر الدم وفصيلة الدم ABO لدى النساء الحوامل؛ دراسة رصدية استرجاعية (طبرق- ليبيا)

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قسم المختبرات الطبية، كلية التقنية الطبية، جامعة طبرق، ليبيا

المستخلص

فقر الدم هو أحد المضـــاعفات الأكثر شـــيوعًا المرتبطة بالحمل. تؤثر التغيرات الفســـيولوجية الطبيعية أثناء الحمل على الهيموجلوبين، ويحدث انخفاض نسبي أو مطلق في تركيز الهيموجلوبين. هدفت هذه الدراسة إلى تقييم معدل الإصابة بفقر الدم بين النســـاء الحوامل وعلاقته بفصـــيلة الدم وحدوث فقر الدم، حتى يمكن اتخاذ التدابير الوقائية لمكافحة فقر الدم لدى النساء الأكثر عرضـة للإصـابة به. أجريت الدراسـة بأثر رجعي على 2469 امرأة حامل تتراوح أعمارهن بين 18 و 45 سنة في مركز طبرق الطبي، وتم تحديد عينات الدم باستخدام طريقة الأنبوب باستخدام المصل المضاد A و B و D وتم تقدير تحليل تركيز الهيموجلوبين باستخدام جهاز Sysmex XP-300. في دراستنا وجدنا أن النساء من فصيلة الدم A+ و 36%) O+) كن أكثر عرضـــة للإصـــابة بفقر الدم، يليهن 20%) B+) و 7%) AB+). أظهرت قيمة مربع كاي 26.538 مع قيمة 0.143 p والتي أظهرت ارتباطًا غير مهم (< 0.05) بين فقر الدم وجميع فصائل الدم. يمكننا أن نستنتج أن الحوامل من فصيلة الدم A و O أكثر عرضـة للإصـابة بفقر الدم، يليهن فصـيلة الدم B وأقل عرضـة للإصـابة بفصـيلة الدم AB. هناك حاجة إلى مزيد من البحث لتحديد أســـباب وعوامل فقر الدم المرتبطة به بين النســـاء الحوامل.إن الآلية الدقيقة وراء العلاقة بين فصيلة الدم ABO وفقر الدم ليست مفهومة بالكامل. ومع ذلك، يُفترض أن الأجسام المضادة التي تنتجها فصـــائل الدم المختلفة قد تتفاعل مع خلايا الدم الحمراء بطرق تؤثر على عمرها أو إنتاجها. إن فهم هذه العلاقة أمر بالغ الأهمية لتطوير تدخلات مستهدفة لإدارة فقر الدم لدى النساء الحوامل، وضمان نتائج أفضل لصحة الأم والجنين.

الكلمات الدالة. فقر الدم، الهيموجلوبين، التركيز، ABO، فصيلة الدم.