

**A RELATION BETWEEN ABO BLOOD GROUP AND RH GROUP  
WITH HYPERTENSION DISORDER AMONG PREGNANT WOMEN  
ATTENDING AN ANTENATAL CLINIC IN KARKH MATERNITY  
HOSPITAL IN BAGHDAD**

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**ABSTRACT**

Objective To examine the association between ABO and RhD blood groups and gestational hypertensive disorders among pregnant women attending an antenatal clinic in Karkh Maternity Hospital. And Identify the Risks of gestational hypertensive disorders, pre-eclampsia, and severe pre-eclampsia, estimated by odds ratios for maternal ABO blood group and RhD status. The total number of women was 400 women. The results of our study indicate that that more than half of the study sample (64,75%) have B blood group, 3% A, 10% AB, and 22,25% O respectively.

**KEYWORD:** ABO Blood, RH group, hypertension disorder, pregnant women.

**INTRODUCTION**

The blood group represents a system of antigenic determinants found on the surface of blood cells. ABO blood group was the first system to be described and remains most significant in transfusion medicine. The blood group antigens play a critical role in susceptibility to many infections. Landsteiner discovered three blood groups A, B, and O in 1900. Identification AB was done in 1902 by decastello and Struli.<sup>[1]</sup>

In humans, 26 blood Group systems with 228 antigens have been Identified. The genes for A and B blood group found on chromosome 9p and expressed in Mandalian co-dominant manner suggested by Epstein and Outenberg 1905. There exist racial and community

differences in the distribution of blood groups in the different country. The first time the correlation between the blood groups and diseases was given in the year 1953.<sup>[2]</sup>

Gestational hypertensive disorders are the leading cause of maternal mortality in developed countries, and are responsible for approximately 16% of all maternal deaths.<sup>[3]</sup>

Most of these deaths are attributed to pre-eclampsia, especially when the condition progresses into severe pre-eclampsia or eclampsia. With the improvement in the early diagnosis of pre-eclampsia and better accessibility to antenatal care, diagnosis of pre-eclampsia has increased during the last two decades in many developed countries, with a rate of approximately 3% of pregnancies in the USA, and more than 4% in Norway.<sup>[4]</sup>

The hypertensive disorders of pregnancy are the leading cause of maternal and perinatal mortality and morbidity internationally (WHO 2011 & Mishra and Pradhan 2013). Moreover, Hypertension complicates approximately 10% of all pregnancies worldwide. Also, pregnancy induced hypertension (PIH) is a multifactorial pregnancy- specific syndrome affecting 5-15% of pregnant women. The exact cause is not known, thought to be multifactorial. ABO blood groups are known to be associated with many disorders in this study we try to find out its association with PIH.<sup>[5]</sup>

Everyday around 800 women dies from preventable causes related to pregnancy and childbirth. Maternal deaths occur as a result of complications during and following pregnancy and childbirth, most develop during pregnancy. Other complications prior to pregnancy are worsened during it. Major complications (around 75%) of maternal deaths include severe bleeding (mostly bleeding after childbirth), infections (usually after childbirth), and high blood pressure during pregnancy, and complications from delivery unsafe abortion.<sup>[6]</sup>

These improvements in diagnosis have not yet been accompanied by a substantial reduction in the case fatality rates, and the etiology of this disease is still poorly understood. However, it is suspected that pre-eclampsia may result from changes in vascular ischaemic function, which can be influenced by ABO blood group.<sup>[7]</sup>

Although some case-control studies have shown a higher risk of pre-eclampsia for blood group AB.<sup>[8]</sup> a meta-analysis in 2008 concluded that the risks for pre-eclampsia were not significantly different in pregnant women with the different ABO blood groups. However, the 17 studies included in this meta-analysis had substantial limitations that make it difficult to

collectively interpret the available studies. Problems included: relatively small sample sizes (14) of 17 studies had <400 cases, a lack of recent data (11 out of 17 studies were conducted before 1990; a lack of control for any potential confounding factors; and non-uniform case definitions of pre-eclampsia.

In addition, the various ethnic origins and differential ABO blood group distributions of the study subjects in the meta-analysis, covering six European countries, two countries from the Middle East, and the USA, could have resulted in further heterogeneity of associations. For all studies in the metaanalysis, the risk of pre-eclampsia in each blood group was estimated by comparison with all other blood groups combined (e.g. blood group A versus non-A), which would be expected to dilute any association.

PIH is defined as hypertension (blood pressure  $\geq 140/90$  mmHg) with or without proteinuria ( $\geq 300$  mg/24 hours) that emerges after 20 weeks gestation, but resolves up to 12 weeks postpartum. It is also defined as new onset proteinuria ( $\geq 300$  mg/24 hours) in hypertensive women exhibiting no proteinuria before 20 weeks gestation (Pillitteri, 2014).<sup>[9]</sup> Risk factors with PIH development include the previous history of PIH, preexisting diabetes multiple pregnancies, null parity, previously raised blood pressure and raised body mass index before pregnancy (Reshmarani, et al, 2014). Blood group antigens are not only important in relation to blood transfusion and organ transplantation, but also have been utilised in genetic research, anthropology and tracing ancestral relation of humans. (Khan M, Ahmed Z, et al, 2010).<sup>[10]</sup> Keeping this in view, the present study was designed to see frequency (%) of blood group type among hypertensive pregnant women in our population attending an antenatal clinic, and to assess the relationship. In view of the blood group is a risk factor for PIH, the suggested mechanism is that the inherited thrombophilias may increase the risk for PIH. Increased plasma concentrations of coagulation factors may result in prothrombotic effect, triggering or exacerbating the pathophysiologic events that result in preeclampsia.<sup>[11]</sup>

Pregnancy induced hypertension (PIH) is the most frequent complication in pregnancy after the 20th week of gestation. This form of hypertension is classified as preeclampsia and gestational hypertension (GH). PE develops in 4-5% of human pregnancies. The condition of PE is the main cause of maternal and perinatal mortality, low birth weight, and intrauterine growth restriction. It is characterized by elevated blood pressure and proteinuria that develops after 20 weeks of gestational age. The cause of preeclampsia is still unknown. A completely satisfactory, unifying hypothesis has not emerged. It is likely that there may be several

etiologies or underlying predispositions with effects that result in preeclampsia, Preeclampsia, a syndrome unique to human pregnancy and one of the leading causes of maternal and foetal morbidity and mortality, is also associated with maternal blood group. AB blood group patients have increased the risk of severe, early-onset or intrauterine growth restriction (IUGR) associated forms of Preeclampsia.<sup>[12]</sup>

### **Aims**

The present study was aiming to identify the association between blood group and hypertension among pregnant Women.

### **Back ground**

**hypertension disorder:** While motherhood is a positive and enjoyable experience, many women are experiencing suffering, illness, and death. Around 15% of pregnant women are expected to develop life-threatening complications during pregnancy, at delivery or post-partum. Hypertensive disorders of pregnancy (HDP) are significant contributors to these complications and sufferings.<sup>[13]</sup>

A pregnant woman is considered hypertensive if her blood pressure is greater than or equal to 140/90 mmHg on two consecutive measurements.<sup>[14]</sup> Hypertensive disorders of pregnancy is a general term for increased blood pressure during pregnancy. It includes pregnancy-induced hypertension (PIH) (without proteinuria), preeclampsia (with proteinuria) and eclampsia (preeclampsia with convulsions), gestational hypertension and chronic hypertension.<sup>[15]</sup>

Hypertensive disorders of pregnancy are public health problems globally. Global studies showed that preeclampsia and eclampsia were associated with higher rates of maternal mortality, prenatal mortality, and morbidity, preterm and small for gestational age deliveries. Women with HDP are five times more likely to have perinatal death compared with women who have no hypertensive disorders of pregnancy.<sup>[16]</sup>

Pregnancy-induced hypertension complicates 10% of all pregnancies. Around 40,000 women, mostly from developing countries, die each year due to preeclampsia or eclampsia. Preeclampsia alone is estimated to account for about 40% to 60% of maternal deaths in developing countries.<sup>[17]</sup> A hospital-based study conducted in South Africa showed that HDP contributed to 20.7% of maternal deaths in the country [11] Hypertensive disorders of pregnancy account for 19% of maternal deaths in Ethiopia.<sup>[18]</sup>

The Antenatal care (ANC) is one of the maternal care services in Iraq. Blood pressure measurement and urine tests for protein urea are among the components of routine ANC. According to the 2016 Iraq demographic and health survey (EDHS) report, 62% of pregnant women had at least one ANC visit. From this, 75% of pregnant women had their blood pressure measured and 66% had a urine test.<sup>[19]</sup>

The prevalence of preeclampsia in developing countries ranges from 1.8% to 16.7%. The incidence of HDP was estimated at 9.8% in a study conducted in South Africa. The prevalence of HDP in Ethiopia ranges from 1.2% to 18.25% according to various studies conducted.<sup>[20]</sup> These studies are inconsistent and inconclusive to show the national magnitude. The country level estimate is essential to design evidence-based interventions. Therefore, this systematic review and meta-analysis were designed to estimate the national pooled prevalence of hypertensive disorders of pregnancy in Iraq and regions.

### **ABO Blood group and RH group**

All cells have different combinations of markers or “antigens” on their surface. Our immune system has learned to use these to help distinguish the body’s own cells (self) from foreign bodies (non-self), like bacteria or toxins. Your immune system learns to ignore normal antigens, but when it recognises that a foreign antigen has entered the body, it releases antibodies, which attach to the foreign entity and mark it so other parts of the immune system can remove and destroy it.

In the case of blood cells, if the immune system recognises that foreign blood cells (i.e. blood cells that are not our type) have been introduced into your body (such as via a transfusion), it will mount an immune response using antibodies against the foreign cells.

The most common systems used for classifying blood are the ABO blood group system and the Rhesus (Rh) type system.

The other blood typing system commonly used is the Rhesus system, also called the Rh system, named after the Rhesus monkey in which it was first discovered. In this system, if you have an antigen called the RhD antigen on the surface of your red blood cells, you are said to be Rhesus positive (Rh+). If you don’t, you are said to be Rhesus negative (Rh-). In Australia, about 83% of people are Rh positive.<sup>[21]</sup>

**Combining your ABO blood group with whether are Rh+ or Rh- means blood can be classified as one of 8 possible types**

O positive (O+)

O negative (O-)

A positive (A+)

A negative (A-)

B positive (B+)

B negative (B-)

AB positive (AB+)

AB negative (AB-)

One difference between the Rhesus system and the ABO group system is that Rh negative people don't usually possess antibodies against RhD (unless they have been previously exposed to it), whereas in the ABO group system if the antigen is absent from the red blood cell, the antibody against it is present in the plasma.

If a mother is Rh negative but her baby is Rh positive (which can happen if the father is Rh positive), the mother could produce antibodies that fight the baby's red blood cells. This can happen if blood from the unborn baby enters the mother's circulation. When there is a risk of this happening (threatened miscarriage, termination, chorionic villus sampling (CVS), abdominal trauma, at delivery), an injection called anti-D can be given to the mother to help prevent these antibodies against Rh positive blood being produced.<sup>[22]</sup>

**Research design**

A descriptive study was used.

**A-Study Setting**

This study was conducted antenatal outpatient in Karkh Maternity Hospital.

**Sample**

The study sample was 400 pregnant women.

**Inclusion criteria**

1. Pregnant women whose regular attendant to the antenatal clinic.
2. Pregnant women diagnosed with hypertensive disorders during pregnancy.

**Exclusion criteria**

- Pregnant women having a chronic disease (chronic hypertension, D.M, Renal disease,).
- All pregnant women having other medical, surgical complication or having a history of any drug use, multi-fetal pregnancy and smoking.

**C-Tools for Data Collection**

Structured interviewing questionnaire sheet developed by researchers, which include three parts for data collection as the, following

- The first part was related to maternal demographics (age, level of education, employment and, income..... ect).
- The second part included (Obstetrics and gynecological history as (gravidity, parity,) the third part included questions about the type of blood group, RH and blood pressure measurement.

**Ethical Consideration**

Permission was obtained from the director of the Hospital. Informed consent was obtained from women on participation in the study, an explanation of the purpose and importance of the study before interviews were conducted. Use of numbers ensured confidentiality and no names appeared anywhere on the questionnaires. The nature of the study was harmless.

**Operational Design**

The operational design included preparatory phase, content validity, reliability, pilot study and fieldwork.

**A-Preparatory Phase**

It included reviewing of literature, different studies and theoretical knowledge of various aspects of the problems using books, articles, internet, periodicals and magazines.

**B- Content Validity & Reliability**

The validity of the questionnaire was measured by using views of several experts and its reliability was done through fcdx.

The process of data collection was carried out from the start of April 2018 till the end of December 2018. The researcher attended at a gynecological outpatient clinic.

Each educated woman was individually filling the first and second parts of the questionnaire by herself; and the researcher filling the third part of the questionnaire which includes (a type of blood group, RH and blood pressure measurement).

During the assessment the researcher measures blood pressure, proteinuria, ABO type and Rh for pregnant women, the purpose of the study was explained prior to get the questionnaire sheet, a questionnaire distributed to be answered within (20-30 minutes).

**The following table shows the distribution of the research sample according to the age variable.**

**Table. 1: Distribution of age groups among the study population.**

Age group (in years)	Number of women
18-25	151
26-35	204
36-45	45

## RESULT

**The below table shows the distribution of ABO and Rhesus blood group among the study population.**

**Table. 2: Distribution of ABO and Rhesus blood group among the study population.**

Blood group	A	B	AB	O	Total
RH Positive	103	69	60	55	287
RH Negative	45	31	12	25	113
Total	148	100	72	80	400

Regarding RH the results of our study which indicated that, the majority of the study sample (287) have positive RH and were diagnosed for gestational Hypertension and pre-eclampsia. Our study result disagrees with a similar study by Lee *et al.*, 2012 It is specifically caused when a mother is Rh-negative and her baby is Rh positive.

Sometimes chronic hypertension or gestational hypertension leads to preeclampsia, a pregnancy complication characterized by high blood pressure and signs of damage to another organ system usually after 20 weeks of pregnancy.

Left untreated, preeclampsia can lead to serious even fatal complications for mother and baby. Previously, preeclampsia was only diagnosed if a pregnant woman had high blood pressure and protein in her urine. However, experts now know that it's possible to have preeclampsia, yet never have protein in the urine. So, we need a similar study to determine

and early detection for hypertensive disorders during pregnancy and early treatment to prevent complications for the mother and fetuses.

And these tables show the relation between numbers of gravidity and hypertensive disorders during pregnancy

**Table. 3: Relation between numbers of gravidity and hypertensive disorders during pregnancy.**

Age	Gestational Hypertension	Pre-eclampsia	Total
18-25	7	144	151
26-35	189	15	204
36-45	20	25	45
Total	216	184	400

And the table [3] show the Relation between the type of Blood Group and hypertensive disorders during pregnancy.

**Table. 3: Relation between the type of BL. Group and hypertensive disorders during pregnancy.**

Type of Blood group	Gestational Hypertension		Pre-eclampsia		Total		P
	N	%	N	%	N	%	
A	9	75	3	25	12	3%	0.000
B	70	27,02	189	72,97%	259	64,75%	0.000
AB	21	52,5	19	47,5	40	10%	0.001
O	65	73,033%	24	26,96%	89	22,25%	0.000
Total	165	41,25%	235	58,75%	400	100%	

Pregnancy-induced hypertension (PIH), which includes both gestational hypertension and preeclampsia, is a common and morbid pregnancy complication for which the pathogenesis remains unclear. The results of our study indicate that that more than half of the study sample (64,75%) have B blood group, 3% A, 10% AB, and 22,25% O respectively.

In our study pregnant women with blood group B have the highest risk for PIH compared to another blood group. Although we found that a statistically significant difference was found between types of ABO and hypertension disorder during pregnancy.

However, the prevalence of gestational hypertension is maximum with O blood groups (73,033%) whereas the incidence of preeclampsia is highest seen in B type individuals (72,97%). Whereas women with A blood group have the lowest risks. Our study result disagrees with a similar study done by (Reshmarani et al 2014)<sup>[23]</sup> who found that

hypertensive disorders of pregnancy in A blood group. In addition, Rwitumita Bharali et.al 2014, their study indicated that AB blood group had the highest risk of developing PIH and the risk increases as the severity of PIH increases. On the other hand, Mishra and Pradhan (2013)<sup>[24]</sup> found that A blood type is significantly associated with hypertensive disorders of pregnancy; however, the incidence of Gestational hypertension is maximum with O blood groups whereas the incidence of preeclampsia and eclampsia are highest seen in A type individual.

But the role of blood groups in hypertensive disorders of pregnancy cannot be concluded without a proper investigation of paternal blood group and its association.

In our opinion this may be related to the different genetic factors, race and living environment. Knowing the risk of specific type blood groups with hypertensive disorders may be clinically useful because it may play a preventive and curative role in maternal and neonatal prognosis as well as pregnancy management. Preeclampsia, a syndrome unique to human pregnancy and one of the leading causes of maternal and fetal morbidity and mortality, is also associated with maternal blood group.

## DISCUSSION

Our results appear to have biological plausibility. One suggested a mechanism of how blood group influences the risk of gestational hypertensive disorders is through the maternal immune response.

A laboratory study of over 1000 women found that placental protein 13, an early biomarker of pre-eclampsia with suspected function in the maternal–fetal immune interface, differentially binds to erythrocytes from distinct ABO groups, with strongest binding to blood group AB<sup>[25]</sup> In addition, compared with O group, A, B, and AB groups are associated with an increased risk of thrombotic events, although this relationship is debated<sup>[26]</sup> Finally, ABO blood groups may differ in the occurrence of known vascular risk factors for preeclampsia, such as endothelial dysfunction<sup>[27]</sup>, insulin resistance<sup>[28]</sup>, and hypercholesterolemia.<sup>[29]</sup>

ABO blood groups display differences in levels of endothelial cell markers, including von Willebrand factor, E-selectin, and thrombomodulin. Recent genome-wide association studies indicate that genetic variants at the ABO locus are associated with soluble E-selectin, P-selectin, and ICAM-1<sup>[30]</sup>, vascular inflammatory agents that are associated with hypertension

and type-2 diabetes. However, of a diverse panel of inflammatory biomarkers, including E-selectin, P-selectin, and ICAM-1, a recent study found that only E-selectin levels were higher in pre-eclampsia cases versus controls.<sup>[31]</sup>

In summary, in the largest study to date of blood groups and pre-eclampsia, we found evidence indicating that women of non-O blood groups, especially blood group AB+, have an increased risk of gestational hypertensive disorders, pre-eclampsia, and severe pre-eclampsia.

Although associations were modest in magnitude, the consistent risks from models with different levels of covariate adjustment and the increase in risk for more severe outcomes suggest biological plausibility. Whereas some strong risk factors for pre-eclampsia have been identified, the etiology of this leading cause of maternal mortality is still poorly understood, and much recent research effort is being directed at investigating biomarkers,<sup>[32]</sup> whose effect on pre-eclampsia may be modified by ABO blood group. Our study suggests that investigations of factors associated with pre-eclampsia should consider the contribution of ABO blood group in order to help improve our understanding of the underlying mechanism of this disease.

The overall pooled prevalence of hypertensive disorders of pregnancy in this study is more or less similar to the large study conducted on HDP in China which was estimated at 5.2%.<sup>[33]</sup> But the finding is higher than the global prevalence<sup>[34]</sup> This difference might be due to socio-cultural, variability in maternal risk factor distribution, and the difference in antenatal care service accessibility. In addition, most of the studies included in this meta-analysis were conducted in hospitals and health centers which might increase the prevalence.<sup>[35]</sup>

## CONCLUSION

The study shows an association between ABO blood group and the occurrence of PIH, with B blood group women having the highest risk. Thus, special attention should be given to pregnant women carrying the B, AB and O blood group in order to prevent the development of PIH. The results of this study suggest there is an association between types of ABO groups and RH with hypertensive disorders during pregnancy.

High blood pressure can be dangerous for pregnant women and their unborn babies. Unhealthy lifestyle choices may lead to high blood pressure during pregnancy. Being overweight or obese, or not staying active, are major risk factors for high blood pressure.

Women experiencing their first pregnancy are more likely to have high blood pressure. Fortunately, there's a lower chance of this condition in subsequent pregnancies with the same partner. Women carrying multiples are more likely to develop hypertension, as their body is under additional stress. Maternal age is also a factor, with pregnant women over the age of 40 being more at risk. According to the American Society for Reproductive Medicine, using assistive technologies (such as IVF) during the conception process can increase the chances of high blood pressure in a pregnant woman. Women who had high blood pressure before pregnancy are at higher risk for related complications during pregnancy than those with normal blood pressure.

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