

## ABO Blood Groups And Their Link With The Risk of Pre-Eclampsia

Sana Shahid<sup>1</sup>, Syeda Sadia Fatima<sup>2</sup>, Seema Ghani<sup>3</sup>

<sup>1</sup>Department of Physiology, Sir Syed College of Medical Sciences for Girls, Karachi, Pakistan,

<sup>2</sup>Department of Biological and Biomedical Sciences, Aga Khan University, Karachi, Pakistan

<sup>3</sup>Department of Obstetrics and Gynecology, Taj Medical Complex, Karachi, Pakistan

Received: May 4, 2018  
Accepted: June 14, 2018

**Abstract: Background:** ABO blood group antigens have been identified as pathological agent in different disease conditions. For some time, the association of blood group with pregnancy associated conditions like pre-eclampsia is extensively under debate. Pre-eclampsia is a distressing condition of pregnancy which commonly causes maternal and fetal mortality around the globe. Multiple risk factors are found to be associated with pre-eclamptic occurrence. In this study our aim was to delineate a specific blood group which could be implicated as a risk factor for pre-eclampsia.

**Methods:** This retrospective study was conducted in a tertiary care hospital of Karachi and retrieved obstetric data including blood group ~~was~~ from medical record files of 368 patients. Obtained data was analyzed by IBM SPSS version 21.

**Results:** The prevalence of B group was recorded to be 41.3% as compared to O (26.1%), A (22.8%) and AB (9.8%). So, it can be concluded that women having blood group B are more prone to develop pre-eclampsia.

**Conclusion:** Blood grouping of pregnant women in early weeks of pregnancy could assist in prediction or better management of pre-eclampsia.

**Keywords:** Blood groups, Pregnancy, Pre-eclampsia

### Corresponding Author:

Syeda Sadia Fatima: Department of Biological and Biomedical Sciences, Aga Khan University, Karachi, Pakistan, Phone: +92-21-34864564, E-mail: sadia.fatima@aku.edu

### Introduction:

Blood group determining ABO antigens are expressed not only on human red blood cells but also on many other distinct cell types like platelets, epithelial cells, nerve cells and vascular endothelium [1]. Due to this diverse expression, many researchers have investigated their possible role in the pathogenesis of several diseases, such as carcinomas, cardiovascular, infectious diseases, neurological and thrombotic disorders [2]. The ABO antigen association with certain diseases (thrombotic disorders) was found to be related with the increased circulating levels of factor VIII and von Willebrand factor in the plasma [3] Along with other different disease conditions, many studies have supported the evidence of ABO antigen relation to adverse pregnancy outcomes [4].

Pre-eclampsia, the most grievous pregnancy outcome is a leading cause of fetal and maternal mortality and morbidity around the world [5], approximately 6% of pregnancies are affected by this condition worldwide [6]. It creates a pathophysiological condition during pregnancy in which maternal body's balanced inflammatory and endothelial affairs are disturbed and exaggerated [7]. Although the exact mechanism of pre-eclamptic origin is still enigmatic, however many research studies have supported the notion of its association with multiple risk factors contributing to occurrence of pre-eclampsia [8]. Along with many risk factors such as first pregnancy, obesity, old maternal age and previous pre-eclamptic pregnancy etc., ABO antigens were also found to have some association with pre-eclampsia [9].

In recent years, many researchers have tried to find a definite type of blood group that can be linked to the pathogenesis of pre-eclampsia; yet no consensus is available for a specific blood group to increase the risk of developing pre-eclampsia.

As the occurrence rate of pre-eclampsia is highest in developing countries, with 19% in Pakistan only [10], the legitimate understanding of blood group association as a risk factor for pre-eclampsia would be conducive to timely diagnose and follow up the pregnant women with risk of developing pre-eclampsia.

Despite the fact that pre-eclampsia is being the most common complication of pregnancy, still there is scanty data on the association of blood group with pre-eclampsia in Pakistan. Hence we desired to assess this association in a group of pregnant women diagnosed with pre-eclampsia. The attained data would be of significant importance for the health facility planners and health providers of Pakistan.



## Methods

The retrospective study was conducted in Basic Medical Sciences Institute (BMSI) in collaboration with Department of Obstetrics and Gynecology of Jinnah Postgraduate Medical Centre (JPMC), a tertiary care hospital of Karachi, which receives large number of pregnant women. Approval for the study was obtained from the Institutional Review Board (IRB) of Jinnah Postgraduate Medical Centre (JPMC) Karachi. (Ref: NO.F.2-81/GENL-2017-IRB/15107/JPMC). All pregnant women who developed pre-eclampsia, between the periods of January 1st 2017 through June 30th 2017 were included. The obstetric and medical history (age, parity, past history, vital signs, weight, height and proteinuria) of 368 subjects was recorded from medical record files. Blood groups were also recorded from patient records. The maternal blood groups were coded as A, B, O, AB and Rh (+/-). Determination of blood group was done by haemagglutination method using monoclonal Anti A, Anti B and Anti D sera. Rh negative blood group subjects were excluded from the study as Rh positive phenotype is common among blood groups [11].

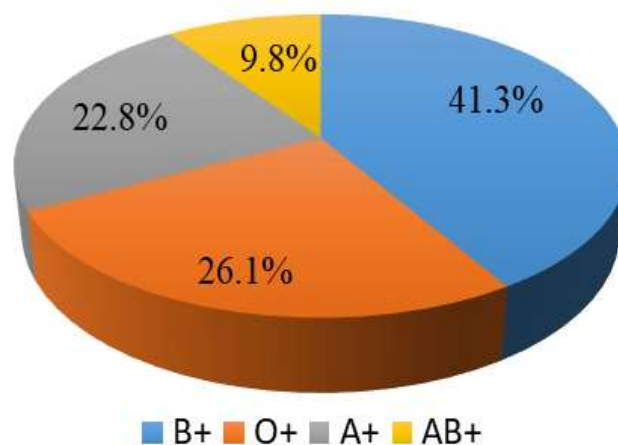
Pre-eclampsia was taken as having high blood pressure ( $\geq 140/90$  mmHg) accompanied by proteinuria  $\geq 300$  mg/24 h urine, after 20th week of pregnancy (Practice ACOG, 2002). IBM SPSS version 21 was used for data recording and analysis. Continuous variables were presented as mean  $\pm$  standard deviation (SD) and categorical data were summarized by counts and percentages analyzed by Student t-test. The limit of statistical significance used was p-value  $< 0.05$ .

## Results

A total of 368 women with diagnosed pre-eclampsia were recruited in the study. Mean age of study subjects was  $27.7 \pm 2.53$  years. Around 35.8% (n=132) of the subjects were primiparae. Majority of the women were multiparous (n=236; 64.1%). Mean age and parity according to blood groups are presented in Table 1. Mean age in O blood group subjects were significantly lower as compared to rest of the groups (p=0.042). The most prevalent blood group was found to be group B Rh+ (41.3%; p=0.035). Prevalence of other blood groups according to this study showed 26.1% of O Rh+, 22.8% of A Rh+ and 9.8% AB Rh+ blood group (Table 1) and (Fig 1).

**Table 1: Blood group distribution of study participants**

Blood Type	Age (year)	Parity (mean)	n (%)
O Rh+	$24.9 \pm 2.24$	2.3	96 (26.1)
A Rh+	$28.9 \pm 1.59$	3.6	84 (22.8)
B Rh+	$28.7 \pm 2.22$	3.2	152 (41.3)
AB Rh+	$28.3 \pm 2.59$	2.5	36 (9.8)



**Figure 1:**

Distribution of blood groups in pre-eclamptic patients



## Discussion

The association of blood group as a risk factor for pre-eclampsia along with other risk factors has been investigated for a long time worldwide in order to timely predict the occurrence of the condition. However, in our region its association with pre-eclampsia is not studied much. The present study attempted to analyze the significant association of B Rh+ve blood group with pre-eclampsia as compared to other blood groups. This was consistent with the finding of Roshdi *et al.* [12] who also found that blood group B Rh+ve has highest association with pre-eclampsia. Regarding the association of Rh-ve group with the disease, we would not be able to comment on it as it is known to be less prevalent in general population [11] and in this study women who were negative for Rh were not included.

Many previous studies reported a wide range of incomparable results such as; the actual relation between blood group and pre-eclampsia, or which blood group labeled as a true associate of pre-eclampsia ranging from no association [13] [14] to labeling AB blood group as having higher risk of developing pre-eclampsia [15, 16] or blood group O to be associated with pre-eclampsia [9]. However, findings of a meta-analysis by Franchini *et al.* [17] reported blood group O as a protected factor against pre-eclampsia. Another cohort study of Sweden showed that women with O blood group have the lowest risks of developing this disorder [18].

It has been observed that association of ABO antigens with structural protein domain of clotting factor VIII and von Willebrand factor crucially affects the mechanism of coagulation [19]. Blood group O containing individuals have increased probability of bleeding episodes because of decreased concentration of these clotting factors, attributable to the fact that only H antigen is present in this blood group. Contrary to that, in non O blood group individuals, the increase levels of factor VIII and von Willebrand factor has been imputed with increased chances of thromboembolic diseases [20, 21]. Previously pre-eclampsia has also been depicted as a condition of inherited thrombophilia involving placental vascular thrombosis [14], hence; the increased concentration of clotting factors in women of A or B antigen containing blood groups may show enhanced thrombotic effects, contributing to pathogenesis of pre-eclampsia [22]. As a matter of fact, various researchers have persistently proclaimed that factor VIII and von Willebrand factor levels are enhanced in pre-eclamptic pregnancy in contrast to healthy pregnancies. This association also, shows the link between A/B antigen and pre-eclamptic risk [23].

Moreover, in previous studies also it has been observed that von Willebrand factor levels showed 25% higher association with A, B or AB antigen as compared to O antigen [24], hence further proving enhanced thromboembolic activity in individuals with blood group A/B.

Another possible mechanism of association of blood group antigens with hypertensive state of pregnancy is through immune response of mother. In pre-eclampsia, Placental Protein (PP 13) acts as an early prediction marker of disease. During early trimester of pregnancy, production of Placental Protein (PP13) occurs which binds to beta-galactoside of A/B antigens, as PP13 has strong affinity for A/B antigen. This results in segregation and ultimately low plasma levels of PP13. Hence, these low levels predispose to hypertensive complications like pre-eclampsia [3].

The obvious disparity of association between blood group and pre-eclampsia in different parts of the world is may be because of a difference in distribution of ABO phenotypes in different populations, and even within different ethnic groups of same population. The reason behind this disparity is still vague [25]. Hence, within Pakistan also different researchers found varying blood group distributions in different regions. Research studies done in Khyber-pukhtunkhwa [26] and Punjab [27] noticed blood group B to be more frequent as compared to other groups in general population as reported by the current study. Also, studies done in Sindh and Balochistan found blood group O to be more dominant in these regions [28, 29]. However, in our region prevalence of a different blood group as compared to other regions of Pakistan is again attributable to difference in ABO phenotypes. However, we could not be able to comment on blood group prevalence on ethnic grounds due to our small sample size. With these findings, we can say that blood group B was found more prevalent in pre-eclampsia, and as a risk factor blood group B has some association with pre-eclampsia.

## Conclusion:

This study proposes association between ABO blood group and pre-eclampsia with women having blood type B being more prone to develop pre-eclampsia. As ABO blood group system has considerable role in body's hemostasis process, the pregnant women with blood type B should be given extra attention and precise antenatal monitoring to be able to predict the risk of pre-eclampsia.



**Disclosure statement:** All authors declare that they have no potential conflict of interest

**Funding:** Pakistan Health Research Council,  
Project Ref No: 119/2016/RDC/AKU, Karachi

## References:

1. Liumbruno GM, Franchini M. Beyond immunohaematology: the role of the ABO blood group in human diseases. *Blood transfusion*. 2013;11:491.
2. Beyazit F, Pek E, Güngör AÇ, Gencer M, Unsal MA. Effect of maternal ABO blood type on birth weight and preeclampsia. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*. 2017;6:2164-7.
3. Manjunatha S, Anita K. The relationship between maternal blood group and preeclampsia. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*. 2017;4:1749-52.
4. Phaloprakarn C, Tangjitgamol S. Maternal ABO blood group and adverse pregnancy outcomes. *Journal of Perinatology*. 2013;33:107.
5. Zeisler H, Llubra E, Chantraine F, Vatish M, Staff AC, Sennström M, et al. Predictive value of the sFlt-1: PlGF ratio in women with suspected preeclampsia. *New England Journal of Medicine*. 2016;374:13-22.
6. Vishnyakova PA, Volodina MA, Tarasova NV, Marey MV, Kan NE, Khodzhaeva ZS, et al. Alterations in antioxidant system, mitochondrial biogenesis and autophagy in preeclamptic myometrium. *BBA clinical*. 2017;8:35-42.
7. Berkane N, Liere P, Oudinet J-P, Hertig A, Lefèvre G, Pluchino N, et al. From pregnancy to preeclampsia: a key role for estrogens. *Endocrine reviews*. 2017;38:123-44.
8. Shah DA, Khalil RA. Bioactive factors in uteroplacental and systemic circulation link placental ischemia to generalized vascular dysfunction in hypertensive pregnancy and preeclampsia. *Biochemical pharmacology*. 2015;95:211-26.
9. Elmugabil A, Rayis DA, Ahmed MA, Adam I, Gasim GI. O blood group as risk factor for preeclampsia among Sudanese women. *Open access Macedonian journal of medical sciences*. 2016;4:603.
10. Rathore R, Butt NF, Iqbal A, Khan MZ. Complications and outcome of patients of pre-eclampsia and eclampsia presenting to medical wards of Mayo Hospital Lahore. *Annals of King Edward Medical University*. 2010;16:17-.
11. Elsayid M, Aseeri YY, Saqri F, Alanazi A, Qureshi S. A Study of Prevalence of Blood Group of Saudi Patients in King Abdulaziz Medical City-Riyadh. *Sci J Public Health*. 2015;3:559-62.
12. Roshdi A, Mostafa A, el Rheim EA. Relationship between types of ABO blood groups and Rh group with Hypertensive disorder among pregnant women in Bani Suef, Egypt. *Nursing*. 2016;5.
13. Aghasadeghi F, Saadat M. Association between ABO and Rh Blood Groups and Risk of Preeclampsia: A Case-Control Study from Iran. *Open access Macedonian journal of medical sciences*. 2017;5:173.
14. Hentschke MR, Caruso FB, Paula LG, Medeiros AK, Gadonski G, Antonello IC, et al. Is there any relationship between ABO/Rh blood group and patients with pre-eclampsia? *Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health*. 2014;4:170-3.
15. Alpoim PN, de Barros Pinheiro M, Junqueira DRG, Freitas LG, das Graças Carvalho M, Fernandes APSM, et al. Preeclampsia and ABO blood groups: a systematic review and meta-analysis. *Molecular biology reports*. 2013;40:2253-61.
16. Avci D, Karagoz H, Ozerhan Ozer KE, Bulut K, Aykas F, Cetinkaya A, et al. Are the blood groups of women with preeclampsia a risk factor for the development of hypertension postpartum? *Therapeutics and clinical risk management*. 2016;12:617.
17. Franchini M, Mengoli C, Lippi G. Relationship between ABO blood group and pregnancy complications: a systematic literature analysis. *Blood Transfusion*. 2016;14:441.
18. Lee B, Zhang Z, Wikman A, Lindqvist P, Reilly M. ABO and RhD blood groups and gestational hypertensive disorders: a population-based cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2012;119:1232-7.
19. Desch KC, Ozel AB, Siemieniak D, Kalish Y, Shavit JA, Thornburg CD, et al. Linkage analysis identifies a locus for plasma von Willebrand factor undetected by genome-wide association. *Proceedings of the National Academy of Sciences*. 2013;110:588-93.
20. Rios DR, Fernandes AP, Figueiredo RC, Guimarães DA, Ferreira CN, e Silva ACS, et al. Relationship between ABO blood groups and von Willebrand factor, ADAMTS13 and factor VIII in patients undergoing hemodialysis. *Journal of thrombosis and thrombolysis*. 2012;33:416-21.



21. Song J, Chen F, Campos M, Bolgiano D, Houck K, Chambless LE, et al. Quantitative influence of ABO blood groups on factor VIII and its ratio to von Willebrand factor, novel observations from an ARIC study of 11,673 subjects. *PLoS one*. 2015;10:e0132626.
22. Mital P, Gupta D, Benwal DK, Gangwal H, Hooja N, Agarwal S, et al. To find any association of maternal blood group as a risk factor for preeclampsia. *International Journal Of Community Medicine And Public Health*. 2016;3:3445-9.
23. Prochazkova J, Slavik L, Ulehlova J, Prochazka M. The role of tissue factor in normal pregnancy and in the development of preeclampsia. A review. 2014.
24. Jenkins PV, O'Donnell JS. ABO blood group determines plasma von Willebrand factor levels: a biologic function after all? *Transfusion*. 2006;46:1836-44.
25. Farshori MPQ, Al-Wakid IH, Ibrahim IKA, ALShammari AF, Alduejieman M, Almhanaa AM, et al. Distribution of ABO and Rhesus (Rh) blood group antigens in male type 2 diabetes mellitus patients in Hail region of Saudi Arabia: High incidences of diabetes mellitus in males with B+ blood type. *Integr Obesity Diabetes*. 2016;2:233-8.
26. Nazli R, Haider J, Khan MA, Akhtar T, Aslam H. Frequency of ABO blood groups and RhD factor in the female population of District Peshawar. *Pakistan journal of medical sciences*. 2015;31:984.
27. Shakir M, Khan SA, Ghani E. Frequency of ABO and Rh (D) blood groups among blood donors in Rawalpindi/Islamabad area. *Pakistan Armed Forces Medical Journal*. 2012:130.
28. Bhatti R, Shiekh D. Variations of ABO blood groups. Gene frequencies in the population of Sindh (Pakistan). *Ann King Edward Med Coll*. 1999;5:328-31.
29. Hussain A, Shiekh S, Haider M, Rasheed T, Malik MR. Frequency of ABO and Rh blood groups in population of Balouchistan (Pakistan). *Pak Armed Forces Med J*. 2001;51:22-6.

