Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(4), 1327-1332 | ISSN:2251-6727

ABO and Rh Antigen Distribution among Pregnant Women in South India: A Descriptive study

Dr Prabu KN[1], Dr Priyatharsini P[*2,] Dr Janakiraman K[3], Dr Anusha N[4]

[1]Postgraduate, Department of Pathology, Vinayaka Mission's Medical College, Vinayaka Mission's Research Foundation (DU), Karaikal, Puducherry

[2]Assistant Professor, Department of Pathology, Vinayaka Mission's Medical College, Vinayaka Mission's Research Foundation (DU), Karaikal, Puducherry

[3]Assistant Professor, Department of Pathology, Vinayaka Mission's Medical College, Vinayaka Mission's Research Foundation (DU), Karaikal, Puducherry

[4]Professor & Head, Department of Pathology, Vinayaka Mission's Medical College and Hospital, Vinayaka Mission's Research Foundation (DU), Karaikal, Puducherry

(Received: 16 May 2025 Revised: 20 June 2025 Accepted: 24 July 2025)

KEYWORDS

ABO blood group, Rh typing, Pregnant women, India

ABSTRACT:

Introduction: Knowing the distribution of ABO and Rh blood groups is clinically significant, especially in obstetric care, where it affects prenatal screening, transfusion choices, and the treatment of neonatal haemolytic illness. The need for localised studies is highlighted by the fact that blood group prevalence varies by region due to genetic and ethnic diversity. In order to support better maternal and foetal health outcomes, this study looks into the distribution of ABO and Rh blood groups among pregnant women in South India.

Objectives: The aim of the present study was to determine the prevalence of ABO and Rh antigen among the pregnant women attending antenatal clinics in South India.

Methods: This was a laboratory based retrospective study conducted in the Department of Pathology, Vinayaka Missions Medical College & Hospital, Karaikal, Puducherry, India between June 2022, and May 2023 among all pregnant women more than 18 years of age attending the outpatient department of Obstetrics and Gynaecology.

Results: The mean (SD) age of the pregnant women was 26.72 years (4.56). Of the 400 pregnant women, 31.0% were in first trimester, 51.7% were in second trimester, and 17.3% were in third trimester. More than one third pregnant women had O blood group type (38.5%) and A blood group type (37.3%). This was followed by B blood group type (17.8%) and AB blood group type (6.5%), in that order. Majority of the included pregnant women had Rh positive status (89.7%), followed by 10.3% with Rh negative status. It was found that 89.9% pregnant women with A blood group type were Rh positive. Similarly, 88.5% pregnant women with AB blood group type, 90.1% pregnant women with B blood group type and 89.6% pregnant women with O blood group type had Rh positivity.

Conclusions: The present study contributes valuable data to the understanding of the demographic and blood group characteristics of pregnant women in the specified region. These findings have clinical implications for personalized prenatal care, blood transfusions, and the management of potential complications related to ABO and Rh factors.

1. Introduction

Blood group distribution among populations is a subject of considerable scientific interest and clinical significance, with implications ranging from transfusion medicine to prenatal care.(1, 2) Understanding the prevalence of ABO blood groups and Rh status in specific demographic cohorts provides essential insights into genetic and population-based factors influencing health outcomes.(3, 4) Pregnancy represents a critical

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(4), 1327-1332 | ISSN:2251-6727

period in a woman's life, necessitating specialized healthcare tailored to individual needs.(5) Blood group information plays a pivotal role in obstetric care, guiding decisions related to blood transfusions, assessing potential risks of haemolytic diseases in newborns, and informing preventive measures during prenatal care.(6, 7) Additionally, the demographic and obstetric characteristics of pregnant populations contribute to our understanding of healthcare needs and potential complications that may arise during pregnancy.(8)

The geographical and ethnic diversity of populations can result in variations in blood group distributions.(9) Therefore, regional studies are crucial to obtaining accurate and context-specific data that can inform healthcare practices and policies. This study, spanning from June 2022 to May 2023, addresses this gap by focusing on pregnant women attending a healthcare facility in South India. The region's unique genetic makeup and cultural factors may contribute to distinct patterns of ABO blood group and Rh status distributions, making this investigation particularly relevant for local healthcare providers.(10, 11)

By exploring the prevalence of ABO blood groups and Rh status in the context of pregnancy, this study aims to contribute valuable data to the existing body of knowledge, inform clinical decision-making, and pave the way for improved maternal and fetal health outcomes. The results of this investigation have the potential to influence prenatal care protocols, blood transfusion practices, and preventive measures related to Rh incompatibility, ultimately enhancing the quality of obstetric healthcare in the specified region.

2. Objectives

The purpose of this study was to ascertain the distribution and prevalence of ABO and Rh (D) blood groups among expectant mothers who visited South Indian antenatal clinics. The study sought to ascertain the percentage of people who are Rh-positive and Rh-negative, as well as the frequency of each ABO blood group (A, B, AB, and O) and any correlations with demographic traits. The study aims to support clinical decision-making in prenatal care, transfusion practices, and the avoidance of complications related to Rh incompatibility by producing region-specific data.

3. Methods

This was a laboratory based retrospective descriptive study conducted in the Department of Pathology, Vinayaka Missions Medical College & Hospital, Karaikal, Puducherry, India between June 2022, and May 2023 among all pregnant women more than 18 years of age attending the outpatient department of Obstetrics and Gynaecology. The study was approved by the Institute Human Ethics Committee (IHEC), Vinayaka Missions Medical College & Hospital. After obtaining necessary approvals from the Dean, Medical Superintendent, and the Head of Medical records department (MRD), the electronic medical records and laboratory information system were accessed. We obtained the sociodemographic characteristics of the pregnant women (including age, parity, gravida and trimester) and the results of the blood group test of the patient for study. We ensured that the ethical principles were followed, and confidentiality was maintained throughout the study.

Al-Kuran O et al. documented that the prevalence of blood group A was 37.3%, AB was 6.3%, B was 17.5% and O was 38.9%.(1) Using this information, considering alpha error to be 5% (type I error), beta error to be 20% (type II error or power to be 80%), and absolute precision of 5%, the estimated minimum required sample size was rounded off to 400. The blood samples were collected from all patients by antecubital vein puncture and were kept in an Ethylene Diamine Tetra Acetic acid (EDTA) anticoagulant bottle and centrifuged at 4000 rpm for 10 min at room temperature. ABO and Rh blood group tests were executed using standard gel centrifugation.(12) The cards used in gel centrifugation have microtubes on each card containing buffered gel solution with specific antibodies, including anti-A, anti-B, anti-AB, anti-D, and anti-C/D/E. Agglutination occurs when the erythrocyte antigen reacts with the corresponding antibodies present in the gel solution or the serum or plasma sample. By using a gel column, agglutinated erythrocytes are captured based on their size. When agglutinated erythrocytes are captured at the top of the gel column, the test is positive. When non-agglutinated erythrocytes reach the bottom of the microtubes, they form a pellet and yield negative results. For the determination of weak D types, direct agglutination molecular tests were used. Weak and partial RhD were considered as Rh positive due to our major concern in RhD-negative pregnant

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(4), 1327-1332 | ISSN:2251-6727

females as it can produce alloimmunization if accidentally given weak/partial RhD antigen-positive blood, knowing that weak D antigen ranges from 0.2 to 1%.

The data so obtained from the medical records were entered into Microsoft Excel, coded, recoded, and analysed using Statistical Package for Social Sciences (SPSS) version 23 (IBM Inc., Armonk, NY, USA). The descriptive analysis, that is the prevalence of different blood group types (categorical variables) was expressed as numbers (frequency) and percentages. For continuous variables, based on data normality tested using Kolmogorov–Smirnov test and the Shapiro–Wilk test either mean (standard deviation) or median (interquartile range) was used. Cross tabulations were made – blood group types and Rh status.

4. Results

The mean (SD) age of the pregnant women included in the present study was 26.72 years (4.56); ranging between 16 and 37 years. Majority of the women (52.7%) were more than or equal to 26 years of age; 47.3% were less than or equal to 25 years of age. The median (IQR) parity of the included pregnant women was 2 (3); ranging between 0 and 6. The median (IQR) gravidity of the included pregnant women was 3 (3); ranging between 0 and 7. Of the 400 pregnant women included in the present study, 31.0% were in first trimester, 51.7% were in second trimester, and 17.3% were in third trimester.

Table 1: Distribution of study variables

		Number N = 400	**Percentage (%)**
Age (in years)	25 and below	189	47.3
	26 and above	211	52.7
Age (in years) *Mean (SD)*		26.72 (4.56)	
Parity *Median (IQR)*		2 (3)	
Gravida *Median (IQR)*		3 (3)	
Trimester	First	124	31.0
	Second	207	51.7
	Third	69	17.3
ABO blood group	A	149	37.3
	AB	26	6.5
	B	71	17.8
	O	154	38.5
Rh	Negative	41	10.3
	Positive	359	89.7
SD, Standard deviation; IQR, Interquartile range			

Distribution of ABO blood group: The results showed that more than one third pregnant women had O blood group type (38.5%) and A blood group type (37.3%). This was followed by B blood group type (17.8%) and AB blood group type (6.5%), in that order.

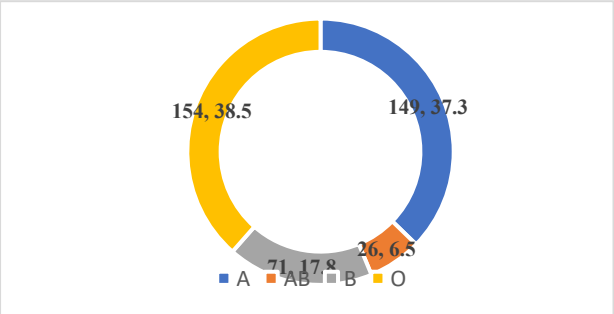

Figure 1: Distribution of ABO blood group types

Distribution of Rh status: Majority of the included pregnant women had Rh positive status (89.7%), followed by 10.3% with Rh negative status.

Table 2: Distribution of Rh typing by ABO blood group types

		Rh		**Total**
		Negative	**Positive**	
ABO blood group	**A**	15 (10.1)	134 (89.9)	149
	AB	3 (11.5)	23 (88.5)	26
	B	7 (9.9)	64 (90.1)	71

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(4), 1327-1332 | ISSN:2251-6727

	O	16 (10.4)	138 (89.6)	154
Total		41	359	400

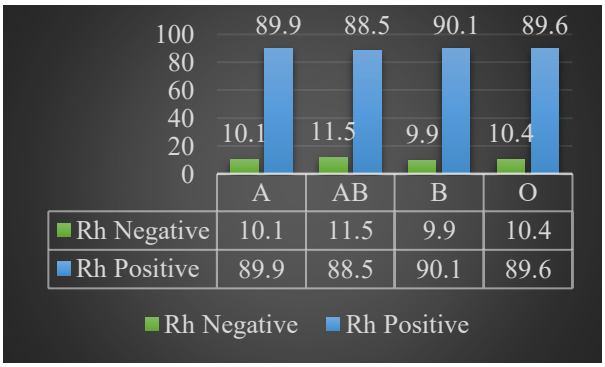

Figure 2: Distribution of Rh typing by ABO blood group types

We also cross tabulated the results of ABO blood group type against Rh status. It was found that 89.9% pregnant women with A blood group type were Rh positive. Similarly, 88.5% pregnant women with AB blood group type, 90.1% pregnant women with B blood group type and 89.6% pregnant women with O blood group type had Rh positivity.

5. Discussion

The mean age of the pregnant women in the study was 26.72 years, with a standard deviation of 4.56. The age range was from 16 to 37 years. This indicates a relatively young population of pregnant women, with the majority (52.7%) being 26 years or older. The findings align with the general trend of women in their twenties being more likely to conceive.(13) Various studies have consistently shown that women in their twenties are more likely to become pregnant, with fertility declining as age increases.(14, 15) The median parity (number of previous live births) was 2, with an interquartile range (IQR) of 3, ranging from 0 to 6. The median gravidity (total number of pregnancies, including the current one) was 3, with an IQR of 3, ranging from 0 to 7. These values suggest that, on average, the included pregnant women had experienced two previous live births and were in their third pregnancy. High parity has been associated with certain pregnancy complications, while gravidity is an important factor in assessing a woman's obstetric history and potential risks during pregnancy.(16, 17)

The distribution of pregnant women across trimesters revealed that 31.0% were in the first trimester, 51.7% were in the second trimester, and 17.3% were in the third trimester. This distribution reflects a relatively even spread across the three trimesters, which is expected in a cross-sectional study. Trimester distribution is crucial for understanding the timing of blood group testing and monitoring potential pregnancy-related complications, such as preeclampsia and gestational diabetes.(18) Understanding the demographic and obstetric characteristics of the study population is essential for clinical practice. Younger pregnant women may have different healthcare needs compared to older ones, and the distribution across trimesters is crucial for appropriate prenatal care planning. Tailoring prenatal care based on maternal age and trimester is in line with the recommendations of organizations like the American College of Obstetricians and Gynaecologists.(19, 20)

The ABO blood group distribution in the studied pregnant population revealed interesting patterns. More than one-third of the participants had O blood group type (38.5%), making it the most prevalent blood group. Following closely, the A blood group type was found in 37.3% of the pregnant women. The B blood group type was less common at 17.8%, and the AB blood group type was the least prevalent at 6.5%. The distribution of ABO blood groups can vary across populations, and regional differences have been documented.(21-23) The predominance of O and A blood groups in this study aligns with global patterns, but specific regional variations may exist. Understanding the ABO blood group distribution is not only important for blood transfusions but also has implications in obstetrics, as certain blood groups may be associated with specific pregnancy complications.(24)

The majority of pregnant women in the study had Rh-positive status, accounting for 89.7% of the participants. In contrast, 10.3% of the pregnant women had Rh-negative status. The high prevalence of Rh-positive status is consistent with global trends, as the majority of individuals worldwide are Rh positive. However, the presence of Rh-negative individuals is noteworthy, particularly in the context of Rh incompatibility during pregnancy, which can lead to haemolytic disease of the

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(4), 1327-1332 | ISSN:2251-6727

newborn.(25) This emphasizes the importance of Rh factor screening during pregnancy to identify potential risks and provide appropriate interventions.(26)

Understanding the distribution of ABO blood groups and Rh status in the studied pregnant population holds clinical significance. Knowledge of ABO blood groups is vital for safe blood transfusions and can inform clinical decisions in cases of obstetric complications. Additionally, Rh status is crucial for managing Rh incompatibility issues that may arise during pregnancy, requiring careful monitoring and intervention to prevent haemolytic disease in the newborn. Clinical guidelines emphasize the importance of ABO and Rh blood group testing during prenatal care to identify potential risks and provide appropriate interventions.(27)

The observed high prevalence of Rh positivity across all ABO blood group types aligns with established population patterns. Studies have consistently shown that the majority of individuals, regardless of ABO blood group, are Rh positive. The Rh factor is inherited independently of the ABO blood group system, and its distribution is relatively consistent in populations. Understanding the relationship between ABO blood group types and Rh status has clinical implications, particularly in the context of prenatal care and potential complications during pregnancy. The high prevalence of Rh positivity across ABO blood group types suggests that Rh incompatibility, a condition that can lead to haemolytic disease of the newborn, is a concern for a significant proportion of pregnant women.(28) Clinical guidelines recommend Rh factor testing during pregnancy to identify Rh-negative individuals and provide appropriate interventions, such as Rh immunoglobulin administration to prevent Rh sensitization and subsequent complications.

6. Conclusion

The present study contributes valuable data to the understanding of the demographic and blood group characteristics of pregnant women in the specified region. These findings have clinical implications for personalized prenatal care, blood transfusions, and the management of potential complications related to ABO and Rh factors. The study sets the groundwork for future research and emphasizes the importance of continued surveillance of blood group distributions in diverse populations to inform healthcare practices and interventions.

References

1. Al-Kuran O, Al-Mehaisen L, Qasem R, Alhajji S, Al-Abdulrahman N, Alfuzai S, et al. Distribution of ABO and Rh blood groups among pregnant women attending the obstetrics and gynecology clinic at the Jordan University Hospital. Sci Rep. 2023;13(1):13196.
2. Singh A, Srivastava RK, Deogharia KS, Singh KK. Distribution of ABO and Rh types in voluntary Blood donors in Jharkhand area as a study conducted by RIMS, Ranchi. J Family Med Prim Care. 2016;5(3):631-6.
3. Andalibi M, Dehnavi Z, Afshari A, Tayefi M, Esmaeili H, Azarpazhooh M, et al. Prevalence of ABO and Rh blood groups and their association with demographic and anthropometric factors in an Iranian population: Mashad study. East Mediterr Health J. 2020;26(8):916-22.
4. Domènech-Montoliu S, Puig-Barberà J, Pac-Sa MR, Vidal-Utrillas P, Latorre-Poveda M, Rio-González AD, et al. ABO Blood Groups and the Incidence of Complications in COVID-19 Patients: A Population-Based Prospective Cohort Study. Int J Environ Res Public Health. 2021;18(19).
5. Marshall NE, Abrams B, Barbour LA, Catalano P, Christian P, Friedman JE, et al. The importance of nutrition in pregnancy and lactation: lifelong consequences. Am J Obstet Gynecol. 2022;226(5):607-32.
6. Dziegiel MH, Krog GR, Hansen AT, Olsen M, Lausen B, Nørgaard LN, et al. Laboratory Monitoring of Mother, Fetus, and Newborn in Hemolytic Disease of Fetus and Newborn. Transfus Med Hemother. 2021;48(5):306-15.
7. Linder GE, Ipe TS. Pregnancy and postpartum transfusion. Annals of Blood. 2022;7.
8. Narayan B, Nelson-Piercy C. Medical problems in pregnancy. Clin Med (Lond). 2017;17(3):251-7.
9. Farhud DD, Zarif Yeganeh M. A brief history of human blood groups. Iran J Public Health. 2013;42(1):1-6.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(4), 1327-1332 | ISSN:2251-6727

10. Agrawal A, Tiwari AK, Mehta N, Bhattacharya P, Wankhede R, Tulsiani S, et al. ABO and Rh (D) group distribution and gene frequency; the first multicentric study in India. Asian J Transfus Sci. 2014;8(2):121-5.

11. Belali TM. Distribution of ABO and Rhesus Types in the Northern Asir Region in Saudi Arabia. J Blood Med. 2022;13:643-8.

12. Mujahid A, Dickert FL. Blood Group Typing: From Classical Strategies to the Application of Synthetic Antibodies Generated by Molecular Imprinting. Sensors (Basel). 2015;16(1).

13. Kornides ML, Kitsantas P, Lindley LL, Wu H. Factors associated with young adults' pregnancy likelihood. J Midwifery Womens Health. 2015;60(2):158-68.

14. Delbaere I, Verbiest S, Tydén T. Knowledge about the impact of age on fertility: a brief review. Ups J Med Sci. 2020;125(2):167-74.

15. Steiner AZ, Jukic AM. Impact of female age and nulligravidity on fecundity in an older reproductive age cohort. Fertil Steril. 2016;105(6):1584-8.e1.

16. Majella MG, Sarveswaran G, Krishnamoorthy Y, Sivaranjini K, Arikrishnan K, Kumar SG. A longitudinal study on high risk pregnancy and its outcome among antenatal women attending rural primary health centre in Puducherry, South India. J Educ Health Promot. 2019;8:12.

17. Al-Farsi YM, Brooks DR, Werler MM, Cabral HJ, Al-Shafaee MA, Wallenburg HC. Effect of high parity on occurrence of some fetal growth indices: a cohort study. Int J Womens Health. 2012;4:289-93.

18. Buchanan TA, Xiang AH, Page KA. Gestational diabetes mellitus: risks and management during and after pregnancy. Nat Rev Endocrinol. 2012;8(11):639-49.

19. Peahl AF, Turrentine M, Barfield W, Blackwell SC, Zahn CM. Michigan Plan for Appropriate Tailored Healthcare in Pregnancy Prenatal Care Recommendations: A Practical Guide for Maternity Care Clinicians. J Womens Health (Larchmt). 2022;31(7):917-25.

20. Antepartum Fetal Surveillance: ACOG Practice Bulletin, Number 229. Obstet Gynecol. 2021;137(6):e116-e27.

21. Sun Y, Wang L, Niu J, Ma T, Xing L, Song A, et al. Distribution characteristics of ABO blood groups in China. Heliyon. 2022;8(9):e10568.

22. Legese B, Shiferaw M, Tamir W, Tiruneh T. Distribution of ABO and Rhesus Blood Group Phenotypes Among Blood Donors at Bahir Dar Blood Bank, Amhara, Northwest Ethiopia: A Retrospective Cross-Sectional Study. J Blood Med. 2021;12:849-54.

23. Enawgaw B, Aynalem M, Melku M. Distribution of ABO and Rh-D Blood Group Antigens Among Blood Donors in the Amhara Regional State, Ethiopia. J Blood Med. 2022;13:97-104.

24. Franchini M, Mengoli C, Lippi G. Relationship between ABO blood group and pregnancy complications: a systematic literature analysis. Blood Transfus. 2016;14(5):441-8.

25. Myle AK, Al-Khattabi GH. Hemolytic Disease of the Newborn: A Review of Current Trends and Prospects. Pediatric Health Med Ther. 2021;12:491-8.

26. Pegoraro V, Urbinati D, Visser GHA, Di Renzo GC, Zipursky A, Stotler BA, et al. Hemolytic disease of the fetus and newborn due to Rh(D) incompatibility: A preventable disease that still produces significant morbidity and mortality in children. PLOS ONE. 2020;15(7):e0235807.

27. Abalos E, Chamillard M, Diaz V, Tuncalp Ö, Gülmezoglu AM. Antenatal care for healthy pregnant women: a mapping of interventions from existing guidelines to inform the development of new WHO guidance on antenatal care. Bjog. 2016;123(4):519-28.

28. Basu S, Kaur R, Kaur G. Hemolytic disease of the fetus and newborn: Current trends and perspectives. Asian J Transfus Sci. 2011;5(1):3-7.