Prevalence of Rhesus Negative Blood Types among Sudanese's Pregnant Women in North Sudan –2025

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*Abstract— **Background:** The Rhesus (Rh) blood group system, particularly the D antigen, holds critical importance in transfusion and obstetric medicine. Rh incompatibility between a pregnant woman and her fetus can lead to hemolytic disease of the fetus and newborn (HDFN), a life-threatening condition. Despite the clinical significance, comprehensive data on the prevalence of Rh-negative blood types among pregnant women in Sudan remains limited. **Objective**: This study aimed to determine the prevalence of Rh-negative blood types among pregnant women attending antenatal care at Port Sudan Teaching Hospital in 2025, and to examine the distribution of ABO blood groups and their association with Rh factor. **Methods:** A descriptive cross-sectional study was conducted on 100 pregnant women. Data were collected via structured interviews and laboratory testing using the slide agglutination method to determine ABO and Rh blood groups. Statistical analysis was performed using SPSS version 26. **Results :** The majority of participants were aged 21–25 years (32%). Blood group O was the most common (49%),followed by A (26%) and B (25%). The prevalence of Rh-negative blood type was 16%, while 84% were Rh positive. No statistically significant association was found between ABO blood group and Rh factor (p = 1.00). **Conclusion:** This study highlights a notable prevalence of Rh-negative blood type among pregnant women in pPort Sudan, higher than some regional data. The findings emphasize the importance of routine antenatal screening and the availability of anti-D immunoglobulin to prevent Rh alloimmunization and associated complications ..*

1.INTRODUCTION :

Blood group systems play a critical role in transfusion medicine, obstetrics, and organ Transplantation.Amongtransplantation. Among these, the Rhesus (Rh) blood group system is second in clinical importance only to the ABO system. [1] The Rh factor, particularly the D antigen, significantly influences maternal and fetal outcomes in pregnancy. Individuals who lack the D antigen are termed Rh-negative, and if an Rhnegative woman conceives a fetus with Rh-positive blood, there is a risk of maternal alloimmunization.[2] This immune response can lead to hemolytic disease of the fetus and newborn (HDFN), a potentially life-threatening condition. Therefore, understanding the prevalence of Rh-negative blood types among pregnant women is crucial in guiding antenatal care strategies and planning preventive interventions.[3] Globally, the distribution of Rh-negative blood types varies significantly according to ethnicity and geographic

location. For instance, Rh negativity is observed in approximately 15% of Caucasians, 5-8% of African populations, and less than 1% among Asians. [4,5] In Sub-

Saharan Africa, including countries like Sudan, the percentage of Rh-negative individuals is generally low but still clinically significant due to the high birth rates and limited access to advanced prenatal care in some regions. Despite the potentially severe outcomes associated with Rh incompatibility, data on the prevalence of Rhnegative pregnancies in many African settings, including Sudan, remains limited and outdated.[6]Port Sudan, the capital city of the Red Sea State in northeastern Sudan, is home to a diverse population with varying ethnic backgrounds. The Port Sudan Teaching Hospital is a major referral center that provides maternal and child health services to a large segment of the population. However, there is a paucity of recent data on the prevalence of Rh-negative blood types among pregnant women attending this facility. Given the importance of early identification and management of Rh incompatibility, it becomes imperative to update and expand the knowledge base in this area.This study aims to determine the prevalence of Rh-negative blood types among pregnant women attending antenatal care at Port Sudan Teaching Hospital in 2025. The findings are expected to inform healthcare providers and policymakers about the current epidemiological patterns of Rh negativity in the region, guide screening and intervention

programs, and ultimately contribute to the reduction of Rh alloimmunization-related complications in pregnancy.

2. MATERIALS AND METHODS :

1. Study Design: This study employed a descriptive cross-sectional design

2. Study Area and Setting: The study was conducted at Port Sudan Teaching Hospital, a major referral and teaching hospital located in Port Sudan, the capital city of Red Sea State in northeastern Sudan

3. Study Population: The study population comprised pregnant women attending antenatal care services at Port Sudan Teaching Hospital during the data collection period in 2025. All women who presented for routine antenatal care and consented to participate were considered eligible for inclusion in the study.

4. Inclusion and Exclusion Criteria

Inclusion Criteria: • Pregnant women attending antenatal care at Port Sudan Teaching Hospital during the data collection period. • Women who provided informed consent to participate in the study. **Exclusion Criteria:** • Pregnant women with a known hematologic disorder or history of recent blood transfusion. • Women who declined to participate or did not provide complete data.

5. Sample Size and Sampling Technique: A total of 100 pregnant women were included in the study. The sample size was determined based on feasibility and the average number of attendees during the study period. A convenience sampling technique was used to select participants who met the inclusion criteria and were available during the data collection days.[8] **6. Data Collection Methods**

Data were collected through: • Structured interviews to obtain demographic information, including age. • Laboratory testing of blood samples to determine ABO blood group and Rhesus factor .

7. Laboratory Procedures: Blood samples were collected aseptically from each participant by trained laboratory technicians. The blood group (ABO) and Rh factor were determined using standard blood grouping techniques, **specifically:** • Slide agglutination method for ABO typing using anti-A, anti-B, and anti-D reagents. • Results were read visually and confirmed by a second technician for accuracy.

8. Data Management and Statistical Analysis Collected data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS (Statistical Package for the Social Sciences) version [9].
Descriptive statistics were used to summarize:

• Age distribution

•Frequency and percentage of ABO blood groups
• Frequency and percentage of Rh-negative and Rh-positive casesFor inferential analysis, a Chi-square test was performed to assess the association between ABO blood groups and Rh factor. The threshold for statistical significance was set at $p < 0.05$.
9.Ethical Considerations: • Informed verbal consent was obtained from all participants • Confidentiality of participant data was maintained. • Ethical approval was obtained from the Ethical Review Committee of Port Sudan Teaching Hospital prior to the commencement of data collection, and from Mashreq University

3. RESULTS:

A total of 100 women enrolled in this study .The age distribution of the participants ranged from 15 to 40 years. The most represented age group was 21–25 years, accounting for 32% of the sample , followed closely by the 15–20 age group, which comprised 24% . The 31–35 age group made up 22% , while the 26–30 age group constituted 21% . Only one participant (1%) fell within the 36–40 age group. The mean age of participants within the 15–20 age group was reported as 25 years.[Table 1]An analysis of blood group distribution among the pregnant women revealed that blood group O was the most prevalent, observed in 49% of the participants. Blood group A was present in 26%, while blood group B accounted for 25% . [Table 2]With regard to Rhesus (Rh) factor status, the majority of the pregnant women were Rh-positive,

comprising 84% of the sample. Only 16% were Rh negative.[Table 3]Among the Rh-positive participants, blood group O was the most common (53%, n=53), followed by group A (25%), and group B (22%). Among Rh-negative women, blood group O accounted for 7% group A for 5%, and group B for 4% of the total sample.The statistical analysis showed no significant association between ABO blood group and Rhesus factor status, with a p-value of 1.00. [Table 4]

Table 1: Age Distribution of Participant

Age group	Frequency	Parentage	Mean age
15-20	24	24%	25
21-25	32	32%	25
26-30	22	22%	25
31-40	1	1%	25
Total	100	100%	25

Table 2: Distribution of blood group

Blood group	Frequency	Parentage
O	49	49%
A	26	26%
B	25	25%
Total	100	100%

Table 3: Rhesus Factor distribution

Rhesus Factor	Frequency	Parentage
-Ve	16	16%
+Ve	84	84%
Total	100	100%

Table 4: The association between Blood Group and Rhesus Factor

4. DISCUSSION :

A total of 100 pregnant women participated, withagesranging from 15 to 40 years. The majority of participants were between 21–25 years of age. The results of this study revealed that blood group O was the most prevalent, observed in 49% of participants, followed by blood groups A (26%) and B (25%). studies conducted in Nigeria showed a similar predominance of blood group O, with prevalence rates ranging from 52.6% in North Central Nigeria [11], 57.54% in Uyo [10], and 64.3% among the Lelna ethnic group in Kebbi State [12]. Similarly, in Ethiopia, Ayenew (2021) reported that blood group O accounted for 39.9% of cases [7]. This consistency reinforces the notion that blood group O remains the most common in African populations.With regard to Rh factor, this study found that 84% of the participants were Rh-positive, while 16% were Rh-negative. This prevalence of Rh-negative status is somewhat higher than figures reported in many other African studies. For example, Bassey et al. [10] and Okeke et al. [13] reported Rh-negative prevalence rates of 4.4% and 4.5%, respectively. In Uganda, Apecu et al. [14] found an even lower Rh-negative rate of 2%. In contrast, the 10.8% pooled prevalence of Rh-negative blood groups reported in Ethiopia by Ayenew (2021) [7] is closer to the findings of the current study. These discrepancies may be attributed to regional genetic variation, sample size differences, or population demographics. Among Rh-positive participants, blood group O was again the most common

(53%), which aligns with patterns observed in other studies, such as those by Bassey et al. [10] and Imoru et al. [14], who reported similar dominance of blood group O among Rh-positive individuals. Among Rhnegative participants in the present study, blood group O also prevailed (7%), followed by A (5%) and B (4%). This mirrors findings in studies by Okeke et al. [13], who found blood group O to represent 4.5%

This mirrors findings in studies by Okeke et al. [13], who found blood group O to represent 64.5% of Rh-negative women in Southeast Nigeria, and [10], who reported 60.78% among Rh-negative participants.The statistical analysis in the current study revealed no significant association between ABO blood group and Rh factor status (p = 1.00). This finding is in concordance with previous reports, such as that of Lugos et al. [11], who also found no statistically significant relationship between ABO blood group and Rh factor. This suggests that the inheritance of ABO and Rh blood groups likely occurs independently, as expected genetically.However, some divergent findings were noted. For example, the relatively higher Rh-negative prevalence in this study compared to other West African studies may highlight population-specific variations or sampling differences. In contrast, studies such as that by Maruta et al.

Blood Group	Rhesus -Ve	Rhesus +Ve	p-value
O	53(53%)	7(7%)	1.00
A	25 (25%)	5(5%)	1.00
B	22 (22%)	4(4%)	1.00
Total	84 (84%)	16(16%)	1.00

[15] in Ethiopia reported a lower Rh-negative prevalence (2.1%) but a higher rate of alloimmunization (17.1%), This underlines the importance of not only identifying Rh-negative status but also evaluating its clinical consequences.

4.1 CONCLUSION :

This study confirms the predominance of blood group O among pregnant women and highlights a relatively high prevalence of Rh-negative status (16%) in the study population. No statistically significant association was found between ABO blood group and Rh factor status. Understanding the distribution of blood groups in pregnant women is vital for planning appropriate antenatal care, especially in preventing Rh alloimmunization and its complications.

4.2 Limitations :

1. The study was limited to a single location, potentially

restricting the applicability of findings to other regions with different genetic or ethnic compositions.

CONSENT

All authors declare that 'written informed consent was obtained from the participants for this study.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the faculty of medical laboratory sciences at Almashriqe University and have therefore been performed in accordance with the ethical
standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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