

A Comparative Study of the Prevalence of Blood Groups System and Rhesus Factor in a Sample of Donors from the Cities of Samawah and Rumaytha

Ahmed A. N. Alfahad

Open Educational College – Muthanna Study Center

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Annotation: An analysis of the distribution pattern and prevalence of (ABO) blood group and (Rh) rhesus factor among the target was studied among 780 individuals in the cities of Samawah and Rumaytha. The findings of our study revealed that blood group O had the highest prevalence among both males and females, with 266 individuals (34.2%). In contrast, blood group AB showed the lowest prevalence, accounting for 62 individuals (7.9 %). Blood group A was observed in 246 individuals (31.5 %), while blood group B was identified in 206 individuals (26.4 %). Analysis of the distribution of Rh that O⁺ was the most common phenotype, observed in 246 individuals (31.5 %), whereas AB⁺ was the least common among Rh-positive groups, with 60 cases (7.7 %). Among Rh-negative phenotypes, O⁻ showed the highest proportion, with 19 individuals (2.4 %), while AB⁻ represented the lowest proportion, with 2 individuals (0.3 %). This research was undertaken to determine the patterns of distribution of the ABO and Rh blood group systems within the general population of Samawah and Rumaytha.

Keywords: distribution, ABO, Rh, Samawah, Rumaytha.

Introduction

In 1900, Landsteiner the first discovery of a human blood groups system ABO (1). The term

(blood groups) refers to antigens present on the surface of red blood cells (RBCs), as well as to the set of genes responsible for determining blood group specificity. These genes may exist as alleles and can be closely linked on the same chromosome (2). The two most extensively investigated genetic markers in human populations are the ABO blood group system and the Rh antigen system. Although the antigens that define these blood groups remain stable and unchanged throughout an individual's lifetime, the distribution of ABO and Rh genotypes and phenotypes is significantly influenced by racial background and geographic location (3). ABO blood groups differ between ethnic groups and geographical regions (4). A person almost always has the same blood type throughout life; however, in very rare cases, it can change due to the addition of a new antigen or the suppression of an existing one, such as in autoimmune diseases or certain malignancies. (5). Although parental genotypes define the possible inheritance patterns of blood groups, the blood types of siblings may differ due to genetic recombination and allele segregation. The ABO blood group phenotype of an individual is determined by the presence or absence of particular antigens, such as (A) or (B) or both, on the surface of red blood cells (6). In the (blood group system), blood type A is characterized by the presence of the A antigen on the surface of red blood cells. Blood type B is defined by the presence of the B antigen. Blood type AB expresses both A and B antigens simultaneously, whereas blood group O is identified by the absence of both A and B antigens on erythrocytes (7). The blood group system is determined by a single genetic locus situated on chromosome 9 within the autosomal genome (8).

Blood groups within the Rh system are categorized as Rh-positive or Rh-negative according to the presence or absence of Rh antigens on the erythrocyte membrane. The expression of Rh antigens is genetically controlled by three closely linked allelic gene pairs located on chromosome 1, which govern the biosynthesis and surface presentation of these antigenic determinants (9;10).

Although the (ABO) and (Rh) systems of blood groups are the same for all human populations, the frequencies and distribution patterns of particular blood types differ greatly among various racial, ethnic and economic and social groups as well as among various geographic populations (11). The (ABO gene) encodes a glycosyltransferase enzyme responsible for catalyzing the transfer of specific carbohydrate residues to precursor oligosaccharide chains on the cell surface. Genetic polymorphisms within the ABO locus result in structural variations of the glycosyltransferase, thereby altering its substrate specificity, these enzymatic differences determine whether N-acetylgalactosamine is added (A antigen), galactose is incorporated (B antigen), or no functional sugar residue is transferred due to loss of enzymatic activity (O blood group) (12).

(Table 1) Structural and Enzymatic Characteristics of ABO Blood Group Antigens (13).

Blood Group	H Antigen (Precursor)	Terminal Sugar Residue Added	Enzyme Function	Antigen Expressed
O	Present	None	Inactive or nonfunctional glycosyltransferase	H antigen only
A	Present	N-acetylgalactosamine (GalNAc)	A-specific glycosyltransferase	A antigen
B	Present	Galactose (Gal)	B-specific glycosyltransferase	B antigen

The H antigen functions as the fundamental precursor oligosaccharide framework in the blood group system. In individuals with blood group A, an N-acetylgalactosamine residue is enzymatically attached to the H antigen by a specific glycosyltransferase. In contrast, in blood group B, a galactose moiety is incorporated into the H structure. In blood group O, the corresponding glycosyltransferase is inactive or absent, leading to the persistence and surface expression of the unaltered H antigen (13).

The (Rh) blood group system was initially characterized approximately six decades ago. A female patient experienced a severe hemolytic transfusion reaction after receiving blood from her husband following the delivery of a stillborn infant affected by erythroblastosis fetalis, her serum demonstrated agglutination of red blood cells from her husband as well as from 80% of ABO-compatible Caucasian donors (14).

Materials and Methods

This investigation was carried out in 2024 over a duration of four months. The study population comprised 780 healthy volunteers, including 386 males and 395 females, who were randomly recruited from the communities of Samawah and Al-Rumaytha. Blood group typing was performed using agglutination assays according to the ABO and Rh blood group systems. All analyses were conducted in accredited laboratories located in Al-Muthanna. To assess the Rh factor status (positive or negative), monoclonal anti-D antibodies of both IgG and IgM classes were employed.

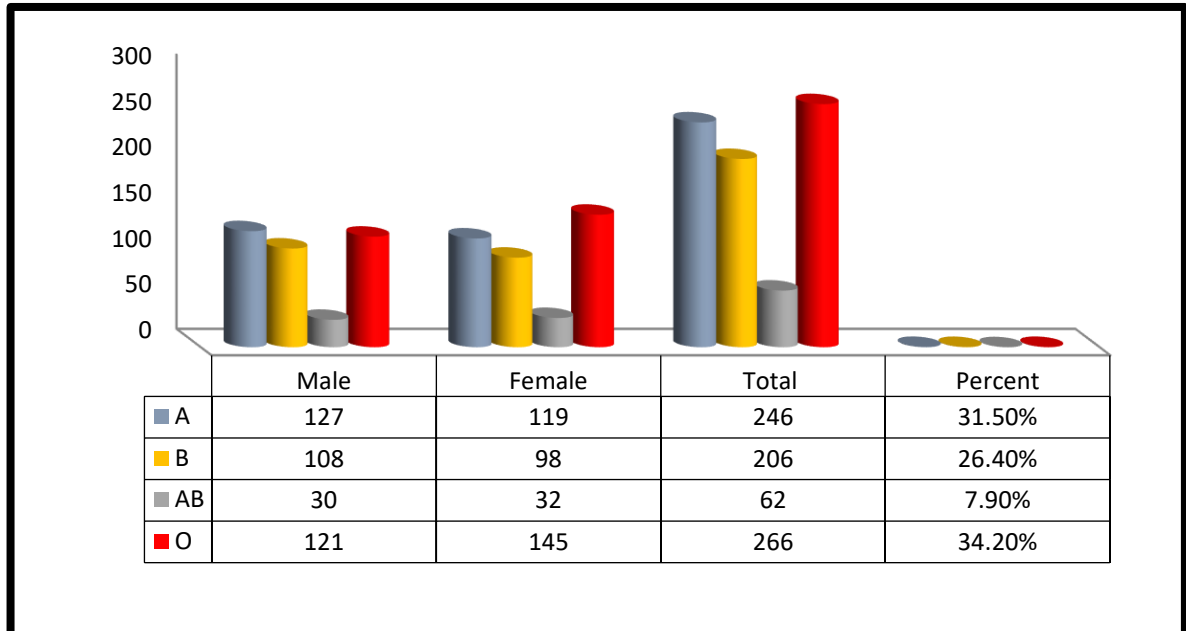
Statistical analysis

SPSS software (version 17) was used to analyse the data that was gathered. Frequency distributions and percentages displayed in tabular form were among the descriptive statistics that were calculated.

Results

The current study included (780) samples to locate the distribution of (ABO) blood groups and (Rh), (Figure 1) show high incidence of group O (266) (34.2%) male and female. While blood group (AB) showed low (62) (7.9%) in male and female, group A (246) (31.5%) and group B (206) (26.4%).

(Figure 1): distribution of ABO blood groups system.



The high incidence of group O^{+ve} (246) (33.5%) in both males and females is depicted in (Figure 2). In contrast, it was also observed low incidence of blood group AB^{+ve}, as evidenced by the following: (61) (8.1%) of males and females. 32.7% for group A^{+ve} (233) and 26.5% for group B^{+ve} (195).

(Figure 2): distribution of Rh^{+ve} blood groups system.

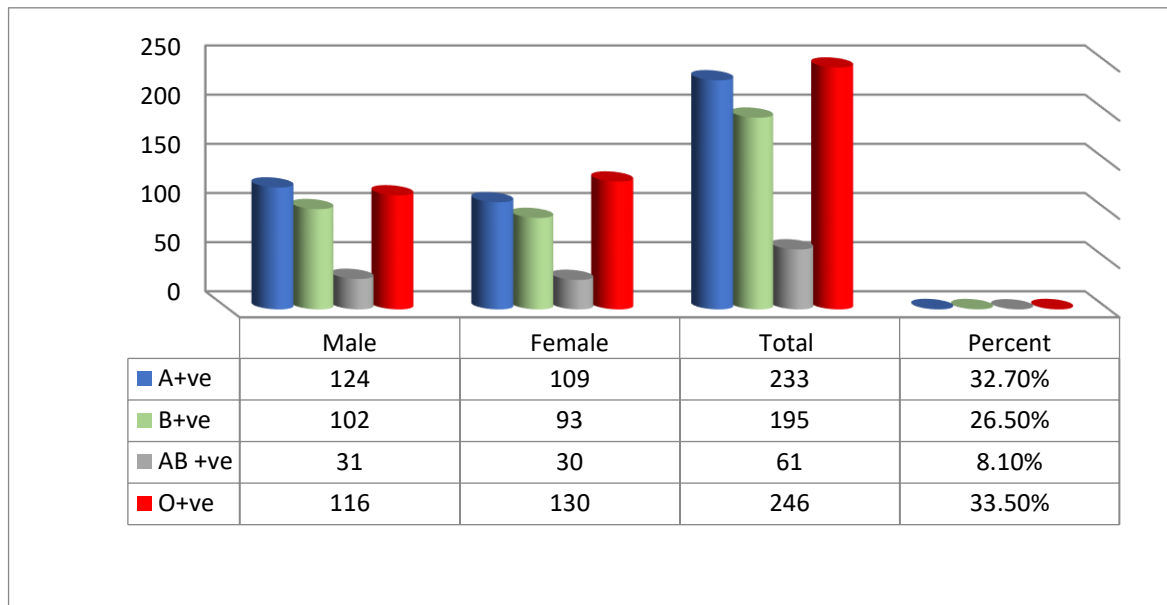
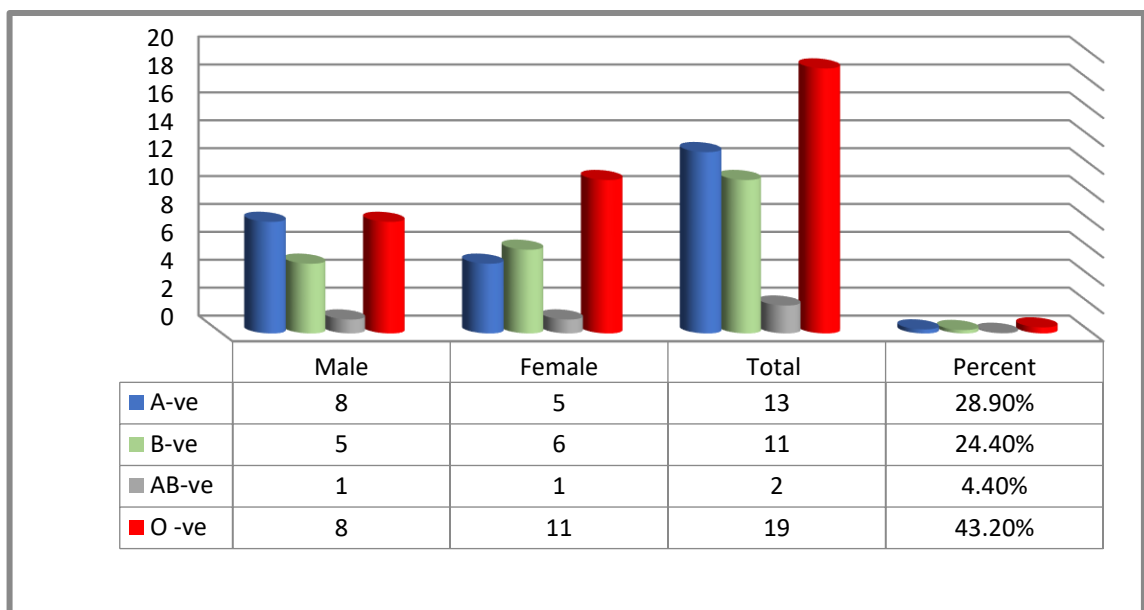


Figure 3 shows the high prevalence of group O^{-ve} (19) (42.2%) in both males and females. The two (4.4%) male and female individuals below demonstrate the low incidence of blood group AB^{-ve} in the city. Groups A^{-ve} (13) (28.9%) and B^{-ve} (11) (24.4%).

(Figure 3): distribution of Rh^{-ve} blood groups system.



The distribution of the Rhesus factor and blood group system between the cities of Samawah and Rumaytha in our study is displayed in (Table 2), The following pattern was observed (O > A > B > AB) and Rh^{+ve} was more common than Rh^{-ve} among the tow cities.

(Table 2): distribution of the Rhesus factor and blood group system between the cities of Samawah and Rumaytha

Blood groups Zones	N.	A	B	AB	O	Rh ^{+ve}	Rh ^{-ve}
Samawah	459	142	123	18	176	428	31
Percentage	58.8 %	30.9 %	26.8 %	3.9 %	38.3 %	93.2 %	6.8 %
Rumaytha	321	93	77	25	126	287	34
Percentage	41.2 %	28.9 %	23.9 %	7.8 %	39.2 %	89.4 %	10.6 %

Discussion

Blood group O showed the highest prevalence (34.2%) in the current study, while blood group AB showed the lowest prevalence (7.9%). These results are in line with earlier studies that were published and carried out in southern Iraq (15;16;17), central parts of Iraq (18;19;20) and north of Iraq (21), which states group AB signed up with the lowest percentage, and phenotype O showed the most hesitation. Our results contrast with the ABO blood group distribution that has been documented in Nepal, where blood group O has been reported to be significantly less common (1.5%), while blood group A makes up the largest percentage (34%) of the population (22). Numerous factors could be at play here, such as disparities in social structures across nations or instances of interfaith marriage that resulted in these disparities (23).

According to the study's findings, O⁺ was the most common blood group among Rh-positive people (33.5%), while AB⁺ was the least common (8.1%). O⁻ had the highest prevalence (43.2%) and AB⁻ had the lowest proportion (4.4%) among Rh-negative individuals. These findings align with those documented in earlier research (24). Similarly, several studies have reported comparable distribution patterns across different geographical regions, including Northwest Ethiopia (25), Western India (26), Uganda (27), Mogadishu, Benadir, Somalia (28), and Nigeria (29). Jahanpour et al.'s research in Tanzania, on the other hand, showed a different distribution pattern, with A negative making up 3% and B and O negatives coming in second and third, respectively, at 2%.(30).

The current study also showed that different blood donation locations have different distributions of ABO and Rh blood groups. This variation emphasises how crucial it is that local blood banks use this data to optimise blood inventory management in accordance with the needs of particular blood groups.

Conclusions

Our findings indicate that blood group (O) exhibited the highest prevalence, whereas blood group (AB) showed the lowest frequency among donors in Samawah and Rumaytha. Such data are of practical significance for blood bank management and transfusion planning. Furthermore, we aim to investigate the potential association between (ABO) blood group phenotypes, fertility outcomes, and recurrent spontaneous abortion. The current study also showed that different blood donation locations have different distributions of (ABO) and (Rh) blood groups. This variation emphasises how crucial it is that local blood banks use this data to optimise blood inventory management in accordance with the needs of particular blood groups.

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