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Original article

Distribution of ABO Blood Groups and Rhesus Factor in Gharyan City, Northwestern Libya

Salha Rajab[1], Mustafa Saieh*[2], Omar Ali Saied[3]

[1]*Histology Department, Faculty of Medicine, Gharyan University, Libya.*
[2]*Zoology Department, Faculty of Sciences- Alassba, Gharyan University, Libya*
[3]*Chemistry Department, Faculty of Sciences- Alassba, Gharyan University, Libya*
Corresponding Email. *saiehmustafa445@gmail.com*

Abstract
Understanding the distribution of ABO and Rh blood types in a population helps genetic research and studies on disease susceptibility associated with blood types. It also helps blood banks efficiently manage donor blood supplies, providing the availability of compatible blood types for transfusions and emergencies. This study was conducted to analyze the distribution of ABO and Rh-D blood groups in Gharyan city, Libya. The statistics suggest that Blood group O (48.73%) is the most frequent, followed by A (36.36%), B (11.61%), and AB (3.28%). A lesser number of the population is Rh-D negative (20.20%), while the majority is Rh-D positive (79.79%). These results could help blood banks manage blood transfusion programs in handling local blood transfusion services.
Keywords. ABO Blood Groups, Rh-d Factor, Blood Group Distribution, Gharyan, Libya.

Introduction

In humans, there are more than 350 antigens located at the outer surface of RBC, some of them serve as cluster of differentiation (CD), based on these antigen types and their genetically controlled, it was classified into many blood group system ex; ABO system, Rh system, MNS system [1]. There are more than 31 blood group systems recognized; the most important are ABO, Rhesus (Rh), and the MN system. In 1900 Landsteiner discovered ABO blood system, which have 4 basic phenotype A, B, AB, O, their antigen located at the outer surface of RBC are complex oligosaccharides which is exist in most body cell and in some body secretion, Over the RBC membrane the antigen corresponding to the ABO blood group phenotype as A antigen in blood group A and absence of A and B antigen on type O blood group, also in the blood antibodies produced by immune system naturally against the ABO antigens not present on an individual's RBCs (ex. Anti-B antibodies in A blood group)[2,3].

The Rh blood group was also discovered by Landsteiner in 1940; its antigen protein is naturally occurring and specific to RBC (expressed on the RBC membrane only). There are about 50 antigens, the most important antigen is D& (C, E, e), D antigen existing or absence had clinically significant. The Rh blood type can be classified by exist or presence of the RhD antigen: Rh-negative (absence of the RhD antigen) or Rh-positive (presence of the RhD antigen) [4].

The frequency of ABO and RH blood groups varies ethnically, geographically, and from one population to another. Together, the ABO and Rh blood group systems define the eight common blood types: A+, A−, B+, B−, AB+, AB−, O+, and O−, and they are Clinically significant as in blood compatibility (Blood transfusion, Organ transplantation, between fetus &mother in Rh blood type that can lead to hemolytic disease of the fetus &newborn (HDFN)), disease association (cancer and cardiovascular disease). Studying their distribution is very important in clinical management for blood typing (ABO & Rh) for cross-matching. It is also important for supporting public health and improving healthcare delivery, as well as essential for ensuring the availability of compatible blood for transfusions and the effective management of blood bank inventories [5],[1].

Methods

A retrospective cross-sectional study was conducted on 396 blood donor data collected within the age group 18-70 years from October 2024 to January 2025 at Gharyan city at Central Gharyan hospital &Combined Gharyan polyclinic. Gharyan is a city in northwestern Libya, situated in the Jabal al Gharbi District. It is situated south of Tripoli, about 80 km, there Coordinates: 32°10′11″N 13°01′00″E. It has a population of about 200,000 -250,000 [6]. The sample size was calculated by Richard Geiger's equation, which was 396 persons, and selected by a random technique. The following is Richard Geiger's equation:

$$n = \frac{\left(\frac{Z}{d}\right)^2 \times P(1-P)}{1 + \frac{1}{N}\left[\left(\frac{Z}{d}\right)^2 \times P(1-P) - 1\right]}$$

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Where (n) was sample size, N was Community size, (P) was the coefficient of variation between population and it is equal to 0.5, which is considered a constant number according to Richard's equation, (z) was the standard score corresponding to the confidence level at the confidence level (95% = 1.96), (d) was the acceptable error level which is its value at the 95% confidence level = 0.05, as result of this equation the sample should be at least 385, our sample was 396. All participants were voluntary, non-remunerated, within the age group of 18-70years.

The slide agglutination method was used for the ABO & RH blood type test. As a start, 1 ml of blood was drawn from peripheral veins and collected in blood tubes containing Ethylenediaminetetraacetic acid anticoagulant (EDTA). Label the tube with the code number corresponding to the patient's name. By a glass marking pencil, divide the clean slide into 3 parts. Label each part as follows: "Anti-A," "Anti-B," and Anti-D" for Rh typing. Then add one drop of the patient's whole blood sample to each section that was previously done. After that, add "Anti-A," "Anti-B," and Anti-D" according to the labeled section corresponding to its label. With a clean stick, mix both thoroughly over each section, move the slide back and forth for about 1-3 minutes, and wait for the result of whether clumping (agglutination) happened or not.

Interpreting the results was based on identifying the particular antigens found on the surface of your red blood cells. Blood group A agglutination occurred in the anti-A section only, blood group B agglutination occurred in the anti-B section only, blood group AB agglutination occurred in the anti-A and anti-B sections, and blood group O agglutination did not occur at all in any section. In case the RH factor result was Rh-positive (Rh+) if agglutination happened (present Rh (D) antigen on the red blood cell outer surface), or Rh-negative (Rh-) if no agglutination happened (absent Rh (D) antigen on the red blood cell outer surface) [7]. We took oral consent from all participants to be part of this study.

Data analysis: SPSS (Statistical Package for Social Sciences) Version 21 software was used to enter the data and statistically analyze it.

Result

396 volunteers were included in the current study, most of them were females, representing about (61.11%), and males (38.88%), as shown in (Table 1), (Figure 1).

Table 1. Distribution of ABO and Rhesus groups in the study sample according to gender.

		Blood group								Total
		A+	A-	B+	B-	O+	O-	AB+	AB-	
Gender	Male	44	16	17	3	54	15	5	0	154
	Female	77	7	19	7	95	29	5	3	242
Percentage %		30.55	5.80	9.1	2.52	37.62	11.11	2.52	0.75	100
Total		121	23	36	10	149	44	10	3	396

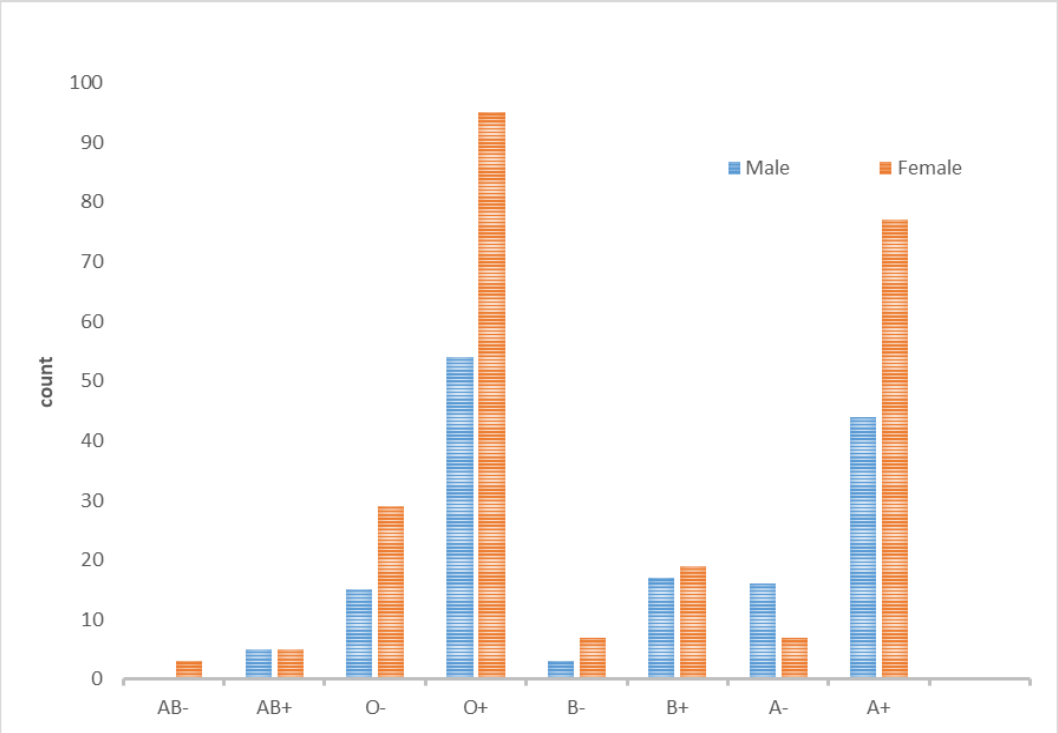

Figure 1. Distributions of ABO and Rh in Gharyan City, Libya, according to gender.

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The most frequent blood group was blood group O (48.73%), followed by A (36.36%), B (11.61%), and AB (3.28%). Regarding the Rh blood factor, Rh positive (Rh+) was most prevalent (79.79%), and Rh negative represented (20.20%), as shown in (Table 2), (Table 3).

Table 2. Distributions of ABO in Gharyan City, Libya.

Blood group	Number	Percent %
A	144	36.36
B	46	11.61
O	193	48.73
AB	13	3.28
Total	396	100

Table 3. Distributions of Rh in Gharyan City, Libya.

Blood group	Number	Percent %
RH +	316	79.79
RH -	*80*	*20.20*
total	396	100

Take into account ABO and Rh blood group wholly, the most common blood group was O positive (37.6%) followed by A positive (30.6%), O negative (11.1%), B positive (9.1%), A negative (5.8%), AB positive (2.5%), B negative (2.5%), and AB negative (0.8%), (Table 4) show that.

Table 4 Distributions of ABO and Rh in Gharyan City, Libya.

Blood group			
		Frequency	Percent %
Valid	A+	121	30.6
	A-	23	5.8
	B+	36	9.1
	B-	10	2.5
	O+	149	37.6
	O-	44	11.1
	AB+	10	2.5
	AB-	3	0.8
	Total	396	100.0

Discussion

Understanding the distribution of ABO and Rh blood types in a population helps genetic research and studies on disease susceptibility associated with blood types. It also helps blood banks efficiently manage donor blood supplies, providing the availability of compatible blood types for transfusions and emergencies. Although there are significant regional differences in frequencies, the distribution of ABO and Rh blood groups in Libya exhibits consistent patterns throughout different locations.

This study attempted to identify the distribution of blood groups ABO & Rh in Gharyan city. It was a comparative cross-sectional study that analyzed 396 participants within the age group 18-70 years from October 2024 to January 2025. Furthermore, based on our studies, the distribution of O, A, B, and AB blood groups is as follows: (48.73%), (36.36%), (11.61%), and (3.28%), respectively. Also, the majority of Libyans are Rh-positive, with frequencies around 79.79%, while the proportion of Rh-negative people is lower at 20.20 %, which is consistent with other studies locally in Libya, as in Tarhuna city, which found blood group O (49.43%) most prevalent in their population & blood group AB (4.43%) less common also found Rh +(86.7%) was found to be more common in the current study, as observed [8]. Another study conducted in West Coast regions (Ragdalin, Aljamail, and Zaltan) found that blood group O was common in Ragdalin (48.15%) and Zaltan (37.3%), where blood group A was common in Aljamail (36.8%), and the low blood group prevalent in 3 cities was the B blood group; also, RH+ was more common in the 3 cities as a percentage (82.2%) [9]. Furthermore, another study done in Bani Waleed City found the same result of our study, that the most prevalent blood group was O (43%), and the least prevalent was AB (7%), and like the previous study, the Rh-positive (76.2%) was the most common [10]. In Sebha city found that blood group ABO and RH distribution were O (42.12%) >A (28.27%) >B (22.77%) >AB (6.83%), with prevalence Rh + (81.7%) more than Rh – [11]. Thus, our research agrees with the conclusions found in Albiyda city [12].

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AzZawya City [13]. Almergeb city [14]), Aljufra [15], Benghazi [16], and another study conducted in the Northeastern of Libya included two cities, Ghemins & Ajdabiya, found similar results as the common blood group was O, and blood group AB had less prevalence, as well as RH + was more common in both cities [17]. Furthermore, there was study conducted in four city Zintan, Alrujban, Jadu and Tripoli the result was similar to current study in two city which are in Zintan and Alrujban as well as different in Tripoli the distribution of blood group was A (36.43%) > O (29.35%) >B (23.98) > AB (10.22%), and in Jadu the lowest blood group prevalent was blood group A (22.15%) it was the only city in Libya had blood group AB (26.23%) as second prevalent blood group, also the frequency of Rh + was (57.43%), Rh – (42.56%) was highest percentage found in the study at Libya, other three city the frequency of Rh is similar to our result [18].
Furthermore globally there were many study conducted around the word which their result was consistent with our as which conducted in Kilimanjaro and Tanzania their result was the frequency blood group O, followed by A, B, and AB[19], Algeria [20] two study carry out in Ethiopia [21], [22] Southwest Saudi Arabia [23], Morocco [24], also in previous studies Rh distribution was consistent with our result as Rh + was dominant. Furthermore, other study different from our result as they found the second common group was B. Their blood group distributions were O > B > A > AB is commonest as studied in Oman [25], Iraq [26], and Bahrain [27].
However, some studies do not agree with our result as they found the blood group distributions were A>O>B>AB as in Palestine [28], Egypt [29], Turkey [30], Jordan [31], and Fayoum City in Egypt [32]. In Pakistan, the result of blood group type was different, as they found blood group B (38%) was the commonest, followed by O, A, and AB [33). These blood group distributions were found in Bangladesh [34] and India [35]. Regarding Rh distribution, all studies mentioned previously agree about Rh + is more prevalent than Rh – in greet differences between the two.

Conclusion

This study was conducted to analyze the distribution of ABO and Rh-D blood groups in Gharyan city, Libya. The statistics suggest that Blood group O (48.73%) is the most frequent, followed by A (36.36%), B (11.61%), and AB (3.28%). A lesser number of the population is Rh-D negative (20.20%), while the majority is Rh-D positive (79.79%). These results could help blood banks that manage blood transfusion programs in handling local blood transfusion services; they are also vital for population studies and clinical research (such as disease correlations).

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