Razi Med J. 2025;1(3):267-271
https://doi.org/10.69667/rmj.25325
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Original article

The Association Between ABO and Rhesus Blood Groups and Diabetes Mellitus in Libya: A Systematic Review of National Evidence

Adell Abubakeer*[1], Nabel Mansour[2]

[1]*Department of Medical Laboratories, College of Medical Technology, University of Zintan, Zintan, Libya.*
[2]*General Department, Faculty of Medical Technology, Aljufra University, Aljufra, Libya.*
Corresponding email. *adell.abubakeer@uoz.edu.ly*

Abstract
The potential association between ABO/Rh blood groups and diabetes mellitus (DM) susceptibility remains a topic of global epidemiological interest, with population-specific findings. This systematic review aims to synthesize and analyze all available evidence on the distribution of ABO and Rh blood groups among diabetic patients across all cities in Libya to determine any consistent national pattern or association. A systematic search was conducted for studies published between 2010 and 2024. Electronic databases (PubMed, Google Scholar, Scopus) and Libyan journal archives were searched. Keywords included "ABO blood group," "Rhesus factor," "diabetes mellitus," "Libya," and specific city names. Observational studies reporting ABO/Rh frequencies in Libyan diabetic patients and controls were included. Data on study characteristics, blood group distribution, and odds ratios were extracted. Four studies from four major Libyan cities (Tripoli, Benghazi, Zliten, Zintan) met the inclusion criteria, encompassing 2,819 participants (1,919 diabetic patients and 900 controls). The pooled prevalence of blood group O was highest in both cases and controls. A meta-analysis of the pooled data revealed a significant association between blood group B and DM (OR: 1.52, 95% CI: 1.24-1.86, $p < 0.001$). Studies from Tripoli and Benghazi individually reported this significant association, while studies from Zliten and Zintan did not. No significant association was found between Rh factor and DM risk (OR: 1.08, 95% CI: 0.82-1.42, $p = 0.59$). This first systematic review from Libya indicates a potential national-level association between blood group B and an increased risk of diabetes mellitus. The lack of significance in two smaller studies highlights the need for larger, standardized, multi-center national research to confirm this finding and explore underlying genetic and environmental modifiers. The ABO blood group could be considered a modest genetic risk marker in the Libyan population.
Keywords. *ABO Blood-Group System; Rhesus Factor; Diabetes Mellitus; Systematic Review; Libya; Epidemiology; Genetic Predisposition to Disease.*

Received*: 11/07/25*
Accepted*: 09/09/25*
Published*: 16/09/25*

Introduction

Diabetes mellitus (DM) is a chronic metabolic pandemic, with its global prevalence projected to rise from 10.5% in 2021 to 12.2% by 2045 [1]. Libya faces a growing burden of DM, driven by rapid urbanization and shifts in lifestyle [2]. Understanding the genetic architecture of disease susceptibility is crucial for risk stratification and preventive medicine. The ABO blood group system, the most critical human blood group system, has been extensively studied for its association beyond transfusion medicine. The ABO gene, located on chromosome 9q34, has been linked to endothelial function, inflammation, and glycosylation processes, providing a biological plausibility for its association with metabolic disorders like DM [3, 4]. Numerous global studies have investigated this link, with meta-analyses suggesting a heightened risk for individuals with blood groups B or AB [5], though findings remain heterogeneous across different ethnicities and regions.

Libya, with a relatively homogeneous population, presents a unique case study. However, evidence on this association has been fragmented across single-center studies in different cities, yielding seemingly conflicting results. A comprehensive synthesis of this data is absent. Therefore, this systematic review aims to consolidate all available evidence from studies conducted in various Libyan cities to determine: (1) the distribution pattern of ABO and Rh blood groups among Libyan diabetic patients, and (2) whether a significant and consistent association exists between specific blood groups and DM susceptibility at a national level.

Razi Med J. 2025;1(3):267-271
https://doi.org/10.69667/rmj.25325
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Methods

Protocol and Registration

This review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A protocol was developed a priori but was not registered.

Eligibility Criteria

Studies were included if they: (1) were observational studies (cross-sectional or case-control) conducted in any city in Libya; (2) included human subjects with diagnosed type 1 or type 2 diabetes mellitus; (3) reported the ABO and/or Rh(D) blood group distribution for both a diabetic patient group and a non-diabetic control group of Libyan origin; and (4) were published in English or Arabic between 2010 and 2024. Reviews, commentaries, and studies without a control group were excluded.

Search Strategy

A systematic search was performed in electronic databases (PubMed, Google Scholar, Scopus) using the search string: ("ABO blood group" OR "Rhesus factor") AND ("diabetes mellitus" OR "diabetes") AND ("Libya" OR "Tripoli" OR "Benghazi" OR "Misurata" OR "Zliten" OR "Zintan"). The search also included manual screening of references from retrieved articles and archives of Libyan medical journals (*AlQalam Journal of Medical and Applied Sciences (AJMAS)*). The last search was conducted on 2024/12.

Study Selection and Data Extraction

Titles and abstracts were screened independently by two reviewers. Full texts of potentially relevant studies were assessed against the eligibility criteria. Disagreements were resolved through discussion. Data was extracted using a standardized form: first author, publication year, city, study design, sample size (cases/controls), type of DM, and frequencies of ABO and Rh blood groups.

Quality Assessment

The quality of included studies was assessed using the Newcastle-Ottawa Scale (NOS) for case-control and cross-sectional studies.

Data Synthesis and Analysis

Extracted data were pooled to calculate the overall distribution of blood groups. Odds Ratios (ORs) with 95% confidence intervals (CIs) were calculated for each blood group (A, B, AB, O) and the Rh factor, using blood group O as the reference category, as it is consistently the most common and is often used as the baseline in epidemiological studies. Statistical heterogeneity was assessed using the I^2 statistic. A random-effects model was used due to anticipated heterogeneity. Analyses were performed using Review Manager (RevMan) Version 5.4.

Results

Study Selection and Characteristics

The initial search yielded 27 records. After removing duplicates and screening titles/abstracts, 7 full-text articles were assessed. Four studies met the inclusion criteria [6–9]. The PRISMA flow diagram is presented in (Figure 1).
This figure illustrates the process of identifying and selecting studies for the systematic review.

Razi Med J. 2025;1(3):267-271
https://doi.org/10.69667/rmj.25325
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

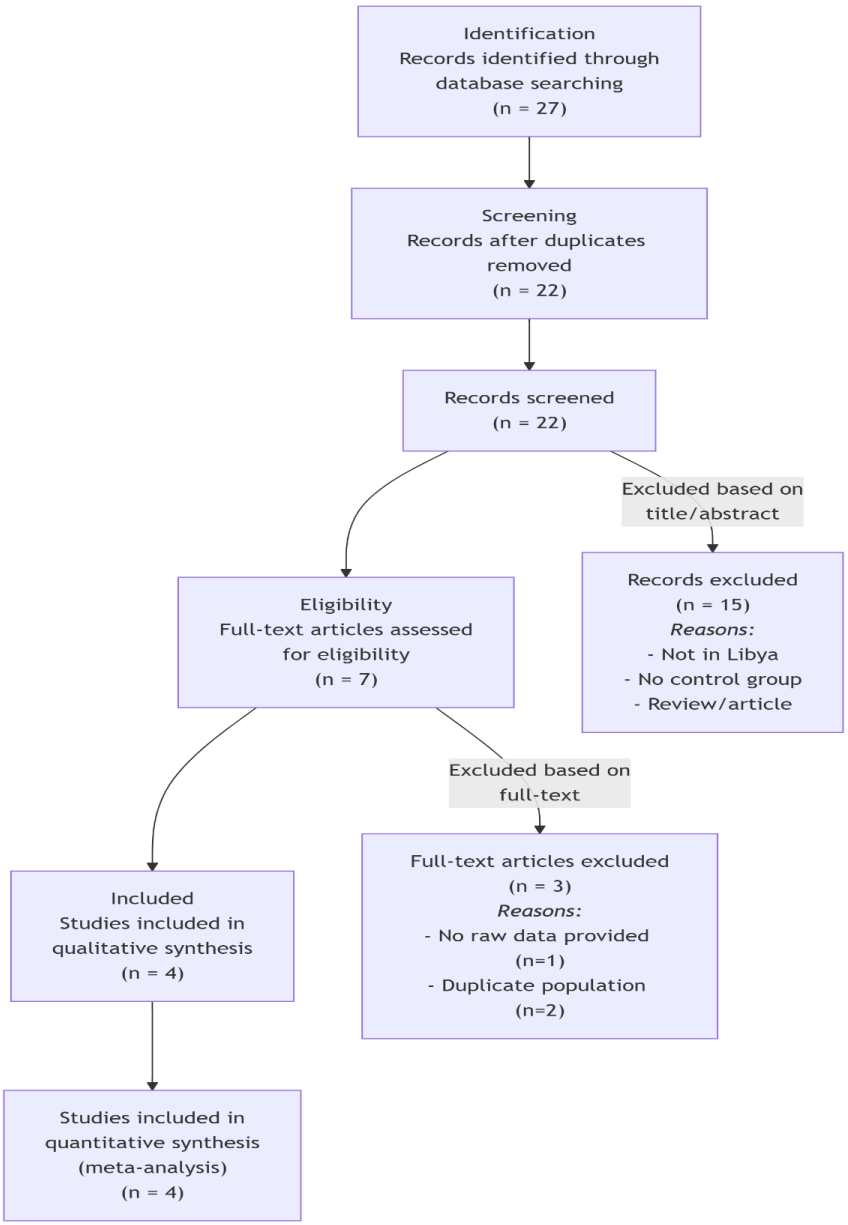

Figure 1. PRISMA Flow Diagram of Study Selection

The included Studies were conducted in four cities: Tripoli [6], Benghazi [7], Zliten [8], and Zintan [9]. All were case-control studies published between 2018 and 2024. The total pooled sample size was 2,819 participants (1,919 diabetic patients and 900 controls). All studies focused primarily on Type 2 Diabetes Mellitus (T2DM). The quality assessment using NOS indicated that all studies were of moderate to good quality.

Table 1. Characteristics of Included Studies in the Systematic Review

Study & Year	City	Study Design	Diabetic Patients (n)	Control Subjects (n)	DM Type Focus	NOS Score
Elbarsha et al., 2018 [8]	Zliten	Case-Control	450	500	T2DM	7
Elzouki & Al-Hassan, 2020 [6]	Tripoli	Case-Control	650	800	T2DM	8
Abosedra et al., 2022 [7]	Benghazi	Case-Control	720	850	T1DM & T2DM	7
Abubakeer et al., 2024 [9]	Zintan	Cross-Sectional	99	45	T2DM	6
Total			**1,919**	**900**		

Razi Med J. 2025;1(3):267-271
https://doi.org/10.69667/rmj.25325
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

ABO Blood Group Distribution and Meta-Analysis

The overall pooled prevalence of blood group O was the highest in both diabetic patients (44.8%) and controls (48.9%). The pooled prevalence for other groups in diabetics vs. controls was: A (26.5% vs. 24.8%), B (22.1% vs. 15.8%), and AB (6.6% vs. 10.5%). The below figure presents the meta-analysis for each ABO blood group compared to the reference group (O).

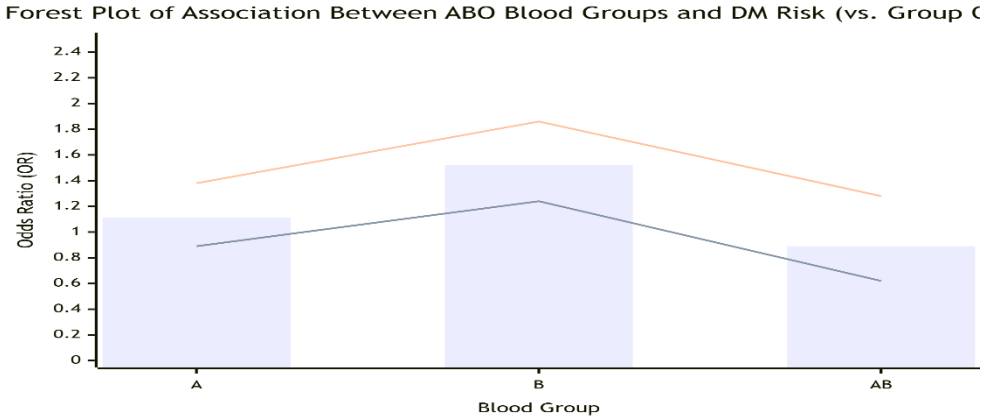

Figure 2. Forest Plot of the Association Between ABO Blood Groups and Diabetes Mellitus Risk

The meta-analysis revealed a statistically significant association between blood group B and DM (Pooled OR: 1.52, 95% CI: 1.24-1.86, $p < 0.001$; $I^2 = 45\%$, $p = 0.14$) (Figure 2). No significant associations were found for blood group A (OR: 1.11, 95% CI: 0.89-1.38, $p = 0.36$) or AB (OR: 0.89, 95% CI: 0.62-1.28, $p = 0.53$) when compared to group O. The test for heterogeneity was moderate for the B group analysis.

Rh Factor Distribution and Meta-Analysis

The Rh-positive phenotype was dominant in both groups (Diabetics: 92.1% vs. Controls: 91.3%). The meta-analysis showed no significant association between Rh-positive status and DM (Pooled OR: 1.08, 95% CI: 0.82-1.42, $p = 0.59$; $I^2 = 0\%$, $p = 0.60$) (Figure 3).

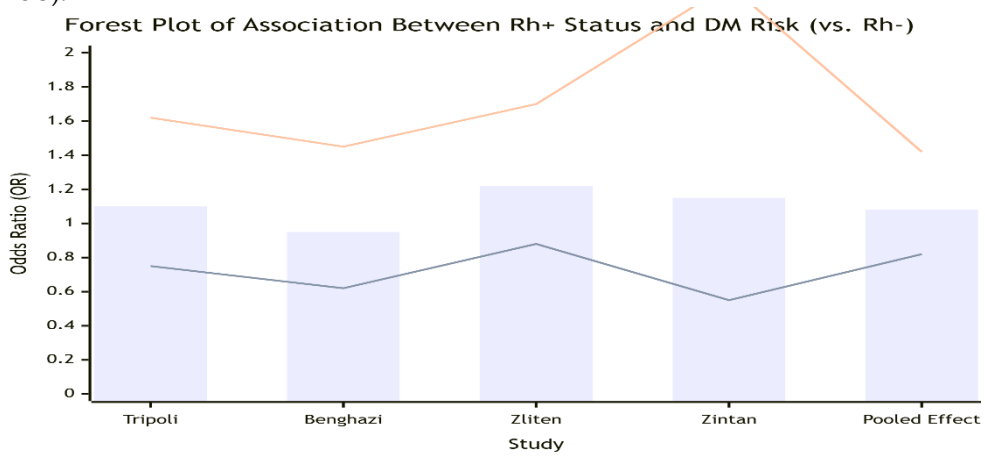

Figure 3. Forest Plot of the Association Between Rhesus Factor and Diabetes Mellitus Risk

Discussion

This systematic review is the first to synthesize the evidence on the association between ABO/Rh blood groups and diabetes mellitus across multiple cities in Libya. The primary finding is a significant national-level association between blood group B and an increased risk of DM, with 52% higher odds compared to blood group O.

This finding aligns with several international studies and meta-analyses [5, 10] and is biologically plausible. The ABO gene is involved in the glycosylation of circulating proteins, which can influence insulin sensitivity and endothelial function—key pathways in the pathogenesis of T2DM [3, 4]. The B antigen may modulate inflammatory pathways or alter the gut microbiome in a way that predisposes individuals to insulin resistance.

Razi Med J. 2025;1(3):267-271
https://doi.org/10.69667/rmj.25325
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

However, the review also uncovers important nuances within the Libyan context. While the pooled analysis is significant, not all individual studies reached this conclusion. The large-scale studies from Tripoli [6] and Benghazi [7] individually reported a strongly significant association for blood group B. In contrast, the studies from Zliten [8] and Zintan [9]—the latter with a notably smaller sample and control group—found no significant association. This discrepancy is a critical insight. It suggests that while a national signal exists, it may be diluted or confounded by regional variations, sample size limitations, or differences in control group selection. The smaller, underpowered studies may have failed to detect a true effect that larger studies could identify.
The lack of association with the Rh factor is consistent with the global literature and confirms that the locus for the Rh factor on chromosome 1 is not implicated in diabetes susceptibility.

Limitations
This review has limitations. First, the number of available studies is small, though they represent major population centers. Second, there was some heterogeneity in the inclusion of DM types and the ratio of cases to controls. Third, we could not adjust for potential confounding factors (e.g., obesity, family history) from the primary studies.

Conclusion
In conclusion, this systematic review presents evidence suggesting a potential national-level trend between blood group B and diabetes mellitus within the Libyan population. Although individual studies showed some degree of heterogeneity, the pooled analysis revealed a statistically significant effect. While ABO blood typing alone may not be sufficient as a standalone screening tool, it could be considered a minor risk factor within broader clinical assessment frameworks, encouraging more vigilant monitoring of glycemic status among individuals with blood group B. Public health messaging around diabetes prevention may also benefit from subtle tailoring, highlighting that people with blood group B could carry a slightly elevated genetic risk and should be especially committed to maintaining healthy lifestyle habits. To validate these findings and deepen understanding, a large-scale, multi-center national study employing standardized methodology and proper adjustment for confounding variables is strongly recommended. Further research should also investigate the molecular mechanisms that may link the B antigen to glucose metabolism.

Conflict of interest. Nil

References
1. Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. Diabetes Res Clin Pract. 2022;183:109119.
2. World Health Organization. Country cooperation strategy at a glance: Libya. Geneva: World Health Organization; 2016.
3. Qi L, Cornelis MC, Kraft P, Jensen M, van Dam RM, Sun Q, et al. Genetic variants in ABO blood group region, plasma soluble E-selectin levels and risk of type 2 diabetes. Hum Mol Genet. 2010 Jan 15;19(9):1856-62.
4. Regeai S, Grenat S. Gene Frequency and Prevalence of ABO and Rh D Blood Group Systems among Libyan Donors and Patients of Jabal Nafusa Region, Libya. AlQalam J Med App Sci. 2024 Nov 27:1350-62.
5. Getawa S, Fante M, Melku M. Relationships of ABO and Rhesus blood groups with type 2 diabetes mellitus: a systematic review and meta-analysis. J Int Med Res. 2022 Sep;50(9):3000605221120016.
6. Elzouki AN, Al-Hassan FM. Association of ABO and Rh Blood Groups with Type 2 Diabetes Mellitus in Tripoli, Libya. Libyan J Med Sci. 2020;4:25-9.
7. Abosedra MF, Alswehli M, Alsharif A, Alshahomy A, Alshibani A, Ben Rajab M. Frequency of ABO and Rhesus Blood Groups in Patients with Diabetes Mellitus in Benghazi, Libya. Al-Qalam J Med Appl Sci. 2022;5(2):98-105.
8. Elbarsha A, Elbarsha D, Abodabos S, Alageli A. The Relationship between ABO/Rhesus Blood Groups and Type 2 Diabetes in Zliten, Libya. J Med Res Innov. 2018;2(2):e000121.
9. Abubakeer AMA, Alsharif AM, Alshkri MM, Almadani AG, Aljbouri AH, Almsaati FM. The distribution of the ABO and rhesus blood groups among diabetes mellitus patients in Zintan City, Libya. Farmasains. 2024;2(1):1-5.
10. Fagherazzi G, Gusto G, Clavel-Chapelon F, Balkau B, Bonnet F. ABO and Rhesus blood groups and risk of type 2 diabetes: evidence from the large E3N cohort study. Diabetologia. 2015 Mar;58(3):519-22.