ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7086-7089 (2026)
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BIOINFORMATION
Discovery at the interface of physical and biological sciences
BIOMEDICAL INFORMATICS
www.bioinformation.net
Volume 22(10)
Research Article

Received October 1, 2026; Revised October 31, 2026; Accepted October 31, 2026, Published October 31, 2026
DOI: 10.6026/973206300227086

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478
2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

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Edited by Yogesh Singh Bisht & Ruby Singh
E-mail: yogeshbishttech@gmail.com & bioinformationruby@gmail.com
Citation: Shukla *et al.* Bioinformation 22(10): 7086-7089 (2026)

Blood groups and associated risk factors in diabetes mellitus: Tertiary care centre study, Central India

Shivani Shukla[1], Amardeep Arya[2] & Sneha Shukla[1,*]

[1]Department of Physiology, Chhindwara Institute of Medical Sciences, Chhindwara, Madhya Pradesh, India; [2]Department of Physiology, Bundelkhand Medical College, Sagar Madhya Pradesh, India; *Corresponding author

Affiliation URL:
https://www.govtmedicalcollegechhindwara.ac.in/
https://www.bmcsagar.edu.in/

Author contact:
Shivani Shukla - E-mail: shivanishukla101995@gmail.com
Amardeep Arya - E-mail: aryaamardeep9@gmail.com

ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7086-7089 (2026)
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Sneha Shukla - E-mail: snehashukla9475@gmail.com

Abstract:
Diabetes mellitus is a major public health problem in India, and its association with ABO blood groups remains unclear. This cross-sectional study included 361 patients with type 2 diabetes mellitus (T2DM), aged 19–59 years, at Bundelkhand Medical College, Sagar. Blood groups were determined by slide agglutination, and risk factors were recorded using a questionnaire and analysed with the chi-square test. Blood group B-positive was the most common and most patients were male, aged 41–59 years, non-vegetarian, sedentary (61.7%) and had a family history of T2DM (60.6%). Thus, data support targeted screening for diabetes in high-risk groups.

Keywords: ABO blood group, diabetes mellitus (DM), blood groups, risk factors, non-communicable diseases (NCDs), public health

Background:
According to the World Health Organization (WHO), diabetes mellitus (DM) affects around 422 million individuals worldwide and its prevalence is steadily increasing. The number of cases has surged from an estimated 30 million in 1985 to 382 million in 2013. If this trend continues, projections suggest that by 2035, over 500 million people will be affected **[1]**. While diabetes is prevalent in both developed and developing nations, the rate of increase is significantly higher in the latter. Reports indicate that the number of cases in developing countries is expected to rise from 84 million in 1995 to 228 million by 2025, marking a 170% increase **[2]**. The South-East Asian region alone had 72 million diabetes cases in 2013 and this figure is anticipated to reach 123 million by 20352. Data from the International Diabetes Federation (IDF) suggest that 8.8% of the global adult population has diabetes, with slightly higher rates among men (9.6%) compared to women (9.0%) **[3]**. As per recent global estimates, approximately 463 million people have diabetes, while 374 million have impaired glucose tolerance (IGT), a prediabetes condition **[4]**. These numbers are expected to rise to 700 million and 548 million, respectively, by 2045, reflecting a 51% increase since 2019 **[3]**. In India, the number of individuals with diabetes increased from 26 million in 1990 to 65 million in 2016 **[4]**. The ABO blood group system was first introduced by Karl Landsteiner **[5]** in 1900. It is based on the presence or absence of two specific agglutinogens, A and B, on the surface of red blood cells (RBCs). Individuals with only the A agglutinogen belong to blood group A, while those with only the B agglutinogen are classified as blood group B. When both A and B agglutinogens are present, the blood group is AB and the absence of both results in blood group O **[6]**. Therefore, it is of interest to evaluate the association of ABO and Rh blood groups and other risk factors with diabetes mellitus and to compare clinical and demographic characteristics between male and female patients attending a tertiary care centre in Central India.

Materials and Methods:
Inclusion criteria:
All Diabetes Mellitus patients of age between 19-59 years of age attending OPD/IPD of Bundelkhand Medical College Sagar, Madhya Pradesh.

Exclusion criteria:
[1] Those who are not willing to give the written informed consent to participate in the study
[2] Patients less than 19 Years and more than 60 Years of age

Study method:
[1] The study was conducted as per and after due approval from the Institutional Ethics Committee.
[2] Patient's random blood glucose level was measured following ADA criteria .It is measured by Digital glucometer. And the patients who have random blood sugar more than 200 mg/dL were included in the study.
[3] Patient's Blood groups was determined by Glass – slide method.
[4] Patients meeting the eligibility criteria were enrolled in the study after obtaining a written informed consent. Face to face questionnaires was conducted by the primary investigator and personal demographic and anthropometric details such as age, sex ,weight, height, occupation ,address ,socio economic status and personal history such as food habits ,sleep , bowel, bladder movements was noted. Also, the family history of hypertension, diabetes mellitus and any other relevant pathological familial disease, was noted. All the study participants were subjected for clinical examination.
[5] For ABO blood grouping, standard serological procedures was followed using the anti-A, anti-B and anti-D antisera by using standard agglutination techniques at central laboratory of BMC, SAGAR. All the results of reports which include blood group and blood pressure were tabulated for analysis.

Results:
Among the 361 patients with type 2 diabetes mellitus (T2DM), blood group B-positive (B+) was the most frequently reported blood group **(Figure 1)**. Males constituted 80.6% (n = 291) of the study population, while females accounted for 19.3% (n = 70) **(Table 1)**. Regarding age distribution, 80.6% (n = 291) of patients were aged 41–59 years, whereas 19.3% (n = 70) were aged 19–40 years **(Table 2)**. Most patients were non-vegetarians (80.6%, n = 291), while 19.3% (n = 70) were vegetarians **(Table 3)**. A sedentary lifestyle was reported by 61.7% (n = 223) of patients, compared with 38.2% (n = 138) who had an active lifestyle **(Table 4)**. Regarding alcohol consumption, 39.3% (n = 142) reported a history of alcohol use, while 60.6% (n = 219) reported no alcohol use **(Table 5)**. A family history of T2DM was present in 60.6% (n = 219) of patients, whereas 39.3% (n = 142) reported no family history **(Table 6)**.

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Table 1: Distribution of type 2 diabetes mellitus patients according to their gender

S. No.	Gender	Type 2 Diabetes Mellitus		Statistical tests
		Number	Percentage (%)	$\chi 2$= 19.905
1.	Female	70	19.3	(df) =1
2.	Male	291	80.6	p value =0.001
Total		361	100	

Table 2: Distribution of type 2 diabetes mellitus patients according to age group

S. No.	Age group	Type 2 Diabetes Mellitus		Statistical tests
		Number	Percentage (%)	$\chi 2$= 19.905
1.	19-40 years	70	19.3	(df) =1
2.	41-59 years	291	80.6	p value =0.001
Total		361	100	

Table 3: Association of diet with type 2 diabetes mellitus patients

S. No.	Diet	Type 2 Diabetes Mellitus		Statistical tests
		Number	Percentage (%)	$\chi 2$=19.905
1	VEG	70	19.3	(df) =1
2	NON VEG	291	80.6	P value =0.001
Total=		361	100	

Table 4: Association of lifestyle with type 2 diabetes mellitus patients

S. No.	lifestyle	Type 2 Diabetes Mellitus		Statistical tests
		Number	Percentage (%)	$\chi 2$= 17.851
1.	SEDENTARY	223	61.7	(df) =1
2.	ACTIVE	138	38.2	p value =0.001
Total		361	100	

Table 5: Association of addiction history of alcohol with type 2 diabetes mellitus patients

S. No.	Addiction history	Type 2 Diabetes Mellitus		Statistical tests
		Number	Percentage (%)	$\chi 2$= 0.000
1.	YES	142	39.3	(df) =1
2.	NO	219	60.6	p value =0.986
Total		361	100	

Table 6: Association of family history of type 2 diabetes mellitus with type 2 diabetes mellitus patients

S. No.	Family history	Type 2 Diabetes Mellitus		Statistical tests
		Number	Percentage (%)	$\chi 2$= 15.102
1.	YES	219	60.6	(df) =1
2.	NO	142	39.3	P value =0.001
	Total	361	100	

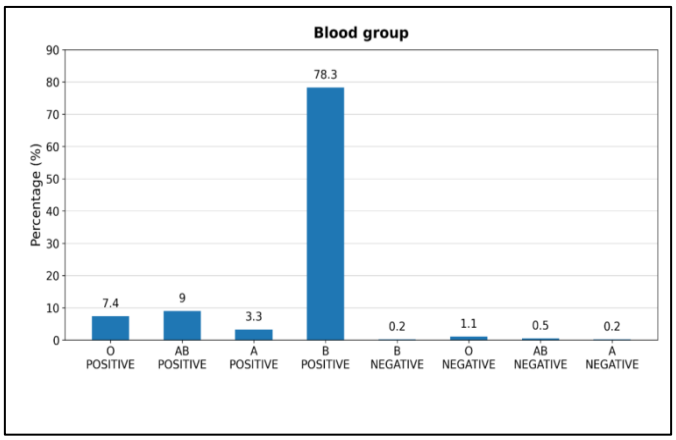


Figure 1: Association of different blood groups with patients having type 2 diabetes mellitus

Discussion:

In our study we found that Blood Group B^{+ve} 78.3 % are more prone to develop Type 2 Diabetes Mellitus among 361 Type 2 Diabetes Mellitus patients. Similar result was observed in study done by Pereira *et al.* found out the values were 4.36, 17.15 and 7.34% for A, B and AB Blood Groups respectively in the diabetic patients **[7]**. In our study among Diabetic patients (361), 19.3% are female and 80.6% are male patients. Mauvais-Jarvis *et al.* done a study on *Sex and gender differences in risk, pathophysiology and complications of type 2 diabetes mellitus found that* Type 2 Diabetes Mellitus was more prevalent in males (78%) compared to females (65%) **[8]**. In this study, in age group of 41-59 years 80.6 % develop Type 2 Diabetes Mellitus and in age group 19-40 years only 19.3 % develop Type 2 Diabetes Mellitus. This observation is in accordance with Chennai Urban Population Study indicated that the prevalence of Type 2 diabetes mellitus increased with age:30–39 years: 2.4%, 40–49 years: 10.2%, 50–59 years: 17.1%. These findings show a significant rise in type 2 diabetes mellitus prevalence as age increases **[9]**. Our study shows that among 361 Type 2 Diabetes Mellitus patients, 19.3% are vegetarian and 80.6% are non- vegetarian. In a study done by Kautzky-Willer *et al.*, Non-vegetarian diets, especially those rich in processed and red meat, were associated with an increased risk of type 2 diabetes mellitus **[9]**. In this study among 361 Type 2 Diabetes Mellitus patients, 61.7 % having sedentary lifestyle and 38.2% have active lifestyle. Similar results were observed in a study done by Varghese *et al* **[10].** Type 2 diabetes and physical activity: Barriers and enablers to diabetes control in Eastern India on 321 Type 2 Diabetes patients found that 41% of patients had a sedentary lifestyle. Sedentary behaviour was linked to poor glycaemic control and increased medication requirements **[11]**. Our study shows that among 361 Type 2 Diabetes Mellitus patients, 39.3 % having addiction history of alcohol and 60.6% patients don't consume alcohol. This observation is in accordance with a study done by Knott *et al.* evaluated the relationship between regular alcohol consumption and insulin sensitivity in a cross-sectional study in Italy and found that fasting insulin concentrations were highest in those who did not drink alcohol and lowest in those who had heavy alcohol consumption, which was defined as > 100 g/day **[12]**. In our study among 361 Type 2 Diabetes Mellitus patients, 60.6% having family history of Type 2 Diabetes Mellitus and 39.3 % patients don't have history of Type 2 Diabetes Mellitus. Our finding is also consistence with other study conducted in India by Smith *et al.* and Hiran *et al.* on the impact of family history of diabetes among type 2 diabetes mellitus patients reported that approximately 68.8% of type 2 diabetes mellitus patients had a family history of diabetes **[13, 14]**.

Conclusion:

The B-positive blood group was the most frequently observed among patients with T2DM, suggesting a possible association that requires further investigation. Older age and a positive family history were common characteristics, highlighting the importance of targeted screening and early risk assessment. Regular screening and lifestyle modifications may support early

detection and prevention efforts, particularly among individuals with a family history of T2DM.

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