



Association of Abo and Rh Blood Groups with Metabolic Syndrome

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KEYWORDS

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ABSTRACT:

Metabolic Syndrome (MetS) is a prevalent chronic metabolic disease that affects many people globally. the sociodemographic profile of the study population indicates a high burden of modifiable risk factors such as overweight and obesity, particularly in the 38–45-year age group. These findings underscore the need for targeted public health strategies aimed at early prevention and management of T2DM, particularly in young and middle-aged adults with known risk factors

INTRODUCTION

India is a one of the fastest developing countries. Over the past few years there has been a rapid increase in industrialization, urbanization, technological advancement, desk job frame work, sedentary lifestyle. Leading a sedentary life style gives rise to significant public health issues. There are several lifestyle disorders like (hypertension, obesity, diabetes mellitus) together they are commonly termed as Metabolic disorder. (Mohan et al., 2016)

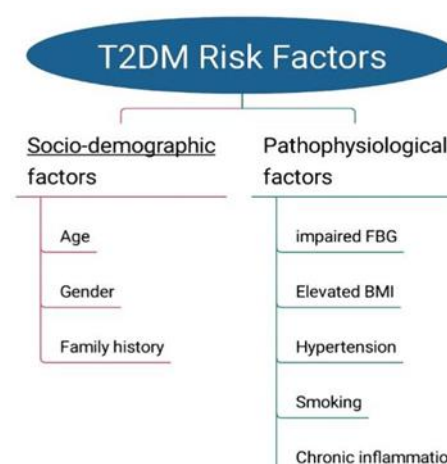
Metabolic Syndrome as a group of conditions that occur together- increased blood pressure, high blood sugar and excess body fat. According to WHO, Metabolic Syndrome is diagnosed when someone has three or more of the following conditions: (Takamiya et al., 2004)

- ✓ Increased waist circumference (male ≥ 90 cm and for female: ≥ 80 cm)
- ✓ Hypertriglyceridemia ≥ 150 mg/dl (1.7 mmol/l)
- ✓ Low HDL (male < 50 mg/dl) (1.3 mmol/l)
- ✓ Elevated blood pressure (systolic blood pressure ≥ 140 mmHg and/ or diastolic blood pressure ≥ 90 mmHg or drug treatment for hypertension)
- ✓ Elevated blood sugar (fasting blood sugar) \geq

100 mg/dl (5.6 mmol/l) or drug treatment for diabetes mellitus

Individuals with insulin resistance do not have sufficient insulin or their insulin receptors do not act effectively, leading to increase in blood sugar levels.

Consequently, this blood sugar gets accumulated into the liver and other parts of the body. As increased blood sugar lead to increase in fatty acid synthesis, it results in individuals being obese with mainly abdominal type obesity. Due to fat deposition, the body has to work extra hard to pump blood throughout the body



ABO blood group was first described by Karl Landsteiner in 1900, based on the presence or absence



of specific antigen on human red blood cell. ABO system is the result of polymorphism of complex carbohydrates with different antigen structure of glycoproteins and glycolipids expressed on the surface of erythrocytes.

(GKpal; Abegaz et al., 2021) Blood group is genetically predetermined and therefore may have a correlation with metabolic syndrome (Diabetes mellitus, Hypertension and Obesity) as metabolic syndrome is also a genetically inherited disease. Hence, finding the association between them would be helpful in predisposition of metabolic syndrome and could be used for prevention and management of the disease.

MATERIALS AND METHODS

TYPE OF STUDY- Cross- Sectional prospective study

PLACE OF STUDY- PGIMS Rohtak

DURATION OF STUDY- 2025 January to 2025 March

INCLUSION CRITERIA-

1. Subjects diagnosed with metabolic syndrome as per WHO norms.
2. Age group between 21- 45
3. Subjects who have signed the informed consent form

EXCLUSION CRITERIA-

1. Pregnancy
2. Infectious diseases

A cross-sectional prospective study was carried out on subjects attending the OPD PGIMS Rohtak. Diagnosed subjects was selected on the basis of inclusion and exclusion criteria and who were willing to participate and give written consent form.

Blood group of diagnosed patients was taken and determined by the slide agglutination method in the haematology laboratory. Subject personal details (name, age, gender, address, etc.) clinical history (duration of disease, family history etc.) anthropometric parameter (height weight, BMI) was noted down.

Statistical analysis

The acquired data were statistically analysed using the Statistical Package for Social Sciences (SPSS, version 25.0) software.

RESULT

Table: Sociodemographic Characteristics of Participants (N = 140)

Characteristics	Category	Frequency (n)	Percentage (%)
Age Group (years)	21-30	35	25%
	31-37	40	28.6%
	38-45	65	46.4%
Gender	Male	75	53.6%
	Female	65	46.4%
BMI	<18.5 (Underweight)	5	3.6%
	18.5–24.9 (Normal)	40	28.6%
	25–29.9 (Overweight)	55	39.3%
	≥30 (Obese)	40	28.6%
Family History of T2DM	Present	60	42.9%
	Absent	80	57.1%

The present study included 140 participants aged between 18 and 45 years, with an analysis of key

sociodemographic variables including age, gender, body mass index (BMI), and family history of Type 2



Diabetes Mellitus (T2DM).

In terms of **gender**, males constituted a slightly higher proportion (53.6%) compared to females (46.4%). This near-equal gender representation adds balance to the sample and allows for better generalization of findings across both genders. However, the slight male predominance might reflect higher healthcare-seeking behaviour or accessibility among men in the study setting.

BMI analysis revealed a high prevalence of overweight (39.3%) and obesity (28.6%) among participants, indicating that nearly 68% of the study population had

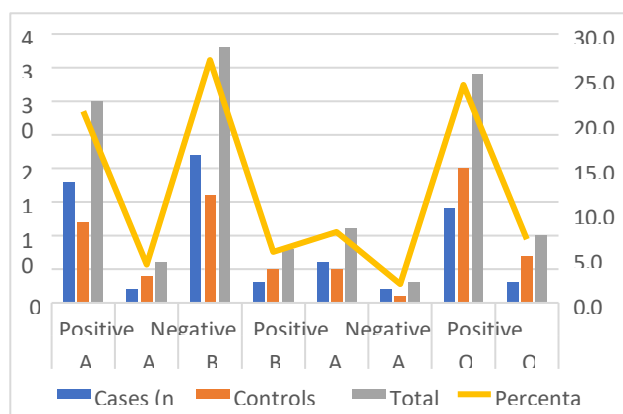
BMI levels above the normal range. Only 3.6% were underweight, and 28.6% had normal BMI. These findings are consistent with global and national

trends where overweight and obesity are major risk factors for the onset and progression of T2DM, especially among younger adults.

A significant proportion of participants (42.9%) reported a **family history of T2DM**, highlighting the importance of genetic predisposition in the development of the disease. The presence of a positive family history is a well-established non-modifiable risk factor and may necessitate early screening and lifestyle interventions in at-risk individuals.

Table 2: Distribution of ABO and Rh Blood Groups Among T2DM Cases and Controls (n = 140)

Blood Group	Rh Factor	Cases (n = 70)	Controls (n = 70)	Total (n)	Percentage (%)
A	Positive	18	12	30	21.4%
A	Negative	2	4	6	4.3%
B	Positive	22	16	38	27.1%
B	Negative	3	5	8	5.7%
AB	Positive	6	5	11	7.9%
AB	Negative	2	1	3	2.1%
O	Positive	14	20	34	24.3%
O	Negative	3	7	10	7.1%



Among 140 participants, the most common blood group was **B Positive (27.1%)**, followed by **O Positive (24.3%)** and **A Positive (21.4%)**. Rh-negative blood types were less common, with **O Negative (7.1%)** being the most frequent among them. Overall, Rh-positive

individuals were more prevalent than Rh-negative in both T2DM cases and controls.

DISCUSSION

Diabetes is a complex disease that has been linked to genetic, immunological, environmental, and sociodemographic variables. A variety of hereditary variables contribute to the chance of developing diabetes. Blood types, like other inherited features, have a genetic basis and may be associated with diabetes. Though various research has been undertaken to study the potential link between blood group phenotypes and T2DM, the findings have been inconsistent and varied from one another.

In this study, the relationships between different blood types and T2DM were explored. As a result, we discovered a higher prevalence of blood group B in T2DM patients than in the control population. Several studies have found that blood type B is more common



in T2DM patients, implying a link between blood group B and T2DM risk.

In the present study, blood group AB was revealed to be strongly related with an increased risk of acquiring diabetes mellitus (DM). This finding is similar with prior research by Karagoz et al., Waseem et al., Bibawi and Khatwa, and Sidhu et al., all of whom found a higher prevalence of blood group B among diabetics. However, opposing results were observed in the research by Buckwalter and Zhang et al., which revealed a decreasing connection between blood group AB and diabetes.

blood group B had a lower association with diabetes, which was supported by Qi et al. but contradicted by studies conducted by Kamil et al., Bener and Yousafzai, Joseph, Hadeal and Ali, and Moinzadeh et al., who reported a higher prevalence of DM in individuals with blood group B.

In general, while other research has reported findings comparable to this one, some have produced results that contradict the current outcome. Differences in racial, socio-demographic, and environmental factors, which most likely play a role in the disease's genetic manifestation, could explain the inconsistent findings.

Overall, the sociodemographic profile of the study population indicates a high burden of modifiable risk factors such as overweight and obesity, particularly in the 38–45-year age group. These findings underscore the need for targeted public health strategies aimed at early prevention and management of T2DM, particularly in young and middle-aged adults with known risk factors

CONCLUSION

Metabolic syndrome is a multifactorial and multigenetic disease. Thus, the role of a particular blood type in metabolic syndrome is most likely to be complex. The relationship between ABO blood group and metabolic syndrome components (such as diabetes, hypertension and obesity) are conflicting in different studies and still remain a matter of debate. Identification of the blood group as a risk factor for metabolic syndrome is crucial as this may further help in prevention, early diagnosis and management of disease by effectively employing lifestyle and modifiable risk factor change.

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