

Association between ABO-Rh Blood Groups and Type-2 Diabetes Mellitus in Aden, Yemen, 2022

Halah N. Hazaea and Hanan H. Omer

DOI: [https://doi.org/10.47372/yjmr.2024\(13\).2.2](https://doi.org/10.47372/yjmr.2024(13).2.2)

Abstract

Introduction: Ongoing research is examining the possible role of blood groups in the etiopathogenesis of various medical conditions including type-2 diabetes mellitus (T2DM). The purpose of this research is to identify association of ABO and Rh blood group in patients with T2DM in the Diabetic Center Aden, Yemen, 2022.

Methods: A cross-sectional study was conducted in the National Blood Transfusion and Research Center (N.B.T.R.C), Aden between May- September 2022. A total of 226 blood samples were collected from type -2 diabetic patients aged ≥ 18 years in the Diabetic Center, Aden, Yemen.

Results: There most common blood group was blood group O (+) followed by A (+) and the least common was blood group AB(-). No association was found between ABO and Rh blood group with either the sex or family history in type-2 diabetic Patients. The most frequent complication observed in the different groups is the neuropathy complications (46.8%) followed by retinopathy complications (40.7%) and finally nephropathy complications (12.5%).

Conclusion: No significant association in T2DM patients between ABO – Rh with sex or family history and the most frequent microvascular complication is neuropathy.

Keywords: Blood groups ABO-RH, Diabetes Mellitus, Association

Para-Clinical Department, Faculty of Medicine and Health Sciences, University of Aden.

Corresponding Author: Halah N. Hazaea **Email:** halahnajib1993@gmail.com

ارتباط النوع الثاني من مرض السكري مع فصائل الدم والعامل الريصي في عدن ، اليمن،
2022

هالة نجيب هزاع و حنان حسن عمر

ملخص الدراسة

المقدمة: تدرس الأبحاث الجارية الدور المحتمل لفصائل الدم في التسبب في العديد من الحالات الطبية بما في ذلك مرض السكري من النوع الثاني. الغرض من البحث هو تحديد ارتباط الأنواع المختلفة لفصائل الدم والعامل الريصي بين مرضى السكري من النوع الثاني في مركز السكر عدن – اليمن، 2022.

المنهجية: أجريت دراسة مقطعية في المركز الوطني لنقل الدم وبحوثه، عدن بين مايو - سبتمبر 2022. تم جمع 226 عينة دم من مرضى السكر النوع الثاني الذين تبلغ أعمارهم 18 عامًا وما فوق في مركز السكر، عدن، اليمن.

النتائج: كانت فصيلة الدم الأكثر شيوعًا هي فصيلة الدم O (+) تليها فصيلة الدم A (+) والأقل شيوعًا هي فصيلة الدم AB (-). لا يوجد ارتباط ذو دلالة إحصائية بين فصيلة الدم وكل من الجنس والتاريخ العائلي لدى مرضى السكري من النوع الثاني. المضاعفات الأكثر شيوعًا التي لوحظت في المجموعات المختلفة هي مضاعفات الاعتلال العصبي (46.8%) تليها مضاعفات اعتلال الشبكية (40.7%) وأخيرًا مضاعفات اعتلال الكلية (12.5%).

الخلاصة: لا يوجد ارتباط بين داء السكري من النوع الثاني و فصائل الدم والعامل الريصي مع الجنس والتاريخ العائلي والمضاعفات الأكثر شيوعًا هي الاعتلال العصبي.
كلمات مفتاحية: فصائل الدم والعامل الريصي، داء السكري ، الارتباط.

قسم الباركليت، كلية الطب والعلوم الصحية جامعة عدن الجمهورية اليمنية

Introduction

Diabetes mellitus, one of the most significant public health difficulties in the world, has a detrimental influence on both socioeconomic development and public health [1, 2]. There were 463 million individuals with diabetes worldwide in 2019, according to the International Diabetes Federation. This number is expected to rise to 700.2 million by 2045 if appropriate preventive measures are not taken [3]. Type-2 diabetes mellitus (T2DM) is described by chronic hyperglycemia that is associated with various long-term complications with negative impact on the persons and subsequently on the society [4]. Recent research has indicated that there is a significant health concern in Yemen, particularly in Aden due to the presence of T2DM and its associated complications and problems [5, 6].

The ABO system is comprised of four major ABO phenotypes, namely A, B, O, and AB. These phenotypic ABO blood categories are polymorphic and inherited antigenic chemicals that are present on the surface of red blood cells (RBCs) and other tissues. Karl Landsteiner initially determined the ABO blood type in 1900. The ABO and Rhesus blood type antigens are the most significant human blood type system antigens in transfusion treatments [7].

Currently, there are more than 50 antigens in the Rhesus (Rh) blood group system but the principal Rh antigens of medical interest are D, C, E, c and e. A person with antigen is referred to as RH (+) while individuals missing the antigen are RH (-) [8].

The ABO blood group antigens can be observed on a range of human cells, such as vascular endothelial cells, brain cells, and red blood cells [9]. Connections between blood type and a diverse array of illnesses have been established, including obesity [10], preeclampsia [11], gestational diabetes [12], gastric cancer, and cardiovascular disorders have been identified [9]. Several studies have demonstrated the association between ABO blood group-related vulnerability and susceptibility to different viral infections, such as hepatitis B, influenza viruses, and severe acute respiratory syndrome coronavirus (SARS-CoV-2). Additionally, it has been revealed that these viral infections display a correlation with ABO blood group [13,14]. A limited amount of the research has indicated a relationship between T2DM and the ABO blood group while some studies have failed to confirm this correlation, others have indicated a positive association [14,15].

Identification of any association between diseases and blood groups is an excellent source for genetic researches in human. The membranes of RBCs have several hundreds of isotopes that their structure is under control of genes that are located on different chromosomes, the Multinational Pancreatic Consortium has achieved success in identifying susceptibility loci in the ABO gene for the pathogenesis of pancreatic cancer [16]. Additional studies have shown an association between gastric cancer and blood group A connected to a higher susceptibility of *Helicobacter pylori* infection and various theoretical frameworks, such as those pertaining to inflammation,

immunological surveillance, and cellular membrane signaling, have been created to explicate the etiology of cancer susceptibility among individuals with diverse blood groups [17]. Furthermore, a Chinese study discovered out that blood type B individuals are susceptible to esophageal and biliary cancer. T2DM is significantly associated with gastric, biliary, and specifically, pancreatic cancer [18].

The purpose of this study is to determine whether there is association between ABO blood groups and the susceptibility to developing T2DM.

Methods

Study design and setting

This a cross-sectional study conducted in Aden Diabetes Center at Al-Gamhouria Modern General Hospital in Aden, Yemen.

Inclusion criteria

Patients diagnosed with T2DM aged ≥ 18 years and diagnosed patients that suffer from complications associated with this research objective (retinopathy, nephropathy and neuropathy) by history taking and prescription, diagnosis.

Exclusion criteria

Type-1 DM, gestational DM, immune-compromised states, patients on steroids, patients with history of recurrent blood transfusion, patients who do not give consent and patients refused to participate were excluded.

Sampling

Patients attended Aden Diabetes Center in the period May - September

2022 and fulfill the study inclusion criteria were enrolled.

Data collection

This study involved 226 patients, each patient allowed two mL of fresh blood to be collected in an Ethylene Diamine Tetra Acetic acid (EDTA) container for ABO blood typing and Rh purpose using the tube method on all samples, alongside with it I also used the slide method and Du test (weak form of (RhD) Antigen) test in some samples according to the needs of each examination in detecting ABO and Rh blood groups [19,20].

The complications data of the subjects such as retinopathy, nephropathy, and neuropathy were extracted from history taking, clinical examinations by doctor's prescription sheet for the patient. From each registered study participants, a proper history was taken through face-to-face interviewing. The subject was then thoroughly examined, performed tests required for research study and finally collected data were recorded using a structured questionnaire.

Statistical analysis

The study utilized SPSS program (Version 23) for statistical analysis, including descriptive analysis, mean, standard deviation, percentage, and inferential statistics, to identify significant differences among patients at 95.0% confidence and P value < 0.05 .

Ethical considerations

Ethical approval was obtained from Research and Ethics Committee, Faculty of Medicine and Health Sciences, University of Aden. Permission to conduct study taken from National Blood Transfusion and Research Center (N.B.T.R.C).

The risk and benefit of the study were explained to all participants and written informed consent was obtained irrespective of their age, gender, ethnicity or socio-economic status from all individuals enrolled in the research study.

Results

In Table 1, no association of blood group and Rh with the sex of T2DM patients can be detected despite some

observed differences. Most common blood group was blood group O (+) followed by A (+) and the least common to be blood group AB(-). Among blood group A(+) and A(-), there were more males (61.5% and 83.3%) than females (38.5% and 16.7%) respectively. Among blood group AB (+) and AB (-), there were more males (60.0% and 100.0%) than females (40.0% and 0.0%) respectively. The frequency of blood group B(+) was more in females (60.7%) than males (39.3%).

Table 1: Association of Blood Group and Rh with Sex in Type-2 Diabetic Patients (n=226)

ABO (+/-) Blood groups	Sex				P
	Males		Females		
	No.	%	No.	%	
Blood group A (+)	40	61.5	25	38.5	0.343
Blood group A (-)	5	83.3	1	16.7	
Blood group B (+)	11	39.3	17	60.7	
Blood group AB (+)	3	60.0	2	40.0	
Blood group AB (-)	1	100.0	0	0.0	
Blood group O (+)	62	55.9	49	44.1	
Blood group O (-)	5	50.0	5	50.0	
Total	127	56.2	99	43.8	

Table 2 displays no statistically significant association of blood group, Rh with family history.

Table 2: Association of Blood Group and Rh with Family History in Type-2 Diabetic Patients (n=226)

ABO (+/-) Blood groups	Family history				P
	Yes		No		
	No.	%	No.	%	
Blood group A (+)	14	21.5	51	78.5	0.238
Blood group A (-)	2	33.3	4	66.7	
Blood group B (+)	9	32.1	19	67.9	
Blood group AB (+)	1	20.0	4	80.0	
Blood group AB (-)	1	100.0	0	0	
Blood group O (+)	26	23.4	85	76.6	
Blood group O (-)	0	0.0	10	100.0	
Total	53	23.5	173	76.5	

Figure 1 illustrates the distribution of the different complications of T2DM patient by blood group. The most frequent complication observed in the different groups is the neuropathy complications (46.8%) distributed as follows according to the blood groups (A:14.8%; B:5.9%;

AB:1.5%; O:24.6%) followed by retinopathy complications (40.7%) with A:12.8%; B:5.6%; AB:1.3%; O:20.9%. Finally; nephropathy complications (12.5%) with A:3.6%; B:1.8%; AB:0.5%; O:6.7%

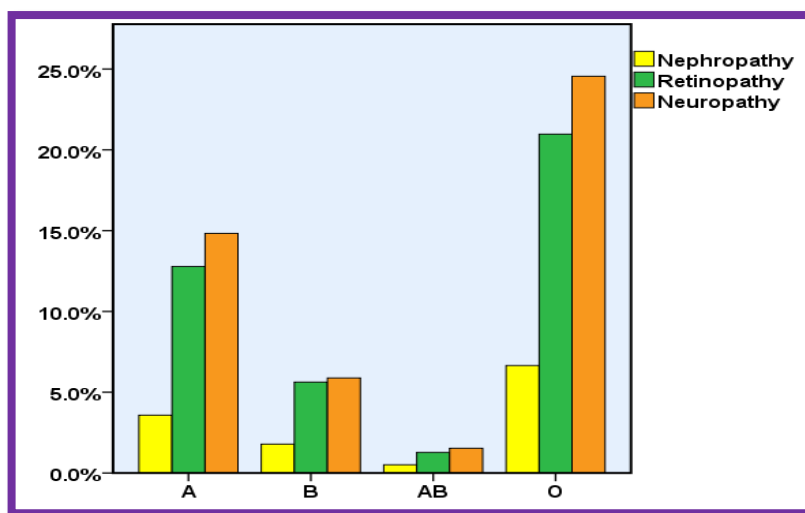


Figure 1: Prevalence of Diabetic Complications as Function of the Blood Group

Discussion

Diabetes is not only connected to environmental influences, but also to genetic factors that are also associated and increase the risk of diabetes. In this study, most common blood group was blood group O (+) followed by A (+) and the least common to be blood group AB(-). A study done in Casablanc's population in 2018 provided similar findings to this study where the most common blood group was blood group O (+) followed by A (+) and the least common to be blood group AB(-) [21].

The present study found blood group A(+) more in type-2 diabetic males (n=40) than type-2 diabetic females (n=25) but the frequency of blood

group B(+) was more in type-2 diabetic females (n=17) than type-2 diabetic males (n=11). This conclusion is supported by a similar study in Karbala, Iraq, which found that blood group A(+) was more in type-2 diabetic males (n=23) than type-2 diabetic females (n=19) but the frequency of blood group B(+) was more in type-2 diabetic females (n=20) than type-2 diabetic males (n=30) [22]. In addition, blood group AB(+) and AB(-), there were more type-2 diabetic males (60.0% and 100.0%) than females (40.0% and 0) respectively. However, no statistically significant association was found between blood groups and sex ($P=0.343$) or family history ($P=0.238$). Such finding is similar to thesis of Pandey (2019) who reported

that blood group AB (+) and AB(-) were higher in diabetic males (53.8% and 100%) than females (46.2% and 0) respectively. Also there was no statistically significant association between blood groups with sex ($P=0.284$) or family history ($P=0.567$) [16]. The possible reason for no association might be differences in sample size, age, gender distribution, ethnic and environmental factors which may affect the distribution of ABO blood group phenotypes and disease incidence [23].

The most frequent complication of T2DM observed in the different groups is the neuropathy complications (46.8%) followed by retinopathy complications (40.7%) and finally nephropathy (12.5%). These results are similar to the findings in Turkey where diabetic nephropathy, retinopathy and neuropathy percentages were 31.3%, 35.2% and 52.0% respectively [24].

Limitation

This study is a cross-sectional one. Therefore, cause-effect relationship between T2DM and blood groups cannot be made. Having small sample size and being conducted in a single center are further constraints. Finally, the availability of glycemic control specifications during the course of diabetes is not provided for comparative analysis with the development of complications in various blood groups.

Conclusion

No significant association in T2DM between of ABO – Rh with either gender or family history. The most

frequent complication observed in T2DM patients within different ABO-Rh is the neuropathy complications, followed by retinopathy complications and finally nephropathy complications.

References

1. Lin X, Xu Y, Pan X, Xu J, Ding Y, Sun X, *et al.* Global, regional, and national burden and trend of diabetes in 195 countries and territories: an analysis from 1990 to 2025. *Scientific reports.* 2020;10(1):1-11.
2. Akhtar S, Shah SWA, Javed S, Alina A. Prevalence of diabetes and prediabetes in district swat Pakistan. *Journal of the Pakistan Medical Association.* 2021; 71(1):243-6.
3. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, *et al.* Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas. *Diabetes Research and Clinical Practice.* 2019;157(9):107843.
4. Kim D-J, Yu JH, Shin M-S, Shin Y-W, Kim M-S. Hyperglycemia reduces efficiency of brain networks in subjects with type 2 diabetes. *PLoS One.* 2016;11(6): e0157268.
5. Mahmood SA, Kassem AM, Abdulqawi FM. Patterns of anti-diabetic drugs utilized by type 2 DM, Aden, 2016. *Yemeni J Medical Health Research* 2018; 7(1&2):37.
6. Mahmood SA, Tareq A, Haithem Y. Anti-diabetics and glycemic control among type 2 Diabetic patients in out-patients clinics.

- Univ Aden J Nat Appl Sci. 2019; 23(2):539-50.
7. Siransy LK, Nanga ZY, Zaba FS, Tufa NY, Dasse SR. ABO/Rh blood groups and risk of HIV infection and Hepatitis B among blood donors of Abidjan, Côte D'ivoire. *Eur J Microbiol Immunol.* 2015;5(3):205-9.
 8. Avent ND, Reid ME. The Rh blood group system: A review. *Blood.* 2000;95(2): 375-87.
 9. Liumbruno GM, Franchini M. Beyond. The role of the ABO blood group in human diseases. *Blood Transfus.* 2013;11(4):491.
 10. Flor CR, Moura ICG, Baldoni AO. Obesity and ABO blood group. *Obes Med.* 2020;18:100-209.
 11. Ting L , Yixiao W , Lan W, Zhonghui L, Chanjuan L, Wei L, *et al.* The association between ABO blood group and preeclampsia: A systematic review and meta-analysis. *Front Cardiovasc Med.* 2021;8:665069.
 12. Sapanont K, Sunsaneevithayakul P, Boriboonhirunsarn D. Relationship between ABO blood group and gestational diabetes mellitus. *J Matern Neonatal Med.*2021;34(8):1255-9.
 13. Jing W, Zhao S, Liu J, Liu M. ABO blood groups and hepatitis B virus infection: a systematic review and meta-analysis. *BMJ Open.* 2020;10(1):e034114.
 14. Wu B-B, Gu D-Z, Yu J-N, Yang J, Shen W-Q. Association between ABO blood groups and COVID-19 infection, severity and demise: A systematic review and meta-analysis. *Infect Genet Evol.* 2020;84:104485.
 15. Legese B, Abebe M, Fasil A. Association of ABO and Rh blood group phenotypes with Type 2 Diabetes Mellitus at Felege Hiwot comprehensive referral hospital Bahir Dar, Northwest Ethiopia. *Int J Chronic Dis.*2020:1-9. doi:10.1155/2020/2535843
 16. Pandey DJ. Association between the ABO-RH blood groups and type-2 diabetes mellitus. Published online 2019.
 17. Gong Y, Yang Y-S, Zhang X-M. ABO blood type, diabetes and risk of gastrointestinal cancer in northern China. *World J Gastroenterol WJG.* 2012;18(6): 563.
 18. Zhang C, Li Y, Wang L. Blood group AB is protective factor for gestational diabetes mellitus: a prospective population- based study in Tianjin, China. *Diabetes Metab Res Rev.* 2015;31(6):627-37.
 19. Mehd S. *Essentials of Blood Banking.* Second Ed. (MD SM, ed.). Jaypee Brothers Medical,2013.
 20. Claudia S, Meghan D, Susan T, Louis M. *Technical manual AABB. Reagent Preparation.* 20th ed.; 2020.
 21. Zahra KF, Mestaghanmi H, Jabari M, Labriji A, Amrani S, Dibane A. Relationship study between blood groups, rhesus factor and the risk of diabetes type 2 in a population of the Sidi Othmane district, Casablanca. *Endocr Abstr.* 2019;153(4):377-87.
 22. Albaroodi KA, Hatf ZS, Al BA. Albaroodi. Association between ABO blood group and Diabetes Mellitus PhD clinical pharmacy , Pharmacy Department, Al Safwa University College , Karbala MS . c. Pharmacy Department, Al Safwa University C. 2019; 22(August).

23. Scott RA, Langenberg C, Sharp SJ, et al. The link between family history and risk of type 2 diabetes is not explained by anthropometric, lifestyle or genetic risk factors: The EPIC-InterAct study. *Diabetologia*. 2013;56(1):60-9.
doi:10.1007/s00125-012-2715-x
24. Faki S, Ince N, Ali TA, et al. Association of ABO blood groups with diabetic microvascular complications. In: *Endocrine Abstract Vol 90*. Bioscientifica; 2023.