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Original Research Article

THALASSEMIA AND BLOOD GROUPS: IS THERE AN ASSOCIATION?

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Abstract: *Thalassemia major is a severe hereditary blood disorder that poses significant health challenges, particularly in regions with high prevalence rates. The distribution of thalassemia major has been observed to vary with ethnicity and blood group, yet few studies have explored these associations within the Pakistani population.* ***Objective:*** *This study aimed to determine the association between thalassemia major, blood groups, and ethnicity among the Pakistani population.* ***Methods:*** *This case-control study was conducted retrospectively using data from a Thalassemia center in Karachi, Pakistan. The study included a total sample size of 1,471 participants, with 731 (49.7%) identified as cases with thalassemia major and 740 (50.3%) as controls from December 2023 to May 2024. Participants were recruited using a convenience sampling technique, and those with incomplete data were excluded. Data were retrieved from an EMR suite, with prior approval from the institutional review board, and all information was identified to ensure confidentiality. Data analysis was performed using SPSS version 26, with descriptive statistics for numerical data and frequency and percentages for categorical data. The association between categorical variables was assessed using the Chi-square test, and odds ratios (OR) were calculated to evaluate the relationship between blood groups and thalassemia major. A p-value of less than 0.05 was considered statistically significant.* ***Results:*** *The study found a statistically significant association between ethnicity and thalassemia major (p = 0.0001). Among the cases, 52.6% were Balochis, 43.1% Sindhi, 64.3% Punjabi, 46.3% Mohajir, 47.7% Pushtoon, 60.9% Gujrati, and 100% Kashmiri. The blood group A positive showed the highest association with thalassemia major (OR 1.49, CI 1.19-1.87), while O positive, O negative, and B negative blood groups were also positively associated. Other blood groups demonstrated a protective association against thalassemia major.* ***Conclusion:*** *The study concluded that blood groups A positive, O positive, O negative, and B negative are positively associated with thalassemia major, while the Bombay blood group showed the most protective association. Additionally, there was a statistically significant association between ethnicity and thalassemia major, emphasizing the importance of considering both blood group and ethnicity in understanding the distribution of this condition in the Pakistani population.*

Keywords: Thalassemia Major, Blood Groups, Ethnicity

Introduction

Thalassemia is a known hereditary disease with patients having atypical hemoglobin. (1). It is transferred from parents to children (2). The irony is the seriousness of the disease that strikes a threatening confrontation with our world (3). Among thalassemia, investigators have laid an accent on Beta thalassemia, the reason being its devastating ramifications and lethal prognostications (4). Different ethnicities exhibit varied hemoglobin variants, which shows diversity. Although the heterozygous conditions of these atypical combinations may not be clinically impactful, in homozygous situations, severe disease arises regardless of the population (5).

A study conducted this year in Bahrami Hospital, Iran, showed that among thalassemia patients, Blood group O was found in 44.1% of patients, type A in 26.7% of patients, type B in 21.5% of patients and type AB in 7.7% of patients (6). Another study done in the United Arab Emirates found similar results, with most thalassemia patients demonstrating blood groups O positive and A positive (7). A hospital-based cross-sectional study in Odisha, India, among pediatric age groups elucidated that 35.3% of thalassemia patients had O+ blood group, 27.7% had B+, 21.6% had A+, 12.9% had AB+, 1.4% had O – and 0.4% having A – blood group (5). A study conducted in Lahore, Pakistan, showed that the male gender was a majority in B thalassemia carrier patients (8). Similar results were depicted by a study in Baquba, Iraq, where males had more thalassemia than females (2). However, a study in India displayed that both genders have an equivalent risk for such blood-borne disorders (5).

Hemoglobinopathies vary in research conducted due to geological region and ethnic distinctiveness, along with the versatile nature of the population (5). Among blood disorders, another arduous predicament is the involvement of children (5). A study in Iraq discovered that Thalassemia major is more prevalent than thalassemia intermedia (2). Though multiple research studies have been conducted, it is now imperative to dive into the various risk factors among different ethnicities and countries (9). Earlier diagnosis and

treatment of thalassemia may impart the channel to dwindle the financial weight and aftermaths in the community (7), as research has indicated that Beta Thalassemia should be investigated in association with blood groups and for their further complications (10). Pakistan is one of the countries where thalassemia patients are voluminous, looking at 100000 patients on blood transfusion (11); hence, we conducted this study to identify and associate the blood groups and ethnicity among thalassemia primary patients.

Methodology

We performed this study, which was case-control in nature, and included patients with thalassemia major as cases at a well-established thalamus center in Karachi that was established in 2003. We studied the medical records of patients using a convenience sampling technique and identified factors among them. The data was retrieved using Elysian HER (Version 2.9; Kidwai, 2018**)** (12). A healthcare information system software where medical records of n=1471 patients were retrieved. There was no direct contact or effect on the participants of the study. Information was first deidentified and then collected on basic demographic variables and blood groups. Blood parameters were analyzed using Uni Cell DXH 800, Coulter Cellular Analysis System. The blood parameters included packed cell volume (PCV), Hb concentration, and RBC count. Cellulose acetate paper strips were used for hemoglobin electrophoresis at a PH 8.5.11 Hb A2 estimation was done by HPLC using Bio-Rad variant II. Beta thalassemia was confirmed if the study participants had Hb A2 > 3.5%. Ethnicity was confirmed using their National Identity cards. Informed consent was obtained from all patients and their guardians, who were assured of the confidentiality of information and the nature of the study. Those who refused consent or had incomplete data were excluded from participation in the study. Data was collected using a questionnaire. Approval was taken from the institutional board. Data analysis was carried out on SPSS version 26. A descriptive analysis was carried out using the mean and standard deviation. Frequency and percentages were used for categorical data. The association was taken out using chi-square for categorical variables. The odds ratio was used to measure the association between blood groups and Thalassemia Major. A p-value of less than 0.05 was considered significant.

Results

Our total sample was n=1471 participants. Our sample comprised n=643(43.7%) females and n=828 (56.3%) males. When seen by ethnicity n= 133(9%) were Balochi, n= 434 (29.5%) were Sindhi, n= 326 (22.2%) were Mohajir's, n= 213 (14.5%) were Punjabi n= 239(16.2%) were Pushtoon, n= 46(3.1%) were Gujrati, n= 7(0.5%) were Kashmiri and n= 73 (5%) were of other origins. When categorized by Thalassemia, n= 731 (49.7%) were Cases, and n= 740 (50.3%) were Controls. When assessed by Blood groups n= 439 (29.8%) were A Positive, n= 27(1.8%) were A negative, n= 396(26.9%) were B positive, n= 31(2.1%) were B negative, n= 401(27.3%) were O positive, n= 33(2.2%) were O negative, n=99(6.7%) were AB positive, n=11(0.7%) were AB negative whereas n= 34(2.3%) had Bombay Blood group. On Analysis based on Ethnicity, it was further seen that among cases only in Balochis n= 70(52.6%) were thalassemia patients, among Sindhi n= 187(43.1%) were thalassemia patients, among Punjabi n= 137 (64.3%) were thalassemia patients, among Mohajir n= 151(46.3%) were of thalassemia, among Pushtoon n= 114(47.7%) were thalassemia patients, among Gujrati n=28(60.9%) and among Kashmiri n= 7(100%) were suffering from it.

When the Odds ratio was calculated among cases of Thalassemia and Blood Groups, it was seen that the positive Blood group showed the highest association OR=1.49 (CI 1.19-1.87), although Blood groups O positive, O negative, and B negative were also positively associated. Results are shown in Table 1. When the association of Ethnicity and Thalassemia was seen by application of chi-square, it was statistically significant (p-value 0.000), as shown in Graph 1.

TABLE 1: ASSOCIATION OF BLOOD GROUPS WITH THALASSEMIA MAJOR

BLOOD GROUPS		CASES	CONTROLS	ODDS RATIO	95% CI	P VALUE
A POSITIVE	+	249	190	1.49	(1.19-1.87)	0.0005
	-	482	550			
A NEGATIVE	+	11	16	0.6	(0.32-1.49)	0.35
	-	720	724			
AB POSITIVE	+	41	58	0.69	(0.46-1.0)	0.08
	-	690	682			
AB NEGATIVE	+	2	9	0.22	(0.05-1.03)	0.05
	-	729	731			
B POSITIVE	+	181	215	0.8	(0.6-1.01)	0.06
	-	550	525			
B NEGATIVE	+	17	14	1.2	(0.6-2.5)	0.56
	-	714	726			
O POSITIVE	+	209	192	1.14	(0.9-1.43)	0.25
	-	522	548			
O NEGATIVE	+	19	14	1.38	(0.68-2.7)	0.36
	-	712	726			
BOMBAY GROUP	+	2	32	0.06	(0.01-0.25)	0.0001
	-	729	708			

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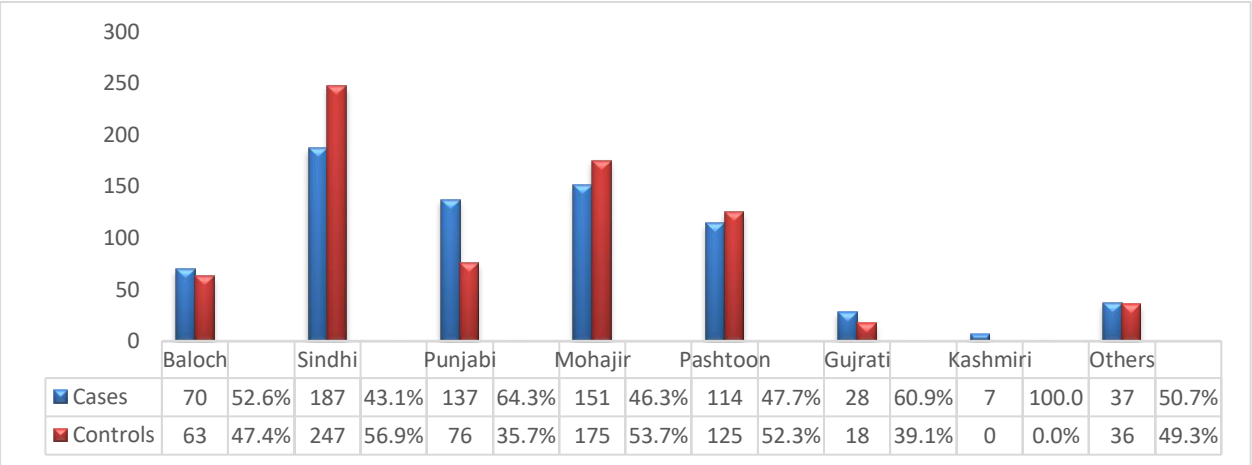

	Baloch		Sindhi		Punjabi		Mohajir		Pashtoon		Gujrati		Kashmiri		Others	
Cases	70	52.6%	187	43.1%	137	64.3%	151	46.3%	114	47.7%	28	60.9%	7	100.0	37	50.7%
Controls	63	47.4%	247	56.9%	76	35.7%	175	53.7%	125	52.3%	18	39.1%	0	0.0%	36	49.3%

Fig 1: Distribution of Cases and Controls Among Different Ethnic Groups.
(The bar chart illustrates the number and percentage distribution of cases and controls across various ethnic groups, including Baloch, Sindhi, Punjabi, Mohajir, Pashtoon, Gujrati, Kashmiri, etc. The blue bars represent the number of cases, while the red bars represent the number of controls. Percentages for each group are shown within the chart for both cases and controls.)

Discussion

Health systems worldwide have been afflicted with Thalassemia, especially in the Middle East, North Africa, India, Central Asia, and South East Asia. (7) When looking at Pakistan, although the prevalence is not surmounted, it is a grave problem where more than 50 lacs are either symptomatic or affected by it (13). In our study, 43.7% were females, and 56.3% were males. This was similar to a survey conducted in Sukkur, which was comprised of 35% females and 65% males (11). A study in Iran, however, displayed an almost similar ratio with 51.3% males and 48.7% females (6). Similarly, another study in India demonstrated that 51.4% were males and 48.6% were females (5). Similar to our study were the survey findings in Kurdistan, Iraq, and another study conducted in Baquba, Iraq, where 55.5% were males and 44.5% of participants were females (2, 14).

Another study in Lahore, Pakistan, elicited the same results with the β-thalassemia gene dominant in the male gender among carriers with a ratio of 2:1 (15). However, according to research in Saudi Arabia, there may be another angle to the male preponderance in thalassemia patients as it may show a cultural preference for getting males treated as compared to affected females who may not be brought to the health center. However, the vital association of gender with genetics cannot be overshadowed (16).

Among the cases in our study, most had A positive blood group, followed by O positive and B positive. This was precisely similar to our study with blood group A+ at 30.48%, followed by O + at 20.95%, B positive at 17.14%, and AB+ at 14.29%. (17). Another study in UAE showed similar results, with thalassemia patients, mostly having O-positive and A-positive blood groups (7). However, a study in India showed that 35.3% of patients had A positive Blood group, 27.7% B positive, 21.6% A positive, 12.9% AB positive, 1.4% O negative, 0.7% B negative, 0.4% A negative (5). A study in Sukkur, Pakistan, showed that in most cases, 37% were A positive, 16.8% were O positive blood group, 13.49% were B positive, and 10.11% were AB Positive (11). Another study in Iraq showed O positive among thalassemia patients was 38%, A positive at 32%, and B positive at 22.5%, whereas the AB blood group was 15% (2). These results are similar to the study in Erbil (14). In our study, A positive, then O negative, B negative, and lastly, O positive showed a positive association with Thalassemia. According to research, the blood group is one essential variable in the community that elicits its association with different morbidities (10). Research in Mumbai highlighted earlier complications in A-positive and B-positive blood groups. However, B positive showed much earlier complications in significant cases of thalamus. O-positive showed complications after 15 to 20 years of life (10). Another research in Baghdad, Iraq, found an O-positive blood group in 59% of Thalassemia Major Patients and the AB Blood group with the slightest association (18). In our research, however, the Bombay blood group, AB negative, A negative, AB positive, and B positive, showed a negative association.

In our study, 29.5% of cases were Sindhi, 22.2% were Mohajirs, and 16.2% were Punjabis. Research has indicated that some ethnicities and communities prefer thalassemia. (19). including Burma, the Middle East, Southeast Asia, and India (20). Another study authenticated this by informing that Sindhi, Punjabi, and other ethnicities have a high proportion of thalassemia, with 15% among migrated Punjabis (11). A study conducted in a blood transfusion center in Punjab displayed that the majority of thalassemia patients were of Punjabi or Pushtoon origin (21). Another survey from transfusion centers in Lahore, Karachi, Peshawar, and Multan elicited that 46.3% of patients hailed from Punjab (Lahore), 22.3% belonged to Sindh (only Karachi), and 20.6% from KPK (Peshawar only) (22).

Our study was saddled with a few reservations. First, the study focused on participants from one thalassemia center only. It lacked screening of family members. However, our strengths cannot be overlooked. To our knowledge, no such study has been carried out earlier in Pakistan associating blood groups and thalassemia via a Case-control study. Very few studies have been carried out on ethnicities among thalassemia in Pakistan, and those conducted earlier were descriptive studies. We associated blood groups and ethnicities in thalassemia through a case-control study that has not been conducted in this region. Our assessment methods were definite as participants were recruited from a

major thalassemia unit in Karachi, which had patients on blood transfusion, which minimized information bias. Ethnicity was confirmed based on their National Identity Card. Multiple centers need to be taken for future studies to provide a holistic picture. Familial screening should be performed in studies to understand the epidemiology of thalassemia, and follow-up studies need to be done as emphasized by earlier research that the connection between blood group and morbidity is imperative for assessing the need for blood groups and managing its supply and demand (10).

Conclusion

Our findings reflected that Blood groups A Positive, O negative, O positive, and B negative were positively associated with thalassemia. Bombay blood group showed the most protective association with thalassemia. By ethnicity, most cases belonged to Kashmiri, Punjabi, Gujarati, and Balochi origin. The association of Ethnicity with Thalassemia was statistically significant.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRB: 03/A-IRB/7-2023)
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

ASIM QIDWAI
Conception of Study, Development of Research Methodology Design, Study Design, manuscript Review, and final approval of manuscript.
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Coordination of collaborative efforts.
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Study Design, Review of Literature.
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Conception of Study, Final approval of manuscript.
WAQAR KHALIL
Manuscript revisions, critical input.
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Manuscript drafting.
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Data entry and data analysis, as well as drafting the article.

References

1. Shivappa P, Bernhardt GV, Mufti MM, Banu A. A review of the epidemiology and thalassemia distribution in relevance to the United Arab Emirates population. OnLine J Biol Sci. 2021;21:280-4.
2. Sahm SF. Studying Some Factors That Increase the Risk of Thalassemia in The City of Baquba. Journal of Techniques. 2022 Nov 15;4(Special Issue):181-4.
3. Amjad F, Fatima T, Fayyaz T, Khan MA, Qadeer MI. Novel genetic therapeutic approaches for modulating the severity of β-thalassemia. Biomedical Reports. 2020 Nov 1;13(5):1-.
4. Jaing TH, Chang TY, Chen SH, Lin CW, Wen YC, Chiu CC. Molecular genetics of β-thalassemia: A narrative review. Medicine. 2021 Nov 11;100(45).
5. Nanda AK, Parida S, Pradhan SK, Padhi S. Epidemiological Profile of Different Hemoglobinopathies in Pediatric Age Group (6 Months-14 Years) in South Odisha. International Journal of Health Sciences. (II):13100-6.
6. Koochakzadeh L, Kajiyazdi M, Khoshhal F, Hashemi A, Khabazkhoob M. Prevalence of Alloantibodies in Thalassemia Patients and Its Relationship With Age, Gender and Blood Group. Acta Medica Iranica. 2023 Mar 11.
7. Assadi RR, Sadhu S, Fatima F, Bhat R, Shivappa P. Retrospective analysis of thalassemia patients in secondary care hospital: Ras Al Khaimah, United Arab Emirates. Advanced Biomedical Research. 2022;11.
8. Raja NU, Mubarak B, Bashir S, Junaid K, Gilani SA. Frequency of thalassemia carriers among the healthy individuals of University of Lahore, Pakistan. Rawal Medical Journal. 2022 Dec 11;47(4):881-.
9. Huang H, Xu L, Chen M, Lin N, Xue H, Chen L, Wang Y, He D, Zhang M, Lin Y. Molecular characterization of thalassemia and hemoglobinopathy in Southeastern China. Scientific reports. 2019 Mar 5;9(1):3493.
10. Sinha PA, Mulkutkar SH, Bhavani JB. Study of distribution of ABO blood groups in ß-thalassemia patients. International Journal of Research in Medical Sciences. 2017 Aug;5(8):3479-83.
11. Ruk M, Ujan JA, AMUR A, UNAR K, PARVEEEN S, Soomro AA, Unar AA, Suhriani SN. To Find Out The Prevalence Of Thalassaemia In Sukkur Pakistan. Journal of Positive School Psychology. 2023 May 1:1422-32.
12. *Kidwai,A. (Elysian Version 2.9). (2018) Retrieved May 22, 2023 from URL: http://192.168.1.100/Elysian/Private.aspx#*
13. Ullah Z, Rasool R, Aziz N, Bano R, Bashir S, Ali SA, Khattak AA. Spectrum of Inherited Hemoglobin Disorder in patients presenting for Hb Electrophoresis: A Single Center Study in District Dera Ismail Khan. Pakistan Journal of Medical & Health Sciences. 2022 Aug 9;16(07):151-.
14. Hassan AN. Molecular and Some Hematological Investigations of β-thalassemic Children in Erbil Governorate. PhD, Salahaddin University, Erbil. 2016 Jun.
15. Sadiq MA, Muqeem A, Yusuf R, Bilal A. Frequency of beta thalassemia trait among the healthy individuals-a single centre study. Pakistan Armed Forces Medical Journal. 2018 Dec 31;68(6):1716-9.
16. Mikael NA, Al-Allawi NA. Factors affecting quality of life in children and adolescents with thalassemia in Iraqi Kurdistan. Saudi medical journal. 2018 Aug;39(8):799.

17. Abid QH, Ereiby AM. Study of relationship between thalassemia disease and blood groups, weight and some of blood parameters. Drug Invention Today. 2019 Nov 1;11(11).
18. Mohssin MY, Mahmood AE, Kamal SB, Batah EH. Frequency distribution of hemoglobin variant and ABO blood groups among thalassemia patients from Ibn-Al-Baladi pediatric hospital in Baghdad/Iraq. WJ Pharma Pharmaceut Sci. 2015 Aug 26;4(11):31-9.
19. Ahmed S. Genetic haemoglobin disorders in Pakistan. National Journal of Health Sciences. 2017 Aug 31;2(3):95-9.
20. Greer JP, Arber DA, Glader B, List AF, Means RT, Paraskevas F, et al. Wintrobe's Clinical Hematology. 13th ed. PA, USA: Lippincott Williams & Wilkins; 2014
21. Khan AM, Abbas Z, Ramzan S, Aziz L. SOCIAL EPIDEMIOLOGICAL ANALYSIS OF RISK FACTORS AND PSYCHOSOCIAL BURDEN OF BETA THALASSEMIA MAJOR (BTM) IN PAKISTAN. Elementary Education Online. 2021 May 18;20(4):2682-.
22. Yasmeen H, Hasnain S. Epidemiology and risk factors of transfusion transmitted infections in thalassemia major: a multicenter study in Pakistan. Hematology, transfusion and cell therapy. 2019 Nov 25;41:316-23.