ORIGINAL ARTICLE

Unlocking the Code: Exploring Autism Spectrum Traits among Medical Students through the Lens of Blood Group Phenotypes

Aiman Farogh Anjum[1], Noman Sadiq[2*], Warda Hussain[3], Waqas Ali[4], Waseem Pasha[5], Mahjabeen Safdar[6], Hafsa Zulfiqar Malik[1], Khadijia Talat[1], Shoaib Naiyar Hashmi[7]

ABSTRACT

Objective: To assess autistic spectrum disorder traits (based on language, social relatedness, sensory-motor discrepancies, and circumscribed interests) prevalence among undergraduates, explore associations with sociodemographic factors and blood group phenotypes, and investigate correlations with anthropometric measures.

Study Design: Cross-sectional study.

Place and Duration of Study: This study was conducted at the Physiology Department, CMH Kharian Medical College Kharian, Pakistan from January 2024 to April 2024.

Methods: A total of 527 undergraduate students were included in the study. Sociodemographic data, blood group phenotypes (ABO and Rh) and anthropometric measures were collected. Autism spectrum disorder traits were assessed using the Rapid Autism Diagnostic Screening (RAADS-14) scale.

Results: Females exhibited higher autism spectrum disorder trait prevalence (35.9%) than males (15.4%). A positive correlation was found between height-to-waist ratio and autistic spectrum disorder traits (r = 0.103). No significant associations were observed between autism spectrum disorder traits and area of residence, blood group phenotypes, or body mass index categories.

Conclusion: Gender and height-to-waist ratio showed significant associations with autism spectrum disorder traits, no significant links were found with blood group phenotypes.

Keywords: *Anthropometry, Autism Spectrum Disorder, Body Mass Index, Students.*

How to cite this: *Anjum AF, Sadiq N, Hussain W, Ali W, Pasha W, Safdar M, Malik HZ, Talat K, Hashmi SN. Unlocking The Code: Exploring Autism Spectrum Traits among Medical Students Through the Lens of Blood Group Phenotypes. Life and Science. 2024; 5(3): 297-302. doi: http://doi.org/10.37185/LnS.1.1.714*

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International license. (https://creativecommons.org/licenses/by-nc/4.0/). Non-commercial uses of the work are permitted, provided the original work is properly cited.

Introduction

Disabilities in social interaction, communication, and repetitive behaviors are hallmarks of Autism Spectrum Disorder (ASD), a complicated neurodevelopmental disorder.[1] The cause of ASD is still unknown, which has led scientists to investigate potential genetic and environmental variables.[2] In recent years, interest has grown in understanding the potential relationship between ASD and biological markers, such as blood group phenotypes, offering novel avenues for exploration within this domain.[3]

To assess ASD traits, the Rapid Autism Diagnostic Screening (RAADS-14) scale, a validated tool designed to quickly screen for autism-related traits in adults, has proven to be quite effective. The RAADS-14 scale encompasses 14 items covering domains such as social interaction, repetitive and restricted behaviors, and communication, providing a

[1]*Department of Physiology/Orthopedic Surgery*[4] *Paediatrics*[5]*/Community Medicine*[6]*/Pathology*[7]
CMH Kharian Medical College Kharian, Pakistan
[2]*Department of Physiology*
Mekran Medical College Turbat, Pakistan
[3]*Department of Pathology*
Nawaz Sharif Medical College Gujrat, Pakistan
Correspondence:
Dr. Noman Sadiq
Associate Professor, Physiology
Mekran Medical College Turbat, Pakistan
E-mail: noman_sadiq89@yahoo.com
Received: Feb 10, 2024; Revised: Jun 12, 2024
Accepted: Jun 18, 2024

comprehensive assessment of ASD traits within a brief timeframe.[4] By employing the RAADS-14 scale, this study aims to provide a standardized measure of ASD traits among medical students, facilitating comparison with existing literature and enhancing the reliability of findings.

Despite extensive research on ASD, much of the focus has been on children, particularly boys, leaving a significant gap in our understanding of ASD among young adults, late-diagnosed individuals, and females.[5] Moreover, within the Pakistani population, there is a scarcity of data regarding ASD prevalence, diagnosis, and associated factors.[6] This knowledge gap is particularly concerning given the potential for late-diagnosed or undiagnosed ASD individuals to experience challenges in academic, social, and professional settings.[7] Thus, investigating ASD traits among young adults, including medical students, can provide crucial insights into the prevalence, presentation, and associated factors of ASD within this demographic. This contributes significantly to a comprehensive understanding of ASD across diverse populations and age groups.[8]

Medical students serve as a unique population for studying ASD prevalence and its associations due to their diverse backgrounds, intensive academic demands, and exposure to various healthcare disciplines.[9] Additionally, investigating the link between ASD traits and blood group phenotypes among medical scholars offers an intriguing perspective, potentially elucidating underlying genetic predispositions or biological mechanisms contributing to ASD susceptibility. This could lead to earlier diagnosis and personalized interventions, ultimately improving health outcomes and quality of life for individuals with ASD.[10]

Furthermore, investigating the potential association between ASD traits and blood group phenotypes holds promise for uncovering underlying genetic factors contributing to ASD propensity. Blood group phenotypes represent genetically determined variations in the surface antigens of red blood cells, with several studies suggesting links between certain blood group alleles and susceptibility to various health conditions.[11] By examining whether specific blood group phenotypes are more prevalent among individuals exhibiting ASD traits, this study seeks to shed light on potential genetic makeup and genetic factors that predispose individuals to ASD.

Moreover, investigating the association between ASD traits and blood group phenotypes in medical students may have broader implications for personalized medicine and clinical practice.[12] If certain blood group phenotypes are found to be associated with ASD traits, this information could potentially inform risk assessment strategies and facilitate early intervention efforts for individuals at higher genetic risk. Screening using the RAADS-14 scale, which is designed to identify ASD traits, could be an effective tool for identifying individuals who might benefit from further genetic testing and personalized intervention plans. Additionally, understanding the genetic factors contributing to ASD susceptibility may pave the way for targeted therapeutic approaches tailored to individuals' specific genetic profiles, representing a significant advancement in the field of neurodevelopmental disorders.[13]

In summary, this study conducted among medical students of CMH Kharian Medical College in Punjab, Pakistan, aims to explore the prevalence of ASD traits and investigate potential associations with blood group phenotypes. Many individuals with milder ASD traits or those who are high functioning may go undiagnosed until later in life, often during periods of increased social and academic demands, such as medical school. Given autism's hereditary nature and early childhood onset, examining family histories will provide context. Understanding these associations could inform risk assessment, and early interventions, and enhance support for medical students, contributing to their well-being and success.

Methods

The cross-sectional study was conducted at the Physiology Department, CMH Kharian Medical College Kharian, Pakistan from January 2024 to April 2024 using convenient sampling techniques. The sample size of n=385 was calculated using the online sample size calculator “Open Epi” keeping a 95% confidence interval and 5% margin of error. The study included a total of 527 medical students, aged between 17 and 25 years, enrolled at CMH Kharian Medical College Kharian, Pakistan. Students with a

known history of chronic illnesses, endocrine disorders, and/or chronic corticosteroid use for conditions such as asthma were excluded from the study based on the aforementioned factors affecting measures of adiposity and body composition. Students with a previous diagnosis of psychiatric and/or neurodevelopmental conditions and/or a history of taking medication for the aforementioned conditions were also not included in the study. Written informed consent was taken from all the subjects before including them in the current project. Approval of the Ethical Review Committee of CMH Kharian Medical College was taken on dated: 04th January 2024 vide letter no: CKMC/IERB/AC-00115.

The Rapid Autism Diagnostic Screening (RAADS-14) scale was utilized to assess ASD traits among participants. The RAADS-14 scale comprises 14 items covering domains such as social interaction, communication, and restricted and repetitive behaviors. The items are graded on a Likert scale of zero to three, with a greater score suggesting greater ASD traits. Additionally, sociodemographic data including age, gender, residence, and anthropometric measures such as Height-to-waist ratio (HWR) and body mass index (BMI) were taken.

Venous blood samples were collected from study participants and processed to separate serum from cellular components. ABO blood group phenotyping was performed using the tube agglutination method, where patient serum was mixed with known anti-A and anti-B monoclonal antibodies, and agglutination reactions were observed to determine blood group A, B, AB, or O. Rh blood group phenotyping was conducted using the direct antiglobulin test (DAT).[14] Quality control measures were implemented throughout the procedures, and data were analyzed to assess any associations between blood group phenotypes and ASD traits or other variables. SPSS version 26 was used to analyze data.

Descriptive statistics were used to summarize the sociodemographic characteristics of the study sample. Chi-square tests were conducted to examine the association between ASD status and categorical variables such as gender, area of residence, blood groups, and BMI categories. Odds ratios (ORs) were calculated to quantify the strength of the association between ASD status and parameters grouped in categories. $P \leq 0.05$ was considered to be statistically significant. Additionally, Pearson correlation was performed to assess the relationship amongst age, BMI, HWR, and RAADS-14 scores.

Results

Table-1 presents the sociodemographic data of the study participants. The mean age of the subjects was 20.75 years (±SD = 1.62). Out of the total subjects, 194 (36.8%) were male and 333 (63.2%) were female. Regarding area of residence, 115 (21.8%) were from rural areas, 346 (65.7%) were from urban areas, and 66 (12.5%) were from sub-urban areas.

Table-2 displays the association of ASD with gender, area of residence, blood groups, and BMI categories.

Table-1: Sociodemographic Data of Study Participants

Age in years (Mean ±SD)	20.75 + 1.62 (n = 527)
Gender	
Male	194 (36.8%)
Female	333 (63.2%)
Area of Residence	
Rural	115 (21.8%)
Urban	346 (65.7%)
Sub Urban	66 (12.5%)

Chi-square analysis revealed a significant association between ASD status and gender ($X^2 = 11.04$, $P = 0.001$), with a higher proportion of females (35.9%) exhibiting ASD traits compared to males (15.4%). However, there was a lack of associations of a significant nature seen between ASD status and area of residence, blood groups, or BMI.

Table-3 presents the correlation of age, BMI, and height-to-waist ratio (HWR) with RAADS-14 scores. Pearson correlation revealed a significant positive correlation between HWR and RAADS-14 scores (r = 0.103, $P < 0.01$), indicating that individuals with

Table-2: Association of autism spectrum disorder with Gender, Area of Residence, Blood Groups & body mass index

Variable	ASD Positive	ASD Negative	Chi-square X^2	*P-value*
Gender				
Male	81	113	11.04	0.001*
Female	189	144		
Area of Residence				
Rural	58	57		
Urban	174	172	1.21	.545
Sub Urban	38	28		
Blood Groups				
A+	58	64		
A-	2	7		
B+	84	80		
B-	8	8	10.90	0.143
AB+	32	17		
AB-	1	3		
O+	79	67		
O-	6	11		
BMI				
Underweight	48	54		
Normal	159	155	2.20	0.531
Overweight	45	33		
Obesity	18	15		

higher HWRs tended to have higher ASD trait scores. However, correlational links between age or BMI and RAADS-14 scores were not seen.

Overall, these findings highlight the prevalence of ASD traits among undergraduate students and provide insights into the sociodemographic and anthropometric factors associated with ASD susceptibility.

Table-3: Correlation of Age, body mass index, and height to waist ratio with Rapid Autism Diagnostic Screening scoring of the study participants

Variable	Age (Years)	BMI (Kg/m^2)	Height to waist ratio (HWR)	*P*-value
RAADS-14 Score	0.044	0.072	0.103**	0.01

*** Pearson correlation r is significant between RAADS-14 score and HWR*

Discussion

The present study aimed to explore the prevalence of Autism Spectrum Disorder (ASD) traits among undergraduate medical students and investigate potential associations with sociodemographic factors, blood group phenotypes, and anthropometric measures. The findings revealed a significant association between gender and ASD traits, with a higher proportion of females exhibiting ASD traits compared to males. However, no significant associations were observed between ASD traits and area of residence, blood group phenotypes, or body mass index (BMI). Additionally, a positive correlation was found between height-to-waist ratio (HWR) and ASD traits, indicating that individuals with higher HWRs tended to exhibit higher ASD trait scores.

The observed gender difference in ASD traits aligns with previous research demonstrating a higher prevalence of ASD traits among females compared to males in adulthood.[15] For example, a study by Hutson found that females with ASD often exhibit different symptom profiles and may be underrepresented in clinical settings due to diagnostic overshadowing.[16] Similarly, Marlborough et al. reported a higher prevalence of ASD traits among females with fragile X syndrome in a large community-based sample, highlighting the importance of considering gender

differences in ASD diagnosis and research.[17]

Contrary to our findings, some studies have reported no significant associations between blood group phenotypes and ASD traits. For instance, a study by Zhang et al. investigated the relationship between parental ABO blood group phenotypes and ASD diagnosis in a large population-based cohort but found no evidence of an association.[18] Similarly, a study by Miles et al. examined the association between maternal Rh status and Rh immunoglobulin and autism but did not find a significant correlation.[19] These conflicting results suggest that the relationship between blood group phenotypes and ASD traits may be influenced by various factors and warrants further investigation in diverse populations.

The positive correlation between HWR and ASD traits observed in the current study contributes to the increasing collection of literature concerning the association between obesity-related measures and ASD susceptibility. Previous research has shown that individuals with ASD may have a higher prevalence of obesity and related metabolic disorders compared to neurotypical individuals. For example, a study by Dhaliwal et al. found that children with ASD were more likely to be obese compared to children without ASD, highlighting the need for targeted interventions to promote healthy lifestyles in this population.[20] However, the underlying mechanisms linking obesity-related measures to ASD traits remain poorly understood and require further elucidation.Reliance on self-report measures, such as the RAADS-14 scale, may introduce bias and inaccuracies in assessing ASD traits, as individuals may underreport or misinterpret their symptoms limiting the findings of our study. Furthermore, we may not be able to generalize the findings of our study as the study sample was drawn from a single educational institution.

Conclusion

In conclusion, the current research gives valuable perspectives on the frequency of ASD traits among undergraduate medical students and their associations with gender, blood group phenotypes, and anthropometric measures. The observed gender difference in ASD traits underscores the importance of considering gender-specific factors in ASD diagnosis and research. While no significant associations were found between blood group phenotypes and ASD traits, the positive correlation between HWR and ASD traits highlights the potential role of obesity-related measures in ASD susceptibility.

Acknowledgment: None

Conflict of Interest: The authors declare no conflict of interest

Grant Support and Financial Disclosure: None

REFERENCES

1. Hodges H, Fealko C, Soares N. Autism spectrum disorder: definition, epidemiology, causes, and clinical evaluation. Translational pediatrics. 2020; 9: S55-65. doi: 10.21037/tp.2019.09.09
2. Yoon S, Choi J, Lee W, Do JT. Genetic and Epigenetic Etiology Underlying Autism Spectrum Disorder. Journal of clinical medicine. 2020; 9: 966. doi: 10.3390/jcm9040966
3. Frye RE, Vassall S, Kaur G, Lewis C, Karim M, Rossignol D. Emerging biomarkers in autism spectrum disorder: A systematic review. Annals of translational medicine. 2019; 7: 792. doi: 10.21037/atm.2019.11.53
4. Sturm A, Huang S, Bal V, Schwartzman B. Psychometric exploration of the RAADS-R with autistic adults: Implications for research and clinical practice. Autism. 2024; 28: 946-57. doi: 10.1177/13623613241228329
5. Lockwood Estrin G, Milner V, Spain D, Happé F, Colvert E. Barriers to Autism Spectrum Disorder Diagnosis for Young Women and Girls: A Systematic Review. Review Journal of Autism and Developmental Disorders. 2021; 8: 451-63. doi: 10.1007/s40489-020-00225-8
6. Ashraf M, Saeed B, Mansoor AF, Ijaz M, Mushtaq F, Khan MA, et al. Autism Spectrum Disorder in Pakistan: A Review. Pakistan Journal of Health Sciences. 2022; 10: 234-45. doi: 10.54393/pjhs.v3i07.384
7. Saeed RF, Mumtaz S, Qazi AS, Awan USA, Akhtar N. Autism-Current Status and Challenges in Pakistan. Life and Science. 2021; 2: 201. doi: 10.37185/LnS.1.1.208
8. Boonnag C, Siritikun S, Chalanun S, Kuntawong P, Wongpakaran N, Wongpakaran T. Prevalence of ADHD symptoms and their correlations with mental health-related variables among medical students. Research Square. 2020. doi: 10.21203/rs.2.22394/v1
9. Giroux M, Pélissier-Simard L. Shedding light on autistic traits in struggling learners: A blind spot in medical education.

Perspectives on Medical Education. 2021; 10: 295-7. doi: 10.1007/s40037-021-00654-z

10. Elfeituri MA, Asaeti ZA, Elgazal NB, El-Amari M, Al-Ojali SM. Study of Possible Association between ABO Blood Groups and Autism Spectrum Disorder. Scholars journal of Applied Medical Sciences. 2022; 10: 789-95. doi: 10.36347/sjams.2022.v10i09.006
11. Abegaz SB. Human ABO blood groups and their associations with different diseases. BioMed research international. 2021; 2021: 6629060. doi: 10.1155/2021/6629060
12. Underwood JF, Kendall KM, Berrett J, Lewis C, Anney R, Van den Bree MB, et al. Autism spectrum disorder diagnosis in adults: Phenotype and genotype findings from a clinically derived cohort. The British Journal of Psychiatry. 2019; 215: 647-53. doi: 10.1192/bjp.2019.30
13. Way H, Williams GE, Hausman-Cohen S, Reeder J. Genomics as a Clinical Decision Support Tool: Successful Proof of Concept for Improved ASD Outcomes. Journal of Personalized Medicine. 2021; 11: 596. doi: 10.3390/jpm11070596
14. Li HY, Guo K. Blood group testing. Frontiers in medicine. 2022; 9: 827619. doi: 10.3389/fmed.2022.827619
15. Lundström S, Mårland C, Kuja-Halkola R, Anckarsäter H, Lichtenstein P, Gillberg C, et al. Assessing autism in females: The importance of a sex-specific comparison. Psychiatry research. 2019; 282: 112566. doi: 10.1016/j.psychres.2019.112566
16. Hutson P, Hutson J. Autism in Females: Understanding the Overlooked Diagnoses, Unique Challenges, and Recommendations. Journal of Clinical & Medical Images. 2023; 3: 1-6.
17. Marlborough M, Welham A, Jones C, Reckless S, Moss J. Autism spectrum disorder in females with fragile X syndrome: a systematic review and meta-analysis of prevalence. Journal of neurodevelopmental disorders. 2021; 13: 1-9. doi: 10.1186/s11689-021-09362-5
18. Wu ZT, Zhang W, Zhang SQ, Yu JG, Lei H, Wang WZ, et al. Lack of Association between Parental ABO Blood Type and Autism Spectrum Disorders. CNS neuroscience & therapeutics. 2012; 18: 604-5. doi: 10.1111/j.1755-5949.2012.00342.x
19. Miles JH, Takahashi TN. Lack of association between Rh status, Rh immune globulin in pregnancy and autism. American journal of medical genetics. 2007; 143: 1397-407. doi: 10.1002/ajmg.a.31846
20. Dhaliwal KK, Orsso CE, Richard C, Haqq AM, Zwaigenbaum L. Risk Factors for Unhealthy Weight Gain and Obesity among Children with Autism Spectrum Disorder. International journal of molecular sciences. 2019; 20: 3285. doi: 10.3390/ijms20133285

Authors Contribution

AFA: Idea conception, study designing, data collection, manuscript writing and proofreading
NS: Idea conception, data analysis, results and interpretation, manuscript writing and proofreading
WH: Idea conception, study designing, manuscript writing and proofreading
WA: Study designing, data collection, data analysis, results and interpretation, manuscript writing and proofreading
WP: Data collection, data analysis, results and interpretation, manuscript writing and proofreading
MS: Study designing, data collection, data analysis, results and interpretation
HZM: Study designing, data collection, data analysis, results and interpretation
KT: Data collection, data analysis, results and interpretation
SNH: Manuscript writing and proofreading