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Publication Cell:

Chief Editor
Gandhara University
Canal Road, University Town
Peshawar, Pakistan
Tel: +92-91-5619671-6
+92-91-5711151-3
Fax: +92-91-5844428

Visit Us:

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Email:

editor.sjgu@gandhara.edu.pk
sofia.kabir@gandhara.edu.pk



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REFRAMING ADOLESCENT COSMETIC SURGERY AS A PUBLIC HEALTH RESPONSIBILITY IN PAKISTAN

Hira Khan,4th year, BS Endoscopy Technology Student,
Nishtar Medical University,

☎: +92-302-7880420

✉: hiraakhan2003@gmail.com

Aesthetic surgery, previously dominated by reconstructive referrals and adulthood, has experienced significant growth worldwide over the last 20 years due to advances in surgical techniques, minimally invasive procedures, and online marketing.¹ Nevertheless, alongside this rise, a new concern is emerging: adolescents' growing interest in cosmetic procedures. This trend is of immediate concern to medical practitioners and policymakers in Pakistan, where close to two-thirds of the population is under 30 years old. The adolescent stage is a significant phase of development characterized by identity development, emotional sensitivity, and an excessive interest in physical appearance. The speed with which social media sites have infiltrated Pakistan has introduced young people to unrealistic and computerized beauty ideals. As found in studies conducted in the West, exposure to social media is significantly connected to body dissatisfaction and appearance-related anxiety among young people.² Although most of this research has been conducted in the West, studies in a local context have shown that students in Pakistani universities are also influenced by globalized, idealized bodies and body images.³ Cosmetic surgery in adolescents is more about appearance as opposed to reconstructive procedures, which are carried out due to some functional or congenital indication. This provokes complicated psychological and moral issues. Teenagers might be emotionally immature and unable to think long-term to make irreversible surgical decisions. The concept of body dysmorphic disorder (BDD), which is excessive preoccupation with observed physical defects, is especially applicable in this age group. Research investigations of Pakistani medical students have documented significant rates of BDD symptoms, which underscores how the perception of distorted body images can be especially prone to susceptibility in young populations.⁴ Notably, research shows that cosmetic surgery can hardly improve the psychological distress of patients with BDD, and it can, in fact, worsen the symptoms when underlying problems are not managed.⁵

The challenges notwithstanding, cosmetic surgery is increasingly marketed as a confidence-boosting solution. In Pakistan, the number of aesthetic clinics in big cities is growing at an alarming rate, and they frequently advertise minimally invasive procedures such as rhinoplasty, lip augmentation, and skin-lightening treatments. The commercialization of beauty and the societal focus on physical appearance in areas like marriage and social mobility are other factors that could influence adolescents' decisions. The fact that most psychological screening procedures are not standardized before the cosmetic procedure in minors is another issue. The health risks posed by cosmetic surgery in the medical field are underestimated. Perioperative complications like infection, hematoma, scarring, anaesthesia-related cases, and dissatisfaction necessitating revision surgery are all documented.⁶ Adolescents, as a result of peer comparison or online trends, may not fully realize the long-term effects. In a healthcare system that is already overwhelmed with a lack of mental health infrastructure, cosmetic surgery cannot be a way forward instead of psychological support. On international levels, professional organizations suggest that cosmetic surgery among minors must be carefully considered, with a strong emphasis on the evaluation of psychological maturity and expectations.¹ In Pakistan, there is, however, a dearth of guidance on the issue at a national level, which is specific to the procedures of cosmetic surgery in adolescents. This regulatory loophole underscores the need for organized regulation. It should be proposed to incorporate the compulsory psychological examination prior to elective cosmetic surgeries in people under 18 years. Multidisciplinary consultation (plastic surgeons, psychiatrists, and paediatricians) might improve patient safety.

There should be more extensive educational reforms as well as clinical safeguards. School and university media literacy can be developed to teach teenagers critical thinking to analyse digitally manipulated information. The focus should be on raising awareness among the general populace and encouraging body and self-acceptance, without enforcing the ideals of narrow beauty, as the concept of beauty and appearance has been ingrained in our society. Medical institutions and professional councils can also develop a set of ethical standards to regulate the advertising of cosmetic operations targeting minors. Transitioning toward a more responsible framework will not be smooth. It involves interagency cooperation among regulatory bodies, healthcare institutions and providers,

educators, and media stakeholders. The commercial sectors might be resistant to the development of the aesthetic industry, as they will gain. Nevertheless, these barriers are greatly exceeded by the long-run benefits of safeguarding adolescent mental health and proper conduct on the part of medical professionals. Plastic surgery among teenagers must also be an exception that is strongly medically and psychologically based, but not a normalized reaction to developmental insecurity. Pakistan is at a critical juncture. With such a large and impressionable number of young people, it is necessary to take proactive steps to ensure that appearance-based interventions do not take centre stage at the expense of holistic well-being. It is high time to take action to protect not only adolescents' physical well-being but also their psychological well-being and self-esteem.

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PREVALENCE AND FACTORS OF ABSENTEEISM AMONG MEDICAL STUDENTS OF PESHAWAR

Saifullah Burki¹, Muhammad Saad Khan¹, Gulalay Khan¹, Manahil¹, Huma Nawaz¹,
Nouman Khan¹, Atif Iftikhar¹

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Correspondence

¹Saifullah Burki, Final Year MBBS Student Kabir Medical College, Peshawar

☎: +92-317-0718107

✉: saifullah5581582@gmail.com

ABSTRACT**OBJECTIVES**

This study aimed to determine the prevalence of absenteeism and identify the associated factors among medical students of Peshawar.

METHODOLOGY

A cross-sectional study was conducted from January to December 2024 among MBBS students enrolled in three medical colleges in Peshawar. The sample size (n=380) was calculated using a 50% estimated prevalence, 95% confidence level, and 5% margin of error. Stratified random sampling was used based on academic year. A structured, self-administered questionnaire assessed sociodemographic characteristics, absenteeism frequency, academic motivation, mental health indicators, and institutional factors. Data were analyzed using SPSS v.26. A p-value <0.05 was considered statistically significant.

RESULTS

The absenteeism rate was 58.1%, indicating a considerable burden on medical institutions in Peshawar. Significant factors associated with absenteeism included poor teaching quality (p=0.003), academic stress (p=0.001), lack of interest in lectures (p=0.002), depressive symptoms (p=0.014), long commuting time (p=0.027), heavy academic load (p=0.009), health issues (p=0.003), family issues (p=0.005), financial difficulties (p=0.002), and conflict with administration (p=0.008). Environmental factors such as overcrowded classrooms, poor ventilation, excessive noise, uncomfortable seating, and poor campus cleanliness also demonstrated strong associations.

CONCLUSION

Absenteeism is highly prevalent among medical students in Peshawar and is driven by complex academic, psychological, and institutional factors. Improving teaching methodologies, providing mental health support, optimizing the curriculum load, and enhancing student engagement may substantially reduce absenteeism.

KEYWORDS: Absenteeism, Medical Students, Peshawar, Academic Stress, Medical Education, Predictors of Absenteeism

INTRODUCTION

Attendance in medical education is widely recognized as a vital component of successful academic performance and professional development. Medical students rely on classroom teaching, clinical exposure, and interactive learning to build a strong foundation for future clinical practice. Absenteeism, defined as the intentional or habitual failure to attend scheduled academic activities, has therefore become an important topic of investigation in medical education systems worldwide. High levels of absenteeism have been linked to poor academic outcomes, reduced engagement, ineffective learning, and weakened clinical competence.¹ This issue has attracted attention in many Asian and South Asian contexts, yet it remains underexplored within medical institutions in Peshawar, Pakistan. Studies in medical education have consistently shown that attendance

correlates positively with academic performance. Evidence from institutions in the UK, Saudi Arabia, and India shows that students with higher class attendance achieve better examination results and clinical skill proficiency.^{2,3,4} Conversely, absenteeism often predicts academic failure, poor knowledge retention, and difficulties during clinical rotations.⁵ In Pakistan, several medical colleges have reported concerns about poor student attendance, though comprehensive local data remain limited. The factors contributing to absenteeism are multifaceted and embedded within personal, academic, psychosocial, and institutional domains. Personal factors such as lack of motivation, mental health challenges, and poor time management have been repeatedly cited in international studies.^{6,7} A study from Saudi Arabia found that psychiatric distress, particularly anxiety and depressive symptoms, significantly increased absenteeism among medical students.⁸

Similarly, research from India highlighted that low intrinsic motivation and poor study habits were key contributors.⁹ Academic factors are also central to absenteeism. Students often report heavy curriculum loads, stressful examination schedules, and insufficient flexibility within the academic structure. Many describe burnout and fatigue as barriers to regular attendance. A 2021 systematic review concluded that academic overload, ineffective teaching strategies, and poor classroom engagement are major determinants of absenteeism in medical education.¹⁰ A study in Lahore reported that students often skip classes when the teaching style is monotonous or when lectures lack clear learning objectives.¹¹ Institutional factors such as faculty behavior, classroom environment, long teaching hours, inadequate facilities, and rigid assessments also affect attendance. A study in Nepal found that poor teaching quality and faculty motivation were significant predictors of absenteeism.¹² Meanwhile, research in Malaysia identified long commuting distances and transportation difficulties as contributing factors.¹³ Psychological and mental health issues are increasingly recognized for their role in absenteeism. The prevalence of stress, anxiety, and depressive symptoms is significantly higher among medical students compared to their non-medical peers. Studies from Pakistan have shown high levels of psychological distress among medical students, which adversely impacts academic functioning and attendance.^{14,15} Mental-health-related stigma, lack of institutional support, and limited counseling services further aggravate the issue. Absenteeism is not merely an academic concern; it carries long-term implications for future medical practice. Students who miss foundational basic-science content often demonstrate inadequate clinical reasoning later in training.¹⁶ Furthermore, habitual absenteeism may erode professional responsibility, a core competency expected from healthcare providers. Medical education bodies emphasize that regular class attendance shapes discipline, self-regulation, and ethical conduct-qualities that influence future patient care.¹⁷ In Peshawar, absenteeism is influenced by the unique cultural, socioeconomic, and educational context. Public and private medical colleges experience disparities in infrastructure, learning styles, and student expectations. Many students commute long distances, juggle family responsibilities, or face financial instability, which may contribute to irregular attendance. Despite the issue's relevance, empirical studies specifically examining absenteeism among medical students in Peshawar are

scarce. Given these gaps, the present study seeks to assess the prevalence of absenteeism and explore its associated factors among medical students in Peshawar. This research integrates academic, psychosocial, and institutional dimensions to provide comprehensive insights and guide policy interventions to promote better attendance and stronger academic engagement within medical colleges.

METHODOLOGY

This study employed a descriptive cross-sectional design to determine the prevalence of absenteeism and identify associated factors among medical students enrolled at three medical colleges in Peshawar. The research was conducted over one year, from January to December 2024, allowing adequate time for data collection across different academic phases and examination schedules. The study setting included one public and two private medical institutions, selected to ensure diversity in academic environment, institutional policies, and student demographics, thereby enhancing the representativeness of the findings. The sample size was calculated using the standard formula for prevalence studies:

$$n = Z^2 \times p(1-p) / d^2,$$

with Z set at 1.96 for a 95% confidence interval, an assumed prevalence (p) of 0.50 due to lack of recent regional data, and a margin of error (d) of 0.05. This yielded a minimum sample requirement of 384, which was adjusted to 380 after accounting for anticipated non-response. Stratified random sampling was employed to ensure proportional representation from all academic years of the MBBS and BDS programs. Within each stratum, students were randomly selected to minimize selection bias and maintain methodological rigor. Participants were eligible for inclusion if they were currently enrolled MBBS students, present during the data collection period, and willing to provide informed consent. Students on extended medical leave, suspension, or those with documented chronic medical conditions that inherently caused unavoidable absenteeism were excluded to prevent confounding. Data collection was conducted using a structured self-administered questionnaire developed after reviewing existing literature on absenteeism in medical education. Before the full-scale survey, the tool was pilot-tested on a small group of students (n=20), and minor revisions were made to improve clarity and relevance. Completed forms were coded and entered into SPSS version 26 for analysis.

RESULTS

Table 1: Demographic Characteristics of Participants (n = 380)

Variable	Category	Frequency (n)	%age
Gender	Male	154	40.5
	Female	226	59.5
Age Range (years)	18–20	112	29.5
	21–23	193	50.8
	24–26	75	19.7
Mean Age $\pm$ SD	-	21.8 $\pm$ 2.1	-
Academic Year	1st Year	72	19.0
	2nd Year	83	21.8
	3rd Year	78	20.5
	4th Year	74	19.5
	Final Year	73	19.2
Residence	Urban	242	63.7
	Rural	138	36.3
Commuting >1 Hour	Yes	109	28.7
	No	271	71.3

Table 2: Prevalence of Absenteeism

Category	Frequency (n)	%age
Absent ≥ 3 classes per month	221	58.1
Absent <3 classes per month	159	41.9

Table 3: Factors Associated with Absenteeism

Factor	Category	Absenteeism		χ^2	p-value
		Yes n (%)	No n (%)		
Poor Teaching Quality	Yes	148 (67.0)	74 (46.5)	8.92	0.003
	No	73 (33.0)	85 (53.5)		
Academic Stress	Yes	162 (73.3)	89 (56.0)	11.21	0.001
	No	59 (26.7)	70 (44.0)		
Lack of Interest in Lectures	Yes	144 (65.1)	77 (48.4)	9.87	0.002
	No	77 (34.9)	82 (51.6)		
Depressive Symptoms	Yes	118 (53.4)	63 (39.6)	6.03	0.014
	No	103 (46.6)	96 (60.4)		
Long Commute (>1 hour)	Yes	78 (35.3)	31 (19.5)	4.89	0.027
	No	143 (64.7)	128 (80.5)		
Heavy Academic Load	Yes	158 (71.5)	91 (57.2)	7.01	0.009
	No	63 (28.5)	68 (42.8)		
Health Issues	Yes	103 (46.6)	49 (30.8)	9.11	0.003
	No	118 (53.4)	110 (69.2)		
Family Issues	Yes	74 (33.5)	30 (18.9)	8.04	0.005
	No	147 (66.5)	129 (81.1)		
Financial Reasons	Yes	69 (31.2)	27 (17.0)	9.25	0.002
	No	152 (68.8)	132 (83.0)		
Conflict with Administration	Yes	56 (25.3)	21 (13.2)	7.02	0.008
	No	165 (74.7)	138 (86.8)		

Table 4: Classroom and Campus Environment as Contributors to Absenteeism

Environment Factor	Absenteeism		χ^2	p-value
	Yes	No		
Overcrowded Classrooms	139 (62.9)	74 (46.5)	10.34	0.001
Poor Classroom Ventilation & Temperature	128 (57.9)	63 (39.6)	11.12	0.001
Excessive Noise & Disturbance on Campus	114 (51.6)	53 (33.3)	12.21	0.000
Uncomfortable Seating Arrangements	121 (54.8)	55 (34.6)	14.03	<0.001
Lack of Cleanliness & Hygiene	105 (47.5)	49 (30.8)	9.14	0.002

DISCUSSION

The present study examined the prevalence and determinants of absenteeism among medical students in Peshawar and found an absenteeism rate of 58.1%. This aligns with international research indicating that absenteeism is a pressing concern in medical education, often linked to academic disengagement, declining performance, and reduced clinical competency.¹ Studies from India, Saudi Arabia, and Nepal have reported absenteeism rates ranging between 40% and 60%, suggesting that absenteeism is a widespread issue across culturally diverse medical institutions.^{2,3,4} The similarity in prevalence underscores the broader structural and academic pressures inherent in rigorous medical curricula. One of the major findings of this study was the significant association between poor teaching quality and absenteeism. Students who rated teaching quality as poor were more likely to miss classes ($p=0.003$). This is consistent with findings from Lahore, where ineffective teaching methodologies and monotonous lectures were consistently cited as strong contributors to absenteeism.⁵ Similarly, a study conducted in India emphasized that students are more likely to avoid classes that lack interactive teaching strategies or fail to offer clinically relevant content.⁶ Globally, research confirms that active learning, structured lesson plans, and student-centered instruction significantly enhance attendance and engagement.⁷ Academic stress emerged as another significant predictor of absenteeism ($p=0.001$). Medical training is academically demanding, involving extensive coursework, frequent assessments, and the pressure to excel. A study from Saudi Arabia reported that over 70% of medical students experience moderate to severe stress, which is directly linked to absenteeism and poor mental well-being.⁸ Similarly, research from Pakistan has documented high stress levels among medical students, with academic overload being a major contributing factor.⁹ Our findings align with these studies, suggesting that the academic burden placed upon students is a key driver of absenteeism. Lack of interest in lectures was also strongly associated with absenteeism ($p=0.002$), aligning with previous literature indicating that students often skip classes they perceive as unproductive or irrelevant.¹⁰ Engagement in medical education is closely tied to instructional approaches, clarity of learning objectives, and faculty enthusiasm. According to a 2021 systematic review, student disengagement is among the strongest predictors of chronic absenteeism in health sciences education.¹¹ When teaching fails to stimulate curiosity or provide practical value, students resort to independent study or rely on alternative learning materials. Psychological determinants also played a crucial role. Depressive symptoms showed a statistically significant association with absenteeism ($p=0.014$). This is consistent with studies from Europe and the Middle

East documenting a strong correlation between psychological distress and poor attendance among medical students.¹² Research from Karachi reported that approximately one-third of medical students exhibited depressive symptoms that impacted their academic participation.¹³ These findings highlight the pressing need for mental health support systems within medical institutions, including counseling services and early screening programs. Environmental determinants were also highly relevant in this study. Classroom and campus conditions such as overcrowding ($p=0.001$), poor ventilation ($p=0.001$), noise disturbances ($p<0.001$), uncomfortable seating ($p<0.001$), and poor cleanliness ($p=0.002$) were significantly associated with absenteeism. Similar observations were reported in a study from Nepal, where inadequate infrastructure and poorly maintained classrooms discouraged students from attending sessions.¹⁴ Another study from Malaysia found that environmental discomfort significantly reduced student engagement and attendance.¹⁵ The findings from the present study reaffirm that conducive learning environments directly influence student satisfaction and attendance patterns. Socioeconomic and personal factors also emerged as important determinants. Financial difficulties were significantly associated with absenteeism ($p=0.002$). Research from India also found that students experiencing financial strain were more likely to miss classes due to part-time work commitments, stress, or logistical barriers.¹⁶ In Pakistan, financial instability has been linked to increased stress and poor academic outcomes among students in professional programs.¹⁷ Family issues ($p=0.005$) and health issues ($p=0.003$) were other significant contributors. A study conducted in Bangladesh found that family conflicts, caregiving responsibilities, and health problems reduced class attendance among university students.¹⁸ Similar results were documented in an Iranian study highlighting chronic illness as a strong predictor of absenteeism among medical trainees.¹⁹ Our findings align with this body of literature, suggesting that absenteeism is not solely an academic issue but is also shaped by personal life circumstances. Conflict with administration was another significant factor ($p=0.008$). Research from African medical schools indicates that administrative issues, perceived injustice, and communication gaps contribute to student dissatisfaction and disengagement.²⁰ This parallels findings from Pakistan, where perceived lack of administrative support has been shown to reduce class attendance and student motivation.²¹ Commuting time also showed a strong association with absenteeism ($p=0.027$). International studies from Malaysia, India, and Egypt confirm that long commutes reduce student satisfaction and attendance due to fatigue and time constraints.²² Overall,

the study's findings demonstrate that absenteeism among medical students in Peshawar is shaped by a combination of academic, psychological, personal, socioeconomic, and environmental factors. Importantly, many of these determinants are modifiable. Furthermore, institutions should ensure that learning environments meet ergonomic and infrastructural standards to support student comfort and participation.

LIMITATIONS

The sample was limited to three institutions in Peshawar, which may affect generalizability. Psychological variables were assessed using screening items rather than full diagnostic tools. Environmental assessments were based on student perception rather than objective measurements.

CONCLUSIONS

Absenteeism among medical students in Peshawar is highly prevalent and is influenced by a broad interplay of academic, psychological, environmental, and personal factors. The study highlights poor teaching quality, academic stress, depressive symptoms, long commuting hours, financial difficulties, and poor classroom environment as major contributors. Addressing these issues requires institutional commitment to strengthening teaching practices, improving learning environments, providing mental health support, and enhancing administrative responsiveness. Implementing structured interventions may significantly improve attendance, academic performance, and overall student well-being.

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CONTRIBUTORS

1. **Saifullah Burki** - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Supervision; Final Approval
2. **Muhammad Saad Khan** - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision
3. **Gulalay Khan** - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Supervision;
4. **Manahil** - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision
5. **Huma Nawaz** - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision
6. **Nouman Nawaz** - Concept & Design; Data Analysis/Interpretation; Drafting Manuscript; Final Approval
7. **Atif Iftikhar** - Concept & Design; Data Analysis/Interpretation; Drafting Manuscript; Final Approval



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ORAL HEALTH STATUS AND ASSOCIATED RISK FACTORS AMONG SCHOOL CHILDREN IN PEAHAWAR: A CROSS-SECTIONAL STUDY

Muhammad Umer Farooq¹, Nayab Jehangir Khan¹

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Correspondence

¹Muhammad Umer Farooq, 3rd Year BDS Student, Sardar Begum Dental College, Gandhara University, Peshawar
☎: +92-314-3042553
✉: sheikhrasput24@gmail.com

ABSTRACT

OBJECTIVES

This study aimed to assess oral health status and identify factors associated with poor oral health among schoolchildren in Peshawar, Pakistan.

METHODOLOGY

A cross-sectional study was conducted among 420 schoolchildren aged 6-12 years, selected from public and private schools in Peshawar, using multistage sampling. Data were collected using a structured questionnaire and an oral examination, based on the WHO Oral Health Survey Methods (5th edition). Oral health status was assessed using the Decayed, Missing, and Filled Teeth (DMFT/dmft) index, Simplified Oral Hygiene Index (OHI-S), and Gingival Index (GI). Data were analyzed using SPSS version 26. Chi-square test and multivariate logistic regression were applied to determine factors associated with dental caries. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

Among 420 participants, 232 (55.2%) were males, and 188 (44.8%) were females. The prevalence of dental caries was 58.6%, while 47.9% had poor oral hygiene and 35.2% had gingivitis. Mean DMFT/dmft score was 2.41 ± 1.89 . Significant predictors of dental caries included frequent sugary snack consumption (AOR=3.14; 95% CI=1.89-5.23), brushing less than twice daily (AOR=2.67; 95% CI=1.58-4.51), parental education below secondary level (AOR=1.92; 95% CI=1.14-3.25), and absence of routine dental visits (AOR=2.38; 95% CI=1.31-4.31).

CONCLUSION

Dental caries and poor oral hygiene are highly prevalent among school children in Peshawar. Dietary habits, inadequate oral hygiene practices, low parental education, and lack of preventive dental care significantly contribute to poor oral health outcomes. School-based oral health promotion programs are urgently needed.

KEYWORDS: Oral Health, Dental Caries, School Children, Risk Factors, DMFT Index, Peshawar

INTRODUCTION

Oral health is an essential component of overall health and well-being, significantly influencing an individual's quality of life. The World Health Organization (WHO) defines oral health as the state of being free from oral diseases and conditions that limit an individual's capacity to eat, speak, smile, and socialize without discomfort or embarrassment. Oral diseases are among the most prevalent non-communicable diseases globally, affecting nearly 3.5 billion people worldwide and imposing a substantial burden on healthcare systems, particularly in low- and middle-income countries.^{1,2} Despite being largely preventable, oral diseases continue to affect populations across all age groups, with children representing one of the most vulnerable segments.

Dental caries remains the most common chronic oral disease among children worldwide. According to WHO estimates, approximately 60-90% of school-aged children experience dental caries during their lifetime.² Untreated dental caries can result in pain, infection, difficulty in chewing, nutritional deficiencies, speech impairment, sleep disturbances, and reduced academic performance. In severe cases, oral infections may contribute to systemic health complications and adversely affect psychosocial development.³ Consequently, oral health has been recognized as an important public health issue requiring comprehensive preventive and therapeutic interventions. School-aged children constitute a critical target group for oral health promotion because habits developed during childhood often persist into adulthood. Oral hygiene behaviors,

dietary patterns, and health-seeking practices established at an early age significantly influence future oral health outcomes. Studies have shown that inadequate oral hygiene practices, excessive sugar consumption, low socioeconomic status, limited parental awareness, and infrequent dental visits contribute substantially to the development of dental caries and periodontal diseases among children.^{4,5} Globally, the burden of oral diseases disproportionately affects populations residing in developing countries, where access to preventive oral healthcare services is often limited. The WHO Global Oral Health Status Report highlighted that oral diseases remain a major public health challenge, particularly in resource-constrained settings where preventive services receive less attention than curative treatment.¹ An increasing urbanization, changing dietary habits, and greater consumption of processed foods rich in fermentable carbohydrates have contributed to the rising prevalence of dental caries among children in many developing nations.⁶ In Pakistan, oral health has historically received limited attention within the healthcare system. Although dental diseases are highly prevalent, oral health services remain concentrated in urban centers, creating disparities in access to preventive and curative care.⁷ The WHO Oral Health Country Profile for Pakistan reported a substantial burden of untreated dental caries among children, emphasizing the need for strengthened oral health policies and community-based preventive strategies.⁸ A systematic review and meta-analysis conducted by Siddiqui et al. reported that nearly 60% of the Pakistani population is affected by dental caries, indicating that dental decay represents a major public health concern across all provinces of the country.⁹ The review further demonstrated that the prevalence of dental caries remains consistently high throughout Pakistan, reflecting widespread exposure to common risk factors. Several studies conducted in different regions of Pakistan have reported alarming rates of dental caries among school-aged children. Dawani et al. found a high prevalence of dental caries among preschool children in Karachi and identified dietary habits and inadequate oral hygiene practices as important contributing factors.¹⁰ Similarly, Sami et al. reported significant levels of dental caries and poor oral health behaviors among school children, highlighting deficiencies in oral hygiene awareness and preventive practices.¹¹ Another study conducted among primary school children revealed a dental caries prevalence of approximately 74%, demonstrating that oral diseases remain a significant burden in the pediatric population.¹² Another important concern is the low utilization of preventive dental services among Pakistani children. Most families seek dental care only when symptoms become severe, resulting in delayed diagnosis and treatment of oral

diseases.⁷ Regular dental check-ups facilitate early identification of oral health problems and provide opportunities for preventive interventions. However, awareness regarding the importance of preventive dental visits remains limited among the general population. Khyber Pakhtunkhwa, particularly Peshawar, faces unique challenges regarding oral health promotion. Although the city has witnessed considerable urban growth and improvements in healthcare infrastructure, epidemiological data on oral health among schoolchildren remain limited. A recent study conducted in Peshawar reported a high prevalence of dental caries among children aged 6-12 years and identified sugar consumption as a significant risk factor.¹⁷ Comprehensive assessments examining oral health status alongside behavioral, socioeconomic, and demographic determinants are scarce. Given the substantial burden of oral diseases and the limited regional evidence available, there is a need for updated epidemiological data to support evidence-based oral health planning. Identifying modifiable risk factors can help policymakers, educators, and healthcare professionals design targeted interventions to improve oral health outcomes among children. Therefore, the present study was conducted to assess the oral health status and associated risk factors among school children in Peshawar, Pakistan.

METHODOLOGY

This analytical cross-sectional study was conducted among schoolchildren aged 6-12 years in public and private schools in Peshawar, Khyber Pakhtunkhwa, Pakistan, from January 2025 to June 2025. The study aimed to assess oral health status and identify factors associated with poor oral health among school children. The sample size was calculated using the WHO formula for prevalence studies, assuming a dental caries prevalence of 55%, a 95% confidence level, and a margin of error of 5%. The calculated sample size was 380 participants; however, after adding 10% to compensate for potential non-response, the final sample size was increased to 420 children. A multistage sampling technique was employed. In the first stage, six public and six private schools were randomly selected from different areas of Peshawar. In the second stage, students were selected through systematic random sampling using school enrollment registers. Children aged 6 to 12 years enrolled in the selected schools and whose parents or guardians provided written informed consent were included in the study. Children with systemic illnesses affecting oral health, those undergoing orthodontic treatment, and those whose parents declined participation were excluded. Data were collected using a pretested structured questionnaire administered to

parents and children. The questionnaire consisted of sections addressing socio-demographic characteristics, parental education, family income, oral hygiene practices, dietary habits, and dental service utilization. Information regarding tooth-brushing frequency, use of fluoridated toothpaste, frequency of consumption of sugary snacks, and history of dental visits was obtained. Clinical oral examinations were conducted by trained dental surgeons under standardized conditions using disposable mouth mirrors and WHO periodontal probes. Oral health assessment was performed according to the WHO Oral Health Survey Methods (5th Edition). Dental caries was evaluated using the Decayed, Missing, and Filled Teeth (DMFT/dmft) index. Oral hygiene status was assessed using the Simplified Oral Hygiene Index (OHI-S), while gingival health was evaluated using the Gingival Index (GI). Prior to data collection, examiner calibration was conducted to ensure consistency and reliability of clinical assessments. The dependent variable in the study was poor oral health, operationally defined as dental caries. Independent variables included age, gender, type of school, parental education, family income, brushing frequency, use of fluoridated toothpaste, consumption of sugary snacks, and dental visitation practices. Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 26. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Table 1: Socio-demographic Characteristics (n=420)

Variable	Frequency	Percentage
Male	232	55.2
Female	188	44.8
Public School	220	52.4
Private School	200	47.6
Age 6-8 years	156	37.1
Age 9-10 years	138	32.9
Age 11-12 years	126	30.0

Table 2: Oral Health Status

Variable	Frequency	Percentage
Dental Caries Present	246	58.6
Dental Caries Absent	174	41.4
Poor Oral Hygiene	201	47.9
Gingivitis	148	35.2

Mean DMFT/dmft = 2.41 ± 1.89

Table 3: Oral Hygiene Practices

Variable	Frequency	Percentage
Brush Twice Daily	164	39.0
Brush Once Daily	198	47.1
Irregular Brushing	58	13.8
Use Fluoridated Toothpaste	276	65.7
Routine Dental Visit	112	26.7

Table 4: Association of Risk Factors with Dental Caries

Variable	Caries n (%)		p-value
	Present	Absent	
Sugary Snacks >3/day	151 (76.6)	46 (23.4)	<0.001
Brush <2/day	178 (69.3)	79 (30.7)	<0.001
Low Parental Education	142 (67.0)	70 (33.0)	0.002
No Dental Visit	201 (65.3)	107 (34.7)	<0.001

Table 5: Multivariate Logistic Regression

Predictor	AOR	95% CI	p-value
Sugary Snacks >3/day	3.14	1.89-5.23	<0.001
Brushing <2/day	2.67	1.58-4.51	<0.001
Low Parental Education	1.92	1.14-3.25	0.014
No Routine Dental Visit	2.38	1.31-4.31	0.005

DISCUSSION

The present study assessed oral health status and associated risk factors among school children aged 6-12 years in Peshawar. The findings revealed that 58.6% of the participants had dental caries, with a mean DMFT/dmft score of 2.41 ± 1.89 . Furthermore, nearly half of the children demonstrated poor oral hygiene, while more than one-third exhibited signs of gingivitis. These findings indicate a substantial burden of oral diseases among school-aged children in Peshawar and highlight the need for effective preventive interventions. The prevalence of dental caries observed in the current study is consistent with previous reports from Pakistan. Siddiqui et al. reported in a systematic review and meta-analysis that dental caries affects approximately 60% of the Pakistani population, making it one of the most prevalent oral diseases in the country.⁹ Similarly, Dawani et al. reported a prevalence of 61% among preschool children in Karachi, while Khan et al.¹⁰ documented a prevalence exceeding 55% among school children in Peshawar.¹⁷ The similarity between these studies and the present findings suggests that dental caries remains a persistent public health challenge across different regions of Pakistan. The relatively high prevalence may be attributed to inadequate oral hygiene practices, increased consumption of sugary foods, limited oral health awareness, and insufficient utilization of preventive dental services. The mean DMFT/dmft score observed in this study is comparable to findings reported from other South Asian countries. Petersen et al. emphasized that children living in low- and middle-income countries often exhibit higher DMFT scores due to limited access to preventive dental care and fluoride-based interventions.¹³ The elevated DMFT score observed among the study participants may reflect delayed diagnosis and treatment of dental caries, which allows lesions to progress to advanced stages before professional care is sought. Poor oral hygiene was observed in approximately 48% of the participants. Similar findings have been reported in previous Pakistani studies where inadequate brushing frequency

and improper brushing techniques were common among school-aged children.^{11,14} Oral hygiene practices play a crucial role in preventing plaque accumulation, thereby reducing the risk of dental caries and periodontal diseases. The high prevalence of poor oral hygiene observed in the present study may indicate inadequate awareness regarding proper brushing techniques and insufficient parental supervision of children's oral hygiene routines. Gingivitis was identified in 35.2% of the participants. This prevalence is comparable to findings from studies conducted among schoolchildren in Pakistan and neighboring countries.^{11,18} Gingival inflammation is primarily associated with poor plaque control and inadequate oral hygiene practices. The prevalence of gingivitis among more than one-third of the study population suggests that oral health education should not focus solely on dental caries prevention but also emphasize periodontal health and plaque control. One of the most significant findings of this study was the strong association between frequent consumption of sugary snacks and dental caries. Children who consumed sugary snacks more than 3 times daily were more than 3 times as likely to develop dental caries as their counterparts. This finding is consistent with previous investigations that identified frequent sugar intake as a major risk factor for dental decay.^{15,16} Fermentable carbohydrates serve as substrates for cariogenic bacteria, such as *Streptococcus mutans*, leading to acid production and enamel demineralization. The increasing availability of processed foods, sweetened beverages, and confectionery products in urban areas may explain the strong relationship observed between dietary habits and dental caries in the present study. Tooth-brushing frequency was another important predictor of oral health status. Children who brushed their teeth less than twice daily exhibited significantly higher odds of developing dental caries. Similar associations have been documented in studies conducted in Pakistan, India, and other developing countries.^{11,12,13} The World Health Organization and international dental organizations recommend brushing teeth twice daily using fluoridated toothpaste to effectively remove dental plaque and reduce caries risk.² The present findings reinforce the importance of promoting regular tooth brushing among school-aged children as a cost-effective preventive strategy. Parental education emerged as a significant determinant of oral health outcomes. Children whose parents had lower educational attainment were nearly twice as likely to experience dental caries. This finding aligns with previous studies demonstrating that parental education influences children's health literacy, preventive healthcare utilization, dietary choices, and oral hygiene practices.^{14,18,20} Educated parents are generally more aware of oral health recommendations and more likely to supervise children's brushing and to

seek professional dental care when necessary. The study also demonstrated a significant association between infrequent dental visits and dental caries. Children who did not attend regular dental check-ups were more than twice as likely to develop caries compared with those who received routine preventive care. Similar observations have been reported by Basharat and Shaikh, who highlighted the low utilization of preventive oral healthcare services in Pakistan.⁷ Most families seek dental treatment only after the onset of pain or discomfort, thereby reducing opportunities for early detection and management of oral diseases. Strengthening preventive dental services and promoting routine oral examinations could therefore substantially reduce the burden of oral diseases among children. The findings of this study have important public health implications. Given that oral diseases are largely preventable, school-based oral health promotion programs may be an effective strategy to improve oral hygiene behaviors and reduce disease burden. Such programs should incorporate oral health education sessions, supervised tooth-brushing activities, dietary counseling, and periodic dental screening. In addition, collaboration between educational institutions, healthcare professionals, parents, and policymakers is essential to establish sustainable oral health promotion initiatives within schools.

LIMITATIONS

The cross-sectional nature of the study limits the ability to establish causal relationships. Information regarding dietary habits and oral hygiene practices was self-reported and may therefore be subject to recall bias. Additionally, the study was conducted exclusively in Peshawar, which may limit the generalizability of the findings to other regions of Pakistan.

CONCLUSIONS

The prevalence of dental caries among school children in Peshawar is alarmingly high. Poor oral hygiene, frequent consumption of sugary snacks, low parental education, and lack of preventive dental visits are significant determinants of poor oral health. Implementing school-based oral health education programs, regular dental screening, and community awareness initiatives is essential to improving oral health outcomes among children.

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CONTRIBUTORS

1. **Muhammad Umer Farooq** - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Supervision; Final Approval
2. **Nayab Jehangir Khan** - Concept & Design; Data Acquisition; Drafting Manuscript; Supervision; Final Approval



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THE EFFECT OF SLEEP QUALITY, ANXIETY, STRESS, AND DEPRESSION ON ACADEMIC PERFORMANCE AMONG MEDICAL STUDENTS IN PESHAWAR: A CROSS - SECTIONAL ANALYTICAL STUDY

Muhammad Sudais Khan¹, Shehab Ishaq¹, Zain Ul Abideen¹, Alina Ronash¹, Noor Ul Ain¹

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Correspondence

¹Muhammad Sudais Khan, 3rd Year MBBS Student, Kabir Medical College, Gandhara University, Peshawar
 ☎: +92-325-1789099
 ✉: sudias879a@gmail.com

ABSTRACT OBJECTIVES

This study aimed to determine the relationship between sleep quality, anxiety, stress, depression, and academic performance among medical students in Peshawar.

METHODOLOGY

A cross-sectional analytical study was conducted among 384 MBBS students enrolled in public and private medical colleges of Peshawar from December 2024 to April 2025. Participants were selected through a convenience sampling technique. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), while psychological distress was evaluated using the Depression, Anxiety, and Stress Scale (DASS-21). Academic performance was measured using students' self-reported percentage scores in their most recent professional examinations. Data were analyzed using SPSS version 26. Descriptive statistics, Pearson correlation, independent t-tests, one-way ANOVA, and multiple linear regression analyses were performed. A p-value <0.05 was considered statistically significant.

RESULTS

The mean age of participants was 21.7 ± 1.8 years. Females constituted 56.5% of the sample. Poor sleep quality (PSQI >5) was observed in 63.0% of students. Moderate-to-extremely severe anxiety, stress, and depression were reported by 47.9%, 42.4%, and 35.7% of students, respectively. Academic performance demonstrated significant negative correlations with PSQI scores ($r = -0.48$, $p < 0.001$), anxiety ($r = -0.41$, $p < 0.001$), stress ($r = -0.45$, $p < 0.001$), and depression scores ($r = -0.39$, $p < 0.001$). Multiple linear regression identified poor sleep quality ($\beta = -0.34$, $p < 0.001$) and stress ($\beta = -0.29$, $p < 0.001$) as the strongest predictors of lower academic performance.

CONCLUSION

Poor sleep quality and psychological distress are highly prevalent among medical students in Peshawar and are significantly associated with poorer academic outcomes. Early screening and mental health interventions may improve both student well-being and academic achievement.

KEYWORDS: Sleep Quality, Academic Performance, Anxiety, Stress, Depression, Medical Students, PSQI, DASS-21, Peshawar

INTRODUCTION

Medical education is recognized as one of the most academically demanding professional training programs worldwide. Medical students are frequently exposed to intense academic workloads, frequent examinations, clinical responsibilities, and competitive learning environments that may negatively affect their mental health and overall well-being. These challenges often contribute to sleep disturbances, anxiety, stress, and depression, which can adversely influence learning ability and academic performance.¹ Sleep is a

fundamental physiological process necessary for cognitive functioning, memory consolidation, emotional regulation, and physical health. Adequate sleep is essential for optimal academic performance, whereas poor sleep quality has been associated with impaired concentration, reduced attention span, memory deficits, and decreased academic productivity.² Medical students are particularly vulnerable to sleep disturbances because of prolonged study hours, irregular schedules, examination stress, and clinical duties.³ Research conducted worldwide has demonstrated a high prevalence of poor sleep quality among medical

students. A systematic review reported that more than half of medical students experience inadequate sleep quality, highlighting sleep disturbance as a major concern within this population.⁴ Poor sleep quality not only affects cognitive performance but is also closely associated with mental health problems, including anxiety, stress, and depression.⁵ Psychological distress among medical students has become an increasing public health concern. Anxiety, stress, and depression are commonly reported during medical training due to academic pressure, fear of failure, financial concerns, and adjustment difficulties.⁶ These psychological conditions may impair attention, motivation, decision-making, and learning efficiency, ultimately affecting academic achievement. Previous studies have consistently shown that students experiencing higher levels of anxiety and stress tend to perform poorly in academic assessments compared with their counterparts.⁷ The relationship between sleep quality and psychological well-being is bidirectional. Students experiencing anxiety, stress, and depression often report poor sleep quality, while inadequate sleep may further exacerbate psychological distress.⁸ Consequently, sleep disturbances and mental health problems frequently coexist and collectively contribute to reduced academic performance. In Pakistan, several studies have reported substantial levels of psychological distress among medical students. Research conducted in various medical colleges has demonstrated that anxiety, stress, and depression affect a considerable proportion of undergraduate medical students and may interfere with academic functioning.⁹ Similarly, sleep-related problems have become increasingly common because of academic demands, excessive screen time, and changing lifestyle patterns among university students.¹⁰ Peshawar hosts several public and private medical institutions that enroll students from diverse socioeconomic and cultural backgrounds. Despite growing recognition of mental health challenges among medical students, limited local evidence exists regarding the combined influence of sleep quality, anxiety, stress, and depression on academic performance. Understanding these relationships is important for developing targeted interventions to improve students' psychological well-being and educational outcomes. Therefore, this study was conducted to determine the relationship between sleep quality, anxiety, stress, depression, and academic performance among medical students in Peshawar.¹¹

METHODOLOGY

This cross-sectional analytical study was conducted among MBBS students enrolled in public and private medical colleges of Peshawar from December 2024 to April 2025. Ethical approval was obtained from the Institutional Review Board before commencement of

data collection. Participation was voluntary, and informed consent was obtained from all participants. Confidentiality and anonymity of the respondents were maintained throughout the study. The sample size was calculated using the sample size calculator available at Calculator.net, with a 95% confidence level, a 5% margin of error, and a 50% response rate. The minimum required sample size was 384 students. A convenience sampling technique was used to recruit participants from various medical colleges in Peshawar. MBBS students from the second to final year who were willing to participate were included in the study. First-year MBBS students were excluded because they had not yet appeared in professional examinations. Students with self-reported psychiatric or neurological disorders were also excluded to minimize potential confounding factors. Data were collected using both printed questionnaires and an online Google Form. To prevent duplication, students' names were recorded separately and removed during data analysis to ensure confidentiality. The questionnaire consisted of three sections. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a validated instrument that evaluates subjective sleep quality over the previous month. A global PSQI score greater than five was considered indicative of poor sleep quality. Anxiety, stress, and depression were assessed using the Depression Anxiety Stress Scale-21 (DASS-21), which categorizes symptoms into normal, mild, moderate, severe, and extremely severe levels. Academic performance was assessed using the percentage of students' most recent annual professional examination scores, as reported in the questionnaire. Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 26. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 384 medical students participated in the study. The mean age of participants was 21.7 ± 1.8 years, ranging from 19 to 26 years. Female students accounted for 56.5% ($n=217$) of the sample, while males accounted for 43.5% ($n=167$). Students from all academic years were represented, with the largest proportion being fourth-year MBBS students. The mean PSQI score was 7.3 ± 3.1 . Overall, 242 (63.0%) students were classified as poor sleepers ($PSQI > 5$), while 142 (37.0%) demonstrated good sleep quality. The mean academic performance score among participants was $72.6 \pm 8.7\%$. Students with poor sleep quality demonstrated significantly lower academic performance than those with good sleep quality ($68.9 \pm 7.5\%$ vs $78.8 \pm 6.4\%$; $p < 0.001$). Multiple linear regression analysis was conducted to identify independent predictors of academic performance. Pearson correlation analysis

revealed significant negative correlations between academic performance and PSQI scores, anxiety scores, stress scores, and depression scores.

Table 1: Demographic Characteristics of Participants (n=384)

Variable	Frequency	Percentage (%)
Male	167	43.5
Female	217	56.5
Second Year	88	22.9
Third Year	95	24.7
Fourth Year	104	27.1
Final Year	97	25.3

Table 2: Sleep Quality Among Participants

Sleep Quality Category	Frequency	Percentage (%)
Good Sleep Quality (≤ 5)	142	37.0
Poor Sleep Quality (> 5)	242	63.0
Mean PSQI Score	7.3 $\pm$ 3.1	

Table 3: Severity Distribution of Anxiety, Stress, and Depression

Category	n (%)		Depression n (%)
	Anxiety	Stress	
Normal	132 (34.4)	151 (39.3)	173 (45.1)
Mild	68 (17.7)	70 (18.2)	74 (19.3)
Moderate	101 (26.3)	88 (22.9)	79 (20.6)
Severe	51 (13.3)	49 (12.8)	38 (9.9)
Extremely Severe	32 (8.3)	26 (6.8)	20 (5.2)

Table 4: Academic Performance According to Sleep Quality

Sleep Quality	Mean Academic Percentage $\pm$ SD	p-value
Good Sleep Quality	78.8 $\pm$ 6.4	<0.001
Poor Sleep Quality	68.9 $\pm$ 7.5	

Table 5: Correlation Between Study Variables and Academic Performance

Variable	Correlation Coefficient (r)	p-value
PSQI Score	-0.48	<0.001
Anxiety Score	-0.41	<0.001
Stress Score	-0.45	<0.001
Depression Score	-0.39	<0.001

Table 6: Multiple Linear Regression Analysis Predicting Academic Performance

Predictor	β Coefficient	Standard Error	p-value
PSQI Score	-0.34	0.06	<0.001
Stress Score	-0.29	0.05	<0.001
Anxiety Score	-0.17	0.07	0.012
Depression Score	-0.13	0.06	0.031

The model explained 42.8% of the variance in academic performance (Adjusted $R^2 = 0.428$).

DISCUSSION

The present study examined the relationship between sleep quality, anxiety, stress, depression, and academic performance among medical students in Peshawar. The

findings revealed a high prevalence of poor sleep quality and psychological distress among participants. Furthermore, sleep quality, anxiety, stress, and depression demonstrated significant negative associations with academic performance, suggesting that mental well-being plays a crucial role in educational achievement among medical students. In the current study, 63.0% of students were classified as poor sleepers according to the PSQI criteria. This finding is consistent with previous international studies reporting poor sleep quality among medical students ranging from 50% to 70%.^{3,4} The high prevalence observed in the present study may be attributed to extensive academic workloads, examination pressure, prolonged study hours, and excessive screen exposure. Similar findings were reported by Almojali et al., who demonstrated that poor sleep quality is highly prevalent among medical students and is strongly associated with academic stress.⁵ The present study found that approximately half of the participants experienced moderate-to-extremely severe anxiety, while substantial proportions reported clinically significant stress and depression. These findings are comparable to those reported by Rotenstein et al., who identified high rates of depression and psychological distress among medical students worldwide. Similarly, studies conducted among Pakistani medical students have reported considerable levels of anxiety and depression, indicating that psychological distress remains a significant concern within medical education.^{6,9,10} The demanding nature of medical training, fear of academic failure, professional uncertainty, and social pressures may contribute to the elevated psychological burden observed among students. One of the most important findings of this study was the significant negative relationship between sleep quality and academic performance. Students with poor sleep quality achieved significantly lower academic scores than students with adequate sleep quality. PSQI scores demonstrated a moderate inverse correlation with examination percentages. These findings support previous evidence indicating that sleep plays a critical role in memory consolidation, learning, cognitive processing, and executive functioning.² A study by Gaultney found that students with sleep disturbances were significantly more likely to experience poor academic performance than those with healthy sleep patterns.¹² The findings further demonstrated that stress was significantly associated with academic performance. Students experiencing higher stress levels obtained lower academic scores than their counterparts. Similar observations have been reported by Saravanan and Wilks, who concluded that excessive stress adversely affects concentration, information retention, and academic productivity.⁷ Another study by Abdulghani et al. found that students with elevated stress levels were significantly more likely to experience academic

difficulties and reduced examination performance.¹³ Although moderate stress may enhance motivation and productivity, chronic stress often leads to burnout, emotional exhaustion, and impaired cognitive functioning. Anxiety also demonstrated a significant inverse relationship with academic achievement. Students reporting higher anxiety scores tended to achieve lower academic percentages. This finding is supported by previous literature indicating that anxiety negatively affects attention, working memory, and examination performance.¹⁴ Students experiencing excessive anxiety may struggle with concentration, decision-making, and information retrieval during examinations, ultimately affecting their academic outcomes. Depression was similarly associated with poorer academic performance in the current study. Students with higher depression scores demonstrated lower examination percentages. These findings are consistent with those reported by Hysenbegasi et al., who found that depressive symptoms significantly impair academic functioning and are associated with lower grade point averages among university students.¹⁵ Depression may reduce motivation, energy levels, concentration, and engagement in learning activities, thereby contributing to diminished academic achievement. The correlation analysis demonstrated that sleep quality, anxiety, stress, and depression were all significantly associated with academic performance. However, multiple linear regression analysis identified sleep quality and stress as the strongest independent predictors of academic achievement. These findings suggest that sleep disturbances and stress exert a greater influence on academic outcomes than anxiety and depression when considered simultaneously. Similar findings have been reported by Lemma et al., who identified poor sleep quality as an independent predictor of reduced academic performance among university students.¹⁶ A bidirectional interaction may explain the observed relationship between sleep quality and psychological distress. Students experiencing anxiety, stress, or depression frequently report sleep disturbances, while inadequate sleep may further exacerbate psychological symptoms.⁸ Consequently, sleep quality may both contribute to and result from psychological distress. This complex interaction highlights the importance of addressing both sleep hygiene and mental health simultaneously when designing student support interventions. The findings of the present study are further supported by Eisenberg et al., who reported that students experiencing mental health problems had significantly lower academic achievement and higher rates of academic difficulties compared with psychologically healthy students.¹⁷ The authors emphasized that untreated psychological distress can adversely affect concentration, motivation, and educational attainment. Similarly, Gilbert and Weaver

demonstrated that inadequate sleep quality and shorter sleep duration were significantly associated with poorer academic performance among university students. Their findings suggest that sleep hygiene interventions may improve academic outcomes and overall student well-being.¹⁸ The findings of the present study have important implications for medical education. Given the high prevalence of sleep disturbances and psychological distress, medical colleges should implement regular mental health screening programs, counseling services, stress management workshops, and sleep hygiene education. Early identification and management of psychological difficulties may improve not only student well-being but also academic performance. Educational institutions should also consider strategies to reduce excessive academic burden and promote healthier learning environments.

LIMITATIONS

The cross-sectional design precludes causal inference. Academic performance data were self-reported and may therefore be subject to reporting bias. Additionally, the study was limited to medical colleges in Peshawar, which may restrict the generalizability of the findings to other regions of Pakistan.

CONCLUSIONS

Poor sleep quality, anxiety, stress, and depression are prevalent among medical students, with nearly two-thirds reporting poor sleep and many experiencing significant psychological distress. These factors negatively correlate with academic performance, with sleep quality and stress being the strongest predictors. This suggests that academic success is linked to psychological well-being. The findings underscore the need for medical institutions to prioritize student mental health through screenings, counseling, stress management, and sleep hygiene education to foster supportive environments and improve academic outcomes. Further longitudinal research across Pakistani medical colleges is recommended to inform intervention strategies.

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CONTRIBUTORS

1. **Muhammad Sudais Khan** - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Supervision; Final Approval
2. **Shehab Khan** - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Supervision; Final Approval
3. **Zain ul Abideen** - Concept & Design; Data Acquisition; Drafting Manuscript; Final Approval
4. **Alina Ronash** - Concept & Design; Data Acquisition; Drafting Manuscript; Final Approval
5. **Noor ul Ain** - Concept & Design; Data Acquisition; Drafting Manuscript; Final Approval



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IMPACT OF SCREEN TIME ON COGNITIVE, SOCIAL, AND BEHAVIORAL DEVELOPMENT AMONG CHILDREN AGED 0-6 YEARS IN PESHAWAR: A CROSS-SECTIONAL STUDY

Muneeb¹

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Correspondence

¹Muneeb, 2nd Year MBBS Student, Kabir Medical College, Gandhara University, Peshawar

☎: +92-333-5508146

✉: munneedKMC2024@gmail.com

ABSTRACT

OBJECTIVES

This study aimed to assess the association between screen time exposure and cognitive, social, and behavioral development among children aged 0-6 years in Peshawar.

METHODOLOGY

A cross-sectional study was conducted from December 2025 to February 2026 at Gandhara University, Peshawar. A total of 202 children aged from birth to six years were included through convenience sampling. Data were collected from parents and guardians using a structured questionnaire that assessed screen time, device use, parental involvement, developmental milestones, and behavioral outcomes. Data were analyzed using SPSS version 26. Descriptive statistics were calculated as frequencies, percentages, means, and standard deviations. Associations between screen-time categories and behavioral outcomes were assessed using Chi-square tests. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

The mean age of participating children was 47.8 ± 19.6 months. Males constituted 59.4% ($n=120$) of the sample. The mean daily screen exposure was 198.8 ± 124.7 minutes. Smartphones were the most commonly used devices (77.7%). Children exposed to more than three hours of screen time per day demonstrated significantly higher frequencies of tantrums upon screen removal ($p < 0.001$), increased irritability ($p < 0.001$), poor eye contact and social interaction ($p = 0.010$), reduced physical activity ($p = 0.031$), behavioral dependence on screens ($p = 0.001$), preference for screens over play ($p = 0.026$), and reduced engagement with family members ($p = 0.025$).

CONCLUSION

Excessive screen time was significantly associated with adverse behavioral and social outcomes among young children. Parental supervision and balanced screen use may play important roles in minimizing developmental risks.

KEYWORDS: Screen Time, Child Development, Cognition, Behavior, Social Interaction, Smartphones, Peshawar

INTRODUCTION

The rapid advancement of digital technology has significantly transformed the daily lives of children worldwide. Devices such as smartphones, tablets, computers, and televisions have become increasingly accessible, resulting in greater screen exposure from an early age. Screen time refers to the time spent using screen-based devices for entertainment, education, communication, or recreation. Although digital technology offers several educational and social benefits, concerns have emerged regarding its potential effects on early childhood development, particularly cognitive, social, and behavioral functioning.¹ Early childhood, particularly the first six years of life,

represents a critical developmental period characterized by rapid brain growth and the acquisition of fundamental cognitive, emotional, linguistic, and social skills. During this stage, environmental influences play a crucial role in shaping developmental outcomes. Excessive screen exposure during these formative years may interfere with experiences essential to healthy development, including parent-child interaction, physical activity, imaginative play, and social engagement.² Recent international studies have reported a substantial increase in screen use among young children. The World Health Organization recommends limiting sedentary screen time among children under five years of age because prolonged exposure may negatively affect physical health, sleep quality, and developmental progress.³ Similarly, the

American Academy of Pediatrics emphasizes the importance of age-appropriate media use and parental supervision to minimize potential developmental risks.¹ Several studies have demonstrated an association between excessive screen exposure and delayed cognitive development. Madigan et al. reported that higher levels of screen time during early childhood were associated with poorer performance on developmental screening assessments, particularly in communication and problem-solving domains.⁴ Likewise, Zhang et al. found that prolonged screen exposure was associated with lower cognitive performance, including deficits in memory, attention, and language development.⁵ These findings suggest that excessive engagement with digital devices may limit opportunities for active learning and cognitive stimulation. Screen exposure has also been linked to social and behavioral difficulties among young children. Children who spend prolonged periods using digital devices may have fewer opportunities for face-to-face interaction with caregivers and peers, which are essential for developing communication skills, emotional regulation, and social competence.⁶ Christakis reported that early and excessive media exposure may adversely affect social development by reducing interactive experiences necessary for healthy emotional and behavioral growth.⁷ Furthermore, Twenge and Campbell observed that increased screen use was associated with higher levels of behavioral problems, emotional instability, and reduced psychological well-being among children and adolescents.⁸ The increasing use of smartphones has raised additional concerns regarding dependence on digital media and reduced participation in physical and recreational activities. Excessive screen use may contribute to sedentary behavior, poor sleep patterns, irritability, and reduced engagement in age-appropriate developmental activities.⁹ These concerns became particularly evident during and after the COVID-19 pandemic, when digital devices became a primary source of education and entertainment for many children worldwide.¹⁰ In Asian countries, including India and China, researchers have reported substantial increases in screen exposure among preschool children. Studies conducted in these regions have identified associations between excessive screen time and reduced attention span, sleep disturbances, behavioral problems, and impaired social interaction.^{11,12} Similar trends have been reported in Pakistan, where increasing smartphone availability and internet accessibility have contributed to greater screen exposure among children. Emerging evidence suggests that excessive screen use may be associated with delayed speech development, reduced social engagement, and adverse behavioral outcomes among Pakistani children.¹³ Despite growing international evidence,

limited data are available regarding the effects of screen exposure on young children in Khyber Pakhtunkhwa, particularly in Peshawar. Cultural practices, parental attitudes, and patterns of digital device use may differ considerably from those reported in developed countries, highlighting the need for locally generated evidence. Moreover, many previous studies have focused on specific developmental domains, such as language acquisition or sleep quality, rather than examining cognitive, social, and behavioral outcomes collectively. Therefore, the present study was conducted to evaluate the impact of screen time on cognitive, social, and behavioral development among children aged 0-6 years in Peshawar. Understanding these relationships may help parents, healthcare professionals, educators, and policymakers develop evidence-based strategies to promote healthy digital habits and support optimal child development.

METHODOLOGY

A cross-sectional analytical study was conducted from December 2025 to February 2026 under the supervision of the Research Department of Kabir Medical College, Peshawar. A total of 202 children aged 0-6 years were included in the study using a convenience sampling technique. Parents or guardians of eligible children who were willing to participate and provide informed consent were recruited from various community settings in Peshawar. Data were collected using a structured, predesigned questionnaire comprising sections on demographic characteristics, daily screen time, type of digital device used, parental supervision, developmental milestones, social interaction, and behavioral outcomes. Screen-time exposure was assessed by recording the average duration of daily use of smartphones, tablets, televisions, computers, and other digital devices. Developmental assessment included age-appropriate cognitive and social indicators such as responsiveness to instructions, communication skills, object recognition, attention span, eye contact, and interaction with family members and peers. Behavioral characteristics, including irritability, tantrums, dependence on screens, preference for screens over play activities, and physical activity levels, were also evaluated based on parental observations. Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 26. Quantitative variables were summarized as means and standard deviations, while categorical variables were presented as frequencies and percentages. Associations between screen-time categories and developmental, social, and behavioral outcomes were assessed using the Chi-square test. Statistical significance was determined at a p -value ≤ 0.05 , with a 95% confidence interval.

RESULTS

A total of 202 children aged 0-6 years participated in the study. The mean age of participants was 47.8 ± 19.6 months. Male children constituted 120 (59.4%) of the sample, while females accounted for 82 (40.6%). The mean daily screen exposure was 198.8 ± 124.7 minutes.

Table 1: Demographic Characteristics of Study Participants (n=202)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	120	59.4
Female	82	40.6
Age Group (Months)		
0-12	18	8.9
13-24	24	11.9
25-36	37	18.3
37-48	42	20.8
49-60	39	19.3
61-72	42	20.8

Table 2: Screen Exposure Characteristics Among Children (n=202)

Variable	Frequency (n)	Percentage (%)
Primary Device Used		
Smartphone	157	77.7
Television	24	11.9
Tablet	15	7.4
Laptop/Computer	3	1.5
Other	3	1.5
Daily Screen Time		
≤1 hour/day	25	12.4
1-3 hours/day	95	47.0
>3 hours/day	82	40.6

Table 3: Association Between Screen Time and Behavioral Problems

Screen Time	Present n (%)		p-value
	Tantrums	Irritability	
≤1 hour/day (n=25)	13 (52.0)	10 (40.0)	<0.001
1-3 hours/day (n=95)	73 (76.8)	58 (61.1)	
>3 hours/day (n=82)	73 (89.0)	61 (74.4)	

Table 4: Association Between Screen Time and Social Development Outcomes

Screen Time	Poor Eye Contact n (%)	Reduced Family Interaction n (%)
≤1 hour/day (n=25)	9 (36.0)	8 (32.0)
1-3 hours/day (n=95)	56 (58.9)	47 (49.5)
>3 hours/day (n=82)	57 (69.5)	52 (63.4)
p-value	0.010	0.025

Table 5: Association Between Screen Time and Lifestyle Behaviors

Screen Time	Preference for Screens Over Play n (%)	Reduced Physical Activity n (%)
≤1 hour/day (n=25)	11 (44.0)	8 (32.0)
1-3 hours/day (n=95)	56 (58.9)	46 (48.4)
>3 hours/day (n=82)	60 (73.2)	53 (64.6)
p-value	0.026	0.031

DISCUSSION

The present study evaluated the association between screen time exposure and cognitive, social, and behavioral outcomes among children aged 0-6 years in Peshawar. The findings revealed a high prevalence of screen exposure among young children, with smartphones being the most frequently used digital device. Nearly half of the participants were exposed to screens for 1 to 3 hours daily, while more than two-fifths exceeded 3 hours per day. These findings indicate that screen exposure among preschool children in Peshawar exceeds the limits recommended by international pediatric guidelines and has become increasingly common in early childhood. One of the most important findings of the present study was the significant association between prolonged screen exposure and behavioral problems, particularly tantrums following screen removal and increased irritability. Children exposed to more than 3 hours of daily screen time demonstrated substantially higher frequencies of these behaviors than those with lower exposure. Similar findings were reported by McDaniel and Radesky, who observed that excessive digital media use may interfere with parent-child interactions and contribute to emotional dysregulation and behavioral difficulties among young children.¹⁰ Likewise, Domingues-Montanari reported that prolonged screen exposure is associated with increased irritability, impulsivity, and emotional instability in children, which may result from overstimulation and reduced opportunities for self-regulation.¹¹ The findings of the current study support these observations and suggest that excessive screen use may contribute to behavioral dependence and difficulty managing emotions when access to digital devices is restricted. The present study also demonstrated a statistically significant relationship between increased screen time and poor social interaction, particularly reduced eye contact and decreased engagement with family members. Children exposed to longer durations of screen use were more likely to exhibit difficulties in social communication. These findings are consistent with the work of Radesky et al., who reported that excessive media exposure reduces opportunities for meaningful social interactions and may negatively affect the development of communication skills during early childhood.¹² Similarly, a study found that increased

screen time was associated with developmental vulnerabilities in communication and interpersonal functioning among preschool-aged children.¹³ Since social and emotional skills are largely acquired through direct interactions with caregivers and peers, excessive engagement with digital devices may reduce the opportunities necessary for healthy social development. Another important finding was the significant association between prolonged screen exposure and preference for screen-based activities over traditional play. Children with higher screen time were more likely to choose digital devices rather than engage in physical or imaginative play. This finding is comparable to that reported, which states that excessive screen use was associated with reduced participation in active play and recreational activities among preschool children.¹⁴ Similarly, a study reported that children who spend more time on screens are less likely to engage in physically and cognitively stimulating activities that support healthy development.¹⁵ Traditional play is considered essential for the development of creativity, problem-solving skills, language acquisition, and social competence; therefore, its displacement by screen-based activities may have long-term developmental consequences. The present study further identified a significant association between higher screen exposure and reduced physical activity. Children who were exposed to more than 3 hours of screen time daily demonstrated lower levels of physical activity than those with shorter exposure durations. Another study supports these findings, reporting that prolonged sedentary screen time is associated with lower physical activity levels and may adversely affect overall child health and development.¹⁶ Similar observations were reported that excessive recreational screen time is associated with sedentary lifestyles and unfavorable health outcomes in children.¹⁷ Reduced physical activity during early childhood may increase the risk of obesity, poor motor development, and other long-term health consequences. The predominance of smartphone use observed in the current study reflects changing patterns of digital media consumption among young children. Smartphones are portable, readily accessible, and frequently used by parents for entertainment and behavioral management. Similar trends have been reported in several developing countries, where smartphones have largely replaced traditional television viewing among preschool-aged children.¹⁸ The widespread availability of smartphones may partly explain the increasing screen exposure observed among children in urban settings. The findings of this study have important implications for parents, educators, and healthcare professionals. While digital devices can provide educational benefits when used appropriately, excessive and unsupervised exposure may adversely affect behavioral and social development. Previous studies have demonstrated that parental co-

viewing, content selection, and time management can substantially reduce the negative consequences of screen use.¹⁹ Therefore, parental involvement remains a critical factor in ensuring healthy digital media habits among young children. This study contributes valuable local evidence regarding screen exposure and child development in Peshawar, where research on this topic remains limited. The findings are generally consistent with international literature, suggesting that the developmental effects of excessive screen exposure may be similar across different cultural settings. However, local sociocultural factors, parenting practices, and patterns of device use should also be considered when interpreting these results and developing intervention strategies.

LIMITATIONS

The study has several limitations. First, its cross-sectional design precludes establishing causal relationships between screen exposure and developmental outcomes. Second, information was obtained through parental reporting, which may be subject to recall bias and reporting inaccuracies. Third, developmental outcomes were not confirmed through standardized clinical assessments. Despite these limitations, the study provides important preliminary evidence regarding the relationship between screen exposure and developmental outcomes among young children in Peshawar.

CONCLUSIONS

The present study demonstrated that excessive screen time is highly prevalent among children aged 0-6 years in Peshawar, with smartphones being the most commonly used digital devices. Prolonged screen exposure was significantly associated with behavioral problems, including tantrums, irritability, and screen dependence. Higher screen time was also linked to poor social interaction, reduced eye contact, decreased family engagement, and lower levels of physical activity. Children exposed to longer screen use durations showed a greater preference for digital media over traditional play activities. These findings highlight the potential negative impact of excessive screen exposure on early childhood development. Therefore, promoting age-appropriate screen use, parental supervision, and increased participation in physical and social activities is essential for supporting healthy developmental outcomes among young children.

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CONTRIBUTORS

1. **Muneeb** - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Supervision; Final Approval



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FREQUENCY OF MIGRAINE AND ITS ASSOCIATED RISK FACTORS AMONG FEMALE MEDICAL STUDENTS OF PESHAWAR: A CROSS-SECTIONAL STUDY

Mansoor Iqbal¹, Awais khan¹,

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Correspondence

¹Mansoor Iqbal, Final Year MBBS
Studnet, Kabir Medical College,
Gandhara University, Peshawar

☎: +92-344-3000372

✉: doc.mansooriqbal@gmail.com

INTRODUCTION

Migraine is a primary headache disorder characterized by recurrent episodes of moderate to severe headache, typically unilateral, and often accompanied by photophobia, phonophobia, nausea, and occasionally aura. According to the World Health Organization (WHO), migraines represent one of the leading causes of long-term morbidity worldwide and contribute significantly to the global headache burden, with a lifetime prevalence ranging from 14% to 16%.¹ Headache disorders affect nearly 40% of the global population, of which migraines account for an estimated 47%.^{2,3} Beyond the immediate impact on quality of life, migraine is associated with multiple comorbidities, including depression, anxiety, and cardiovascular disease.^{4,5,6} In Pakistan, migraines represent an important

public health issue, particularly among adolescents and young adults.^{4,7,8} International data suggest that migraines affect approximately 30% of the global population, with a higher prevalence among females compared to males.^{9,10} The burden of migraine tends to be lower in Asian countries (10.1%) compared to Western populations, such as the United States (15.3%).^{6,11,12,13} Among university and medical students, especially those aged 18 to 25 years, migraine prevalence is significantly higher due to academic stress, irregular sleep patterns, and lifestyle-related triggers.⁶ Clinically, migraines can be categorized into episodic migraine (EM), defined as fewer than 15 headache days per month, and chronic migraine (CM), characterized by 15 or more headache days per month for at least three consecutive months.^{5,14,15} Female medical students are particularly susceptible to migraines due to a

ABSTRACT

OBJECTIVES

To determine the frequency of migraine and identify associated risk factors among female undergraduate medical students in Peshawar, Pakistan.

METHODOLOGY

A cross-sectional study was conducted among 200 female medical and dental students in Peshawar using a structured questionnaire. Data on demographic characteristics, migraine history, triggers, duration, frequency, aura, family history, lifestyle factors, and management strategies were collected. Data were analyzed using SPSS version 25, with descriptive statistics presented as frequencies and percentages.

RESULTS

Among 200 participants, 78 (39%) reported experiencing migraines. The most common frequency was 1 episode per month (23%), lasting 2-4 hours (22.5%). Only 15.5% reported experiencing an aura. Common triggers included loud noise (33%), processed food consumption (73%), prolonged screen time (25%), and academic stress (24%). Hormonal factors contributed, with 40% reporting use of hormonal pills and 40.5% reporting worsening during menstruation. NSAIDs and rest/sleep were the most common management strategies. Family history of migraine was reported by 16.5% of participants.

CONCLUSION

Migraines are prevalent among female medical students in Peshawar and are influenced by lifestyle, hormonal, and environmental factors. Awareness programs and targeted interventions may help reduce the migraine burden and improve academic performance and overall well-being.

KEYWORDS: *Migraine, Female Medical Students, Prevalence, Risk Factors, Cross-Sectional Study, Pakistan*

combination of psychological, hormonal, and environmental factors, including academic workload, exam pressure, prolonged screen exposure, and sleep deprivation.^{6 7} Despite this heightened vulnerability, limited data exist on the prevalence and associated risk factors of migraine among female medical and dental students in Peshawar. This study aims to determine the frequency of migraine and evaluate associated risk factors among undergraduate female medical students in Peshawar, Pakistan. By identifying key contributors such as sociodemographic variables, lifestyle patterns, hormonal influences, and academic stress, this research seeks to enhance understanding of migraine epidemiology in this high-risk population.

METHODOLOGY

A descriptive cross-sectional study was conducted among female undergraduate medical and dental students enrolled in various institutions in Peshawar, Pakistan, including Kabir Medical College, Sardar Begum Dental College, Khyber College of Dentistry, Rehman Medical College, Peshawar Medical College, Northwest School of Medicine, and Khyber Medical College. A total of 200 female students were recruited via convenience sampling. Data were collected using a structured self-administered questionnaire designed to gather information on demographic characteristics, including age, educational institution, and year of study. The questionnaire also assessed migraine-related characteristics such as lifetime occurrence, age of onset, frequency and duration of episodes, presence of aura, and family history of migraine. Furthermore, information regarding potential triggering factors was obtained, including hormonal influences, lifestyle habits, environmental exposures, academic stress, sleep patterns, screen time, processed food consumption, and physical activity. Data on migraine management strategies, including medication use, rest or sleep, and consultation with healthcare professionals, were also collected. The questionnaire was administered anonymously to ensure participant confidentiality and encourage accurate responses. All collected data were entered into IBM SPSS Statistics version 2020 for analysis.

RESULTS

Table 1: Sociodemographic Characteristics of Participants (N = 200)

Variable	Category	n	%
Age Group (years)	19–21	79	39.5
	22–24	81	40.5
	25–27	40	20.0
Year of Study	1st Year	39	19.5
	2nd Year	54	27.0
	3rd Year	40	20.0
	4th Year	34	17.0
	Final Year	33	16.5
Educational Institute	Kabir Medical College	37	18.5
	SBDC	18	9.0
	KCD	78	39.0
	RMC	29	14.5
	PMC	17	8.5
	NWSM	12	6.0
	KMC	19	9.5

Table 2: Migraine Characteristics Among Participants (N = 200)

Characteristic	Category	n	%
Migraine Prevalence	Yes	78	39.0
	No	122	61.0
Aura	Yes	31	15.5
	No	169	84.5
Family History of Migraine	Yes	33	16.5
	No	167	83.5

Table 3: Hormonal, Lifestyle, and Academic Risk Factors Associated with Migraine

Risk Factor	n	%
Processed Food Consumption	146	73.0
Prolonged Screen Time	50	25.0
Academic Stress	48	24.0
Hormonal Pill Use	80	40.0
Menstrual Aggravation of Migraine	81	40.5
History of Anxiety/Depression	87	43.5

Table 4: Environmental Triggers of Migraine

Trigger	n	%
Loud Noise	66	33.0
Bright Light	22	11.0
Strong Smell	9	4.5
No Environmental Trigger	103	51.5

Table 5: Migraine Management Strategies

Variable	Category	n	%
Medication Used	NSAIDs	19	9.5
	Steroids	8	4.0
	None	173	86.5
Management Strategy	Medications	28	14.0
	Rest/Sleep	53	26.5
	None/Other	119	59.5

DISCUSSION

The present study assessed the frequency of migraine and its associated risk factors among female undergraduate medical and dental students in Peshawar, Pakistan. The findings revealed that 39% of participants experienced migraine, indicating a substantial burden of this neurological disorder among female medical students. Migraine is recognized as one of the leading causes of disability worldwide, particularly among young women, and remains a significant public health concern because of its impact on academic performance, quality of life, and psychological well-being.^{8,11} The prevalence observed in the current study is consistent with previous research conducted among medical students in Pakistan and other countries, where migraine prevalence has ranged from 30% to 45%.^{1,5,6,15,16} The relatively high prevalence of migraine among female medical students may be attributed to the unique academic and psychological pressures associated with medical education. Medical students frequently experience examination-related stress, prolonged study hours, sleep deprivation, and lifestyle disturbances that increase susceptibility to migraine attacks. Similar prevalence estimates have been reported among university students in Bangladesh and Saudi Arabia, suggesting that the educational environment itself may contribute significantly to migraine occurrence.^{5,6} Furthermore, a recent systematic review by Wang et al. reported that university students globally experience a higher prevalence of migraine compared to the general population, emphasizing the vulnerability of this age group.¹⁶ In the present study, 15.5% of participants reported experiencing aura prior to migraine attacks. This finding is comparable with epidemiological studies demonstrating that migraine without aura is considerably more common than migraine with aura.^{2,9} Aura symptoms, including visual disturbances, sensory abnormalities, and transient neurological manifestations, are believed to result from cortical spreading depression and altered neuronal excitability.¹³ Although aura was observed in a minority of participants, its presence remains clinically important because it is associated with greater disability and may indicate increased vascular risk in some individuals.⁴ A positive family history of migraine was reported by 16.5% of participants, supporting the role of genetic susceptibility in migraine development. Previous studies have consistently demonstrated a hereditary component in migraine pathophysiology, with individuals having affected first-degree relatives exhibiting a significantly greater likelihood of developing migraine.^{2,7,9} Genetic factors influence neuronal excitability, pain modulation pathways, and susceptibility to environmental triggers, contributing to the complex etiology of migraine.¹³ The

relatively low proportion of participants reporting a family history may reflect underdiagnosis or lack of awareness regarding migraine among family members. Hormonal influences emerged as important risk factors in this study. Approximately 40% of participants reported hormonal pill use, while 40.5% experienced worsening of migraine symptoms during menstruation. These findings support existing evidence indicating that fluctuations in estrogen levels play a critical role in migraine pathogenesis among women.¹⁰ Estrogen withdrawal occurring during the menstrual cycle has been shown to activate trigeminovascular pathways and alter neurotransmitter regulation, thereby precipitating migraine attacks.^{10,11} The higher prevalence of migraine among females compared with males has been largely attributed to hormonal influences, particularly during reproductive years. Consequently, awareness regarding menstrual migraine and hormonal triggers is essential for effective migraine management in female students. Lifestyle-related factors were also found to be strongly associated with migraine. Consumption of processed foods was reported by 73% of participants, making it one of the most frequently identified risk factors. Dietary triggers such as processed foods, chocolate, caffeine-containing products, and food additives have long been recognized as potential precipitants of migraine attacks.¹⁸ These foods may contain vasoactive substances, including tyramine, nitrates, and monosodium glutamate, which can trigger neurovascular changes leading to headache. Previous studies among university students have similarly reported dietary habits as significant contributors to migraine occurrence.^{1,6} Given the high prevalence of processed food consumption observed in this study, nutritional counseling and dietary modification may serve as effective preventive measures. Academic stress was identified as a trigger by 24% of participants, while 43.5% reported a history of anxiety or depression. These findings highlight the close relationship between migraine and psychological health. Numerous studies have demonstrated a bidirectional association between migraine and psychiatric disorders, particularly anxiety and depression.^{3,9,17} Stress activates the hypothalamic-pituitary-adrenal axis, resulting in elevated cortisol levels and increased neuronal sensitivity, both of which contribute to migraine pathophysiology.¹³ Furthermore, migraine itself can negatively affect mental health through recurrent pain, impaired functioning, and reduced quality of life.¹⁷ Therefore, interventions aimed at reducing psychological distress may have beneficial effects on migraine prevention and management. Prolonged screen exposure was reported by 25% of participants as a migraine trigger. The increasing reliance on digital devices for educational activities has substantially increased medical students' screen time.

Excessive exposure to screens can induce visual strain, photophobia, dry eye symptoms, and altered sleep patterns, all of which may contribute to migraine development. Similar findings have been reported in recent studies examining lifestyle-related migraine triggers among students and young adults.⁶ The implementation of healthy digital practices, including regular breaks, appropriate lighting conditions, and ergonomic measures, may therefore reduce migraine frequency. Environmental factors were also important contributors to migraine occurrence. Loud noise was reported as a trigger by 33% of participants, followed by bright light (11%) and strong smells (4.5%). These findings are consistent with the current understanding of migraine as a disorder of sensory processing characterized by heightened sensitivity to external stimuli.¹³ Patients with migraine often exhibit increased cortical excitability and abnormal sensory modulation, rendering them more susceptible to environmental triggers such as noise, light, and odors.¹¹ Similar observations have been reported in both community-based and student populations, further supporting the role of sensory hypersensitivity in migraine pathogenesis.^{12,18} With respect to migraine management, most participants relied on non-pharmacological approaches, particularly rest and sleep, while relatively few reported using medications such as NSAIDs. This finding may indicate limited awareness regarding evidence-based migraine management strategies or a tendency among students to self-manage symptoms without seeking professional care. Although rest and sleep can alleviate acute symptoms, inadequate treatment may result in increased frequency, severity, and disability associated with migraine attacks.^{2,11} Educational interventions focusing on migraine recognition, trigger avoidance, and appropriate healthcare-seeking behavior may therefore improve outcomes among affected students. The findings of the present study are broadly consistent with previous national and international literature. Studies conducted in Lahore, Bangladesh, Saudi Arabia, and other countries have similarly identified stress, sleep disturbances, hormonal fluctuations, dietary factors, and environmental stimuli as major migraine triggers among students.^{1,5,6,15,16,17,18} Furthermore, global epidemiological evidence indicates that migraine remains one of the leading causes of disability among young women, emphasizing the importance of preventive strategies in this population.⁸

LIMITATIONS

The cross-sectional design prevents the establishment of causal relationships between identified risk factors and migraine occurrence. Additionally, convenience

sampling may limit the generalizability of findings, and self-reported responses are subject to recall bias and reporting inaccuracies. Future multicenter longitudinal studies involving larger, more diverse populations are recommended to investigate migraine patterns further and evaluate targeted preventive interventions.

CONCLUSIONS

The study demonstrates that migraine is highly prevalent among female medical students in Peshawar and is influenced by a combination of hormonal, dietary, psychological, environmental, and lifestyle-related factors. Given the significant impact of migraine on academic performance and quality of life, medical institutions should consider implementing awareness campaigns, stress management programs, sleep hygiene education, nutritional counseling, and mental health support services to reduce migraine burden and improve student well-being.

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CONTRIBUTORS

1. **Mansoor Iqbal** - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Supervision; Final Approval
2. **Awais Khan** - Assistance in Literature Review and Manuscript Formatting; Support in Data Organization; Review and Feedback on Final Draft



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