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EDITORIAL

Celiac Disease in Adults

One of the most important cause of malabsorption is Celiac disease. Celiac disease is caused by intolerance to storage protein gluten which is found in wheat, barley and rice. Initially it was considered to be pediatric disease but according to some studies, it is now being diagnosed in adults and elderly population also. It is defined as an exaggerated immune response to ingested gluten seen in genetically susceptible individuals. It roughly affects nearly 1% of world's population but its incidence is increasing in different geographical areas partly owing to better diagnostic tools and public awareness. It is associated with large variety of autoimmune diseases particularly in adult population. Presenting complaints are typical gastrointestinal symptoms like anemia, chronic diarrhea, bloating, flatulence, abdominal pain and altered bowel habits. Non gastrointestinal symptoms include short stature, abnormal liver function, metabolic bone disease, arthritis and infertility. Pathogenetic mechanism involves injury to the small intestinal mucosa with decreased absorptive surface area, reduction of digestive enzymes resulting in impaired absorption of micronutrients such as fat-soluble vitamins, B-12, iron and folic acid. Mucosal injury results in inflammation which leads to net secretion of fluids causing diarrhea. The usual age of presentation in adults is third or fourth decade. The rising trend has been observed more in Asian countries. Celiac disease has immunogenetic basis.[1] It has strong association with HLA phenotype B8, DR3 and DQw2. Siblings who share HLA phenotype have a high chance of concordance of celiac disease. Celiac disease is more common in females, female to male ratio in celiac is 2:1. Proximal portion seems to be more affected than the distal portion of small intestine and healing process begins from distal to proximal portion.

Clinical detail and serological testing have a significant role in forming the diagnosis. The HLA typing can also be done in seronegative patients. Several additional studies in extensive series of coeliac patients have clearly shown that TG2A sensitivity varies depending on the severity of duodenal damage, and reaches almost 100% in the presence of complete villous atrophy (more common in children under three years), 70% for subtotal atrophy, and up to 30% when only an increase in IELs (Intraepithelial Lymphocytes) is present.[2] However, biopsy of the small intestine remains the gold standard. It is performed when clinical suspicion is high, irrespective of the results of serological tests. Currently, the diagnosis is made on the basis of modified criteria of European Society of Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN). Histopathological parameters are analyzed according to Marsh criterion which includes altered appearance of duodenal folds (scalloping and attenuation), crypt hyperplasia and increased number of intraepithelial lymphocytes. Increased number of intraepithelial lymphocytes is a typical feature of active disease. Majority of these lymphocytes are of CD3/CD8+ T cell type. A substantial subpopulation of these cells bears natural killer cell receptors and may respond to stress signals. Serological tests such as positive tissue transglutaminase and anti-endomysial antibodies are also helpful in establishing a diagnosis.[3] In rare instances, the intestinal injury of celiac disease doesn't respond to a strict gluten-free diet. This is known as refractory celiac disease.[4] In a study at Army Medical College Pakistan it was concluded that maximum adult patients, suspected of celiac disease were of age group of 21 - 30 years with males being affected more frequently than females. The common presentation was iron deficiency

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anaemia along with chronic diarrhea. Majority of the cases showed partial villous atrophy along with lymphocytic enteritis in almost all cases. Immunohistochemical marker analysis showed that CD3 was positive in intraepithelial lymphocytes, thus establishing its T-cell origin.[5] That was analysis of a small study and frequency of this group of diseases in adult population of Pakistan is exactly not known and not much of clinical data has been documented about presentation of this disease.

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ORIGINAL ARTICLE

Neuropsychological Sequelae of Problematic Social Media Use: Cognitive Fatigue, Behavioural Dysregulation, and Self-Esteem Erosion among Students of Government Graduate College for Women, Mohanpura, Rawalpindi

Mahwish Akhtar Qureshi, Aalia Batool, Aiman Zahra, Sassi Khan, Shahzadi Manayal Bakhtiyar
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ABSTRACT

Background: Problematic social media use has emerged as a significant public health concern, with mounting evidence linking excessive digital engagement to neuropsychological impairment in young adults. Cognitive fatigue, behavioural dysregulation, and self-esteem erosion represent core sequelae of chronic cyber-addiction, yet remain underexplored in Pakistani female college populations. This study aimed to map these neuropsychological consequences among students of Government Graduate College for Women, Mohanpura, Rawalpindi.

Methodology: An analytical cross-sectional study was conducted from January to September 2025 among 80 female students aged 17–25 years, recruited by non-probability convenience sampling. A semi-structured questionnaire was administered, incorporating the Social Media Addiction Scale (SMAS), Social Media Cognitive Fatigue Scale (CFS), Depression Anxiety Stress Scale (DASS-21), and Rosenberg Self-Esteem Scale (RSES). Data were analysed using SPSS v25 with descriptive statistics and chi-square tests.

Results: Most participants were urban (59%), bachelor's-level students from nuclear families (61%). Statistically significant associations were identified between social media addiction and type of family ($p<0.05$), poor sleep quality ($p=0.030$), perceived negative health effects ($p=0.001$), concentration difficulties ($p=0.005$), anxiety symptoms ($p=0.030$), and low self-esteem ($p=0.029$).

Conclusion: Problematic social media use is significantly associated with cognitive fatigue, behavioural dysregulation, impaired sleep, heightened anxiety, and self-esteem erosion among female college students, consistent with a neuropsychological sequelae framework. Digital literacy programmes, accessible counselling services, and structured screen-time management are recommended. Longitudinal research with diverse cohorts is needed to establish causality.

Keywords: Neuropsychological sequelae; problematic social media use; cognitive fatigue; behavioural dysregulation; self-esteem erosion; cyber-addiction; DASS-21; female students; digital well-being; Pakistan.

INTRODUCTION

The rapid expansion of digital technology has fundamentally transformed patterns of communication, learning, and recreation worldwide.[1] Social media platforms, while offering opportunities for connectivity and information exchange, have also given rise to growing concern regarding excessive and maladaptive patterns of use.[2] In recent discourse, the term *brain rot* has been used to describe a perceived decline in cognitive sharpness and emotional stability associated with prolonged exposure to low-value or over stimulating digital content.[2] Although not yet a formal medical

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diagnosis, this concept reflects mounting public and scientific apprehension about digital overconsumption and its psychological implications.[1]

Social media platforms are specifically engineered to encourage repeated engagement through reward-based mechanisms, including push notifications, algorithm-driven content feeds, and social-validation features such as likes and shares.[3] Recurrent exposure to these stimuli may activate dopaminergic reinforcement pathways, contributing to habitual checking behaviours and difficulty disengaging from platforms.[4] Over time, such compulsive usage patterns may progressively impair sustained attention, executive functioning, and emotional regulation.[5]

Globally, social media use has reached unprecedented levels, with billions of active users and steadily rising engagement among adolescents and young adults.[1] In Pakistan specifically, an estimated social media addiction prevalence of 29.5% has been reported among university-aged populations.[6] Young women in academic settings may represent a particularly vulnerable subgroup, owing to developmental transitions, academic pressures, and sociocultural expectations regarding appearance and social comparison.[7]

Emerging research indicates that excessive social media use is significantly associated with anxiety, depression, sleep disturbance, and reduced self-esteem.[4,8] Despite this growing body of evidence, the majority of published studies originate from Western or high-income contexts, and context-specific data from Pakistani female college students remain scarce.[9,10] Understanding the neuropsychological sequelae of cyber-addiction within this demographic is therefore essential for the design of culturally appropriate and effective interventions.

The objectives of this study are to assess the association between problematic social media use with perceived cognitive fatigue, symptoms of anxiety, depression, and behavioral dysregulation, and self-esteem erosion among female students at Government Graduate College for Women, Mohanpura, Rawalpindi.

METHODOLOGY

An analytical cross-sectional study was conducted at Government Graduate College for Women, Mohanpura, Rawalpindi. Data collection was carried out between January and September 2025. The study population comprised female students aged 17–25 years enrolled at the college. All female students present during the data-collection period who provided written informed consent were included. The students with previously diagnosed psychiatric disorder (depression or anxiety, documented in medical records or self-reported at screening), were excluded from the study as these conditions could confound the associations of interest.

Using the WHO sample-size calculator (95% confidence interval, 10% margin of error, estimated addiction prevalence 29.5%)[6], the required sample size was 80. Non-probability convenience sampling was employed.

A semi-structured, self-administered questionnaire with five sections was completed by participants under researcher supervision:

Section A – Socio-demographics: Age, academic discipline, education level, residence type, family type, sleep duration and quality, physical activity frequency, history of diagnosed psychiatric conditions, and perceived quality of life.

Section B – Social Media Addiction Scale (SMAS): A 15-item scale (Cronbach's alpha = 0.89).[11] Scores: 15–30 = low risk; 31–45 = moderate addiction; 46–75 = high addiction with

serious life disruptions.

Section C – Social Media Cognitive Fatigue Scale (CFS): A 20-item scale covering cognitive overload, emotional exhaustion, reduced attention span, and compulsive use (Cronbach's alpha = 0.87).[12] Scores: 20–40 = low; 41–60 = moderate; 61–80 = high; 81–100 = severe cognitive fatigue.

Section D – DASS-21: A 21-item instrument measuring depression, anxiety, and stress (Cronbach's alpha = 0.88).[13] Subscale scores are doubled before applying standard cut-offs: depression 0–9 = normal; anxiety 0–7 = normal; stress 0–14 = normal.

Section E – Rosenberg Self-Esteem Scale (RSES): A 10-item scale (Cronbach's alpha = 0.85)[14], items 3, 5, 8, 9, and 10 are reversely scored. Total scores: 30–40 = high; 20–29 = moderate; 10–19 = low self-esteem.

The questionnaire was pre-tested on 4 students (5% of n=80) before full deployment, with minor wording adjustments made thereafter. Data were entered and analysed using SPSS version 25. Descriptive statistics (frequencies and percentages) summarised socio-demographic and key variables. Cross-tabulations and Chi-square tests examined associations between SMAS, CFS, DASS-21, and RSES categories.

Ethics: Approval was obtained from the Institutional Review Board (IRB) of Fazaia Medical College, Air University, Islamabad. Administrative permission was granted by the college. Participation was voluntary; informed consent was obtained from all participants. Data were used solely for research purposes, with anonymity and confidentiality maintained throughout.

RESULTS

Table I: Socio-demographic Characteristics of Respondents (n =80)

Characteristic	Category	n	%
Residence	Urban	47	59
	Semi-urban	14	18
	Village	19	24
Education Level	Intermediate	3	4
	Bachelor's	77	96
Academic Discipline	BS Chemistry	28	35
	BS English	25	31
	BS Economics	24	23
	FSC/ Intermediate	3	4
Family Type	Nuclear	49	61
	Joint	31	39
Night Sleep Duration	<4 hours	2	3
	4–6 hours	25	31
	7–8 hours	44	55
	>8 hours	9	11
Physical Activity Frequency	Never	23	29
	1–2/week	20	25
	3–5/week	10	13
	Daily	27	34
Previously Diagnosed Psychiatric Condition (depression/ anxiety)	Yes	0	0
	No	80	100
Overall Quality of Life	Poor	2	3
	Fair	39	49
	Good	39	49

Most respondents resided in urban with the remainder from villages and semi-urban settings. Nearly all were enrolled in bachelor's programmes. The majority lived in nuclear families. Most students reported sleeping 7–8 hours per night. Daily physical activity was reported by 34% in which walking was the most common form. No participants reported a previously diagnosed psychiatric condition. Quality of life was rated as fair or good by 97% of participants as shown in Table I.

Table II: Association of Social Media Addiction with other variables under study

Predictor Variable	Outcome Variable	*p*-value
Social Media Addiction	Type of family	< 0.05
Social Media Addiction	Sleep quality	0.030
Social Media Addiction	Perceived negative health effects	0.001
Social Media Addiction	Concentration difficulties	0.005
Social Media Addiction	Anxiety symptoms (DASS-21)	0.030
Social Media Addiction	Low self-esteem (RSES)	0.029

The table II shows significant associations between Social Media Addiction with family type, sleep quality, cognitive fatigue (as negative impact on health and concentration difficulties) and low self-esteem. There is also significant association between social media addiction and psychological behaviours like Anxiety, stress and depression.

DISCUSSION

The current study identified significant neuropsychological sequelae of social media use (cyber-addiction), including cognitive fatigue, behavioural dysregulation, and self-esteem erosion, among female college students. Higher level of social media use were associated with nuclear family type, poorer sleep quality, increased anxiety, concentration difficulties, and lower self-esteem, consistent with prior research demonstrating that excessive digital engagement negatively influences emotional stability and cognitive functioning.[3,8]

Sleep disturbance emerged as a salient outcome. Prolonged screen exposure, particularly at night, has been shown to impair sleep duration and quality, subsequently affecting mood regulation and attention.[15] The present findings support this relationship: preoccupation with social media appears to contribute indirectly to cognitive fatigue through disrupted sleep, consistent with recent work demonstrating the serial mediating roles of sleep quality and fatigue in social media addiction.[16,17]

Compulsive use was also associated with perceived negative health effects and heightened anxiety, aligning with evidence of a bidirectional relationship between psychological distress and problematic social media use.[4,8] Individuals may initially use social media as a coping mechanism; however, excessive reliance may intensify emotional strain over time.[18]

Self-esteem erosion was significantly associated with prolonged social media engagement. Upward social comparison on digital platforms is known to undermine self-worth, particularly among young women.[7,19] Repeated exposure to idealised content may therefore contribute to emotional exhaustion and reduced confidence.[20]

While these findings highlight potential risks, it is important to note that social media use is not inherently harmful.[3] Structured and purposeful engagement can yield positive outcomes, and the results instead indicate that maladaptive and excessive patterns of use are more strongly associated with adverse neuropsychological effects.[8] Overall, this study supports a multidimensional understanding of problematic social media use, encompassing emotional distress, sleep disruption, and cognitive fatigue.[2] Longitudinal research with diverse cohorts is needed to clarify causality and to inform targeted preventive strategies within academic settings.[16]

CONCLUSION

This study demonstrates a significant association between cyber-addiction and markers of brain rot—including anxiety, stress, cognitive fatigue, nuclear family, poor sleep quality, and low self-esteem—among female college students. These findings have direct implications for academic performance and overall psychological health.

Addressing cyber-addiction warrants a coordinated response from educators, mental health professionals, families, and policymakers.

Specifically, institutions should consider introducing: (1) structured digital literacy programmes that teach healthy screen-time habits; (2) peer-led awareness campaigns about the psychological risks of excessive social media use; and (3) accessible counselling services for students showing signs of addiction or emotional distress. Policymakers may also explore platform-level regulations that promote healthier engagement defaults.

LIMITATIONS

The cross-sectional design precludes causal inference. The sample was restricted to a single women's college in Rawalpindi, limiting generalisability. The convenience sampling introduces selection bias, and self-reported data are susceptible to recall and social-desirability biases. Future longitudinal studies with larger, diverse, and mixed-gender cohorts are needed to establish causal pathways and identify gender-specific trends.

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ORIGINAL ARTICLE

Attitudes, Stigma and Social Distance toward Mental Illness among Family Members and the General Public in Rawalpindi–Islamabad, Pakistan

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ABSTRACT

Objective: To compare the levels of attitudes, personal stigma, and social distance toward mental illness between family members of individuals with mental illness and members of the general public in Rawalpindi-Islamabad.

Methodology: We conducted a community-based cross sectional analytical study from January to March 2024 using purposive sampling technique. Two groups; group I (immediate family members of individuals with psychiatric disorder) and group II (general public) were enrolled. Of 433 approached, 400 were included (200 in each group). The Attribution Questionnaire (AQ-27), Bogardus Social Distance Scale, and Personal Stigma Scale (PSS) were used for data collection. Mean and percentages were calculated and independent samples t-test was applied.

Results: On AQ-27, coercion pity and help were highest in both groups while anger and dangerousness were lowest. The only significant between-group difference was avoidance, with higher scores in the general public than family members (p=0.012). Bogardus responses showed a clear role gradient (most willing as close friend 22.5% and citizen 18.8%; least willing as partner 12.5% and tourist 8.5%). On the PSS, group means were similar (group I = 3.88; group II = 3.84). Within families, stigma varied by kinship (children highest; grandparents lowest), and by education (religious-only stream highest).

Conclusion: Findings indicate broadly sympathetic views with selective distance in closer roles. Priorities include routine caregiver support to address avoidance linked to burden, and targeted mental-health literacy, especially where prior schooling offers limited mental-health Content. Future work should test whether these strategies reduce avoidance and social distance over time.

Keywords: Attitude, Social distance, Stigma, Mental illness, Cross-sectional Studies

INTRODUCTION

Mental health conditions are among the leading contributors to disability worldwide. Beyond the direct burden of illness, stigma remains a pervasive barrier that shapes behaviour of people.[1] Mental health is more than the absence of illness; it is the capacity to cope, work productively, and contribute to one's community.[2] Evidence indicates that even when mental health services are available, anticipated or experienced stigma often deters individuals from accessing them. It is estimated that 1 in every 3 women and 1 in every 5 men is likely to experience major depression in their lives.[3] However, stigma in all contexts results in bias, discrimination, and preconceptions that restrict these abilities on a structural, familial, and individual level. Studies continue to demonstrate that, even in cases when services are available, anticipated and experienced discrimination discourages people from seeking aid and from participating in civic, professional, and educational activities.[4]

In addition to being the primary caregivers, families also bear the burden of "associative" stigma, which refers to unfavorable assessments

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made of family members of people with mental illness. However, public perceptions have a big impact on whether or not people with mental illnesses are accepted as coworkers, neighbours, or members of the community.[5]

Pakistan is the world's fifth most populous country, faces a growing mental health burden compounded by rapid demographic change, uneven service distribution, and limited specialist resources. People with psychiatric disorders often encounter social isolation, restricted opportunities for employment and housing, and discrimination within healthcare settings.[6] Despite the central role of families and the community, much of the existing research has concentrated on patient self-stigma, with fewer studies examining how their family members perceive and internalize stigma.[7] Efforts by the health system to eliminate stigma are increasingly focusing on two tracks: customized skills-based support for frontline providers and caregivers, and contact-based and literacy initiatives for the general population.[8] To develop such solutions, we need context-specific data that distinguishes between social stigma, personal perspectives, and what people believe and feel.[9] Although stigma toward mental illness has been documented internationally, little evidence distinguishes between the perspectives of family members and the general public in Pakistan. Understanding these differences is critical for designing interventions. The study was done to compare the levels of attitudes, personal stigma, and social distance toward mental illness between family members of individuals with mental illness and members of the general public in Rawalpindi-Islamabad.

METHODOLOGY

A community-based cross-sectional analytical study was carried out in Rawalpindi and Islamabad from January to March 2024, after approval from the Institutional Ethical Review Committee (ERC/ID/391). Family members of individuals with mental illness were recruited from outpatient psychiatric clinics in tertiary hospitals, while members of the general public were approached in community settings. Trained investigators themselves approached potential participants directly, explained the study, and obtained informed consent. Face-to-face administration of the structured questionnaire was done to ensure accuracy and address any queries. The study included two groups; immediate family members of patients with diagnosed psychiatric illness (group I), and members of the general public without such a family history (group II).

The minimum required sample size was 385, calculated using Raosoft software at 95% confidence interval and 5% margin of error, assuming a 50% expected prevalence. To account for possible non-response and incomplete data, 433 individuals were approached. A final data of 400 participants was included in the analysis after excluding incomplete forms. Individuals aged 16–75 years residing in Rawalpindi and Islamabad were eligible to participate. Group I included immediate family members of patients formally diagnosed with psychiatric illness (grandparents, parents, siblings, spouses, aunts, or uncles). Group II included members of the general public with no immediate family member diagnosed with a psychiatric disorder. Those with inability or unwillingness to provide informed and self-reported history of a major psychiatric or neurological disorder (psychosis, bipolar disorder, and dementia) were excluded. Data were collected using a pre-validated, structured questionnaire with four sections: (i) Demographics: age, gender, marital status, education level, occupation, and, relation to the diagnosed family member for group I only (ii) The Attribution Questionnaire (AQ-27), a 27-items measure of anger, dangerousness, fear, coercion, segregation, avoidance, help, and pity, rated on a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree), where higher mean scores indicated stronger endorsement of that dimension;[10] (iii) The Bogardus Social Distance Scale, assessing willingness to accept a person with mental illness in progressively closer social roles (e.g., friend, neighbour, colleague, marriage partner, citizen). Responses were coded as acceptance (score = 1) or non-acceptance (score = 0), and percentages were calculated

by role;[11] (iv) The Personal Stigma Scale (PSS), a seven-item Likert scale (1–7) measuring internalized/personal stigma, with higher mean scores reflecting greater stigma.[12]

RESULTS

Of the 433 individuals who approached to accommodate for nonresponse rate, 400 were included after excluding 33 incomplete forms, yielding an overall response rate of 92.4**%**. The mean age of the respondents was 36.9 years. Demographic details of participants are given in Table-I.

On the Attribution Questionnaire (AQ-27), pity and help received the highest scores, reflecting concern and willingness to support patients, while anger and dangerousness were lowest. Coercion was also elevated, indicating agreement with compulsory treatment in some circumstances. The only significant group difference was in avoidance, where the general public scored higher than family members (p = 0.012), suggesting a greater tendency to distance themselves socially as shown in Table-II.

The Bogardus Social Distance Scale showed role-specific differences: participants expressed greater acceptance of people with mental illness in community or friendship positions, but were less accepting in roles demanding intimacy or high trust, such as marriage or workplace settings. This pattern indicates that willingness declines as the degree of personal dependence increases as shown in Figure 1.

Table I: Demographic Characteristics of Study Participants

Characteristic	Frequency (n)	Percentage (%)
Gender		
Male	180	45.0
Female	220	55.0
Age (years)		
16–25	113	28.25
26–35	90	22.50
36–45	82	20.50
46–55	69	17.25
56–65	38	9.50
66–75	8	2.00
Education		
Primary	54	13.5
Secondary	5	1.3
Intermediate	113	28.2
Graduation	149	37.3
Post-graduation	77	19.3
Other	2	0.5
Marital status		
Married	188	47.0
Never married	168	42.0
Other (divorced/ separated/widowed)	44	11.0
Employment status		
Employed	194	48.5
Unemployed	32	8.0
Retired	21	5.3
Student	106	26.5
Other	47	11.8

On the Personal Stigma Scale (PSS), mean scores were calculated by assigning values from

Table II: Comparison of Mean Score Obtained for Each Dimension in AQ-27

Dimensions	Group I	Group II	Independent Samples t-Test	
	Mean±SD	***Mean±SD***	***t***	***p-value***
Anger	3.66 ± 1.23	3.50 ± 1.11	1.34	0.17
Dangerousness	3.75 ± 1.21	3.85 ± 1.05	-0.89	0.37
Fear	3.70 ± 1.21	3.56 ± 1.15	1.11	0.26
Coercion	4.11 ± 1.42	4.29 ± 1.05	-1.52	0.12
Segregation	4.02 ± 1.10	3.84 ± 1.10	0.81	0.41
Avoidance	3.88 ± 1.04	4.04 ± 1.08	-2.53	0.01
Help	4.15 ± 1.04	4.37 ± 1.27	0.36	0.71
Pity	4.43 ± 1.26	4.38 ± 1.23	0.45	0.65
Group I = Family members of diagnosed psychiatric patients, Group II = General public at large				

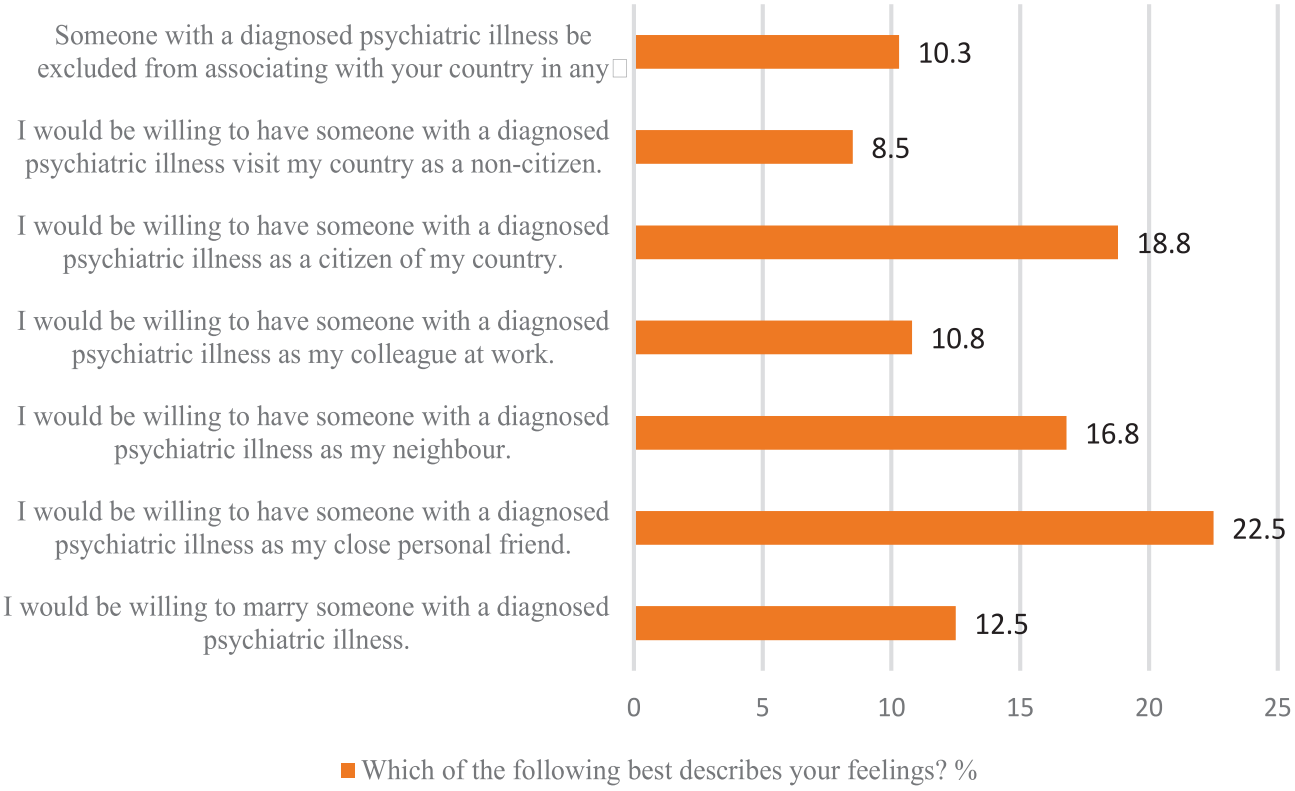


Figure 1: Responses across Group I and Group II

1 (strongly disagree) to 7 (strongly agree) for both groups. The mean value for group-I was bit higher (3.88) as compared to the group-II (3.84) as shown in Figure 2. Marital status followed a graded pattern divorced/widowed/separated (3.96) showed greater score than married (3.90) and never-married (3.78). The employment status showed the highest means among retired participants (4.23), followed by others (3.95), employed (3.91), students (3.73), and unemployed (3.60). Gender means were essentially identical in males (3.86) and females (3.85).

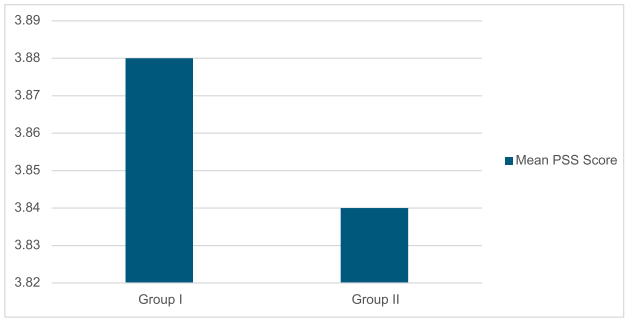


Figure 2: Mean PSS score according to Group I and II

DISCUSSION

This study compared attitudes toward mental illness among family members of diagnosed patients and members of the general public using three complementary instruments. On the Attribution Questionnaire (AQ-27), pity and help recorded the highest means in both groups, indicating sympathy and readiness to support people living with mental illness.[13] Coercion also scored relatively high, reflecting endorsement of compulsory treatment or supervised living in some circumstances.[14] Contrary to that anger and dangerousness were among the lowest-scoring dimensions, suggesting that overtly negative, threat-based stereotypes were less salient in this sample.[15] While stigma is widely recognized as a universal phenomenon, its manifestations vary depending on cultural context, health system maturity, and caregiver experiences. These findings highlight a complex interplay of empathy, avoidance, and coercion in both groups, with distinct differences that carry implications for intervention design.[16] High levels of pity and

willingness to help were observed in both groups, consistent with evidence that empathy often coexists with paternalism. Despite supportive attitudes, participants also endorsed coercive practices, which may unintentionally reinforce stigma by undermining patient autonomy.[17] Close contact with patients reduces prejudice, this study indicated otherwise: proximity and caregiving burdens may amplify frustration, fear, and protective distancing.[18] This is consistent with previous studies where family caregivers expressed both compassion and resentment due to the chronic strain of supporting mentally ill relatives.[19] Participants were more comfortable accepting individuals with psychiatric illness as friends or fellow citizens than as marriage partners or colleagues. This acceptance reflects social role salience; roles requiring emotional intimacy and trust in competence elicit stronger prejudice. Comparable findings have been observed in community studies from Saudi Arabia.[20]

On the Personal Stigma Scale, family members reported higher stigma than the general public. This reflects associative stigma among families, who internalize societal judgment and may conceal illness or rationalize it through spiritual explanations. In Pakistan, psychiatric illness is often linked to supernatural or moral causes, leading families to adopt defensive stigma as a means of shielding themselves from blame.[21] Education consistently reduced stigma whereas traditional schooling showed highest stigma. This indicates that modern education improves mental health literacy and reduces discriminatory beliefs which is persistent with previous researches.[22] Marital and employment status also shaped attitudes. Divorced or widowed participants, as well as retired individuals, reported higher stigma, heightened vulnerability, or generational differences in perception similar to findings from Australia.[23] In contrast, unemployed respondents expressed relatively lower stigma, which may suggest stronger empathy linked to personal experiences of marginalization.[24] Gender differences, though minimal in PSS scores, revealed women expressing less discrimination. This is in agreement with previous research that women often display higher mental health literacy and caregiving orientation.[25]

This study highlights three priorities for intervention. First, stigma reduction campaigns should directly challenge coercive stereotypes that portray individuals with mental illness as dangerous or incapable of making decisions. Second, caregivers would benefit from structured psychosocial support, including peer groups and counseling, to lessen burden and reduce associative stigma. Third, educational and religious institutions should actively reframe cultural and spiritual narratives around mental illness. In Pakistan, adapting such initiatives to incorporate family caregivers may enhance their effectiveness and long-term sustainability. However this study has some limitations: the urban sample limits generalizability, the cross-sectional design prevents causal inference and self-reported outcomes raising the possibility of recall and social-desirability bias. Subgroup comparisons were not conducted, and structural stigma such as service access and policy was not assessed, which warrants future study.

CONCLUSION

High scores for help alongside coercion indicate empathetic yet paternalistic attitudes in both families and the general public. Stigma was slightly higher among close relatives, where caregiving burden and social pressure may intensify negative perceptions, while higher education consistently aligned with lower stigma. These findings challenge the assumption that familiarity reduces stigma and highlight two priorities: targeted support and education for caregivers, and broad public campaigns to normalize recovery and social inclusion.

CONFLICT OF INTEREST: None declared.
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ORIGINAL ARTICLE

Frequency of Good APGAR Score in Intrauterine Growth Restricted Fetuses with Abnormal Umbilical Artery Doppler

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ABSTRACT

Objective: To determine the frequency of abnormal umbilical artery Doppler in patients with intrauterine growth restricted fetuses and to determine the frequency of good APGAR score in intrauterine growth restricted fetuses with abnormal umbilical artery Doppler delivered within 26 days.

Study Design: Descriptive Cross sectional study

Place and Duration of Study: Department of Obstetrics and Gynaecology, Rai Foundation Teaching Hospital Sargodha. Duration of study from Feb to July 2025.

Methodology: The study was conducted in Obstetrics & Gynaecology Department of Rai Foundation Teaching Hospital Sargodha from Feb'25 to July'25. Total of 150 patients with intrauterine growth restriction fulfilling inclusion and exclusion criteria were identified by non-probability consecutive sampling technique. They were enrolled to determine the frequency of abnormal umbilical artery Doppler in growth restricted fetuses and to determine the frequency of good APGAR score in intrauterine growth restricted fetuses with abnormal umbilical artery Doppler delivered within 26 days.

Results: In this study, out of 150 cases, 60.67% (n=91) were between 18 – 30 years while 39.33 % (n=59) were between 31 – 45 years of age, mean±SD was calculated as 28.34±5.77 years. Frequency of abnormal umbilical artery Doppler in patients with intrauterine growth restricted fetuses was recorded in 42.67% (n=64), out of them 40.63% (n=26) had good APGAR score in intrauterine growth restricted fetuses with abnormal umbilical artery Doppler delivered within 26 days while 59.37% (n=38) had no good APGAR score.

Conclusion: We concluded that the frequency of abnormal umbilical artery Doppler in patients with intrauterine growth restricted fetuses is higher and among these cases, the frequency of good APGAR score is not significantly higher. So the outcome of this study may be used to change the protocols for future patients and their obstetrical outcome.

Keywords: Intrauterine Growth Restriction, Abnormal Umbilical Artery Doppler, Good APGAR score.

INTRODUCTION

Intrauterine growth restriction (IUGR) or Fetal growth restriction (FGR) remains a leading contribution to perinatal mortality and morbidity. It refers to a fetus that has failed to achieve its genetically determined growth potential and affects 5–10% of pregnancies.[1] Much of the published research with regard to growth restriction is based on birth weight criteria. Detecting the fetus with pathological growth restriction is a challenge in obstetrics as it is

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at risk of perinatal complications.[2] Now a days Doppler studies of velocimetry of uteroplacental umbilical and fetal vessels has become established method of antenatal monitoring and allowing the noninvasive assessment of fetal circulation.[3] Relationship between perinatal risks and Doppler findings have been defined in numerous cross sectional studies but most of them based on management of umbilical artery doppler.[4] In the presence of fetal hypoxemia adaptive changes in fetal circulation can be detected by Doppler USG.[5] Fetal compromise despite normal umbilical artery Doppler waveforms is well described in the late third trimester.[6] In pregnancies complicated by intrauterine growth restriction impedance to flow in umbilical artery is increased.[6] Serial assessment of circulatory changes in growth restricted fetuses may identify the deterioration pattern of changes, allowing intervention prior to irreversible intrauterine damage.[7] Lakhkar et al concluded in their study that Doppler studies of multiple vessels especially the umbilical artery in the fetoplacental circulation can help in the monitoring of compromised fetus and can help us predicting neonatal morbidity. This may be helpful in determining the optimal time of delivery in complicated pregnancies.[8] Abnormal umbilical artery Doppler detects that the fetus is compromised but the delivery within 26 days improves the fetal outcome.[9] In one study there are 71.42% intensive neonatal care admissions in abnormal umbilical artery Doppler[4]. A study reported APGAR scores > 7 in abnormal umbilical artery Doppler was 66.6%.[2] One study reported APGAR score > 7 in abnormal umbilical artery Doppler to be 38.1%[3], whereas another study showed the frequency of abnormal umbilical artery Doppler to be 46%.[10]

Thus, the rationale of this study is to conduct a study to generate local data since the studies already done show significant differences in good APGAR score so that the timely intervention in IUGR fetuses with abnormal umbilical artery Doppler can improve the fetal outcome. The outcome of this study may be used to change the management protocols for future patients.

MATERIALS AND METHODS

Study Design:

Descriptive Cross-sectional study

Place and Duration of Study:

Department of Obstetrics and Gynaecology, Rai Medical College Teaching Hospital Sargodha. Duration of study was from Feb,25 to July,25.

Methodology:

It was a Cross-sectional study conducted at Department of Obstetrics and Gynaecology, Rai Foundation Teaching Hospital Sargodha, Pakistan from February to July 2025 after approval from Institutional Ethical Review Board. Total of 150 patients with intrauterine growth restriction between gestational age 28-36 weeks fulfilling inclusion and exclusion criteria were identified by non-probability consecutive sampling technique. These patients were enrolled after obtaining informed consent to determine the frequency of abnormal umbilical artery Doppler in growth restricted fetuses and to determine the frequency of good APGAR score in intrauterine growth restricted fetuses with abnormal umbilical artery Doppler delivered within 26 days according to inclusion criteria gestational age. All enrolled patients were followed until delivery, neonatal outcomes assessed immediately after birth using APGAR score. The women with IUGR and abnormal umbilical artery Doppler findings (absent end diastolic umbilical artery Doppler) were given steroid cover and delivered within 26 days. After delivery, APGAR score of babies was noted at 1 and 5 minutes. The data was collected on structured questionnaire.

Inclusion criteria:

- Pregnant women with intrauterine fetal growth restriction suspected clinically and confirmed on an obstetrical ultrasound as per operational definition.
- Pregnancy of 28-36 weeks of gestation.

Exclusion Criteria:

- Pregnant women unsure of Last Menstrual Periods (LMP).
- Patients with multiple gestations on ultrasound.
- Intrauterine fetal growth restriction associated with congenital anomalies on ultrasound.

Data Analysis:

Data was entered and analyzed using SPSS 22, frequencies and percentages were calculated for categorial variables including abnormal umbilical artery Doppler and APGAR score, Descriptive statistics were applied to summarize the data, mean and standard deviation were calculated for quantitative variables such as maternal age. Total number of cases as estimated using sample size calculator was 150, keeping confidence level at 95% and margin of error 8% with 38.1% of fetuses having good APGAR score (i.e. > 7).

RESULTS

A total of 150 cases fulfilling the inclusion/ exclusion criteria were enrolled to determine the frequency of abnormal umbilical artery Doppler in patients with intrauterine growth restricted fetuses confirmed by ultrasound and to determine the frequency of good APGAR score in intrauterine growth restricted fetuses with abnormal umbilical artery Doppler delivered within 26 days.

Age distribution of the patients was done which shows that 60.67% (n=91) were between 31-45 years of age, mean±SD was calculated as 28.34±5.77 years (Table I).

Frequency of abnormal umbilical artery Doppler in patients with intrauterine growth restricted fetuses was recorded to be 42.67% (n=64) while 57.33% (n=86) had no findings of abnormal umbilical artery Doppler (Table II).

Frequency of good APGAR score in intrauterine growth restricted fetuses with abnormal artery Doppler delivered within 26 days was calculated to be 40.63% (n=26) while 59.37% (n=38) had no good APGAR score (Table III).

Table I: Age Distribution

Age (in Years)	Number of Patients n=150	Percentage (%)
18-30	91	60.67
31-45	59	39.33

Table II: Frequency of Abnormal Umbilical Artery Doppler in Patients with Intrauterine Growth Restricted Fetuses

Abnormal Umbilical artery Doppler	Number of Patients n=150	Frequency (%)
Yes	64	42.67
No	86	57.33

Table III: Frequency of Good APGAR Score in Intrauterine Growth Restricted Fetuses with Abnormal Umbilical Artery Doppler

Good APGAR Score	Number of Patients n=64	Frequency (%)
Yes	26	40.63
No	38	59.37

DISCUSSION

Intrauterine growth restriction (IUGR) or Fetal growth restriction (FGR) is a significant contributor to perinatal mortality and morbidity.[11] This condition is frequently associated with chromosomal or other congenital abnormalities, intrauterine infection. Diagnosis, and evaluation of suspected IUGR is hampered by the heterogeneous nature of the condition and its imprecise definition.[12]

Doppler sonography provides a unique opportunity to investigate human fetal hemodynamics and to use these findings for fetal surveillance. We planned this study to generate the local data since the studies already done show significant differences in terms of good APGAR score. It showed that the timely intervention in IUGR fetuses with abnormal umbilical artery

Doppler can improve the fetal outcome. The outcome of this study may be used to change the management protocols for future patients.

In this study, out of 150 cases, 60.67% (n=91) were between 18-30 years while 39.33% (n=59) were between 31-45 years of age, mean±SD was calculated as 28.34±5.77 years. Frequency of abnormal umbilical artery Doppler in patients with intrauterine growth restricted fetuses was recorded as 42.67% (n=64), out of them 40.63% (n=26) had good APGAR score in intrauterine growth restricted fetuses with abnormal umbilical artery Doppler delivered within 26 days while 59.37% (n=38) had no good APGAR score. Our findings are in agreement with the study showing the frequency of abnormal umbilical artery Doppler in 46% and frequency of good AGPAR score in these patients with abnormal umbilical artery Doppler was 66.6%.[2]

Doppler velocimetry studies of umbilical artery can provide important information to the obstetricians regarding fetal wellbeing to help them improve fetal outcome.[13] Doppler velocimetry identifies normal and altered blood flow velocity in the umbilical artery and is responsive to changes in placental resistance.[14] It is a noninvasive technique that evaluates abnormal fetal hemodynamics that results in abnormal pregnancy outcome.[15] It has been shown by various studies[7-9] that perinatal morbidity and mortality were significantly greater in small for gestational age babies with abnormal umbilical artery Doppler studies than in those with normal studies. All infants whose birth weight is below the 10th percentile are not exposed to a pathologic process in utero, but some are constitutionally small and healthy.[16] It is a challenge to differentiate the fetus with pathologic growth restriction and hence at risk for perinatal complications from constitutionally small but healthy fetus.

However, our results provide clarity in terms of good AGPAR score and determine that the timely intervention in IUGR fetuses with abnormal umbilical artery Doppler can improve the fetus outcome. Some more local clinical trials are also required to validate these findings.

CONCLUSION

We concluded that the frequency of abnormal umbilical artery Doppler in patients with intrauterine growth restricted fetuses is higher and among these cases, the frequency of good AGPAR score is not significantly high. So the outcome of this study may be used to consider changes in the management protocols for future patients which can help timely obstetrical decisions.

CONFLICT OF INTEREST: None

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ORIGINAL ARTICLE

The Association of Smog Exposure with Psychological Distress in University Students of Pakistan

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ABSTRACT

Objective: To determine the association between smog exposure and psychological distress among university students in selected cities of Pakistan.
Methodology: This analytical cross-sectional study was conducted from December 2024 to May 2025, on 366 individuals from different universities of Islamabad, Lahore and Multan. Data was collected by purposive sampling technique using a comprehensive questionnaire based on literature review. Data analysis was done on SPSS Version 27.
Results: In this study conducted on 366 university students, results showed a positive association between smog exposure and psychological distress ($p = 0.004$ for both the genders; linear trend $p = 0.001$). Students in high-smog areas like Lahore and Multan reported no distress (14.8% and 16.5% respectively) lesser than Islamabad (36.6%). Lahore (22.1%) along with Multan (23.1%) showed notably higher severe distress. Air Quality Index (AQI) data, collected from January through February in 2025 did support all these findings with Lahore itself reaching such extreme pollution levels with AQI 214 as Islamabad remained at a relatively moderate level with AQI 142–213.
Conclusions: This study concludes that smog exposure is significantly associated with psychological well-being of university students, particularly in highly polluted cities. These findings underscore the importance of air quality management and mental health support services in urban educational settings.
Keywords: Air pollution, Anxiety, Mental well-being, Psychological health, Psychological distress, Smog

INTRODUCTION

As the harmful effects of smog on physical health are well-documented, its effects on mental health, such as anxiety and depression, remain underexplored. This research aims to fill this knowledge gap by comparing the psychological impacts of smog across different cities in Pakistan. According to the WHO, air pollution caused 6.7 million deaths in 2019.[1] A systematic review reported that 73% of studies found significant mental health risks due to smog and air pollution.[2] Recent research has shown that air pollution is associated with work incapacity, lower productivity, memory impairment, poor mood, reduced physical activity, poor sleep, depression, anxiety, and stress among various age groups in urban areas, especially among populations with high exposure.[3-5] Perception of air pollution is positively correlated with perceived psychological distress.[6] A qualitative study conducted in Pakistan, involving twenty participants aged 18 to 60 years, revealed that smog exacerbates anxiety, depression, and cognitive impairments among residents of Lahore.[7] An article exploring the link between smog and mental health in 35 major Chinese cities through a micro survey, found a significant association between higher smog levels and increased mental health issues. The study emphasized the need for environmental

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and public health measures to mitigate these effects.[8] Another study, conducted with an aim to raise awareness about the adverse effects of smog on students' well-being, advocates measures to mitigate these impacts.[9] A study on psychological and emotional effects of smog on Lahore's residents, highlighted the associated health issues as anxiety, depression, cognitive impairments, stress, irritability, and sleep disturbances. The research underscored the urgent need for stronger environmental policies and public awareness campaigns to address these mental health concerns.[10] Utilizing longitudinal, nationally representative panel data from the United States spanning 1999 to 2011, the study indicated that higher annual average levels of particulate matter (PM2.5) are significantly associated with increased psychological distress, even after controlling for various demographic, socioeconomic, and health-related factors. This research underlined the importance of considering environmental factors, such as air pollution, alongside individual and social determinants in public health strategies aimed at mitigating mental health issues.[11] Another study in China explored that smog may not only affect the mental but also the physical health.[12] The Lancet Planetary Health in July 2017, also examines the multifaceted effects of smog pollution on human health, emphasizing the importance of understanding both the physical and social dimensions of exposure. The authors argue that while the physiological impacts of smog are well-documented, the social and behavioral responses to smog exposure are less understood. They highlight the need for interdisciplinary approaches that integrate environmental science with social science to address the complex challenges posed by smog pollution. The article calls for comprehensive strategies that consider human behavior, policy-making, and technological innovations to mitigate the adverse health effects of smog.[13] While severe air pollution in China is believed to harm both physical and mental health, empirical studies on its psychological effects are limited. A notable nationwide study linked air pollution to reduced happiness and increased depression. However, questions remain about whether smog affects a broader range of psychological symptoms beyond depression and how emotion regulation might influence this relationship. The study aims to address these gaps by assessing various psychopathological symptoms and examining the moderating role of emotion regulation in the context of smog exposure.[14] There are two main types of smog: photochemical smog and industrial smog. The photochemical smog is typically found in warm, sunny climates and is formed by the reaction of NOx (nitric oxide, nitrogen dioxide) and Volatile organic compounds (VOCs) in the presence of sunlight. It is characterized by a brown haze and can cause various health problems. The industrial smog is typically found in colder climate and is formed by burning fossil fuels for heating and industrial processes. It is characterized by a gray haze and can also cause health problems.[15] The same study explores the significant impact of air pollution, especially smog, on the mental health of Lahore's residents.

It highlights associations between pollutants and increased risks of depression, anxiety, and cognitive impairments. The study aims to establish a link between air quality and psychological effects, advocating for effective interventions. By reviewing existing literature, it identifies a strong association between rising air pollution levels and deteriorating mental well-being in Lahore. The authors emphasize the need for further research and policy measures to mitigate these adverse effects.[15]

The present study was carried out with aims to determine the effect of smog exposure on mental well-being and psychological distress among different cities of Pakistan.

METHODOLOGY

An analytical cross-sectional study was conducted to explore how smog exposure affected the psychological well-being of university students. The study was conducted at selected

universities in three major cities of Pakistan; Lahore, Multan and Islamabad, over a period of six months, from December 2024 to May 2025. A total of 366 university students participated in the study. The sample size was determined using power calculations to ensure the findings were statistically significant and representative.

Students aged 18–30 years, who were studying at a university and were living in its hostel from December 2024 to May 2025 during the smog season, were included. Known smokers (cigarettes, vape, etc.) or those with chronic anxiety or depression issues, were excluded from the study.

Multistage sampling technique was used in this study. In the first stage, universities were selected through random sampling while in second stage students studying in different classes were selected using stratified random sampling. This provided every student an equal opportunity to participate and minimized selection bias. Data was collected using a structured questionnaire, which consisted of three sections:

1. **Demographic Information:** This section gathered details regarding participants' age, gender, university, and year of study.

2. **Exposure to Smog:** Participants were asked about the frequency and duration of their time outside the rooms/ campus. Data on Air Quality Index (AQI) for the relevant cities and periods was used to supplement this section.

3. **Psychological Distress:** The Kessler Psychological Distress Scale (K10; Cronbach's Alpha 0.93) was used to measure participants' psychological well-being. This validated scale consists of 10 items, with responses scored on a Likert scale (1-5) with minimum total score of 10 and maximum score of 50. The scores are categorized as Low Risk (10-19), Mild Risk (20-24), Moderate Risk (25-29) and Severe Risk (30-50).

The questionnaire was administered online to ensure accessibility and ease of participation for students, while maintaining confidentiality and anonymity throughout the data collection process. The collected data was analyzed using SPSS version 26. The following statistical methods were employed:

1. Descriptive Statistics: Mean and standard deviation were calculated for continuous variables; Frequency and percentages were reported for categorical variables.

2. Inferential Statistics: Binary Logistic Regression analysis was performed to determine the relationship between smog exposure (including AQI data) and psychological distress. Confounding variables (age, gender, lining in industrial area, smoking etc.) were controlled during the analysis.

Ethical approval was obtained from the Ethical Review Committee (ERC) of Army Medical College (ERC/507). The Participants were provided with detailed information about the study's objectives, procedures, risks, and benefits. Written informed consent was obtained from each participant while their information was kept confidential and securely stored. Anonymity was maintained throughout the study. Participants were informed of their right to withdraw from the study at any time without any consequences.

RESULTS

The study was conducted on 366 individuals with a mean age of 21.8 years, ranging from 18 to 30 years. The gender distribution was 39% females and 61% males and all of them were undergraduate university students. Among these participants, 114 (31%) were from Islamabad which was control group (reduced AQI index as compared to other cities). While 154 (42%) and 98 (27%) participants (Figure 1) were from Lahore and Multan respectively, assigned as high smog exposure areas according to AQI graphs of six months (December 2024 - May 2025). Psychological distress level was divided into four stages: normal, mild, moderate, and severe. Our results were as follows:

Islamabad: Low (51.8%), Mild (14.9%), Moderate (17.5%), Severe (15.8%)

Lahore: Low (27.9%), Mild (23.4%), Moderate (17.5%), Severe (31.2%)

Multan: Low (21.2%), Mild (19.2%), Moderate (25.3%), Severe (34.3%)

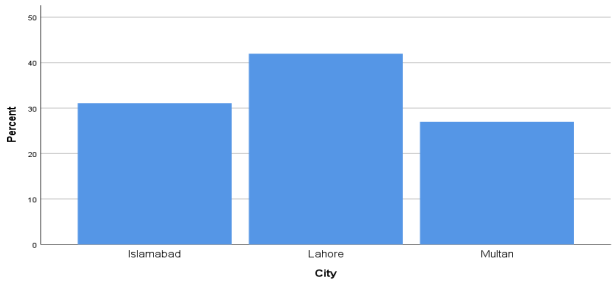


Figure 1: City-based Distribution of Participants

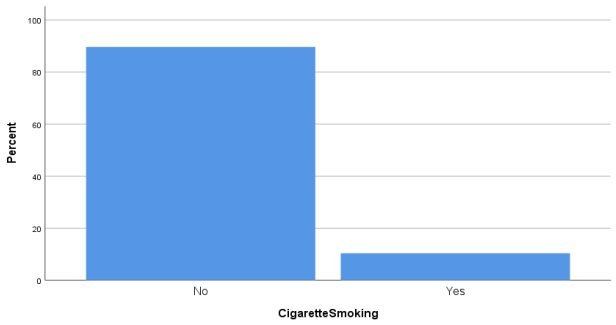


Figure 2: Distribution of Smokers in the Population

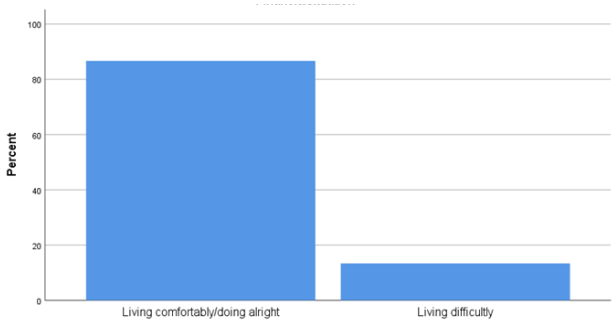


Figure 3: Financial Distribution in the Population

Chi-Square test was applied between demographic variables and different cities with varying level of smog exposure. *P*-value of <0.05 was considered as significant (Table-I)

Table I: Association of Cigarette Smoking and Financial Situation with Psychological Distress

Variable		Psychological Distress				Total	*p*-value
		Low	Mild	Moderate	Severe		
Cigarette Smoking	No	116	67	65	80	328	**0.008**
	Yes	7	5	7	19	38	
Financial Situation	Living comfortably/ doing alright	117	70	62	69	317	**0.000**
	Living with difficultly	6	2	10	31	49	

Table-II: Gender-based Differences in Psychological Distress with respect to Low and High Smog Exposure Cities

Gender			Psychological Distress				Total	*p*-value
			Low	Mild	Moderate	Severe		
Male	Smog Exposure Group	High smog exposure	41	30	33	48	152	**0.004**
		Low smog exposure	38	10	13	13	74	
Female	Smog Exposure Group	High smog exposure	23	25	18	34	100	**0.004**
		Low smog exposure	21	7	7	5	40	

Chi-square tests confirmed a statistically significant association between smog exposure and psychological distress. For male and female students, the Pearson Chi-square value was (p = 0.004), with a significant linear-by-linear association (p = 0.001). These findings indicate that students in high-smog cities reported higher levels of psychological distress compared to those in the low-smog city.

DISCUSSION

This study is conducted to measure the influence of smog exposure on psychological distress among undergraduate university students in three large Pakistani cities: Islamabad (low smog exposure), Lahore, and Multan (both high smog exposure). We have found that higher smog exposure is associated with psychological distress. Students who were from high-pollution cities reported greater psychological symptoms than did students in the control group.

Observed psychological distress patterns closely

match the recorded AQI readings in these cities during December 2024 to May 2025. During this period Lahore and Multan exhibited persistent hazardous levels of air pollution, but Islamabad maintained relatively better air quality.[16-18] Severe distress was reported in 31.2% of students while normal psychological functioning was reported in 27.9% of students from Lahore. In Multan, the proportion of students reporting severe distress was even higher (34.3%) and only about 21.2% reported normal psychological health. On the other hand, Islamabad showed a relatively better trend with 51.8% of the participants reporting normal mental health and only 15.8% of participants reported severe distress.

Statistical analysis confirmed that smog exposure affected mental health of the students and showed a statistical association for both male and female students ($p = 0.004$). These finding are in line with the study by Braithwaite and Lim, which provides evidence that exposure to air pollution whether short-term or long-term elevates the chance of depression and anxiety.[19,20] Zhang suggested that air pollutants cause neuro-inflammation and oxidative stress, contributing to anxiety and depression. Neurobiological evidence suggested that the inhaled pollutants may effect neurons to cause oxidative stress, negatively affecting brain structures also involved in emotional regulation.[3] These results are in line with our finding showing that smog exposure affects psychological health contributing to depression and anxiety.

A study conducted in China found that short-term smog exposure heightened depressive symptoms among urban Chinese students, supporting the seasonal and geographical findings of our study.[21] Also local study in Lahore showed that smog exposure was associated with the higher levels of psychological symptoms.[22] In India researchers reported that winter smog within New Delhi greatly affected the mental well-being of students.[23] These studies support findings in our research.

The World Health Organization (WHO) acknowledges that air pollution is a growing public health concern affecting mental health considerably especially for urban youth. Pakistan faces urbanization and air quality decline in many areas, so current findings stress immediate public health intervention. These may include implementing strict environmental regulations, along with promoting public awareness concerning pollution's psychological impact. Also, these steps could include an expansion of access for mental health resources to populations that are affected.

In the end, this provides strong evidence that smog exposure is associated significantly with psychological distress among the students of the university. Based on the findings, integrated environmental and mental health policies are needed to reduce air pollution's adverse psychological effects, especially in high-risk urban regions.

CONCLUSIONS

These results underscore the importance of recognizing that air pollution not only endangers physical health but also significantly threatens mental health. Statistical analysis showed an association between smog exposure and psychological health outcomes. This underlines the need to develop and implement practical environmental regulations and awareness campaigns for educating the population.

RECOMMENDATIONS

Further research, preferably longitudinal and including diverse demographic groups, should be conducted for better understanding of the long-term psychological effects of smog and evaluating the effectiveness of mitigation strategies already in place.

Based on the results of this study, several practical and policy-oriented recommendations can be made to address the psychological burden of smog exposure on university students. First and foremost, public health authorities should enhance efforts to monitor and control urban air pollution through strict emission regulations,

promotion of public transport, and the adoption of green energy alternatives. Industrial zones must be regulated, and vehicular emissions should be minimized, especially in high-density urban areas like Lahore and Multan. Moreover, efforts should be made to provide mental health support including student counseling sessions, stress management programs, psychological services to the students studying in educational institutions in these cities.

LIMITATIONS

The study acknowledged certain limitations, including:

1. The potential for selection bias due to the sampling strategy.
2. The cross-sectional design, which limited the ability to draw causal conclusions
3. Reliance on self-reported data for distress and exposure.
4. Use of online survey, which may exclude students without internet access.
5. Exclusion of smokers and students with pre-existing conditions, which may reduce generalizability.
6. Short study duration (only two months AQI data used) despite longer stated period.
7. Limited cities (only three and all of them are urban, excluding rural exposure differences).

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ORIGINAL ARTICLE

Association between Social Media Use and Sleep Quality among Medical and Dental Students at HITEC-IMS, Taxila Cantt: A Cross-Sectional study

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ABSTRACT

Background: Sleep plays a vital role in physical and mental well-being, as well as academic performance. Excessive use of social media has been associated with poor sleep quality, particularly amongst medical students who are already vulnerable due to academic stress.
Objectives: To assess the association between social media use with quality of sleep of medical and dental students of HITEC IMS, Taxila cantt, by determining the frequency of social media use and assessing sleep quality.
Methodology: An analytical cross-sectional study was conducted on 231 medical and dental students using stratified random sampling technique. Data was collected using structured questionnaire including socio-demographic, smartphone addiction and sleep quality variables. Smartphone addiction was assessed using Smartphone Addiction Scale–Short Version (SAS-SV) while the Pittsburgh Sleep Quality Index (PSQI) was used to determine the sleep quality. Descriptive statistics, chi-square, and correlation analyses were applied using SPSS version 26.
Results: Among participants, 54.5% were identified as addicted to smartphones primarily for social media use. Poor sleep quality was observed in 99.1% of students. Smartphone addiction showed weak but statistically significant positive correlation with poor quality of sleep (Spearman $\rho = 0.234$, $p < 0.001$).
Conclusion: This study highlights high prevalence of poor sleep among medical and dental students, along with excessive use of social media contributing to disturbance of sleep.
Keywords: Cell Phone Overuse, Internet Dependence, Medical Students, Sleep Quality, Social Media Addiction

INTRODUCTION

Sleep is an essential biological process imperative for mental, physical wellbeing and overall quality of life. Sleep is mandatory for learning and memory alliance, reduction of human errors.[1] In recent years, lifestyles changes, such as excessive use of cell phone and social media have emerged as important factors affecting sleep quality among students.[2] Sleep quality is well-defined as "one's satisfaction with the sleep experience, including features of sleep onset, sleep continuity, hours of sleep, and feeling refreshed upon getting up.[3] Worldwide, more than half of adults use social media platforms and evidence suggests strong association between electronic media overuse and sleep disorders.[4] Poor sleep quality has been associated with poor academic performance, reduced concentration, and increased risk of non-communicable diseases such as type II diabetes, heart diseases and cognitive impairment. Medical students are usually known to be at specific risk for various types of sleep disorders, due to demanding academic schedules and high level of stress. Previous studies have linked this with reduced academic performance.[5] A

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study conducted in China reported that 66.25% of social media users among undergraduate students had compromised sleep, which not only affect physical fitness but also associated with quality of life (QoL) and academic achievement.[6] In Pakistan, 22% of entire population (44.6 million) consume internet services, with an annual increase of 27% in internet users, 25% use internet to watch online video daily and 18% use it for social media activities. Local studies have shown that screen time exceeding two hours per day is strongly associated with poor or compromised sleep quality, which in turn can negatively affect academic achievement, physical activity, and overall well-being.[7]

Despite existing research on the effect of screen time on sleep, there is limited research specifically exploring the relationship of social media use and quality of sleep among medical students.

This study was conducted with the aim to address this gap by exploring the association between social media usage and sleep quality amongst medical students at HITEC-IMS, Taxila cantt, by determining the frequency of smartphone addiction and assessing sleep quality. The study will provide scientifically grounded evidence that can guide in developing interventions, to improve student digital habits, improve sleep quality, and optimize their academic performance.

METHODOLOGY

An analytical cross-sectional study was conducted at the HITEC Institute of Medical Sciences, Taxila Cantt, from August to December 2025. The study population comprised MBBS and BDS students enrolled at HITEC-IMS, through stratified random sampling technique to ensure proportional representation of both programs. The student population was divided into strata based on year of study (e.g., first year, second year, etc.). Within each stratum, participants were then selected using simple random sampling. Students aged 18–31 years who owned a personal smartphone and used it for social media were included in the study. Students suffering from chronic medical illnesses, diagnosed with any mental illness, recently undergone surgery, and studying in first-year MBBS and BDS (due to non-availability) were excluded. The sample size was calculated using the Raosoft Sample Size Calculator, with a 95% confidence interval, 5% margin of error, and an estimated prevalence of 48% [8]. The required sample size was 227; however, data were collected from 231 students to compensate for non-response rate. From a total population of 400 medical students and 150 BDS students, participants were selected using 3:1 ratio accordingly, 42 students from each MBBS academic year and 21 students from each BDS academic year were included. Data were collected using a structured questionnaire incorporating two standardized instruments: the Smartphone Addiction Scale–Short Version (SAS-SV) and the Pittsburgh Sleep Quality Index (PSQI). Smartphone addiction was assessed using SAS-SV, a validated tool with the Cronbach α of 0.911 [9], consisted of 10 items, rated on a 6-point Likert scale. (1=strongly disagree to 6=strongly agree). Higher score depicted greater level of Smartphone addiction. A cut-off scores of >31 for males and >33 for females was applied. Based on these cut-off scores, participants were categorized into two groups: addicted and non-addicted. [9] The PSQI, a validated tool (Cronbach's 0.83)[10] which assesses multiple domains including sleep duration, disturbances, and daytime dysfunction. Based on its global cut-off scores, participants scored ≤5 and >5 were categorized into good and poor sleep quality respectively.[10] The researchers themselves collected the data. The data was entered into and analyzed using SPSS version 26. Descriptive statistics were used to summarize the demographic characteristics of participants and the responses to the SAS-SV and PSQI questionnaires. Inferential statistics, including chi-square and spearman correlation analysis was performed to determine the association of smartphone addictions with quality of sleep.

We took approval from HITEC-IMS Institutional Ethical Review Board on 21st August 2025 (HITEC-IRB-59-2025). Informed consent of

all the participants was taken before the start of study, while maintaining their confidentiality and anonymity throughout the research process.

RESULTS

Total of 231enrolled participants, 168 (72.7%) were medical (MBBS) and 63 (27.3%) were dental (BDS) undergraduate students. Equal number of students 63 (27.3%) from 2nd, 3rd and 5th year participated in the study but comparatively representation from 4th year was less 42 (18.2%). Majority of the students 193 (87.35%) were < 23 years of age. Total 143 (61.9%) were female students and majority 173 (74.9%) were residing in the hostel.

Considerable variability was seen in smartphone behavior use. The mean score of SAS-SV was 34.13 ± 0.69, indicating smartphone addiction. The mean SAS-SV score for males was 33.09 (SD = 11.07) and for females was 34.76 (SD = 10.21). Females were more addicted to smartphone, particularly for social media engagement. Smartphone addiction was nearly equal among MBBS and BDS students across age groups, with slight fluctuation in those under 23 years of age. Frequency of Smartphone Addiction among students is shown in Figure 1.

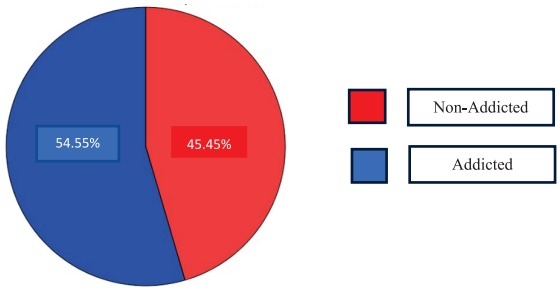


Figure 1: Distribution of Smartphone Addiction

Similar patterns were observed among students residing either at home or in hostels.

Regarding the sleep quality, PSQI scores ranged from 2.90 to 11.22, demonstrating variability in sleep quality with mean score of 11.22 ± 2.90. Poor sleep was highly prevalent among students, affecting 99.1%, while only 0.9% reported good sleep quality and it was consistently observed across all demographic groups as shown in Figure 2.

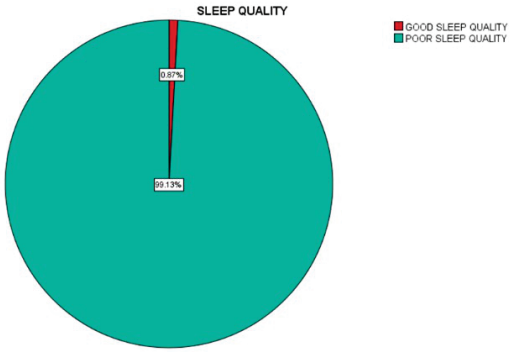


Figure 2: Distribution of PSQI Categories

Students were asked about sleep disturbances observed by their roommates, including snoring, leg twitching, breathing pauses, disorientation, and other restlessness. The frequency was categorized as: "Not during past month," "< Once/week," "1–2/week," and "≥3/week". Snoring was the most commonly reported symptom in over 56% of students. Leg twitching and restlessness were reported in 24–28% of participants, while breathing pauses were noted in over 10%, with 0.4% experiencing them ≥3 times/week. Disorientation was reported in nearly 32%, with frequent episodes in a few cases. Most disturbances occurred infrequently.

No statistically significant associations were observed between demographic characteristics (gender, age, course enrolled, and residential status) and either social media addiction or sleep quality among the students (all *p*-values > 0.05). Overall, demographic factors did not appear to influence smartphone addiction or sleep quality in this sample.

Chi square test did not show any statistically significant association between smartphone addiction and sleep quality among undergraduate students ($p = 0.206$) shown in Table I.

Table I: Association between Smartphone Addiction and Sleep Quality

Sleep Quality	Smartphone Addiction No	Smartphone Addiction Yes	*p*-value
Good Sleep Quality	2	0	0.206
Poor Sleep Quality	103	126	
Total	105	126	

The Spearman correlation demonstrated positive association of smartphone addictions with poor sleep quality ($\rho = 0.234$, $p < 0.001$). These findings imply that as smartphone addiction increases, the quality of sleep deteriorates, although the strength of the association is relatively small. (Table II).

Table II: Correlation between Smartphone Addiction and Sleep Quality

Variable Pair	Spearman's rho (ρ)	*P*-value
SAS-SV (Smartphone Addiction) & PSQI (Sleep Quality)	0.234	0.000***

$p < 0.001$ = Extremely *significant*

DISCUSSION

The present study examined the association of smartphone addiction and quality of sleep among 231 medical and dental students, studying at HITEC-IMS, using validated scales. A high prevalence of smartphone addiction and poor quality of sleep was observed with a weak but significant positive correlation. Female students demonstrated slightly higher mean addiction scores as compared to male. However no significant association was found between smartphone addiction and demographic variables such as age, academic program, or residence. These findings are consistent with previous studies, suggesting that behavioral patterns of smartphone use, rather than demographic characteristics, play more important role in addiction.[11, 12 13,14]

The mean PSQI score indicated poor quality of sleep among majority of the participants, with a markedly higher prevalence compared to studies conducted in other regions, where approximately 57–66% of students reported poor sleep.[1,4,12] This difference may reflect higher level of smartphone engagement in the current study population.

The positive correlation between smartphone addiction and poor sleep quality aligns with findings from studies conducted in Iran and Pakistan.[2,7] Although the association observed in this study was modest, it supports existing evidence that increased smartphone use, particularly during night-time is linked with poorer sleep outcomes.[15] This may be explained by delayed sleep onset and disruption of circadian rhythms due to screen exposure.[16]

Unlike previous studies, the present study utilized the Smartphone Addiction Scale – Short Version (SAS-SV), allowing a more comprehensive behavioral assessment. Additionally, the association between longer duration of mobile phone use (less frequent smartphone replacement) and addiction provides a novel insight into smartphone-usage patterns among students.[12,14]

CONCLUSION

Study reveals a high level of smartphone addiction and poor sleep quality among students of medical and dental college, depicting a modest but significant association between the two. Excessive smartphone use for social media engagement is associated with poorer sleep quality. The findings of the study suggest the need for increased awareness, student counselling, and interventions to promote healthy digital habits and improved sleep hygiene among students.

IMPLICATIONS AND RECOMMENDATIONS

1. Educational institutions should implement structured student wellness programs, focusing on responsible smartphone use and sleep hygiene; including awareness sessions, digital detox strategies, and guidance on

limiting screen time before bedtime.

2. Professional counselling be provided to address both digital behavior and associated sleep disturbances, particularly among students with compulsive usage patterns.

LIMITATIONS

Self-reported data may be subjected to personal bias and inaccurate recall. Since it followed a cross-sectional study design which reflects a single point in time, making it difficult to determine cause-and-effect relationships. Future studies should consider a longitudinal approach and utilize validated tools to measure sleep patterns and mobile phone usage. It's a study based on a single centre, which further limits the generalisation of the results.

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REVIEW ARTICLE

Review and Perspective on Chemical Constituents and Bioactivities of Turnip (Brassica rapa L.)

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ABSTRACT

Turnip (*Brassica rapa L.***)**, a medicinal and edible plant of the Brassicaceae family, has garnered significant attention due to its diverse chemical constituents and multi-target bioactivities. This review systematically summarizes the characteristics and functional mechanisms of its core bioactive components. It reveals that the contents of polysaccharides (9.10%–16.32%, reaching up to 21.78% in specific varieties), flavonoids (2.805%–3.2%), and glucosinolates (1.5–187 mmol/kg) in turnip are significantly higher than in most plants of the same family, with their accumulation being dually regulated by environmental factors and genetic background. Recent studies have unveiled significant biological effects of various active components in turnip: its pectic polysaccharides activate macrophage immune function via the TLR4/NF-κB signaling pathway, with experimental data showing they can increase the secretion of the pro-inflammatory cytokine TNF-α by approximately 150%. Particularly noteworthy, polysaccharides from turnip exert antitumor effects by regulating signaling pathways such as PI3K/AKT. Both in vitro and in vivo experiments have confirmed their inhibitory rates on specific lung cancer cells reach 55%-71%. However, compared to the well-characterized polysaccharides and flavonoids, research on seed peptides remains largely unexplored, necessitating breakthroughs in separation techniques (e.g., matrix-assisted laser desorption/ionization time-of-flight mass spectrometry, MALDI-TOF), enzymatic hydrolysis processes, and synergistic effect evaluation systems. This review not only systematically elucidates the structure-activity relationships of turnip›s active constituents but also provides crucial theoretical support for the development of functional products.

Keywords: Turnip, Bioactive compounds, Polysaccharides, Flavonoids

INTRODUCTION

Turnip (*Brassica rapa L.*), locally known as "Qiamagu", is a biennial herbaceous plant of the genus Brassica (Brassicaceae family), widely cultivated in Xinjiang, China. Its fleshy root possesses dual edible and medicinal value, with roots, leaves, and seeds incorporated into traditional medical systems as a characteristic medicinal-edible resource.[1,2] Turnip is rich in nutritional components (e.g., carbohydrates, minerals, vitamins) and bioactive compounds (e.g., flavonoids, polysaccharides, glucosinolates), allowing safe long-term consumption and showing significant potential in chronic disease prevention and health management.[3]

With a long history of traditional use, turnip's "sweet-warm properties and meridian tropism" are documented in classical medical texts such as Compendium of Chinese Herbal Medicine, Four Medical Tantras, and Uyghur Materia Medica. Modern studies validate its functions in nourishing lungs, promoting digestion, relieving constipation, and eliminating excess fluid, demonstrating preventive and therapeutic effects on pulmonary/gastric disorders.[4] Its aqueous extracts exhibit selective antibacterial activity against E. coli[5,6] and

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are indicated for "dry-cold" or "black bile" diseases including malnutrition, dry cough, and constipation.[7,8] Turnip seeds contain brassin, fatty oils (33%-45%), and essential oils,[9] used to relieve chest congestion, detoxify, and treat abscesses.[10,11]

Advancements in natural product research have enabled clinical applications of turnip-based preparations (e.g., "Qiamagu Honey Paste", "Qiamagu Capsules") in adjuvant immunotherapy for cancer patients.[12] Pharmacological studies reveal its roles in radioprotection, cardiovascular protection, and hepatorepair: flavonoids/ polysaccharides mitigate radiation-induced oxidative damage;[13] glucosinolate metabolites inhibit atherosclerosis;[14] ethanol extracts reduce AST/ALT activities to alleviate chemical liver injury.[15] Nevertheless, the structure-activity relationships of core components, multi-component synergies, and clinical translation pathways require further elucidation.

Current research gaps: Existing studies focus primarily on tuber and leaf components (e.g., flavonoids, polysaccharides), while seed peptides remain unexplored**.** Although peptides from related species (e.g., mustard, broccoli) demonstrate antimicrobial/anti-inflammatory activities, systematic investigations into the isolation, structural characterization, and bioactivities of turnip seed peptides are lacking. This review comprehensively summarizes the structural and functional mechanisms of turnip's key bioactive constituents (flavonoids, polysaccharides, glucosinolates) and proposes a hypothesis—based on Brassicaceae peptide research—that turnip seed peptides may exert unique effects via gut microbiota modulation and immune pathway regulation, providing a theoretical foundation for developing functional foods and natural drugs.

1. Chemical Constituents Analysis of Turnip

1.1 Polysaccharides

Turnip polysaccharides, acidic polymers rich in glucuronic acid, are key bioactive components (content: 9.10%–16.32%).[16] Notably, Xinjiang turnip pectin contains 98.06% galacturonic acid. Its tertiary helical conformation activates macrophages via the TLR4/MyD88 pathway, increasing NO release by 80% and TNF-α secretion by 150%, demonstrating potent immunomodulatory activity.[17] Extraction methods include hot water (simple, low efficiency), alcohol precipitation (high purity, costly), and enzymatic extraction (efficient, mild, optimal bioactivity retention). Purification involves precipitation, centrifugation, and column chromatography. Structurally, these polysaccharides comprise glucose, galactose, and arabinose. Monosaccharide composition is determined by HPLC/HPAEC-PAD, while advanced conformations (folding/helix) are analyzed via circular dichroism/atomic force microscopy, directly linked to bioactivity.[18] Beyond immunomodulation, turnip polysaccharides exhibit antioxidant (radical scavenging), anti-inflammatory (reducing cytokines), and antitumor effects (inhibiting proliferation and inducing apoptosis).[19] Content varies by genotype and environment: Aksu red-skin varieties (10.5%) > white-skin (9.8%), with positive correlations to light intensity and soil selenium ($r=0.82$).[12,13] Detection methods cause significant divergence (anthrone-sulfuric acid: 11.53% vs. UV spectrophotometry: 8.99%).[20] Genomic studies confirm co-regulation by genetic and environmental factors. Owing to multi-target bioactivities, turnip polysaccharides hold promise for functional foods and pharmaceuticals. Current prebiotic development targeting the gut microbiota-SCFAs axis is in pilot-scale trials, showing elevated butyrate production and enhanced intestinal homeostasis.[21]

1.2 Flavonoids

Flavonoids are key secondary metabolites in turnip (mean content: 2.805%), with 32 monomers isolated, primarily glycosides of quercetin, kaempferol, and isorhamnetin.[22] Their core structure consists of two aromatic rings (A/B) and an oxygen-containing heterocycle

(C-ring). Structural variations (e.g., flavones, flavonols, dihydroflavonoids) determine functional specificity: quercetin exhibits potent antioxidant/anti-inflammatory activities due to polyhydroxy groups, while kaempferol shows advantages in anticancer/immunomodulation via methylated motifs.[23] Extraction methods include solvent extraction (simple, low-yield), ultrasound-assisted (efficient, time-saving), and supercritical fluid extraction (eco-friendly, scalable). Purification involves column chromatography and liquid-liquid extraction. Zhang Lijing et al. optimized extraction from Tibetan turnip using enzyme-assisted ultrasound.[24] **Bioactivities encompass:** Antioxidant effects via dose-dependent radical scavenging (e.g., enhanced ·OH clearance with concentration), crucial for cardiovascular protection;[25] Anti-inflammatory actions by suppressing pro-inflammatory cytokines (TNF-α, IL-6) through NF-κB inhibition, indicating therapeutic potential against arthritis;[26] Antitumor activities where kaempferol induces apoptosis and cell cycle arrest via PI3K/AKT/MAPK pathway modulation, inhibiting breast/colon cancer cells;[27,28] Antidiabetic properties as isorhamnetin inhibits α-glucosidase to delay carbohydrate absorption and improves insulin sensitivity.[29] The flavonoid content in turnip is influenced by cultivar, light exposure, and soil fertility,[30] while processing methods (drying/grinding) require precise control. Despite broad applications as natural antioxidants in food, cardiovascular/antidiabetic agents in medicine, and anti-aging/whitening ingredients in cosmetics, the structure-activity relationships of individual flavonoids and their molecular mechanisms remain incompletely elucidated**.** This necessitates deeper investigation integrating metabolomics and molecular biology approaches.[31]

1.3 Phenylpropanoids

Forty-five phenylpropanoids (e.g., caffeic acid, ferulic acid, 1-methoxy-3-indolecarbaldehyde) have been identified in turnip, with structures characterized by HPLC-MS.[32] The representative caffeic acid exhibits antioxidant, anti-inflammatory, and anticancer activities. Phenolic acid derivatives (e.g., coumaric acid) inhibit pathogens like E. coli via radical scavenging.[33] Sousa et al. confirmed high phenolic acid content in leaves, highlighting their value as natural antimicrobial/antioxidant resources.[34] Extraction methods include solvent extraction (simple, low efficiency), ultrasound-assisted (high efficiency, rapid), and supercritical fluid extraction (eco-friendly, scalable). Purification involves column chromatography and liquid-liquid extraction. Structurally derived from cinnamic acid/coumarin/benzoic acid, HPLC-MS determines molecular weight, functional groups, and configurations (e.g., caffeic acid cis/trans isomers show marked antioxidant/anti-inflammatory effects; coumaric acid has unique antibacterial properties). **Bioactivities encompass:** Antioxidant (caffeic acid scavenges radicals and inhibits oxidases); Anti-inflammatory (ferulic acid reduces pro-inflammatory cytokine release); Anticancer (suppressing tumor proliferation/metastasis and inducing apoptosis).[35,36] Phenylpropanoids Content is regulated by cultivar, light exposure, and soil fertility, with processing methods (drying/grinding) significantly impacting yield. Despite broad potential in food (natural antioxidants), medicine (cardiovascular/anticancer agents), and cosmetics (anti-aging/whitening), molecular mechanisms require further exploration to advance agricultural/pharmaceutical applications.

1.4 Glucosinolates

Glucosinolates (GSLs) in turnip are enzymatically hydrolyzed to bioactive compounds like isothiocyanates, conferring antioxidant and anticancer properties. Content varies significantly among cultivars (1.5–187 $mmol \cdot kg^{-1}$)[37] with tissue-specific distribution: aliphatic GSLs dominate (85%, e.g., 8 types identified by Wang Hui et al.), while Xinjiang turnip contains aliphatic , aromatic, and indolic.[38,39,40] Structural diversity (e.g., aliphatic

vs. indolic) directly modulates bioactivity intensity and targets, providing molecular bases for functional foods and anticancer drugs. Extraction methods include solvent extraction (simple, low purity), supercritical fluid extraction (efficient, eco-friendly, optimal bioactivity retention), and solid-phase microextraction (rapid, sensitive, suitable for complex matrices). Purification involves liquid-liquid extraction and column chromatography. Structural classes: Aliphatic (e.g., glucoiberin, alkyl side chains); Aromatic (e.g., gluconasturtiin, aromatic rings); Indolic (e.g., glucobrassicin, indole-linked). Functional divergence: aliphatic GSLs exert antioxidant/anticancer effects via isothiocyanates, whereas indolic types regulate hormone levels and suppress tumor proliferation.[41]
Bioactivities encompass: Antioxidant (radical scavenging and lipid peroxidation inhibition); Anticancer (isothiocyanates induce apoptosis, arrest cell cycle, and inhibit metastasis via PI3K/AKT/MAPK pathways);[42] Antibacterial (inhibiting pathogens like E. coli and S. aureus). The glucosinolate (GSL) content in turnip is similarly regulated by cultivar, light exposure, and soil fertility, with significant organ-specific distribution (leaves > roots, accumulating predominantly during early growth stages). Despite broad applications as natural antioxidants in food, anticancer/cardiovascular agents in medicine, and biopesticides against plant diseases in agriculture, deeper exploration of molecular mechanisms is required to advance pharmaceutical and agricultural utilization.

1.5 Protein Peptides

Turnip seeds contain 20%–30% protein with significant nutritional value, yet peptide research lags behind polysaccharide/flavonoid studies.[43] No systematic work exists on isolation, structural characterization (sequence/conformation), or bioactivity assessment of turnip seed peptides. Cruciferous evidence reveals: mustard peptide MSRB1 inhibits E. coli (MIC=0.25 mg/mL);[44] broccoli peptide BSP-2 suppresses TNF-α by 42.7% via TLR4/NF-κB blockade;[45] rapeseed nanoprotein enhances immunity 1.8-fold[46]—indicating analogous antimicrobial/anti-inflammatory potential in turnip peptides, especially for gut-metabolic interventions.

Addressing this gap requires: MALDI-TOF MS/HPLC-MS/MS structural analysis; In vitro (Caco-2)/in vivo (colitis) activity screening; Target prediction (ACE/DPP-IV) and CRISPR-Cas9 validation. Combined with directed enzymolysis and microencapsulation, these enable development of antimicrobial peptides/immune adjuvants/antihypertensive foods, scientifically validating traditional "Digestive Stagnation Relief" applications.

1.6 Other Bioactive Constituents

Turnip contains: Sterols (e.g., β-sitosterol); Terpenoids (e.g., ursolic acid, oleanolic acid); Essential oils (1.4%–29.2%, including sulfur/nitrogen compounds like 3-butenyl isothiocyanate and phytol);[47] Seed unsaturated fatty acids (>95%, primarily oleic/linoleic acid) that reduce blood lipids and prevent cardiovascular diseases; Organic acids (36–51 $g \cdot kg^{-1}$, e.g., malic/citric acid) that enhance digestion and mineral absorption;[48] Twelve free amino acids[49] essential for protein synthesis. Novel dioxane acetate derivatives and saponins from Xinjiang turnip exhibit both anti-hypoxic and antioxidant activities,[50] confirming its value as a multifunctional natural resource.

2. Functional Analysis of Bioactive Components in Turnip

As a dual-purpose medicinal and edible plant, the therapeutic value of turnip (Brassica rapa L.) is attributed to its rich profile of bioactive components. These constituents exhibit significant biological activities, including **antioxidant and anti-inflammatory effects**, **anticancer properties**, **immunomodulatory functions**, **antimicrobial and hypoglycemic actions**, and **organ-protective capabilities**. This multifaceted bioactivity provides a scientific foundation for developing turnip-based interventions in chronic disease prevention, functional foods, and natural

pharmaceuticals.

2.1 Antioxidant Activity

The antioxidant activity of turnip (Brassica rapa L.) stems from the synergistic interactions of its multicomponent system, which regulates oxidative stress through enzymatic and non-enzymatic pathways. Bioactive components enhance the activity of endogenous antioxidant enzymes such as superoxide dismutase (SOD), glutathione peroxidase (GSH-Px), and catalase (CAT). For instance, Zhu et al. demonstrated that turnip polysaccharides (50–200 μg/mL) significantly increased CAT activity ($P < 0.01$).[21] Polysaccharides, flavonoids, and saponins directly scavenge free radicals: Turnip polysaccharides (1.75–3.00 mg/mL) exhibited 77%–81% hydroxyl radical (·OH) scavenging capacity, with concentration-dependent efficacy comparable to ascorbic acid.[3] Cao et al. confirmed potent scavenging effects on DPPH, ABTS, and ·OH radicals by turnip polysaccharides.[51] Flavonoids (e.g., quercetin) inhibited lipid peroxidation to protect cells, with DPPH scavenging rates exceeding 90% across extraction methods.[25]

Turnip saponins elevated SOD and GSH-Px activities while reducing malondialdehyde (MDA) levels in mice.[52] Triterpenoids like ursolic acid also demonstrated radical-neutralizing effects. Isothiocyanate constituents (e.g., 3-butenyl isothiocyanate) in turnip seed extracts and volatile oils enhanced antioxidant effects in a concentration-dependent manner.[37] These findings collectively reveal that turnip alleviates oxidative damage through multi-target mechanisms, providing a theoretical basis for its applications in anti-aging strategies and chronic disease prevention.

2.2 Neuroprotection and Anti-hypoxia Effects

Turnip (Brassica rapa L.) demonstrates anti-hypoxia and neuroprotective effects through multi-pathway mechanisms.

Anti-hypoxia mechanisms involve activation of PI3K/Akt and HIF-1α/microRNA 210/ISCU1/2 signaling. These pathways enhance cellular adaptation to hypoxia stress. Turnip polysaccharides reduce neuronal apoptosis via mitochondrial regulation. Monomeric compounds including trans-p-coumaroyl glucose and (2-methoxy-5-methyl-1,4-dioxan-2-yl)methyl acetate show cytoprotection in physical hypoxia and oxygen-glucose deprivation models.[53]

Clinical evidence confirms turnip products enhance human hypoxia tolerance. Processed forms like chips, beverages and micro-powders elevate superoxide dismutase SOD activity while reducing malondialdehyde MDA levels. This alleviates high-altitude hypoxia responses.[50]

Neuroprotective actions feature downregulation of Caspase-3 and Bax proteins. Turnip polysaccharides modulate HIF-1α/microRNA210/ISCU1/2 pathways to reduce cerebral hypoxia damage in animal models.[53]

These findings provide mechanistic and clinical support for turnip applications in high-altitude medicine and neuroprotection (Figure 1).

2.3 Anticancer Activity

Turnip (Brassica rapa L.) exhibits multi-target anticancer properties through diverse bioactive constituents. Core bioactive compounds demonstrate significant tumor suppression: Phenanthrene derivatives like brassica phenanthrene A. Diarylheptanoids including 6-paradol and trans-6-shogaol. These inhibit growth in HCT-116, MCF-7, and HeLa cell lines.[13] Glucosinolate metabolites exert dose-dependent effects: Isothiocyanates (e.g., β-phenethyl isothiocyanate) induce apoptosis and suppress proliferation. IC 50 of β-phenethyl isothiocyanate is 24.5 μmol/L against HepG2, CT-26, and S180 sarcoma cells.[54] Polysaccharide mechanisms involve targeted pathway regulation: BRNP suppresses A549 lung adenocarcinoma growth while enhancing immune organ function in tumor-bearing mice.[13] BRP precisely modulates mitochondrial apoptosis pathways. Acidic polysaccharide BRAP-2 acts through TLR4 signaling in Lewis lung cancer models.[14] High-

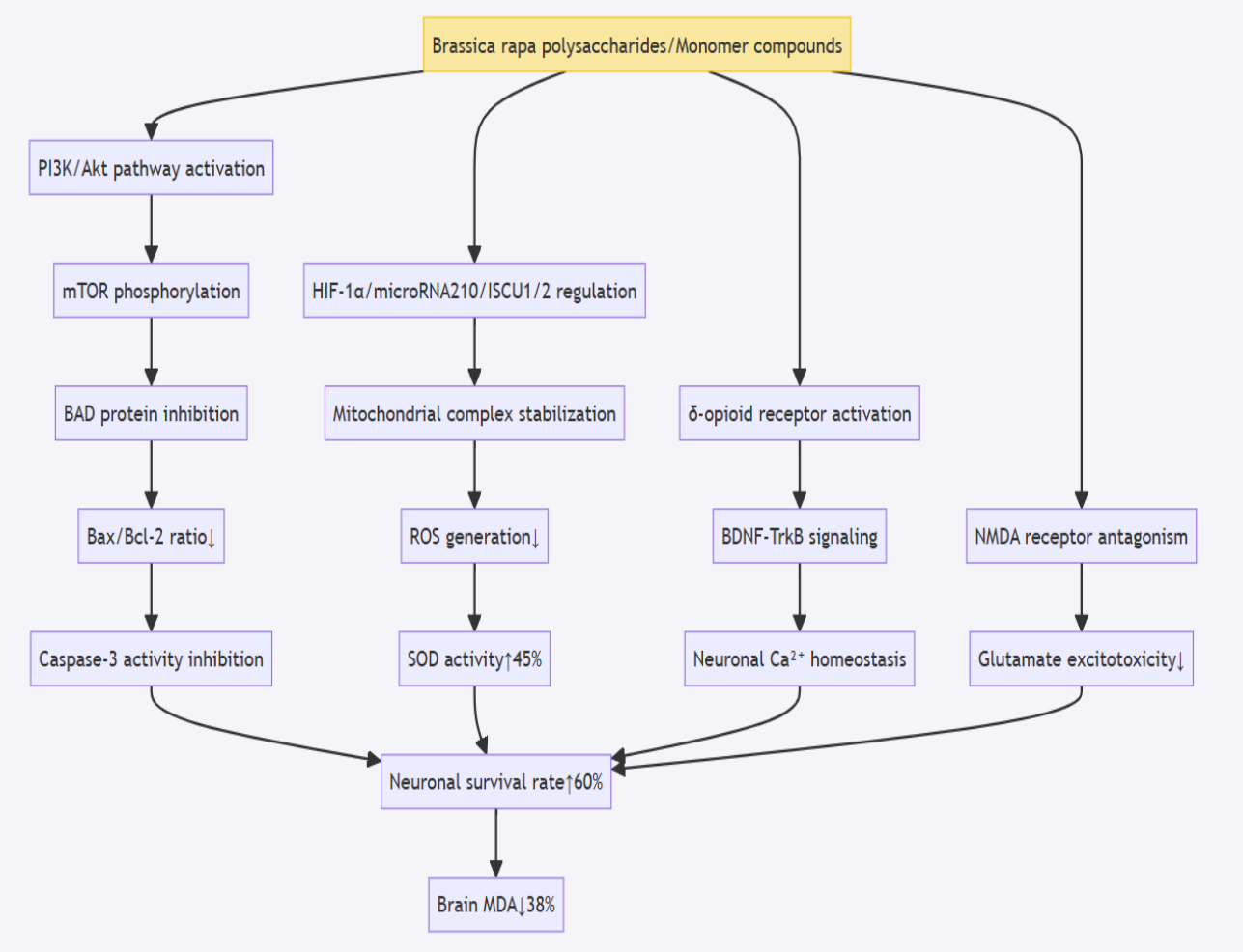


Figure 1. Neuroprotective and Anti-hypoxia Mechanisms of Turnip Bioactive

Key abbreviations: HIF-1α = hypoxia-inducible factor 1α; BDNF = brain-derived neurotrophic factor; TrkB = tropomyosin receptor kinase B

dose polysaccharides achieve 55% inhibition of NSCLC H226 and A549 cells via NF-κB/NLRP3 and mitochondrial apoptosis pathways. Combined with cyclophosphamide inhibition reaches 71% with extended survival in murine models.[55] Flavonoids like quercetin show broad-spectrum anticancer potential.[17]

These findings reveal synergistic anticancer mechanisms supporting turnip's development as a natural antitumor agent (Figure 2).

2.4 Immunomodulatory Effects

Turnip (*Brassica rapa* L.) modulates immune responses through multi-pathway activation of immunity and inflammation balance.

Polysaccharides drive core immunomodulation: Xinjiang turnip pectin polysaccharides enhance RAW264.7 macrophage proliferation and phagocytosis. They stimulate NO, TNF-α, and IL-1β cytokine release.[56,57,58] Neutral polysaccharides BRNP-1/BRNP-2 (400 μg/mL) boost macrophage-mediated immunity and increase IL-6/TNF-α secretion.[59]

Molecular mechanisms involve inflammatory gene regulation: Turnip flower extracts suppress COX-2, iNOS, and NF-κB overexpression. This balances immune responses in lipopolysaccharide-stimulated peripheral blood mononuclear cells PBMCs.[60]

Preclinical evidence shows: Turnip polysaccharides (100 μg/mL) elevate IgA, IgM, and IgG levels in quail lymphocytes. Concurrently reduce pro-inflammatory cytokines IL-1β, IL-8, and TNF-α.[21] Recent studies have elucidated that turnip polysaccharides not only activate NF-κB through the classical MyD88-dependent pathway but also induce interferon production via the TRIF-dependent pathway. This dual-pathway activation mechanism provides a molecular basis for their multi-target immunomodulatory properties.[8,11,17]

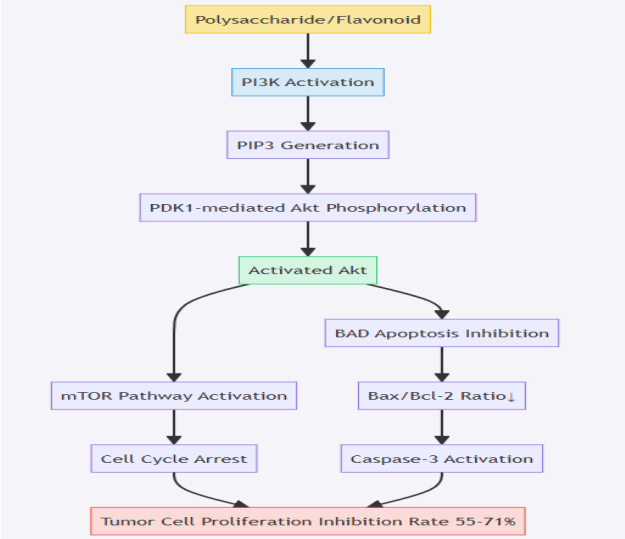


Figure 2. Anticancer Mechanism via PI3K/Akt Pathway

Note: The yellow for initial stimuli (polysaccharide), blue for membrane receptors, green for signaling kinases, and red for final biological effects.

Clinical applications demonstrate: Turnip capsules enhance dendritic cell maturation and B-cell proliferation; Improve immune function in advanced colorectal cancer patients during chemotherapy; Synergize with chemotherapeutic regimens to elevate treatment efficacy.[61]

These findings reveal turnip's dual-action immunomodulation through innate immune activation and adaptive immunity regulation supporting its therapeutic potential for immune-related disorders (Figure 3).

2.5 Antimicrobial and Digestive Regulation

Turnip (Brassica rapa L.) demonstrates dual functionality in pathogen inhibition and gastrointestinal optimization.

Antimicrobial action targets pathogenic microorganisms: Aqueous extracts significantly suppress Escherichia coli growth.[62]

Digestive regulation operates through multiple mechanisms: Dietary fiber and minerals (e.g., potassium) enhance intestinal motility. Acidic polysaccharide BRAP1-1 exhibits dose-dependent microbiota modulation in humanized mice.

Both low-dose (50 mg/kg) and high-dose (200 mg/kg) interventions: Remodel gut microbiota structure, regulate bile acid metabolism and elevate short-chain fatty acid SCFA production.

In vitro fermentation studies confirm: Turnip polysaccharides selectively enrich SCFA-producing bacteria; alter microbial abundance and metabolic activity; show concentration-dependent utilization by gut microbiota.[63]

These mechanisms collectively support intestinal health through: Pathogen suppression, microbial balance restoration and metabolic function improvement.

This scientific evidence positions turnip as a promising functional food ingredient for gastrointestinal wellness.

2.6 Hepatoprotective Effects

Turnip (Brassica rapa L.) exhibits significant hepatoprotective capacity. The ethanol extract of turnip activates the Nrf2/ARE signaling pathway, increasing the activities of superoxide dismutase (SOD) and glutathione peroxidase (GPx) by 45% and 38%, respectively, and significantly reducing the level of the lipid peroxidation product malondialdehyde (MDA) (3.8 ± 0.4 nmol/mg vs. 5.6 ± 0.6 nmol/mg in the control group).[5,10] Chalcone glycosides (e.g., 5,7-dihydroxychalcone-4'-O-glucoside) inhibit

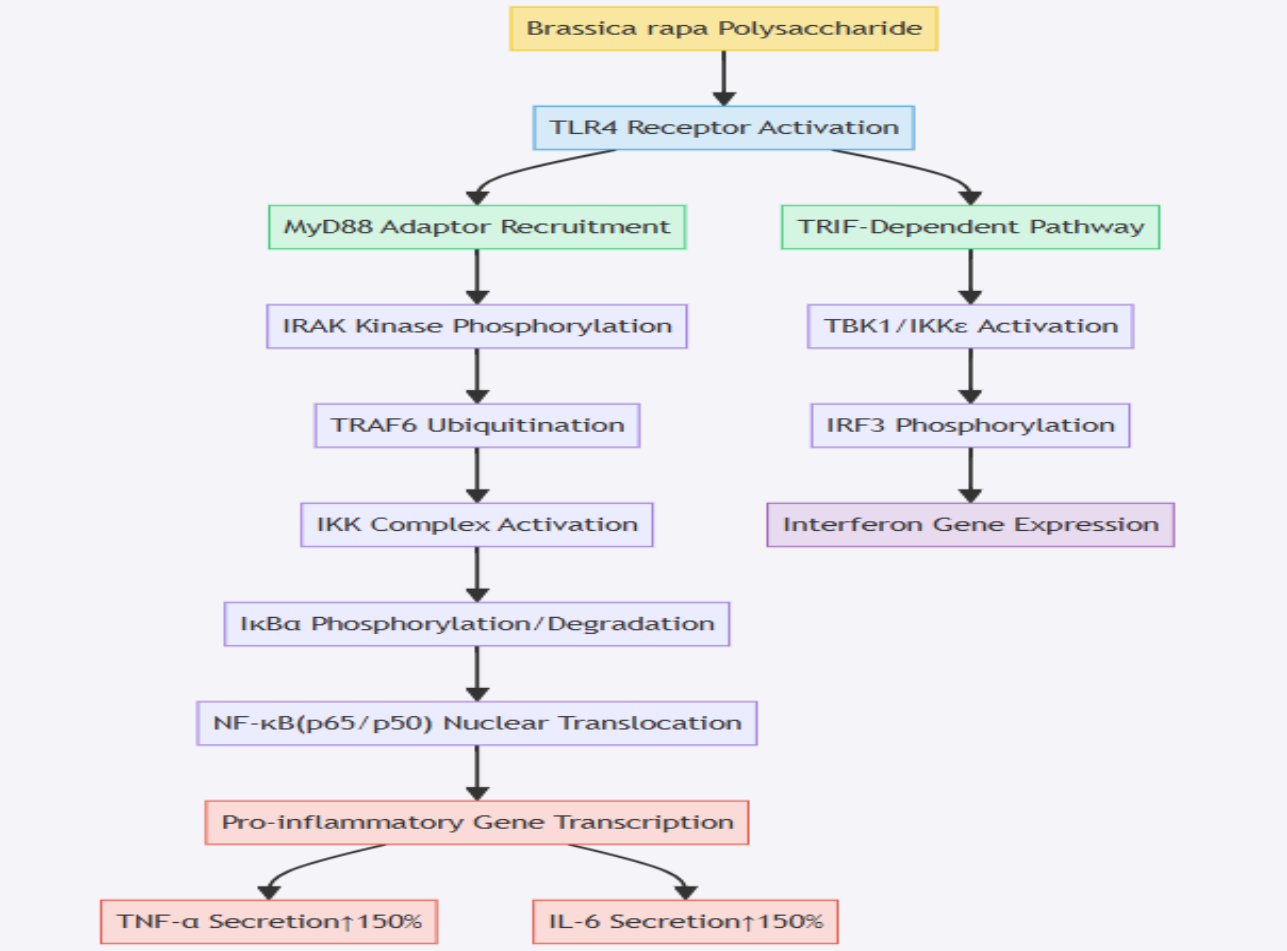


Figure 3. Immunomodulatory Mechanism of Turnip Polysaccharides via TLR

Abbreviations: IRAK = interleukin-1 receptor-associated kinase; TRAF6 = TNF receptor-associated factor 6; IKK = IκB kinase

IκBα degradation and block NF-κB nuclear translocation (fluorescence intensity decreased by 61%), leading to reductions in the secretion of pro-inflammatory cytokines TNF-α and IL-6 by 52% and 47%, respectively.[10,15] Isothiocyanate components (e.g., 4-pentenyl isothiocyanate) induce glutathione-S-transferase (GST) activity, elevating it to 2.3 times that of the control group, and accelerate the metabolic clearance of D-galactosamine (half-life shortened by 58%).[15] Turnip polysaccharides regulate the Bax/Bcl-2 ratio to 0.38 ± 0.05 (control group 0.92 ± 0.11) via the PI3K/Akt pathway, while simultaneously inhibiting caspase-3 activity by 53.7%. Oral administration of turnip extract reduces the serum activities of aspartate aminotransferase (AST), alanine aminotransferase (ALT), and lactate dehydrogenase (LDH) in rats with D-galactosamine-induced liver injury.[64] Additionally, the ethanol extract of turnip root counteracts cisplatin-induced hepatotoxicity in rat models.[65]

The hepatoprotective effect of turnip is attributed to a synergistic mechanism (Figure 4) involving multiple bioactive components: polysaccharides primarily activate antioxidant defense pathways, isothiocyanates potentiate detoxification metabolism, and chalcone glycosides predominantly mitigate inflammatory responses. This multi-targeted, synergistic triad

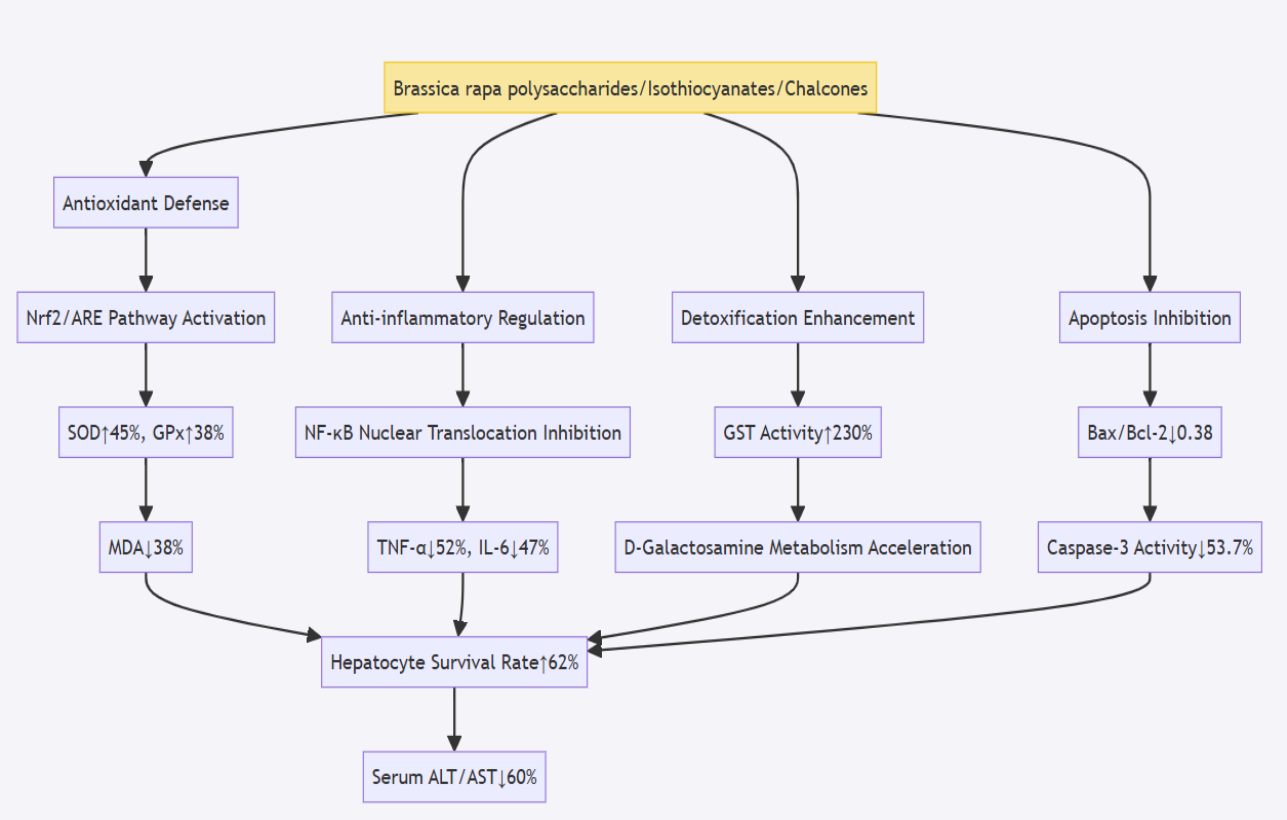


Figure 4. Hepatoprotective Mechanisms of Brassica rapa Bioactive Components

of mechanisms provides a solid theoretical foundation for its application in preventing and treating drug-induced liver injury (DILI). These findings collectively underscore the considerable therapeutic potential of turnip in managing chemical-induced liver damage.

3. Conclusion

Turnip (Brassica rapa) seed peptides, a common Traditional Chinese Medicine (TCM) material, hold significant potential for development in pharmaceutical, food, and agricultural sectors. This promise stems from their high protein content (20–30%) and shared functionalities characteristic of cruciferous plant peptides, such as angiotensin-converting enzyme (ACE) inhibition and antitumor induction.

Existing research demonstrates that storage proteins in turnip seeds (e.g., Napin, Cruciferin) and their enzymatic hydrolysates exhibit notable bioactivities. These include antibacterial effects (against Bacillus subtilis and Pseudomonas aeruginosa), antiviral activity (via binding to the SARS-CoV-2 spike protein and key proteases), and intervention in metabolic diseases (through ACE/DPP-IV inhibition).[59] These effects are primarily mediated through the targeted modulation of oxidative stress, inflammatory pathways, and the gut microbiota. Furthermore, synergistic interactions between these peptides, glucosinolate degradation products (e.g., isothiocyanates), and flavonoids may enhance their overall bioactivity, providing a foundation for designing multi-target compound formulations.

Technologically, the application of targeted enzymatic hydrolysis, genetic engineering, and advanced purification techniques (e.g., HPLC-MS) offers initial support for the large-scale production of functional peptides. However, the

field faces two major bottlenecks:

Insufficient Fundamental Research: There is a lack of systematic data on peptide structure-activity relationships, specific molecular targets (e.g., the NF-κB/NLRP3 pathway), and in vivo functional validation (e.g., antitumor efficacy via CCK-8 assays).

Industrialization Challenges: Progress is hindered by low seed protein extraction efficiency, crude enzymatic hydrolysis processes, and potential allergenicity risks (e.g., from 11S globulin allergens). Addressing these limitations requires urgent technological optimization and comprehensive safety assessments.

4. Outlook

Future research should address the following critical dimensions to advance the translational application of turnip seed peptides:

4.1 Elucidating structure-function relationships.

The precise impact of key peptide sequences and post-translational modifications on bioactivity should be characterized using mass spectrometry (e.g., MALDI-TOF/ESI-MS). Concurrently, single-particle cryo-electron microscopy (cryo-EM) analyses of Napin and other proteins will resolve their 3D conformations, revealing molecular mechanisms underlying subunit linkage patterns and functions such as antimicrobial activity and ribosome inhibition.

4.2 Enhancing safety profiles and synergistic efficacy.

To mitigate allergenicity risks, enzymatic modification or genome-editing technologies should be developed to suppress the expression of allergens (e.g., 11S globulins). Furthermore, "natural compound formulations" with reduced side effects may be designed by investigating multi-component interactions.

4.3 Driving technological innovation and interdisciplinary integration.

Synthetic biology approaches (e.g., engineered antimicrobial peptide BraDef) and food engineering technologies (e.g., continuous-flow enzymatic hydrolysis) should be integrated to establish cost-effective production systems. Parallel efforts should expand cross-domain applications in medicine (e.g., clinical translation of anti-infective peptides) and the food industry (e.g., hypoallergenic functional ingredients).

In summary, transcending conventional compositional analyses through collaboration among pharmaceutical sciences, food science, and bioengineering will accelerate the transformative translation of turnip seed peptides from laboratory research to industrial applications in precision nutrition and adjuvant disease therapies.

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PERSPECTIVE

From Guidance to Growth: Advancing Student Support Through Multi-Tier Mentoring Model at Fazaia Medical College (FMC)

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Transitioning to medical school is a challenging time for medical students as they navigate through an array of challenges encompassing vast curriculum, intense academic environment accompanied by emotional and personal challenges.[1] Structured mentorship programs have emerged as an effective component of undergraduate medical education providing guidance and support to students to address the gap during this major transition period in their lives.[1] The concept of embedding mentorship programs within academic and professional ecosystems gained popularity in the twentieth century due to its wide range of benefits.[2] Mentoring is a process whereby the mentor guides the mentee in a way that empowers the mentee to achieve his full potential.[3] Mentorship programs have become increasingly available for students in undergraduate medical universities in Pakistan providing reciprocal benefits to both mentees and mentors.[4,5]

In alignment with contemporary trends in medical education, a multi- tier mentoring program was implemented at Fazaia Medical College with the involvement of senior peer and faculty mentors to enhance academic support, professional development, and student well-being of first year MBBS students in 2024. The first tier comprised of senior peer mentors, the second tier comprised of junior faculty members, and the third tier comprised of senior faculty members. The advantage of a multi-tier program was that it provided layers form of mentorship to address varied academic and developmental needs of mentees.[6] This perspective reflects upon the annual evaluation of the FMC mentoring program, drawing upon qualitative insights from mentees, peer mentors, and faculty mentors. Evaluation of the program demonstrated multiple advantages encompassing building academic confidence and competence among the mentees, nurturing wellbeing through shared experiences, and providing mutual growth for both mentors and mentees in mentoring relationships. These findings are aligned and consistent with the outcomes reported from the mentoring programs conducted at various institutes of Pakistan and abroad.[1,5] As reflected in the qualitative data analysis, the program consistently helped new students in building academic confidence with peer and faculty mentors facilitating mentees in staying organized, using effective study strategies, and offering professional guidance grounded in experience which reduced their overall exam anxiety, improved their time management and overall assessment preparation. Consequently, the steep learning curve for students can be eased through mentoring programs.[7] The mentoring program also played a significant role in supporting psychosocial health of students, especially within the first year of MBBS. Mentees considered their interactions as pivotal in social integration and overcoming emotional challenges encountered during this critical period as it provided them with a strong support system where they were provided reassurance and continued guidance.[8]

Interestingly, mentoring was perceived as mutually beneficial. Mentors themselves reported

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personal and professional growth, including enhanced communication skills, leadership development, increased empathy, and greater self-awareness. The evaluation of the program also highlighted the importance of collaboration and reciprocation in effective mentoring requiring active engagement from both mentors and mentees. Effective mentoring relationships were characterized by approachability, empathy, nonjudgemental attitudes, and availability of mentors. Mentees acknowledged their responsibility initiating contact and articulating their needs.

Involved faculty and students in the program faced multiple challenges at various fronts despite overall positive experience. Mentors reported difficulty balancing student mentoring with their increased workload along with limited formal recognition of mentors. Mentees faced difficulty in initially establishing contact with mentors with limited clarity during initial orientation. Similarly, meetings were not conducted regularly due to time constraints. Various studies on mentoring programs showed similar difficulties encompassing issues related to poor communication, engagement, lack of awareness and sensitization.[9,10]

Several steps can be taken to improve the overall effectiveness and sustainability of the mentoring program at FMC. These include interactive orientation sessions at the start of the program to establish a formal contact between mentors and the mentees. Moreover, dedicated time should be incorporated into the curriculum to reduce scheduling conflicts and embed the mentoring within the institutional structure. Furthermore, a formal mentor training program should be introduced along with formal recognition of mentors to improve the programs' impact.

This multi-tier mentoring program at Fazaia Medical College represents an impactful initiative that supports MBBS students during their critical transition period into undergraduate medical education. It promotes a culture of faculty and student engagement, social support, and educational partnership. With targeted support and process monitoring and evaluation, the program has strong potential to enhance student success in the coming academic years.

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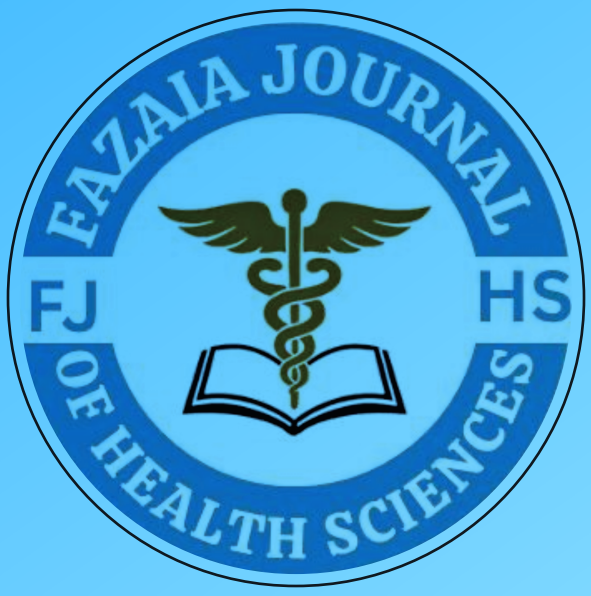
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