

Brain Fog: Impact on Mental Health and Academic Performance Among Medical Students

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Abstract:

The mental and educational well-being of students represents a significant health concern. This study aims to examine the correlation between brain fog and its impact on students' mental health and academic performance. Brain fog, a cognitive dysfunction affecting 15-40% of chronic pain patients, is often linked with mental health issues and conditions like chronic fatigue syndrome, fibromyalgia, and COVID-19. It involves memory challenges, focus issues, and mental cloudiness. Factors such as stress, poor sleep, and mental health disorders, amplified during the COVID-19 pandemic, contribute to its onset. The relationship between brain fog and cognitive impairments remains unclear, with some studies suggesting they are distinct while others view them as overlapping. Further research is needed to understand its mechanisms and develop targeted interventions. This cross-sectional study examined cognitive impairment, or "brain fog," and its associations with mental health and academic performance among medical students aged 18-25 in Karachi. Data were collected over one year from various universities using non-probability convenience sampling, resulting in a sample of 345 participants. Validated questionnaires were used: the Brain Fog Scale (BFS) for cognitive assessment, the General Health Questionnaire (GHQ-12) for mental health, and an Academic Performance Scale (APS). Analysis was conducted using SPSS version 22. A total of 345 participants were included in the study, categorized by age, gender, academic field, year of study, brain fog, and psychological distress. In terms of age, the largest group was 20-21 years (141 participants, 40.9%), while the 18-19 age group had the fewest (14 participants, 4.1%). Gender distribution showed 106 males (30.7%) and 239 females (69.3%). Academically, 41.2% were pursuing MBBS (142 students), followed by DPT (35.4%, 122 students) and BDS (23.5%, 81 students). Most participants were in their 3rd year (42.3%, 146 students), with fewer in the 5th year (10.4%, 36 students). Regarding brain fog, 0.3% were normal, 20.6% mild, 67.5% moderate, and 11.6% severe. In terms of psychological distress, 2.6% were normal, 5.5% mild, 33.3% moderate, and 58.6% severe. Performance levels indicated that 17.1% performed excellently, 49.0% had good performance, 31.9% moderate, and 2.0% performed poorly. This study revealed a high prevalence of brain fog among Karachi medical students, with

most experiencing moderate to severe symptoms. There was a notable link between brain fog, mental health issues, and academic performance. Given the significant rates of psychological distress, targeted interventions were needed to address these challenges. Further research was essential to better understand the underlying mechanisms and improve student outcomes.

Keywords: Brain Fog, Brain Fog Scale, General Health Questionnaire, Academic Performance.

Introduction:

The mental and academic well-being of students is a growing concern in public health, with increasing attention on how cognitive impairments like brain fog may contribute to psychological distress and poor academic performance. Brain fog, a widely recognized medical term, refers to a state of mental confusion characterized by symptoms such as memory lapses, difficulty concentrating, and slowed thinking [[1]]. While not a standalone diagnosis, it frequently accompanies chronic illnesses, mental health disorders, and even infections like COVID-19, significantly impacting daily functioning [[2]]. Understanding its effects on students is critical, as cognitive dysfunction can hinder learning, memory retention, and overall academic success. Research suggests that brain fog is particularly prevalent among individuals with chronic conditions, with studies indicating that 15–40% of chronic pain patients experience cognitive dysfunction [[1]]. Additionally, mental health disorders such as depression and anxiety often co-occur with chronic pain, further exacerbating cognitive impairments [[3]]. This intersection is especially concerning for students, as heightened stress, sleep deprivation, and academic pressure may trigger or worsen brain fog symptoms. For instance, during the COVID-19 pandemic, university students in Pakistan reported significant levels of stress (14.8%), anxiety (10.5%), and depression (18.8%)—factors closely linked to cognitive decline [[4]]. These findings highlight the need to explore how brain fog interacts with psychological well-being and academic performance. Brain fog is also a hallmark of chronic fatigue syndrome, a debilitating condition marked by persistent exhaustion and cognitive slowing [[2]]. Symptoms range from mild forgetfulness to severe mental clouding, disrupting essential tasks such as studying, problem-solving, and even basic communication [[6]]. Sleep disturbances often accompany brain fog, creating a vicious cycle where poor sleep worsens cognitive function, further impairing academic productivity. Moreover, lifestyle factors—such as stress, poor nutrition, and hormonal changes—can contribute to brain fog, suggesting that student populations may be particularly vulnerable due to erratic schedules and high demands [[7]]. The long-term consequences of untreated brain fog are concerning, as cognitive deficits may progress, leading to increased academic struggles and emotional distress. Some researchers debate whether brain fog is merely a symptom of broader conditions or a distinct syndrome itself, particularly given its strong associations with psychiatric and psychological disorders [[5]]. The COVID-19 pandemic has further underscored these concerns, with studies indicating that younger individuals and women are at higher risk for anxiety, depression, and cognitive dysfunction [[8],[9]]. Given these complexities, this study seeks to investigate the relationship between brain fog, mental health, and academic outcomes in students. By examining its underlying mechanisms and effects, we aim to contribute to more effective interventions that support cognitive health and academic success. Further research is needed to clarify the pathophysiology of brain fog and develop targeted strategies to mitigate its impact [[6]]. Addressing this issue is not only vital for individual well-being but also for fostering a more productive and mentally resilient student population.

Methodology:

A one-year cross-sectional study was conducted among undergraduate medical students aged 18–25 years from multiple medical universities in Karachi. Participants were recruited through non-

probability convenience sampling to represent the target population. Based on sample size calculations performed in OpenEpi using prior estimates of brain fog prevalence in comparable groups, a total of 345 participants were required. All consenting medical students within the specified age range, regardless of gender, were eligible for inclusion. Exclusion criteria encompassed non-medical students, individuals with diagnosed neurological or psychiatric disorders, those using cognition-altering medications (including sedatives or stimulants), and participants unable to provide informed consent due to language barriers. Three validated instruments were administered: The Brain Fog Scale (BFS) quantified cognitive symptoms, the General Health Questionnaire (GHQ-12) assessed mental well-being, and an Academic Performance Scale (APS) measured educational outcomes. Data were managed and analyzed using SPSS version 22. Descriptive statistics (frequencies, means, and standard deviations) characterized participant demographics. For inferential analysis, relationships between variables were examined through correlational analyses: Chi-square tests handled categorical data, Pearson's correlation coefficient analyzed normally distributed continuous variables, and Spearman's rank correlation addressed non-normally distributed data. This comprehensive approach enabled rigorous investigation of associations between brain fog, psychological health, and academic functioning.

Result:

A total of 345 participants were included in this study, with age distribution as follows: 14 (4.1%) were aged 18–19 years, 141 (40.9%) in the 20–21 year cohort, 132 (38.3%) in the 22–23 year group, and 58 (16.8%) aged 24–25 years. The sample comprised 106 males (30.7%) and 239 females (69.3%). Academic program distribution showed MBBS as the most represented field (n=142, 41.2%), followed by DPT (n=122, 35.4%) and BDS (n=81, 23.5%). By year of study, 3rd-year students formed the largest group (n=146, 42.3%), with 4th-year (n=109, 31.6%), 2nd-year (n=54, 15.7%), and 5th-year (n=36, 10.4%) students completing the cohort. Brain fog severity assessments revealed only 1 participant (0.3%) was symptom-free, while 71 (20.6%) experienced mild symptoms. Moderate brain fog affected the majority (n=233, 67.5%), with 40 (11.6%) reporting severe manifestations. Psychological distress levels were notably high: merely 9 participants (2.6%) showed no distress, while 19 (5.5%) had mild symptoms. Moderate distress affected 115 (33.3%), and severe distress was prevalent in 202 participants (58.6%). Academic performance outcomes demonstrated excellent achievement in 59 students (17.1%), good performance in 169 (49.0%), moderate performance in 110 (31.9%), and poor performance in 7 (2.0%).

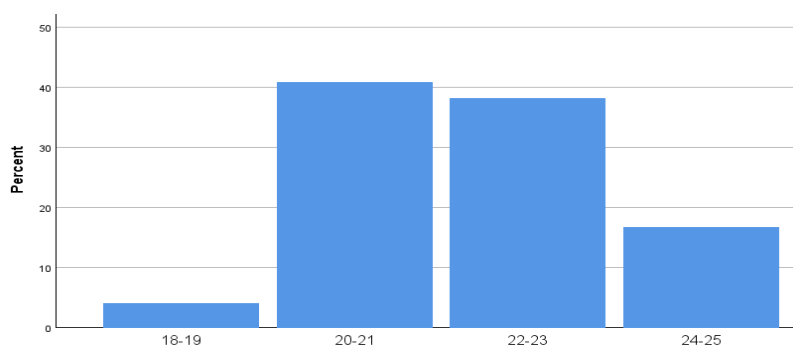


Figure-I: Age of participant

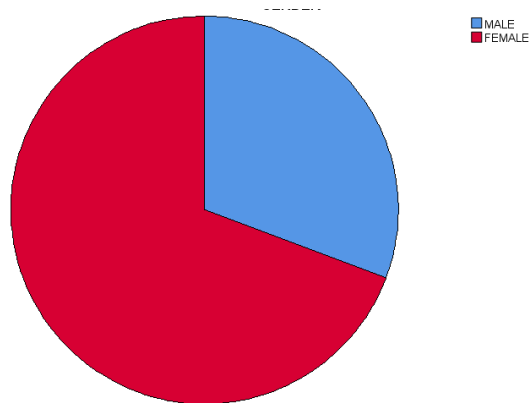


Figure-II: Frequency of male and female

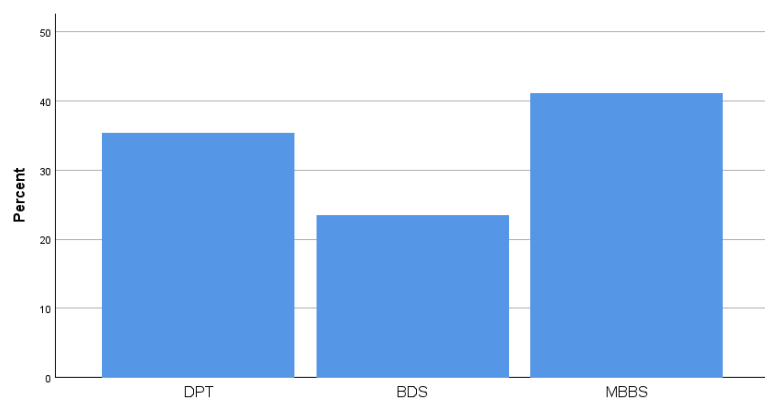


Figure III : Field of study

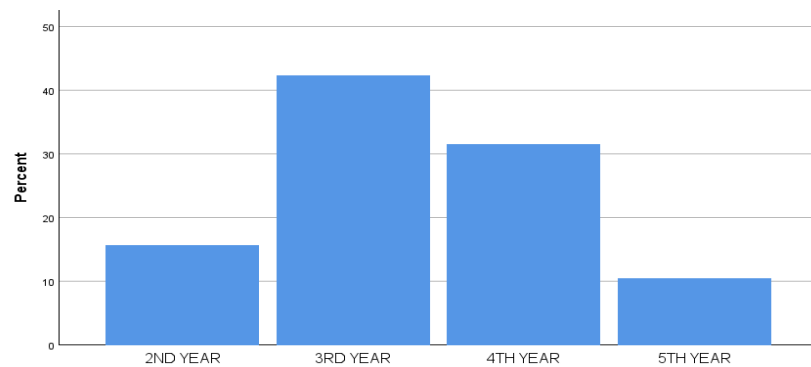


Figure-IV: Year of study

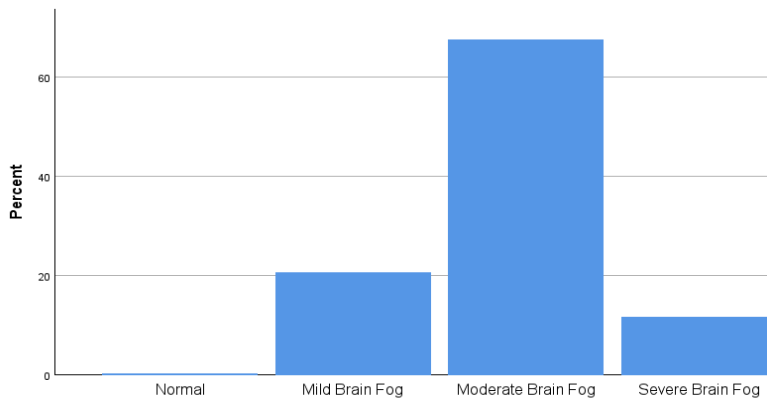


Figure-V: Brain Fog Scale (BFS) scoring

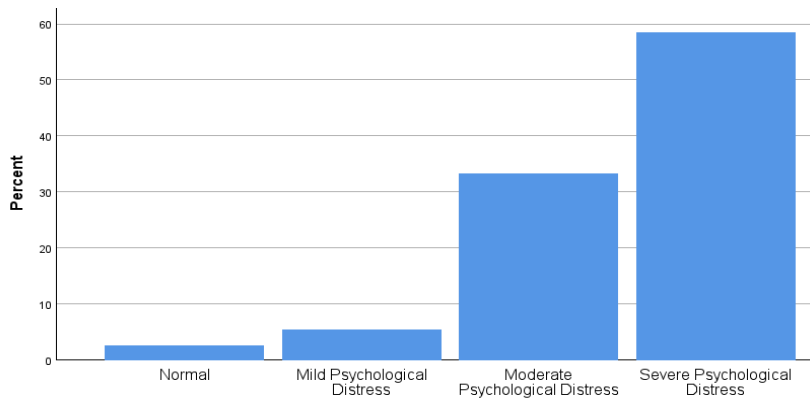


Figure-VI: General Health Questionnaire (GHQ) scoring

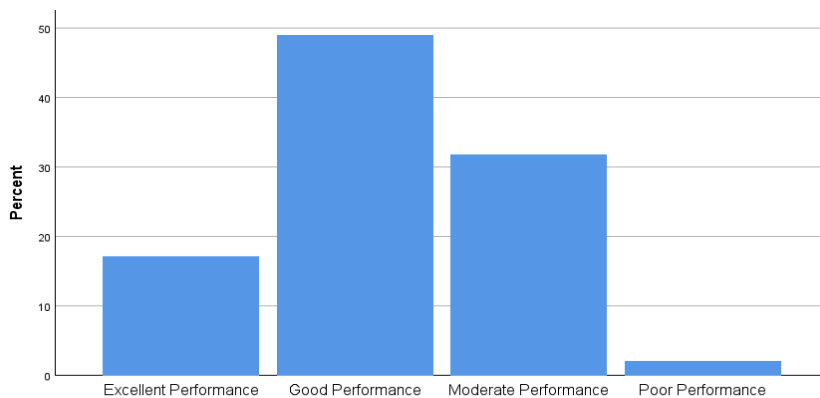


Figure-VII: Academic Performance Scale (APS) scoring

Discussion

Our findings indicate that the majority of participants (40.9%) were aged 20–21 years, aligning with Orfei et al. (2022) [[12]], who identified early adulthood in high-pressure academic environments as a critical period for susceptibility to cognitive challenges like brain fog. Notably, 69.3% of our sample were female—a demographic disproportion resonating with Salfi et al. (2021) [[8]], whose work underscores women’s heightened vulnerability to psychological symptoms (e.g., anxiety, depression) and associated cognitive dysfunction under academic stress. This gender

disparity highlights an urgent need for tailored interventions addressing the intersection of societal expectations, cognitive load, and mental well-being in medical education. Programmatically, MBBS students constituted the largest cohort (41.2%), followed by DPT (35.4%) and BDS (23.5%) learners. This distribution reflects Debowska et al.'s (2024) [[11]] observations that MBBS curricula impose exceptional cognitive demands, directly contributing to mental fatigue and brain fog through relentless academic and clinical pressures. Furthermore, middle-year students (3rd/4th year: 73.9%) faced the greatest burden, corroborating Colm et al.'s (2022) [[16]] findings that the transition to clinical training precipitates peak stress and cognitive impairment risks. Critically, 79.1% of participants reported moderate-to-severe brain fog—characterized by impaired concentration, memory deficits, and mental cloudiness—mirroring Dass et al.'s (2023) [[13]] linkage between chronic stress and cognitive dysfunction. This prevalence coincided with alarming psychological distress levels: 91.9% of students experienced moderate-to-severe symptoms, with 58.6% in the severe category. These results reinforce Sheline et al.'s (2009) [[14]] model of bidirectional cognitive-mental health deterioration, where conditions like depression exacerbate attention and executive function deficits. Despite these challenges, 66.1% maintained good-to-excellent academic performance—a finding consistent with Brooke et al.'s (2019) [[15]] warning that students often "push through" cognitive strain at the cost of future burnout. This apparent resilience underscores the insidious nature of brain fog: academic metrics may not immediately reflect underlying impairment, masking urgent needs for cognitive support and mental health intervention.

Conclusion:

It is concluded that brain fog is highly prevalent among medical students, significantly impacting their mental health and academic performance. The severity of brain fog is closely associated with increased psychological distress, indicating that students are highly vulnerable to cognitive challenges. This emphasizes the importance of understanding the contributing factors of brain fog to support the overall well-being and academic success of medical students.

Conflict of Interest:

Authors declare no conflict of interest.

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