

Impact of Breakfast Skipping on Cognitive Performance among Medical Students: A Cross-Sectional Study.

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ABSTRACT

Background and objectives:

Breakfast skipping is increasingly common among young adults, including medical students, and is relevant to attention, memory, executive functioning, and academic performance. This study assessed the association between breakfast habits and cognitive performance among undergraduate medical students.

Methods: A cross-sectional observational study was conducted in the Department of Physiology, Government Siddhartha Medical College, Vijayawada, Andhra Pradesh, India, from January to June 2025. One hundred undergraduate medical students aged 18-25 years were enrolled. Participants were categorized as regular breakfast consumers (≥ 5 days/week) or breakfast skippers (≤ 2 days/week or irregular intake). Cognitive performance was evaluated using the Digit Span Test, Word List Recall Test, Trail Making Test, and Stroop Test. Academic performance was recorded from recent internal assessment scores. Data were analyzed using independent t-tests, chi-square tests, and Pearson correlation.

Results: The mean age was 21.3 ± 1.8 years; 52% were male, and 48% were female. Regular breakfast consumption was reported by 56 students, while 44 were breakfast skippers. Regular breakfast consumers had higher scores for attention and concentration (81.2 ± 7.6 vs. 72.5 ± 8.4 , $p < 0.01$), immediate recall (77.5 ± 8.1 vs. 68.4 ± 9.2 , $p < 0.01$), delayed recall (74.1 ± 6.9 vs. 64.7 ± 7.8 , $p < 0.01$), and executive function (78.6 ± 7.2 vs. 70.3 ± 8.9 , $p < 0.05$). Breakfast intake showed a positive correlation with academic performance ($r = 0.42$, $p < 0.01$).

Conclusion: Regular breakfast consumption was associated with better cognitive scores and academic performance among medical students.

Recommendations: Medical colleges should strengthen nutrition education, encourage timely morning meals, and integrate breakfast-promoting strategies into student wellness programs.

Keywords: breakfast skipping, cognitive performance, medical students, academic performance, attention, memory.

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Introduction

Breakfast is widely regarded as the first important nutritional event of the day because it ends the overnight fast and provides substrates needed for cerebral metabolism, alertness, and early daytime functioning [2-6]. The brain relies heavily on a continuous supply of glucose, and morning fasting has

been linked to poorer performance in tasks involving attention, working memory, and information processing [2,3]. Evidence accumulated over several decades suggests that regular breakfast consumption supports aspects of cognition, particularly memory and concentration, although the magnitude of effect varies with age, nutritional status, meal

composition, and study design [1-3]. Reviews of the literature have consistently shown that breakfast omission is more often associated with suboptimal cognitive and school-related outcomes than with benefit [4-6].

Among adolescents and young adults, breakfast skipping has become increasingly common because of academic pressure, irregular sleep, oversleeping, lack of appetite in the morning, dieting behavior, and limited time before classes [8,11-13]. This pattern is especially relevant in medical students, who often follow demanding schedules, experience sleep restriction, and require sustained attention for lectures, clinical learning, and frequent examinations [8,13]. A descriptive study among medical students demonstrated that breakfast skipping is common in this group, while recent university-based studies have shown that skipping breakfast remains prevalent across different regions and is often linked with fatigue, inattention, and poorer academic outcomes [8,11-13]. These findings indicate that breakfast behavior is not merely a dietary preference but part of a broader lifestyle profile that can influence learning efficiency and daily functioning [10-14].

Several observational and experimental studies have examined the relationship between breakfast and cognition. Regular breakfast intake has been associated with better attention-concentration, immediate memory, delayed recall, and school achievement [1,7,9]. Population-level data also suggest that breakfast skipping is associated with poorer educational engagement and academic outcomes [9,10]. In addition, a recent Mendelian randomization study reported that breakfast skipping is linked to decreased cognitive performance, supporting the biological plausibility of this association beyond simple behavioral correlation [14]. Despite this growing literature, institution-specific data from Indian medical colleges remain limited, particularly studies using structured cognitive testing alongside academic indicators.

In this context, the present study was undertaken among undergraduate medical students at Government Siddhartha Medical College, Vijayawada, Andhra Pradesh, India. The objectives were to determine the pattern of breakfast consumption among medical students; to compare attention and concentration, immediate recall, delayed recall, and executive function between regular breakfast consumers and breakfast skippers; and to assess the association between breakfast habits and academic performance.

Methodology

Study design and setting

This cross-sectional observational study was conducted in the Department of Physiology, Government Siddhartha Medical

College, Vijayawada, Andhra Pradesh, India, over a six-month period from January to June 2025. Government Siddhartha Medical College is a government medical teaching institution located in Vijayawada that provides undergraduate medical education and functions within a tertiary clinical-academic environment. The setting was selected because undergraduate medical students follow structured academic schedules and represent a population in which morning dietary habits, sustained attention, and academic performance are closely relevant.

Study population

Undergraduate medical students aged 18 to 25 years were eligible for inclusion. Students were recruited consecutively from available undergraduate batches during the study period until the required sample size was achieved. Students with known neurological disease, chronic systemic illness, major psychiatric disorder, acute febrile illness, current substance dependence, or ongoing use of drugs that could alter cognitive performance were excluded to reduce potential confounding. Students with incomplete questionnaire responses, incomplete cognitive test records, or unavailable academic assessment data were excluded from analysis.

Study size

The required study size was estimated using the single-proportion formula $n = Z^2pq/d^2$. Because no previous institution-specific estimate of breakfast skipping was available during planning, an expected prevalence of 50% was used to obtain the maximum required sample size. With $Z = 1.96$ at 95% confidence level, $p = 0.50$, $q = 0.50$, and an absolute precision of 10%, the calculated sample size was 96.04. This was rounded to 100 students to improve precision, allow practical group comparison, and account for minor data loss during the six-month study period.

Data collection procedure

Data were collected using a predesigned structured questionnaire administered in person. Information on age, sex, and breakfast habits was recorded. For operational classification, students who reported consuming breakfast on at least 5 days per week were categorized as regular breakfast consumers, whereas those consuming breakfast on 2 days per week or less, or following irregular breakfast intake, were categorized as breakfast skippers [8,13]. This classification was chosen to distinguish habitual breakfast behavior from sporadic intake and to align the analysis with commonly used definitions in breakfast research.

Assessment of cognitive performance

Cognitive domains were assessed in a quiet classroom environment under standardized morning conditions by trained investigators. Attention and concentration were evaluated using the Digit Span Test. Immediate and delayed memory were assessed using the Word List Recall Test. Executive functioning was evaluated using the Trail Making Test and Stroop Test, which reflect mental flexibility, response inhibition, and processing efficiency [1,6,7]. Students were instructed uniformly, and sufficient time was provided to complete each task. Scores obtained from these instruments were recorded and summarized as mean $\pm$ standard deviation for group comparison.

Assessment of academic performance and statistical analysis

Academic performance was obtained from the most recent internal assessment marks available for each participant. These scores were used to explore the educational relevance of breakfast behavior. Data were entered in Microsoft Excel and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized as frequency and percentage, whereas continuous variables were expressed as mean $\pm$ standard deviation. Between-group comparisons were performed using the chi-square test for categorical variables and the independent samples t-test for continuous variables. Pearson correlation coefficient was used to assess the association between breakfast consumption pattern and academic performance. A p-value below 0.05 was considered statistically significant [9,10].

Bias

Potential selection bias was addressed by recruiting students during routine academic sessions and using the same eligibility criteria for all participants. Information bias was

reduced by using a structured questionnaire, predefined operational categories for breakfast habits, and standardized cognitive testing instructions. Measurement bias was minimized by conducting cognitive assessment under quiet morning conditions and by using the same set of tests for all students. Confounding was partly addressed by excluding students with major illness, psychiatric disorders, substance dependence, acute febrile illness, or medication use likely to affect cognitive performance. Academic performance was taken from internal assessment records rather than self-reports. Data were checked for completeness before analysis to reduce entry-related errors.

Ethical considerations

The study was conducted after approval from the Institutional Ethics Committee of Government Siddhartha Medical College, Vijayawada, Andhra Pradesh, India. Written informed consent was obtained from all participants prior to enrolment. Confidentiality of individual responses and academic records was strictly maintained throughout the study.

Results

During the data-collection period, 100 potentially eligible undergraduate medical students were approached and examined for eligibility. All 100 students fulfilled the eligibility criteria, provided written informed consent, completed the questionnaire, underwent cognitive assessment, and had academic assessment data available. Therefore, 100 students were included in the final analysis. No non-participation, withdrawal, incomplete data, or loss to follow-up occurred among the students approached for final recruitment. Because the study was cross-sectional, follow-up after enrolment was not applicable. The participant flow is shown in Figure 1 and Table 1.

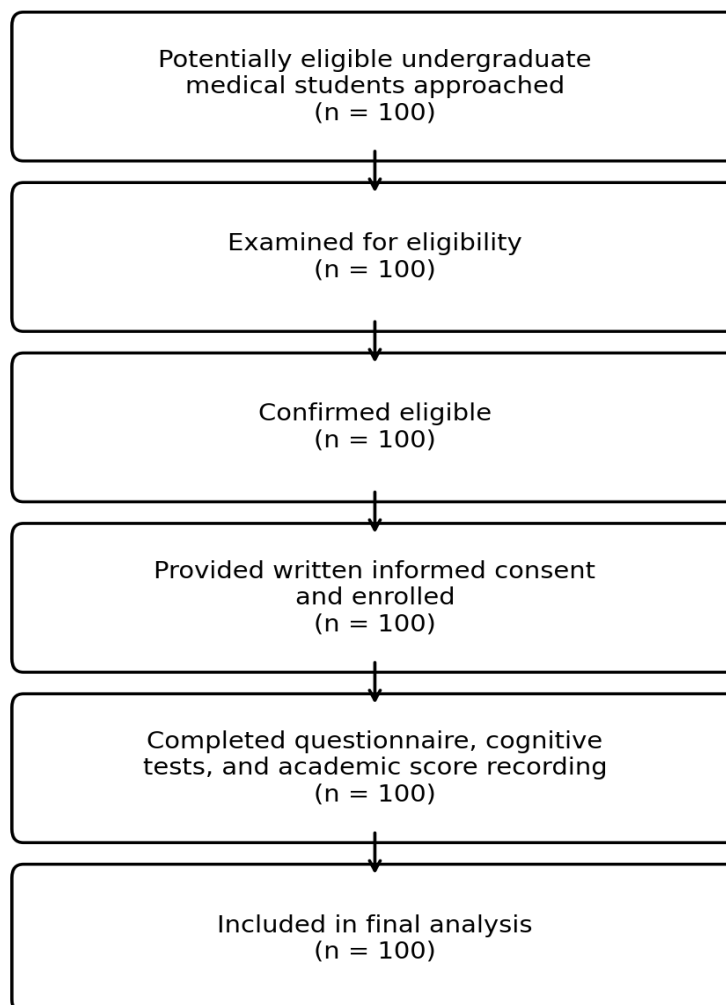


Figure 1. Participant flow diagram.

Table 1. Participant flow through the study.

Study stage	Number [n]	Remarks/reasons
Potentially eligible undergraduate students approached	100	Students available during data-collection sessions
Examined for eligibility	100	Eligibility criteria applied uniformly
Confirmed eligible	100	No exclusion among approached students
Provided written informed consent and enrolled	100	No non-participation among approached students
Completed questionnaire and cognitive assessment	100	No incomplete records
Academic assessment data available	100	Internal assessment scores available
Included in final analysis	100	Final analytical sample

A total of 100 medical students were included in the analysis. The mean age of the participants was 21.3 ± 1.8 years. The gender distribution was nearly balanced, with 52 males (52%) and 48 females (48%). The demographic profile of the study population is presented in Table 2.

Table 2. Demographic profile of participants [N = 100].

Variable	Value
Age [years, mean $\pm$ SD]	21.3 ± 1.8
Gender - Male	52 [52%]
Gender - Female	48 [48%]

With respect to breakfast habits, 56 students (56%) reported regular breakfast consumption, whereas 44 students (44%) were categorized as breakfast skippers. This indicates that nearly two-fifths of the study population did not maintain a regular breakfast routine. The distribution of breakfast habits is shown in Table 3.

Table 3. Breakfast habits among medical students [N = 100].

Breakfast habit	Frequency [n]	Percentage [%]
Regular breakfast consumers	56	56
Breakfast skippers	44	44

Comparison of cognitive domain scores revealed a consistent advantage among regular breakfast consumers. Mean attention and concentration scores were higher in breakfast consumers than in skippers (81.2 ± 7.6 vs. 72.5 ± 8.4 , $p < 0.01$). Similar differences were observed for immediate recall (77.5 ± 8.1 vs. 68.4 ± 9.2 , $p < 0.01$), delayed recall (74.1 ± 6.9 vs. 64.7 ± 7.8 , $p < 0.01$), and executive function (78.6 ± 7.2 vs. 70.3 ± 8.9 , $p < 0.05$). These findings are summarized in Table 4.

Table 4. Cognitive function scores between study groups.

Cognitive domain	Regular breakfast [Mean $\pm$ SD]	Breakfast skippers [Mean $\pm$ SD]	p-value
Attention and concentration	81.2 ± 7.6	72.5 ± 8.4	<0.01
Immediate recall	77.5 ± 8.1	68.4 ± 9.2	<0.01
Delayed recall	74.1 ± 6.9	64.7 ± 7.8	<0.01
Executive function	78.6 ± 7.2	70.3 ± 8.9	<0.05

A positive correlation was observed between regular breakfast consumption and academic performance ($r = 0.42$, $p < 0.01$). Female participants had slightly higher memory scores than male participants; however, this difference was not statistically significant. These additional analytical findings are presented in Table 5.

Table 5. Correlation and gender-related analytical findings.

Analysis	Result
Correlation of breakfast with academic performance	$r = 0.42$, $p < 0.01$ [positive correlation]
Gender differences in memory scores	Females slightly higher; difference not statistically significant.

DISCUSSION

The present study demonstrated that breakfast consumption was regular in a little over half of the participants, whereas 44% of medical students skipped breakfast. This indicates that breakfast skipping is common even among students in health-related training, a finding consistent with earlier work among medical and university students showing that academic schedules, poor morning routine, and limited time frequently disrupt breakfast intake [8,11-13]. The proportion of skippers in the current study is comparable to figures reported in several university-based surveys, supporting the view that breakfast omission has become a routine lifestyle pattern in young adults rather than an occasional event [8,11,12].

A key finding of the study was the significantly higher performance of regular breakfast consumers across attention and concentration, immediate recall, delayed recall, and executive function. This pattern agrees with earlier observational work by Gajre et al., who reported better attention-concentration, memory, and school achievement among students with regular breakfast habits [1]. Similar beneficial associations have also been reported in adolescent experimental studies and systematic reviews, where breakfast consumption was linked most consistently with memory and attention-related domains [2-7]. The broad direction of these findings, therefore, fits well within the established literature and adds institution-specific evidence from an Indian medical college setting.

The positive correlation between breakfast consumption and academic performance in the present study is also noteworthy. Educational outcome studies have shown that regular breakfast intake is associated with better engagement, improved classroom functioning, and superior educational performance [9,10]. In a large multinational university survey, breakfast skipping was also linked with poor academic performance alongside unhealthy behaviors and adverse mental health indicators [11]. These findings extend this association to undergraduate medical students and suggest

that breakfast behavior can serve as a practical marker of academic readiness and everyday self-care.

Several biological and behavioral pathways could explain these findings. Breakfast intake restores circulating glucose after the nocturnal fast and can support neurotransmitter synthesis, attention regulation, and memory processing during the early part of the day. Review evidence further suggests that both the presence of breakfast and its composition can influence cognitive efficiency, particularly for tasks requiring sustained attention and recall. In contrast, breakfast skipping often clusters with irregular sleep, hurried routines, fatigue, and reduced overall dietary quality, all of which can indirectly compromise learning performance [11-14]. Although the present study did not quantify these additional lifestyle variables in detail, the observed pattern is biologically plausible and consistent with prior evidence.

Generalizability of the present findings is strongest for undergraduate medical students in similar tertiary teaching institutions with comparable academic demands and lifestyle pressures. Because the study was conducted in a single medical college and involved a relatively homogeneous student population, extrapolation to non-medical students, older adults, or community populations should be done cautiously. Even so, the direction of association observed here closely mirrors reports from other student populations, supporting the broader relevance of the findings.

Conclusion

Regular breakfast consumption was associated with better attention, concentration, immediate recall, delayed recall, executive function, and academic performance among undergraduate medical students in this study. In contrast, breakfast skipping was common and was linked with poorer cognitive scores across all measured domains. These findings reinforce the importance of breakfast as a modifiable daily behavior with educational relevance in young adults undergoing intensive academic training. Within the limitations of a single-center cross-sectional design, the study

supports the view that promoting regular breakfast habits can form part of a practical strategy to improve student well-being, classroom readiness, and learning efficiency in medical colleges and comparable educational settings.

Limitations

The cross-sectional design precludes temporal inference. Breakfast habits were self-reported and vulnerable to recall error and social desirability bias. Cognitive testing was performed at a single time point, so day-to-day variation was not captured. The study was limited to one medical college and undergraduate students, which restricts wider external validity. Important confounders such as sleep quality, caffeine intake, stress, and dietary composition were not comprehensively measured.

Recommendations

Medical colleges should incorporate breakfast awareness into student wellness and mentoring programs, with emphasis on its relationship to attention, memory, and academic functioning. Institutions can support healthy behavior by aligning class schedules with feasible morning meal timing, strengthening hostel and canteen breakfast availability, and providing low-cost, nutritious options. Periodic nutrition education, peer-led campaigns, and counseling for students with irregular eating and sleep routines are advisable. Future research should include larger multicentric samples, repeated cognitive assessments, and measurement of sleep, stress, meal composition, and metabolic markers to clarify causal pathways and identify the most effective interventions for improving student cognitive health.

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Abbreviations

IBM - International Business Machines

SD - Standard deviation

SPSS - Statistical Package for the Social Sciences

Source of funding

The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

KN - Concept and design of the study, data collection, literature review, results interpretation, first draft preparation, statistical analysis, and manuscript revision.

KPR - Study design, academic supervision, results interpretation, critical review of literature, manuscript drafting support, and revision of the manuscript.

WM - Academic supervision, methodological guidance, interpretation of findings, critical intellectual review, and final approval of the manuscript.

Data availability

The data are available from the corresponding author on reasonable request.

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