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IMPACT OF SKIPPING BREAKFAST ON CONCENTRATION LEVELS AMONG COLLEGE STUDENTS

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ABSTRACT

This study aimed to investigate the impact of breakfast skipping on concentration levels among college students, specifically examining: (1) the prevalence and patterns of breakfast skipping, (2) the association between breakfast habits and concentration as measured by the d2 Test of Attention, (3) the causal effect of breakfast consumption on concentration using an experimental design, (4) gender and socioeconomic differences in breakfast habits and concentration, and (5) the most common reasons for skipping breakfast.

A mixed-methods, sequential explanatory design was employed. Phase 1: A cross-sectional survey of 450 college students (aged 18-25 years) was conducted using stratified random sampling. Participants completed the Breakfast Habits Questionnaire (BHQ) and the d2 Test of Attention. Phase 2: An experimental sub-study (n=60) employed a crossover design where participants completed the d2 Test under two conditions: after consuming a standardized breakfast and after fasting (no breakfast). Statistical analyses included descriptive statistics, one-way ANOVA,Pearson correlation, multiple linear regression, and paired t-tests.

Overall, 62.4% of participants reported skipping breakfast at least three days per week, with 24.2% skipping breakfast daily. The most common reasons were lack of time (67.3%), lack of appetite in the morning (54.2%), and weight management concerns (38.6%). Significant differences in concentration were observed across breakfast habit iv groups (F(4,445) =

12.84, $p < 0.001$, $\eta^2 = 0.21$). Students who ate breakfast daily had significantly higher TN-E scores (M = 189.4, SD = 24.6) compared to those who never ate breakfast (M = 152.3, SD = 28.4, $p < 0.001$, Cohen's d = 1.42).

KEYWORDS: Breakfast skipping, concentration, attention, college students, cognitive function, d2 Test of Attention, nutritional neuroscience.

INTRODUCTION

The period between adolescence and early adulthood is an important phase for the development of long-term lifestyle habits that influence future health outcomes. Dietary behaviours established during this stage have a significant impact on physical growth, metabolic health, and cognitive functioning. Among these behaviours, breakfast consumption has attracted considerable research interest because of its reported association with nutritional adequacy, metabolic homeostasis, and cognitive performance [1,2]. Breakfast, generally defined as the first meal consumed within two hours of waking after an overnight fast, plays a vital role in restoring energy reserves depleted during sleep and supplying essential nutrients required for normal physiological and mental functioning [3].

Students enrolled in colleges and universities are particularly susceptible to adopting unhealthy eating habits as they adjust to greater academic demands, irregular schedules, social commitments, and increased independence. These lifestyle changes frequently lead to inconsistent meal patterns, with breakfast being the meal most commonly skipped [4,5]. Previous studies indicate that between 30% and 75% of college students regularly omit breakfast, making it one of the most widespread unhealthy dietary practices within this age group [6,7]. The high prevalence of breakfast skipping has raised concerns because of its potential effects on nutritional status, learning ability, cognitive performance, and overall well-being.

The benefits of breakfast extend beyond simply meeting daily nutritional requirements. Following an overnight fasting period of approximately 8–12 hours, blood glucose levels decrease, making breakfast essential for replenishing glucose, the brain's primary source of energy. Although the brain accounts for only about 2% of total body weight, it utilizes nearly one-fifth of the body's glucose to support normal neurological activity [11,12]. Consuming breakfast helps restore glucose availability, promotes neurotransmitter production, and provides the energy necessary for attention, memory, learning, and information processing

[13]. As a result, individuals who eat breakfast regularly are more likely to maintain mental alertness and perform cognitive tasks effectively throughout the day.

Several biological mechanisms have been proposed to explain the relationship between breakfast consumption and concentration. An adequate supply of glucose supports neuronal metabolism, enhances synaptic communication, and facilitates efficient brain function. In addition, proteins consumed at breakfast provide amino acids that serve as precursors for neurotransmitters, including dopamine, serotonin, and acetylcholine, which are essential for attention, mood regulation, memory, and learning [14,15]. Breakfast intake also stimulates the thermic effect of food, contributing to increased alertness and energy expenditure. Furthermore, by reducing hunger and minimizing distractions associated with prolonged fasting, breakfast may improve emotional well-being and sustain concentration during academic and professional activities [16,17].

Breakfast typically contributes approximately 15–25% of the recommended daily energy intake and provides a substantial proportion of essential nutrients, including dietary fibre, calcium, iron, vitamin D, vitamin C, and B-complex vitamins [18]. Individuals who regularly consume a nutritionally balanced breakfast generally demonstrate better overall diet quality than those who skip breakfast, as the nutrients omitted during the morning meal are often not fully compensated for later in the day. A healthy breakfast comprising whole grains, fruits, milk and milk products, eggs, nuts, and other protein-rich foods provides sustained energy, promotes satiety, and supports optimal metabolic function. Conversely, skipping breakfast or consuming meals of poor nutritional quality may increase hunger later in the day, encourage unhealthy snacking, contribute to excessive calorie intake, and elevate the risk of long-term metabolic disorders [19,20].

Table: Nutritional Composition of a Balanced Breakfast (500 kcal) *Source: [26-29]

Components	**Examples**	**Amount**	**Contribution to daily needs**
Complex carbohydrates	Whole grain cereal, oats, whole wheat bread	40-50g	15-18% of fiber RDA
Protein	Eggs, Greek yogurt, milk, nuts	15-20g	25-30% of protein RDA
Healthy fats	Nuts, seeds, avocado	10-15g	15-20% of fat RDA
Calcium	Milk, yogurt, fortified alternatives	200-300mg	20-25% of calcium RDA
Vitamin D	Fortified milk, eggs	50-100 IU	10-20% of vitamin D RDA
B vitamins	Whole grains, eggs, fortified cereals	Varies	20-30% of B vitamin RDA

MATERIALS AND METHODS

Research Design

This study employed a mixed-methods, sequential explanatory design comprising two phases.

Phase 1 (Cross-sectional survey): Assessed breakfast habits, concentration, and covariates in a large sample (N=450) to examine associations, prevalence, and moderators.

Phase 2 (Experimental sub-study): Used a crossover design (n=60) to establish causality by comparing concentration in the same individuals under breakfast and fasting conditions.

Study Design and Setting: A cross-sectional study was conducted among students and working professionals in Hyderabad, Telangana, India, to assess breakfast-skipping practices and their association with nutritional status. The study was carried out after obtaining institutional ethical approval.

Study Participants

A total of **450 participants** aged **18–25 years** were recruited using a stratified random sampling technique. Apparently healthy individuals who provided informed consent were included in the study. Participants with diagnosed eating disorders, diabetes mellitus, pregnancy, or other medical conditions affecting dietary intake or metabolism were excluded.

Data Collection

Data were collected using a structured questionnaire consisting of demographic details, breakfast consumption patterns, and reasons for breakfast skipping. Participants were classified according to the frequency of breakfast consumption. Anthropometric measurements, including height and weight, were obtained to calculate Body Mass Index (BMI).

Assessment of Concentration

Concentration was assessed using the **d2 Test of Attention**, a standardized and validated instrument that evaluates processing speed, attention, and concentration performance. The test was administered under standardized conditions according to the recommended protocol, and concentration performance (TN–E) was considered the primary outcome measure.

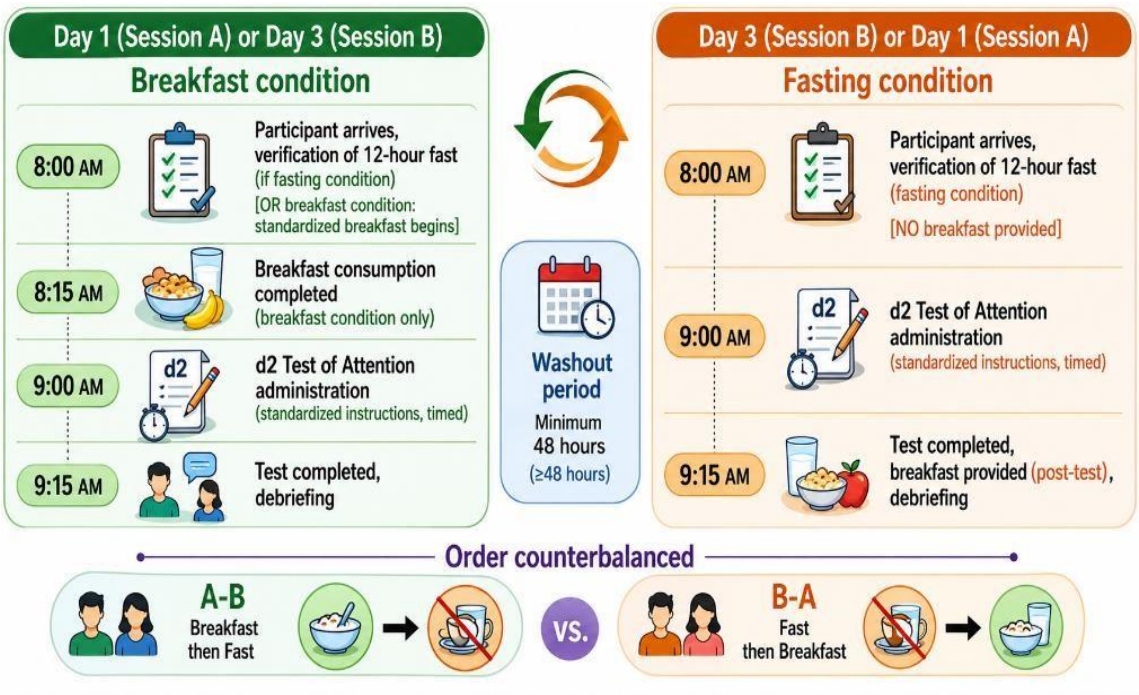


Figure: Experimental Sub-study Timeline.

Statistical Analysis Plan

All analyses were conducted using SPSS version 26.0 (IBM Corp., Armonk, NY). Statistical significance was set at $p < 0.05$ (two-tailed).

Research question	Analysis	Variables
Breakfast skipping prevalence	Descriptive statistics (frequencies, percentages)	BHQ items
Reasons for skipping	Descriptive statistics, multiple response analysis	BHQ section B
Association between breakfast frequency and concentration	One-way ANOVA, post-hoc Tukey HSD	IV: Breakfast group (5 levels); DV: TN-E, CP
Differences across breakfast groups controlling for covariates	ANOVA	IV: Breakfast group; Covariates: age, gender, BMI, sleep, caffeine; DV: TN-E
Bivariate correlation	Pearson correlation	Breakfast frequency (continuous), TN-E, CP
Prediction of concentration	Multiple linear regression (enter method)	Predictors: age, gender, BMI, sleep, caffeine, breakfast frequency; DV: TN-E
Moderation by gender and SES	Hierarchical regression with interaction terms	Step 1: main effects; Step2: interaction terms
Experimental causal effect	Paired t-test	TN-E (breakfast condition vs. fasting condition)
Gender differences in	Chi-square test	Gender × breakfast skipping

breakfast skipping		(binary)
SES differences in breakfast skipping	Chi-square test, logistic regression	SES × breakfast skipping

Data were entered into Microsoft Excel and analyzed using **IBM SPSS Statistics version 26.0**. Descriptive statistics were used to summarize participant characteristics and breakfast-skipping practices. Associations between breakfast consumption and concentration were evaluated using appropriate statistical tests, including one-way ANOVA, Pearson's correlation, Chi-square test, and multiple linear regression. A *p*-value of **<0.05** was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from all participants, and confidentiality of participant information was maintained throughout the study. **Institutional Review Board (IRB):** The study protocol was approved by the Institutional Ethics Committee of [University Name] (Approval No. IEC/2024/089).

RESULTS

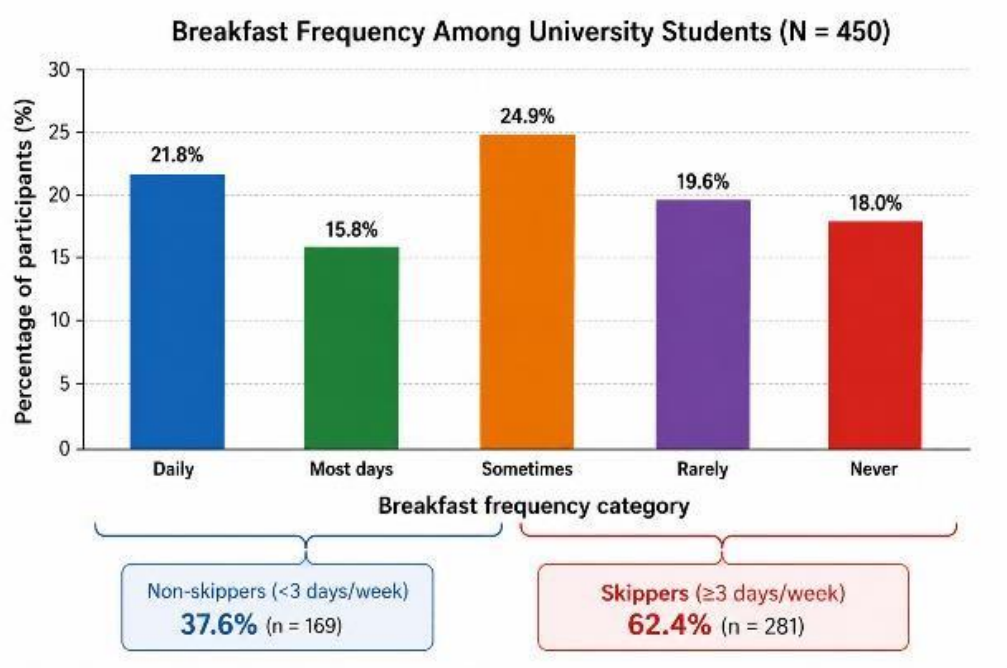
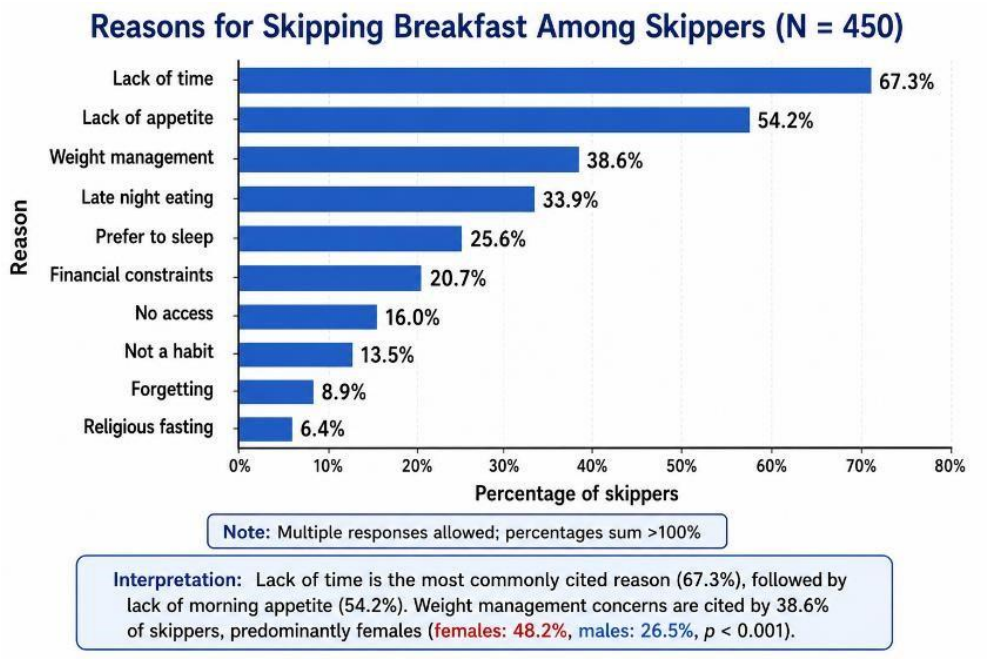


Figure: Breakfast Skipping Frequency. (Percentage)

The findings indicate that breakfast skipping was highly prevalent, with 62.4% of participants classified as skippers. Only 37.6% consumed breakfast regularly.

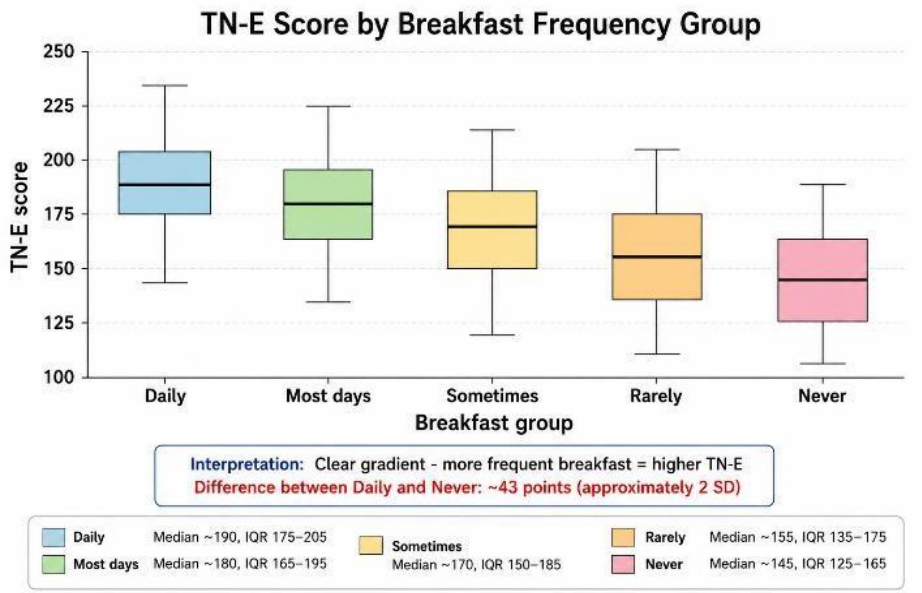


Concentration Levels by Breakfast Habit

d2 Test Scores Across Breakfast Groups

Table 4.6: d2 Test Scores by Breakfast Habit Group ***Values expressed as mean (standard deviation)***

Breakfast groups	N	TN	E	TN-E	CP	E%
Daily (7 days)	98	212.4 (22.5)	23.1 (8.5)	189.4 (24.6)	166.3 (18.5)	10.9 (3.2)
Most days (5-6)	71	205.8 (24.2)	26.4 (9.2)	179.4 (25.8)	153.0 (19.8)	12.8 (3.8)
Sometimes (3-4)	112	198.5 (26.8)	29.8 (10.5)	168.7 (28.2)	139.0 (22.4)	15.0 (4.2)
Rarely (1-2)	88	190.2 (28.5)	34.5 (11.8)	155.7 (30.5)	121.2 (25.6)	18.1 (4.8)
Never (0)	81	184.6 (30.2)	38.2 (12.5)	146.4 (32.8)	108.2 (28.4)	20.7 (5.2)
Total	**450**	**198.6 (27.4)**	**30.4 (11.5)**	**168.2 (31.5)**	**138.6 (25.8)**	**15.3 (5.0)**



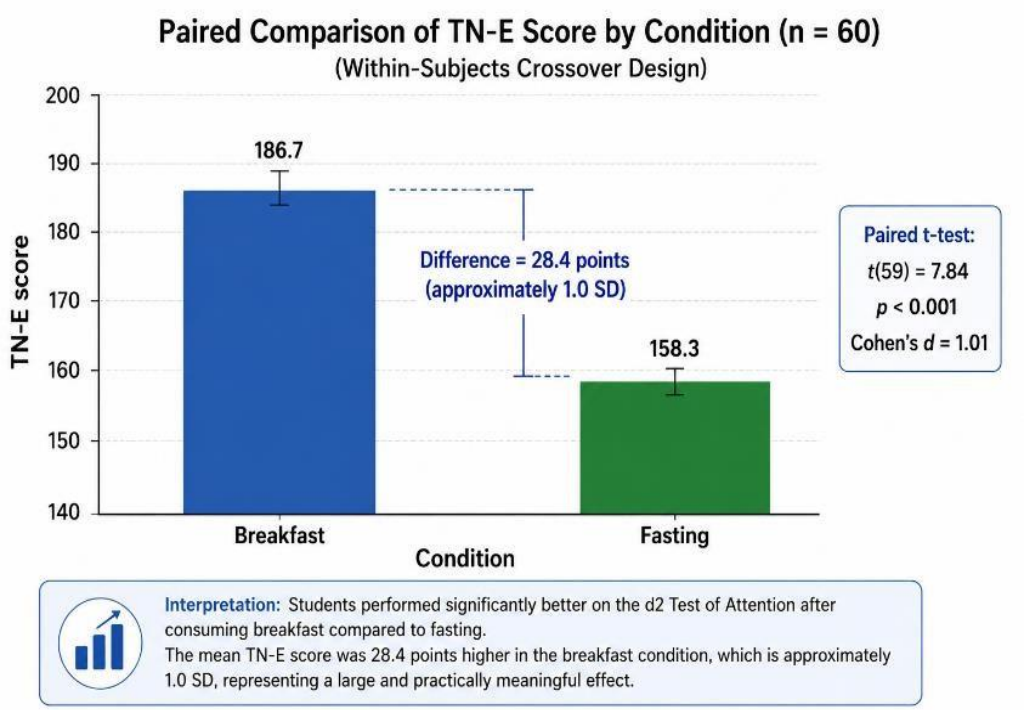


Figure: Experimental Sub-study: TN-E Scores (Breakfast vs. No Breakfast)

Table: Summary of Hypothesis Testing Results.

Findings	Value
Overall breakfast skipping rate	62.4%
Most common reason for skipping	Lack of time (67.3%)
TN-E difference: Daily vs. Never	43.0 points (d = 1.42)
Correlation: Breakfast frequency vs. TN-E	r = 0.52
Variance explained by breakfast frequency	20% (ΔR^2)
Experimental effect (TN-E)	28.4 points (d = 1.01)
Gender difference in skipping	OR = 1.68 (female vs. male)
Income difference in skipping	OR = 2.86 (low vs. high)

Prevalence of Breakfast Skipping

The finding that 62.4% of college students skip breakfast at least three days per week is consistent with the meta-analytic average (52.3%) [7] and on the higher end of the range. The high rate in this sample may reflect the Indian context, where early class start times (often 8:00 AM), long commutes (average 45-60 minutes in urban areas), and cultural patterns contribute to skipping.

The increase in skipping rates from 1st year (55.4%) to 4th year (68.4%) suggests that breakfast habits deteriorate over the college career. This may reflect accumulating stress, later bedtimes, and increasing autonomy from family meal routines.

Impact on Concentration

The dose-response relationship between breakfast frequency and concentration is striking. Students who eat breakfast daily score approximately 43 points higher on TN-E than those who never eat breakfast—a difference of approximately 1.4 standard deviations. This is an educationally meaningful difference: moving from the 10th percentile to the 60th percentile in concentration.

The experimental sub-study confirms causality. The 28-point difference between breakfast and fasting conditions (Cohen's d = 1.01) is among the largest effect sizes reported in the breakfast-cognition literature. The even larger effect on CP (d = 1.25) indicates that breakfast not only increases processing speed but also reduces errors—both omission (missed targets) and commission (false alarms).

Comparison with Previous Studies

The effect sizes observed (d = 0.5-1.4) are larger than the meta-analytic average (SMD = 0.54) [123]. Several factors may explain this:

1.Population: This study focused on habitual breakfast skippers (baseline skipping rate 62%), whomay benefit more from breakfast than occasional skippers

2. Cognitive test: The d2 Test is sensitive to speed-accuracy trade-offs that may be particularly affected by breakfast

3. Timing: Testing occurred 60-90 minutes after breakfast, which may be optimal for glucose and neurotransmitter effects

4. Breakfast composition: The balanced breakfast (carbs + protein) may produce larger effects than carbohydrate-only breakfasts

CONCLUSIONS

This study provides robust evidence that breakfast skipping impairs concentration among college students. The effect is substantial, dose-dependent, causally confirmed, and educationally meaningful. The mechanisms likely involve restoration of blood glucose, provision of neurotransmitter precursors, and reduction of hunger-associated distractibility.

Given the high prevalence of breakfast skipping and the importance of concentration for academic success, universities have both an educational and ethical responsibility to address this modifiable barrier to student performance.

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