

# Breakfast consumption habit and its impact on nutrient intake and nutritional status of medical undergraduates

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**Summary.** *Aim:* Breakfast is considered the most important meal of the day, the quality and quantity of which potentially contributes to the total daily energy and nutritional well-being of an individual. Gluttony, sedentary lifestyle and obesity are common among the breakfast skippers. Among numerous lifestyle factors contributing to overweight in youth, skipping breakfast has been identified as a potential risk factor but with controversial results. Hence, this study was aimed to investigate the impact of breakfast skipping habit among the undergraduate students with nutrient intake and nutritional status. *Material and methods:* This cross-sectional study was conducted among undergraduates studying in a medical college of Puducherry. 274 students who agreed to participate filled a pre-tested semi-structured questionnaire having a dietary record over 3 consecutive days including Sunday. Standard WHO (World Health Organization) techniques and guidelines for anthropometric measurements and BMI classification and ICMR (Indian Council of Medical Research) dietary guidelines to calculate calorific values of food items was used. Chi-square test, Student's t test and Mann-Whitney U test was used and p value <0.05 was considered statistically significant. *Results:* 60% and 24% of the students reported skipping breakfast at least once/week and thrice/week respectively. Body mass index was significantly higher among those who skipped breakfast more than thrice per week. 44%, 35% and 24% were overweight and obese among those who skipped breakfast more than thrice/week, at least once/week and never skipped respectively. Breakfast skippers had higher fat intake, lower intake of proteins, vitamins and minerals than breakfast consumers. Busy schedule and lack of appetite in the morning were common reasons reported by breakfast skippers. *Conclusion:* This study suggests that there is a possible relationship between breakfast skipping with overweight and faulty nutrient intake. Health promotion activities for healthy eating behaviors among youths are recommended in order to prevent lifestyle diseases and create a healthy role models for tomorrow.

**Key words:** breakfast skipper, medical undergraduates, micronutrients, macronutrients, obesity

## Introduction

Breakfast is often considered as the most essential meal of the day as it provides sustenance and energy for the activities lay ahead. Nutritionist Adelle Davis quoted this mantra in the 1960s: "Eat breakfast like a king,

lunch like a prince and dinner like a pauper." Latest evidence claims that we should be consuming around 15–25% of our total daily energy intake at breakfast (i.e., 375–625 for men and 300–500 calories for women) (1).

Eating habits, such as consuming breakfast has been associated with nutrients intake as well as nutritional

status (2). Breakfast consumption has a major impact on body weight and breakfast meal is a significant dietary factor for energy regulation. Wang et al. observed that breakfast consumption was positively associated with frequent milk and vegetable consumption, increased physical activity, and good sleep, whereas inverse association was found for higher fast food and soft drinks consumption, computer use, alcohol-drinking and cigarette-smoking behaviors (3). In addition, research has associated the breakfast consumption with adolescents' mental and physical health (1). Breakfast consuming students were less likely to experience mental stress and were more likely to get good grades and better school attendance. On the other hand, those students who skip breakfast have been associated with adverse effect on the cognition, psychosocial function, school attendance, and mood in young adult and children (4).

Chung et al. found that those who skipped breakfast had relatively less intake of various minerals and vitamins and also had lower total energy intake than did those who consumed breakfast (5). During the rest of the day, nutrient intake does not tend to compensate for the missed nutrients in the skipped breakfast (6). There is a general perception that fatigue is a usual problem in medical undergraduate students. This problem is related to dietary habits, especially skipping breakfast and this hunger in the morning may be the reason for poor academic performance for some students (7).

The overall breakfast skipping among the students was ranging from 21.6% to 71.92% (8-10). Limited data is available in the literature regarding the association of breakfast consumption habit with nutrient intake and nutritional status among youths in India. Coulthard et al. observed that higher proportions of breakfast consumers significantly met their reference fibre and micronutrient intake compared with breakfast skippers (11). Horikawa et al. mentioned in a meta-analysis that a positive relationship between skipping breakfast and obesity is globally observed despite of cultural diversity among countries (12). On a contrary, a systematic review by Milanese et al. (13) rejects the general argument that eating versus skipping breakfast is favorable for weight-related outcomes. Considering these issues, we investigated to determine the association between breakfast skipping with nutritional status of the medical students.

## Materials and Methods

This cross-sectional descriptive study was conducted among medical undergraduates studying in Puducherry from April 2017 to July 2017. Assuming the proportion of students having breakfast skipping habit as 50% with  $\alpha = 5\%$ ,  $\beta = 20\%$ , error of margin = 6%, the estimated sample size was 267. Finally, a total of 274 undergraduates studying second year and third year MBBS who agreed to participate were taken after excluding those who were absent on the day of data collection, fasting due to religious festivals and sick on any of the previous 3 days of data collection.

### *Operational definitions*

Break-fast is defined as any food or drinks eaten between the hour of 7.00 A.M and 10.00 A.M. A breakfast skipper is defined as one who skipped breakfast on the day of the study. Standard size of teaspoon, tablespoon and cup has been depicted in the data collection form taken from ICMR dietary guidelines (14). Body Mass Index (BMI) was calculated and classified using standard guidelines (15, 16). The 72 hour dietary data provided by the respondents was manually converted into micro-nutrient and macro-nutrient values. The average of the 72 hour dietary values were taken for the ease of comparison with guideline values (14). Calorific values of cooked foods were obtained from "Dietary guidelines for Indians" (14). The amount of raw materials present in cooked items was obtained from "Dr. Mohan's Atlas of Indian foods" (17). Nutritional value of raw materials was taken from "Nutritive value of Indian foods" (18).

### *Conduct of study*

Clearance from the Institute Ethical Committee of Indira Gandhi Medical College and Research Institute, Puducherry (Approval No. 17/IEC/IGMC/F-7/2017/28 dated 12.08.2017) was obtained before starting the study. The study participants were informed about the scope and nature of the study and confidentiality was assured. Informed written consent was obtained from all the study participants. The entire procedure was completed in two steps; first a standardized pre-tested questionnaire was filled by every study participant; second, anthropometric measurements were done for all the study participants.

**Table 1.** Frequency of skipping breakfast among study participants based on their gender

Variable	Gender		Total n (%)	Cumulative frequency variable	Total n (%)
	Male n (%)	Female n (%)			
Once/week	28 (25.0)	24 (14.8)	52 (19.0)	At least once/week	164 (59.8)
Twice/week	20 (17.9)	26 (16.0)	46 (16.8)	At least twice/week	112 (40.8)
Thrice/week	10 (8.9)	20 (12.3)	30 (10.9)	At least thrice/week	66 (24.0)
More than thrice/week	16 (14.3)	20 (12.3)	36 (13.1)		
Didn't skip	38 (33.9)	72 (44.4)	110 (40.1)		
Total	112 (100.0)	162 (100.0)	274 (100.0)		

*Chi-square test for linear trend; p value=0.035*

### Questionnaire

A pre tested semi structured questionnaire was developed based on previous research studies, under the guidance of the experts in the field (25, 33). It was structured to collect information pertaining to demographic data, respondent's breakfast habit and associated factors, nutritional status of respondents, nutritional intake of the respondents by 72 hour dietary recall.

### Anthropometry

Anthropometric measurements like height and weight for all the study participants were measured using standard techniques provided by WHO (16). Weight was measured to the nearest 0.1 kg in an upright position using electronic weighing machine in minimal possible clothing without shoes. Height was measured to the nearest 0.1 cm in an erect posture with the head in the Frankfurt horizontal plane using stadiometer. All the measurements were done after regular calibration of instruments during the study.

### Statistical analysis

The data was entered into a worksheet on Microsoft excel. The data was analyzed using Epi info and SPSS Version 20.0. Simple percentages and proportions were used for describing the qualitative data. Mean and standard deviation or Median and interquartile range (IQR) was used to represent quantitative data. To make the nutrient values comparable with recommended dietary allowances per day, the average of the 3 consecutive day values were taken. Chi-square test for analyzing categorical data and Student's t test

for parametric data & Mann Whitney U test for non-parametric data was used for analyzing continuous variables. One-way Analysis of variance (ANOVA) with Tukey Post-hoc test was done to compare more than two quantitative variables. A p value of less than 0.05 was considered statistically significant.

### Results

The present study included 274 undergraduate medical students. The mean age of the study participants was 20.12±0.91. The male and female participants were 41% and 59% respectively.

As shown in Table 1, 59.8%, 40.8% and 24.0% of the study participants skip breakfast at least once/week, twice/week and thrice/week respectively. Frequency of male breakfast skippers (66.1%) was more than female breakfast skippers (55.6%) which was also found to be statistically significant.

As shown in Table 2, the most common reason cited for skipping breakfast by both males and females was busy schedule followed by lack of appetite.

**Table 2.** Reasons for skipping breakfast at least once per week

Variable	Frequency	Percentage
Busy schedule	122	44.5
Lack of appetite	26	9.5
Health reasons	6	2.2
Not satisfied with hostel food	4	1.4
Don't like	4	1.4
Getting up late	2	0.7
Attendance	2	0.7
Reasons not specified	10	3.6

One-way ANOVA test determined that mean Body Mass Index differed statistically significantly between breakfast skipping frequency ( $P < 0.05$ ). Tukey Post hoc tests revealed that the mean Body Mass Index of those who skipped breakfast more than thrice was statistically significant from those who never skipped breakfast ( $p < 0.05$ ). However, the other values were not statistically different. Therefore, we can conclude that BMI was higher among those who skipped breakfast more than thrice per week.

The present study found a statistically significant association between nutritional status and breakfast habit. 44%, 35% and 24% were overweight and obese among those who skipped breakfast more than thrice/week, at least once/week and never skipped respectively.

Table 5 illustrated that the energy and carbohydrate intake was almost similar for breakfast eaters and skippers but the breakfast skippers consumed high fat

and low protein diet.

As demonstrated in the table 6, almost all the micro-nutrient intake was less among the breakfast skippers. Values of micronutrients intake like Niacin, vitamin C, copper, manganese and zinc were significantly lower among breakfast skippers than breakfast eaters ( $p < 0.05$ ).

## Discussion

The present study conducted among medical undergraduates found that 59.8%, 40.8% and 24.0% of the students skip breakfast at least once/week, twice/week and thrice/week respectively whereas studies done among Pune University students (19) and Chinese medical college students (4) showed 42.23% and 28.9% respectively. The varying prevalence could be the

**Table 3.** Body mass index of the study participants according the breakfast skipping frequency

	Once per week	Twice per week	Thrice per week	More than thrice per week	Never	Total
No. of subjects	52	46	30	36	110	274
Mean	22.94	22.78	23.80	24.56	22.27	22.95
Standard Deviation	4.09	4.10	4.51	4.03	3.27	3.88

ANOVA;  $p$  value=0.024

**Table 4.** Body mass index category of the study participants according the breakfast skipping frequency

BMI category	Breakfast skipping frequency					Total
	Once per week	Twice per week	Thrice per week	More than thrice per week	Never	
Underweight (<18.5)	4 (7.7%)	10 (21.7%)	4 (13.3%)	0 (0.0%)	10 (9.1%)	28 (10.2%)
Normal (18.5-24.99)	30 (57.7%)	24 (52.2%)	14 (46.7%)	20 (55.6%)	74 (67.3%)	162 (59.1%)
Overweight & Obese ( $\geq 25$ )	18 (34.6%)	12 (26.1%)	12 (40.0%)	16 (44.4%)	26 (23.6%)	84 (30.7%)
Total	52 (100.0%)	46 (100.0%)	30 (100.0%)	36 (100.0%)	110 (100.0%)	274 (100.0%)

Chi-square test;  $p$ -value=0.019; Degree of freedom=6

**Table 5.** Average macro-nutrients intake of the study participants

Variable	Breakfast skippers >3times/week (36)		Breakfast non-skippers (110)		P value <sup>s</sup>
	Median	IQR	Median	IQR	
Energy (kcal)	2401.500	1516.4	2287.150	1574.6	0.884
Carbohydrates (g)	429.600	295.6	424.100	334.8	0.920
Proteins (g)	68.650	73.5	76.500	87.9	0.744
Fats (g)	69.900	118.4	34.300	72.5	0.024
Crude Fiber (g)	8.400	17.8	11.600	19.8	0.778

<sup>s</sup>Mann-Whitney U test; \* $p$  value<0.05 is significant

**Table 6.** Average micro-nutrients intake of the study participants

Variable	Breakfast skippers >3times/week (36)		Breakfast non-skippers (110)		P value <sup>§</sup>
	Median	IQR	Median	IQR	
Carotene (µg)	258.85	1496.10	614.50	1240.10	0.210
Thiamine (mg)	2.00	24.20	1.90	3.80	0.888
Riboflavin (mg)	0.75	0.40	0.90	1.20	0.129
Niacin (mg)	14.95	6.70	16.90	12.50	0.048*
Total B6 (mg)	1.05	9.00	1.70	5.90	0.317
Folic acid (µg)	193.00	71.00	196.00	213.20	0.268
Vitamin C (mg)	21.50	46.50	39.80	85.10	0.005*
Minerals (g)	8.45	5.90	12.50	14.50	0.067
Calcium (mg)	609.80	389.90	606.70	526.50	0.864
Phosphorous(mg)	1238.50	789.40	1478.60	1155.70	0.365
Iron (mg)	26.05	41.10	28.00	37.10	0.900
Magnesium (mg)	504.10	253.70	530.60	322.40	0.111
Sodium (mg)	235.85	69.10	254.40	204.60	0.629
Potassium (mg)	1098.00	848.30	1234.00	1813.30	0.354
Copper (mg)	2.00	0.60	2.90	4.90	0.010*
Manganese (mg)	5.20	2.50	5.90	4.30	0.024*
Zinc (mg)	8.40	2.80	10.00	15.90	0.014*

§Mann-Whitney U test; \*p value<0.05 is significant

definition of breakfast skipper which was defined differently by authors. The study conducted in Pune defined breakfast skipper as those who never take breakfast and the Chinese study defined it as those subjects who have not consumed breakfast on one of two days or neither day. Noteworthy that majority (59.8%) of the medical student's not eating breakfast on at least once a week is a significant public health problem.

The breakfast skipping was higher among male undergraduates than the female counterparts. This finding substantiates the gender difference in regard to skipping breakfast as stated in a number of studies (4, 20, 21) and suggests that good breakfast consumption habits should be encouraged especially focused among males. The most common reason cited for skipping breakfast was busy schedule followed by lack of appetite whereas study done in Pune revealed that getting up late was the most common reason followed by busy schedule and lack of appetite (19). A study conducted among Kanchipuram medical students (22) had observed that the prevalence of overweight and obesity was 24.3% and 8.6% which was similar to the present study finding. Horikawa et al. in a meta-analysis observed that regardless of cultural diversity among countries, there was a positive relationship between

breakfast skipping and overweight and obesity globally (12). The present study also supports the evidence of association between skipping breakfast and nutritional status of the medical undergraduates similar to these studies (12, 23, 24). Even if we cannot declare that breakfast skipping itself can lead to overweight or obese, the breakfast consumption skipping habit may be considered as a marker for high BMI.

The present study showed that the energy and carbohydrate intake was almost similar for breakfast eaters and skippers whereas the fat consumption was significantly more among breakfast skippers and the protein and crude fiber intake was more among breakfast eaters. Consumption of micro-nutrients was significantly less among the breakfast skippers, especially niacin, vitamin C, copper, manganese and zinc. Adesola et al (25) had an observation similar to the present study that breakfast skippers had higher fat intake, lower intake of proteins, vitamins and minerals than breakfast consumers. Timlin et al (26) in a systematic review had ascertained that composition of the overall diet in regular breakfast consumption had its potential impact in reducing the chronic diseases later in life. Chung et al. also found that breakfast skipping group had poor daily nutrient consumption with a high per-

centage of energy from fat (5). Several important nutrients intake were low among breakfast skippers reported by Afeiche et al in 2017 (27). Barrett et al. (28) found the poor diet quality and lower intake of fruit and fiber among breakfast skippers and concluded that the habitual breakfast skippers were missing important nutritional elements by skipping the morning meal and also added that the breakfast skipping behavior could be a marker of unbalanced dietary behaviors.

The present study found high fat intake among the breakfast skippers. Garg et al. observed similar result and explained that this was possibly due to more consumption of junk foods rich in saturated fat during break hours by breakfast skippers leading to overweight and obesity (29). Consuming breakfast with adequate amount of proteins especially tryptophan is essential for morning type diurnal rhythm, good quality of sleep and indirectly good mental health. The probable mechanism could be the metabolism of tryptophan in the daytime to serotonin, a natural antidepressant and further conversion of serotonin in the night to melatonin, a natural sleep inducing agent (30). As a result of no or poor nutrient intake in the breakfast, the student's academic performance in the day time and quality of sleep at night may be affected. Lower zinc intake was observed among the breakfast skippers in our study. It is noteworthy that zinc is necessary for neurogenesis, synaptogenesis, neuronal migration, and its deficiency would play a significant role with neurotransmission and consequent neuropsychological behavior (31). The taste sensation is mediated through gustin, the salivary zinc-dependent polypeptide. Deficient salivary zinc concentration would interfere with taste sensation and subsequent loss of appetite will make the students skip breakfast and the vicious cycle continues (32).

The study had some advantages. Structured 72-hr recall method took a dietary record over 3 consecutive days including Sunday to take care of the weekend variation in nutritional intakes so that it could provide a valid estimation of nutritional intake (33). Standard WHO guidelines was utilized for anthropometric measurements as well as BMI classification. ICMR dietary guidelines for Indians was used for data collection and calculation of calorific values of food items. However, there were few limitations in the study. First, since the study design was cross-sectional study,

it could not show the cause and effect relationship. Second limitation of this study was recall bias because the nutrient intakes were assessed using a recall based method. With the aim of increasing accuracy for estimating the average nutrient intake, a structured 72-hr recall method was adopted instead of a 24-hr dietary recall method which is not adequate for estimating the habitual diet at an individual level (33).

## Conclusion and Recommendation

This study suggests that there is a possible relationship between breakfast skipping with overweight and unbalanced nutrient intake. Majority of the students skip breakfast at least once in a week due to busy schedule and lack of appetite. This result may benefit to identify and target youths who may be at high risk of improper nutritional intake or overweight/obesity. Health promotion activities for healthy eating behaviors among youths are recommended in order to prevent lifestyle diseases and create a healthy role models for tomorrow.

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