Short Sleep Duration and Skipping Main Meals among University Students

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Abstract

Introduction   Admission to university influences lifestyle behaviors and is marked by a daily routine of accumulation of activities that can interfere with sleep duration, affecting food choices and meal consumption habits throughout the day.

Objective   To analyze the association between short sleep duration and skipping main meals among university students.

Materials and Methods   We conducted a cross-sectional study with 1,608 university students aged between 16 and 25 years, who were enrolled in full-time undergraduate courses at a public university in the Midwestern region of Brazil. Information on skipping breakfast, lunch, and dinner was collected through the question "On average, how often do you eat the following meals?". Given the lack of a uniform criterion to define "skipping a meal", in the present study, any answer that did not correspond to the daily consumption of the meal was classified as meal skipping, based on the recommendation of the Dietary Guidelines for the Brazilian Population. Short sleep duration was determined according to sleep time during the night (≤ 6 hours for those aged ≥ 18 years and ≤ 7 hours for those under 18 years of age). Associations were estimated using adjusted Poisson regression models.

Results   The prevalences of skipping breakfast, lunch, and dinner were of 51.0%, 13.9%, and 35.6% respectively. Short sleep duration was observed in 27.2% of the study population. After adjusting for confounding variables, short sleep duration was positively associated with skipping breakfast (adjusted prevalence ratio [PRadj] = 1.20; 95% confidence interval [95%CI] = 1.08–1.34) and skipping lunch (PRadj = 1.64; 95% CI = 1.27–2.12).

Conclusion   University students presented a high prevalence of skipping main meals. Short sleep duration was directly associated with skipping two major meals of the day: breakfast and lunch.

Keywords
► meals
► sleep duration
► sleep deprivation
► students

Introduction

Sleep disorders are becoming a major health problem worldwide,[1] with negative consequences on the functioning of the neurocognitive system and psychomotor performance.[2] Sleep is one of the basic biological needs of a human being,[3] and adequate sleep is responsible for maintaining the body's homeostasis and it also has a regenerative function. The duration, quality, and timing of sleep affect the circadian rhythm,[4] interfering with several physiological conditions, including those related to food intake.

Entry into university can lead to changes in lifestyle-related behaviors such as sleep habits, including short sleep duration, which is a common phenomenon among university students[5] that contributes to the development of unhealthy eating habits.[6] Among university students, factors such as academic workload, living far from the family, and having to do household chores, as well as participation in social events can change sleep habits, contributing to irregular meal consumption.[7]

Furthermore, a stressful lifestyle, factors related to socialization, and lack of time to prepare meals, in addition to easy access to ready-made meals or fast food, can influence the eating behaviors of university students.[8,9] Therefore, these youths are a population group with unique characteristics of vulnerability to meal skipping.[10]

Regular consumption of meals is one of the recommendations of the Dietary Guidelines for the Brazilian Population[11] to encourage a healthy and adequate diet. This recommendation is based on the premise of having three main meals daily (breakfast, lunch, and dinner), interspersed with small healthy snacks, which increases diet quality.[12]

Meal skipping is characterized by not having one or more main meals during the day.[13] The estimated prevalence of meal skipping among university students is high,[14] and among young adults it is higher for breakfast, with a range from 14% to 88.5%, followed by lunch, whose skipping ranges from 8% to 57%, and then by dinner, which is not consumed by a proportion of students ranging from 4% to 57%.[15]

The habit of skipping meals may be related to disturbances in the peripheral circadian clock and metabolism. Individuals with poor sleep quality or short sleep duration are more likely to present irregular eating patterns.[16,17] Considering the vulnerability of university students to unhealthy eating habits, the objective of the present study was to analyze the association between short sleep duration and skipping main meals among university students.

Materials and Methods

Study Design and Population

In the present cross-sectional study, we analyzed data from the Longitudinal Study on Lifestyle and Health of University Students (Estudo Longitudinal sobre Estilo de Vida e Saúde em Estudantes Universitários, ELESEU, in Portuguese), conducted at a public university in the Midwestern Region of Brazil. The eligibility criteria were students aged ≤ 25 years enrolled in a full-time undergraduate course. We excluded

students who had already earned another higher education degree, or were pregnant and/or breastfeeding women. The criterion of age was used because the ELESEU cohort study was designed with the main objective of evaluating possible changes in lifestyle and outcomes in health related to the transition between high school and university. Further details on the design of the ELESEU study can be found in the publication by Nogueira et al.[18] (2018).

Data were collected in the first semester of the years 2015, 2016, and 2017 by trained interviewers, on previously scheduled visits, during the academic period. Sociodemographic, economic, and lifestyle-related information and questions about meal consumption habits were collected through a self-administered questionnaire.

In 2015, among the 599 students eligible for the study, 58 (9.7%) did not answer the questionnaire and 46 (7.7%) refused to participate in the study, which resulted in a total of 495 participants (82.6% of the eligible ones). In 2016, among the eligible students ($n = 613$), 28 (4.6%) refused to participate in the study and 42 (6.9%) did not answer the questionnaire; thus, 543 students were evaluated (88.6% of the eligible ones). Of the 615 eligible for the study in 2017, 16 (2.6%) did not answer the questionnaire and 29 (4.7%) refused to participate in the study, hence 570 college students were evaluated (92.7% of the eligible ones). Therefore, a total of 1,608 university students were included in the present analysis in the three years of assessment, representing 88.0% of the eligible students.

Dependent Variables

Information on skipping breakfast, lunch, and dinner was collected through the question "On average, how often do you eat the following meals?". The answer options were separated for each meal: daily; 5 to 6 times a week; 3 to 4 times a week; 1 to 2 times a week; and never or almost never. Given the lack of a uniform criterion to define "skipping a meal", in the present study, any answer that did not correspond to the daily consumption of the meal was classified as meal skipping, based on the recommendation of the Dietary Guidelines for the Brazilian Population,[11] which recommends the daily consumption of breakfast, lunch, and dinner.

Independent Variable

The independent variable was short sleep duration, determined by the question "During the last month, how many hours of sleep did you have per night?". The answers were recorded as a number of hours on a continuous scale, and not as several hours. The variable was later categorized for analysis, to characterize short sleep duration. For students aged ≥ 18 years, short sleep duration was detected when the participant slept ≤ 6 hours per night, and for those aged < 18 years, when the total hours of sleep were ≤ 7 per night.[19]

Covariables

Age was assessed in years, and the sample grouped into two categories: 16 to 19 years and 20 to 25 years. The socioeconomic class was assessed using the Brazil criterion,[20] and it was categorized into: A, B, and C/D/E, according to the score

achieved by the quantification of material goods at home, presence of a domestic worker, and level of schooling of the head of the family, with category "A" being the highest and "E", the lowest. The students' living situation was also evaluated (on one's own, with parents/relatives, and with others).

The degree programs were classified according to the table adopted by the Brazilian Ministry of Education[21] and grouped by interdisciplinarities. Information about the time of the day the students attended classes was collected by consulting the Pedagogical Course Project (PPC) available on the university's web site.

Body mass was measured using a TANITA UM-080 (Arlington Heights, IL. United States) body composition analyzer with a capacity of 150 kg and a variation of 0.1 kg. Height was measured in duplicate using a portable Sanny ES2040 (São Bernardo do Campo, SP, Brazil) stadiometer, with a maximum length of 210 cm and a variation of 1 mm. The mean of the two height measurements was considered as the final height. Body mass and height were measured using standardized techniques.[22]

Weight status was assessed using the Body Mass Index (BMI, in kg/m^2) and classified based on the measurements of weight and height. For adolescents (16 to 19 years of age), BMI for age (BMI/age) was expressed in the z score of the World Health Organization (WHO) reference curve.[23] Those with BMI/age z-scores < -2 were classified as underweight; those with z score ≥ -2 and $\leq +1$ were rated as having normal weight; those classified with z score $> +1$ and $\leq +2$, as overweight, and those with BMI/age z score $> +2$ were considered obese.[23] For adults (20 to 25 years of age), the classification of weight status followed the cut-off points recommended by the WHO:[24] low weight: BMI < 18.5 kg/m^2; normal weight: BMI between 18.5 kg/m^2 and 24.9 kg/m^2; overweight: BMI between 25.0 kg/m^2 and 29.9 kg/m^2; and obese: BMI ≥ 30.0 kg/m^2.

Physical activity was assessed through the student's self-perception regarding the change or maintenance of the level of physical activity after entering university. The following question was used: "Upon entering university, do you think that your level of physical activity (time and frequency) was reduced, maintained, or increased?".

Sedentary behavior was assessed according to the daily use of screens, including television, computers, video games, and games, and was defined with the cut-off point based on the 75th percentile of the participants' screen time distribution (≤ 4 hours/day or > 4 hours/day). Smoking was defined by the use of cigarettes in the 30 days prior to the interview,[25] and it was categorized as yes/no; alcohol consumption was assessed based on the students' reports for the 30 days prior to the interview,[26] and it was also categorized as yes/no.

Statistical Analysis

Statistical analyses were performed using the IBM SPSS Statistics for Windows (IBM Corp., Armonk, NY, United States) software, version 20.0. The Chi-squared test was used in comparisons among proportions to analyze the association between the independent variable (short sleep duration) and the outcomes of skipping breakfast, lunch, and dinner. Poisson regression models were used to estimate the associations, calculating the crude and adjusted prevalence ratios, considering 95% confidence intervals (95%CIs). Separated statistical models were constructed for each dependent variable. The covariables that presented a p-value $\leq$ 0.20 in the bivariate analysis were selected for adjustments in the final models.

Results

A total of 1,608 university students were evaluated, 50.7% of whom were male. Most of them (77.9%) were aged between 16 and 19 years; 48.2% belonged to socioeconomic class "B," and 70% lived with their parents or relatives. The prevalence rates regarding skipping breakfast, lunch, and dinner were of 51.0%, 13.9%, and 35.6% respectively (►Table 1). The students reported sleeping for an average of 6.51 hours per night. Short sleep duration was found in 27.2% of the study participants.

In the bivariate analysis, skipping breakfast showed a significant association with the older age group ($p = 0.04$), and it was also associated with the lowest socioeconomic class ($p = 0.04$) and the fact that students live in shared houses, with a boyfriend or girlfriend, colleagues, and other people ($p = 0.03$). Skipping lunch was associated with the female students and the older age group ($p = 0.01$ and $p < 0.01$ respectively), as well as skipping dinner ($p < 0.01$ and $p = 0.04$ respectively) (►Table 1).

As for the field of study and time of day attending university (morning shift, afternoon shift, evening shift), both variables were only associated with skipping breakfast ($p < 0.01$). Skipping breakfast was more prevalent among degree programs in the fields of Social Sciences and Humanities (59.0%) and among students (67.0%) taking morning and evening classes (►Table 2).

Regarding lifestyle-related behavior variables, sedentary behavior was directly associated with skipping lunch ($p = 0.02$) and dinner ($p = 0.04$), with a marginal association with skipping breakfast ($p = 0.05$). Smoking was directly associated with skipping breakfast ($p = 0.01$) and lunch ($p = 0.01$). Short sleep duration was directly associated with skipping breakfast ($p = 0.04$) and lunch ($p < 0.01$). The student's weight status, perception of change in physical activity after entering university, and alcohol consumption were not associated with skipping the meals evaluated in the present study (►Table 3).

After adjusting for confounding factors, short sleep duration was directly associated with skipping breakfast (adjusted prevalence ratio [PRadj] = 1.20; 95% confidence interval [95%CI] = 1.08–1.34) and lunch (PRadj = 1.64; 95%CI = 1.27–2.12) (►Table 4).

Discussion

In the present study, short sleep duration was associated with skipping breakfast and lunch after adjustments for demographic and socioeconomic variables, field of study, weight status, and lifestyle-related behaviors.

Table 1 Distribution of university students and prevalence of skipping meals according to sociodemographic and economic variables.

Variables		Skipping breakfast		Skipping lunch		Skipping dinner	
		n (%)		n (%)		n (%)	
	Total	820 (51.0)		222 (13.9)		572 (35.6)	
	1,608						
	Prevalence	Prevalence	*p*-value*	Prevalence	*p*-value*	Prevalence	*p*-value*
Male subjects	50.7	49.8	0.31	11.8	0.01	27.9	< 0.01
Female subjects	49.3	52.3		16.2		43.5	
Age range (in years)							
16–19	77.9	49.6	0.04	12.5	< 0.01	34.3	0.04
20–25	22.1	55.9		19.1		40.2	
Socioeconomic class[a]							
A	19.7	50.6	0.04	12.7	0.09	38.9	0.16
B	48.2	47.1		12.7		35.4	
C-D-E	32.1	56.5		16.4		33.9	
Living situation							
On one's own	14.3	45.7	0.03	17.0	0.30	41.3	0.52
With parents or relatives	70.0	51.1		12.0		33.9	
Other	15.7	55.6		19.8		38.1	

Notes: *p-value associated with the Chi-squared test. [a]Assessed according to the Brazil criterion.[20]

Table 2 Distribution of university students and prevalence of skipping meals according to field of study and time of day attending university.

Variables		Skipping breakfast		Skipping lunch		Skipping dinner	
	Total	n (%)		n (%)		n (%)	
Total	1,608	820 (51.0)		222 (13.9)		572 (35.6)	
	Prevalence	Prevalence	*p*-value*	Prevalence	*p*-value*	Prevalence	*p*-value*
Agrarian Sciences	21.0	48.7	< 0.01	15.1	0.44	37.7	0.64
Engineering	19.4	40.7		10.3		36.9	
Exact and Earth Sciences	27.4	56.6		14.5		29.1	
Biological and Health Sciences	20.6	51.1		13.6		37.3	
Social Sciences and Humanities	11.7	59.0		17.0		42.0	
Time of day attending university[b]							
Morning and afternoon	59.9	50.6	< 0.01	14.2	0.07	35.4	0.54
Morning and evening	16.4	67.0		18.6		33.0	
Afternoon and evening	4.3	42.0		8.7		42.0	
Morning, afternoon, and evening	19.4	40.7		10.3		36.9	

Notes: *p-value associated with the Chi-squared test. [a]Brasil (2017). [b]Time of day attending university reported in the Pedagogical Project of Full-time Undergraduate Degree Programs, Universidade Federal de Mato Grosso (2018).

In the ELESEU study, the mean number of sleep hours observed among university students was of 6.51 hours, which is lower than the ones found in previous studies with university students,[5] and it may be considered insufficient for the age groups of the students assessed in the present study.[19] Short sleep duration was observed in 27.2% of the students, which is in agreement with the results found by Lu et al.[5] (2017) in a meta-analysis of 57 studies on short sleep duration among university students, whose prevalence rates ranged from 8.4% to 43.9%.

The transition from high school to university is marked by the establishment of new routines and behaviors. As a result

Table 3 Distribution of university students and prevalence of skipping meals according to variables related to weight status and lifestyle behaviors.

Variables	Total	Skipping breakfast		Skipping lunch		Skipping dinner	
		n (%)		n (%)		n (%)	
	1,608	820 (51.0)		222 (13.9)		572 (35.6)	
		Prevalence	*p*-value*	Prevalence	*p*-value*	Prevalence	*p*-value*
Weight status[a]							
Low weight	5.0	51.2	0.59	13.8	0.17	35.0	0.61
Normal weight	70.9	51.3		13.4		35.7	
Overweight	17.0	48.5		14.0		37.1	
Obesity	7.1	56.1		19.3		30.7	
Perception of change in physical activity[b]							
Reduced	55.8	54.8	0.68	51.8	0.42	55.3	0.94
Increased	23.3	22.5		25.4		23.3	
Maintained	20.9	20.8		22.8		21.4	
Sedentary behavior							
≤ 4 hours/day	76.4	49.6	0.05	12.8	0.02	34.2	0.04
> 4 hours/day	23.6	55.4		17.7		40.1	
Smoking[c]			0.01		0.01		0.11
No	86.2	49.5		13.0		34.9	
Yes	13.8	59.5		19.5		40.5	
Alcohol consumption[d]							
No	41.0	39.0	0.09	42.9	0.56	39.2	0.27
Yes	59.0	61.0		57.1		60.8	

Notes: *p-value associated with the chi-squareD test.
[a]World Health Organization.[23,24]
[b]Perception of change in physical activity after entering university.
[c]World Health Organization (1998).
[d]Moura and Malta.[26]

Table 4 Crude (PRc) and adjusted (PRadj) prevalence ratios and 95% confidence intervals (95%CIs) of the association between short sleep duration and skipping meals.

Variables	Skipping breakfast[a]		Skipping lunch[b]		Skipping dinner[c]	
	PRc (95%CI)	PRadj (95%CI)	PRc (95% CI)	PRadj (95%CI)	PRc (95%CI)	PRadj (95%CI)
Short sleep duration[a]						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.12 (1.01;1.24)	1.20 (1.08;1.34)	1.52 (1.18;1.95)	1.64 (1.27;2.12)	1.13 (0.98;1.30)	1.13 (0.98;1.30)

Notes: [a]Hirshkowitz, et al. (2015). [1]Model adjusted for age group, socioeconomic class, living situation, field of study, sedentary behavior, smoking and alcohol consumption; [2]Model adjusted for sex, age group, socioeconomic class, time of day attending university, weight status, sedentary behavior and smoking; [3]Model adjusted for sex, age group, socioeconomic class, sedentary behavior and smoking.

of the changes in their daily routine, university students develop an unhealthy lifestyle, characterized by greater exposure to risk factors such as smoking, alcohol consumption, stress, unhealthy eating habits, reduced levels of physical activity, and sleep deprivation.[27]

Many factors contribute to sleep deprivation among university students, including circadian physiology itself, and class schedules that are not always aligned with young people's circadian patterns. Thus, sleepiness is a phenomenon observed

among university students, and it may be related to the intense academic workload and social events during this period of life, when the use of substances such as caffeine, energy drinks, and alcohol is common, which can compromise the quality and quantity of sleep,[28] interfering with several physiological aspects, including the habit of skipping meals.

In relation to skipping meals among university students, studies have shown that the most skipped meal is breakfast, as was found in the present study. Unlike other studies

with university students, the second most skipped meal among the participants of the present was dinner, not lunch.[15] The habit of skipping main meals favors the consumption of snacks, which, in the case of this population, tend to be of low nutritional quality and high energy density.[29] Due to academic routines, university students tend to opt for quick meals without a set time, and this choice is influenced, among other factors, by the unhealthy eating environment at universities.[30,31]

The differences in the prevalence of meal skipping may be explained by the criteria adopted in the present study for its classification.[15] Given the lack of a uniform definition for skipping a meal, in the present study, we considered skipping meals not having breakfast, lunch, and/or dinner every day, reinforcing the recommendations of the Dietary Guidelines for the Brazilian Population,[11] which emphasize the importance of the daily consumption of these meals. It is worth mentioning that the criteria adopted to define skipping a meal in a study are expected to affect the associations observed with other variables, including short sleep duration.

The literature[5] has shown an association between short sleep duration and various health outcomes; however, the evaluation of the association between short sleep duration and skipping meals in the population of university students is still little explored. In the present study, this association was found, even after adjustments for potential confounding factors. Among students who presented short sleep duration, the prevalence of skipping breakfast was 20% higher (PRadj = 1.20; 95%CI = 1.08–1.34) and that of skipping lunch was 64% higher (PRadj = 1.64; 95%CI = 1.27–2.12) compared with those who did not have this sleep disorder.

In the present study, we observed a direct association between short sleep duration and skipping breakfast. This result has a relevant implication, given that breakfast is an important meal which provides an adequate supply of daily portions of certain food groups such as grains, fruits and fruit juice, milk, and dairy products.[11,32] In other words, breakfast offers an opportunity for the consumption of foods rich in nutrients such as proteins, calcium, vitamins, minerals, and fibers.[32] Breakfast skipping is associated with countless losses, from changes in cognitive performance[33] to a greater risk of developing chronic noncommunicable diseases.[32]

Additionally, in the present study, short sleep duration was also positively associated with skipping lunch. This result may also interfere with the adequacy of the diet, since lunch is considered the main meal of the day in Brazil,[8] and it provides the largest energy supply, that is, ~ 41% of the total daily energy.[9] Skipping lunch can lead to problems resulting from prolonged fasting, such as the consumption of big meals as a mechanism to compensate for the fasting period,[34] promoting weight gain, a common phenomenon among university students,[35] which can lead to excess weight. It is worth mentioning that, in Brazil, lunch represents an opportunity for the intake of foods that should be part of a healthy diet, such as vegetables, as recommended in the Dietary Guidelines for the Brazilian Population.[11]

The results of the present study are supported by the literature; the effect of sleep deprivation or its partial reduction on food consumption was demonstrated in a longitudinal study with university students.[36] The results showed that sleep deprivation is a source of stress for individuals, and it impacts consumption and the choice of food, inducing the intake of fewer healthy foods, thus leading to a reduction in the consumption of traditional meals. Studies[36,37] have shown that having adequate sleep is positively related to healthy behaviors, such as the adoption of a healthy diet, since adequate sleep influences meal patterns.

Previous cross-sectional studies[14,37] performed with adolescents and adults have shown a higher prevalence of skipped meals among people who sleep fewer hours at night compared with those who have enough hours of sleep. A cross-sectional study[38] with 14,992 adults in the United States showed that participants who slept an adequate number of hours for their age (7 to 8 hours) had a higher prevalence of consuming breakfast (86.0% versus 83.0%) and dinner (93.0 versus 91.0%) compared with those who slept for fewer hours (≤6 hours). Among Chinese adolescents ($n = 10,726$) aged between 12 and 19 years, it was observed that the chance of skipping breakfast was 94% higher than among adolescents who reported adequate sleep hours for their age.[39] In Japan, a cross-sectional study[40] with 85,931 adolescent students showed that among those with short sleep duration, only 29.3% consumed breakfast almost every day, 38.5% consumed it sometimes, and 46.6% skipped breakfast regularly.

Sleep deprivation causes an increase in ghrelin levels concomitantly with a decrease in leptin levels. These hormones are strongly influenced by sleep and cause decreased satiety and increased hunger. This aspect is of great relevance as a determinant of eating habits, as it interferes in food choices and in the consumption or skipping of meals, thus contributing to the development of obesity.[6] There is a relationship between sleep and food, due to the role of the former in the circadian cycle, which enables us to infer that there is an influence of sleep patterns on food intake, since the master clock in the suprachiasmatic nucleus (SCN) not only exerts rigid control over the sleep-wake cycle and hormonal rhythms but also participates in the daily rhythm of eating.[41]

The existence of a bidirectional relationship between the exposure and the outcomes evaluated in the present study is noteworthy, since meal skipping also influences an individual's sleep habits.[42] According to Gwin and Leidy[44] (2018), intake/skipping of food at a biologically inadequate moment, as a result of an irregular meal pattern, leads to changes in the peripheral circadian clock regarding metabolism. These changes are related to sleep/wake disorders and circadian misalignment.

The present study has limitations. The cross-sectional design does not enable us to draw conclusions regarding a causal relationship between short sleep duration and skipping meals, which would only be possible in longitudinal studies. However, studies performed in the general population of the same age, conducted both with adolescents[39,40]

and adults,[38] and involving a large number of participants, found results similar to those observed in the present study.

On the other hand, the present study also has potential. We showed the association between short sleep duration and meal skipping among university students, a topic that has not yet been explored in the literature. In this sense, the study contributes with important information to the field of health, providing support for the development of educational programs aimed at improving the quality of life and health, by promoting a healthy lifestyle. Another positive aspect was the inclusion of students from different fields of knowledge, not just the field of health, as is commonly observed in the literature.

We emphasize the importance of the university canteen, which, in our public university, offers three main meals with healthy food, at an affordable price, which has helped students to have access to adequate and healthy food during their study routine. Our university also has physical activity programs for students, which contribute to health and quality of life, promoting, among other benefits, a better quality of sleep.

Conclusion

The estimated prevalence rates of skipping breakfast, lunch, and dinner among university students were similar to those found in the literature. Skipping breakfast, in particular, presented the highest prevalence rate among the other meals that could be skipped. Short sleep duration showed a statistically significant association with skipping breakfast and lunch, regardless of potential confounding factors.

Ethical Aspects

The present research project was approved by the Research Ethics Committee of Hospital Universitário Júlio Müller Universidade Federal de Mato Grosso, under opinion no. 1,006,048, of 03/31/2015. All participants were informed about the objectives of the study, and data collection was performed only after they had signed the Informed Consent Form.

Conflict of Interests
The authors have no conflict of interests to declare.

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