Effects of Midnight Eating Habits and Sleep Duration on the Incidence of Overnutrition in Adolescents in Medan City

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Abstract: College students constitute a cohort of late adolescents undergoing a phase of rapid growth and development, necessitating adequate food intake, sufficient sleep, and the cultivation of sound dietary practices. The purpose of this study was to analyze the relationship between night eating patterns and sleep duration on the incidence of overnutrition among college students in Medan City. The research adopts a cross-sectional design, encompassing active students aged 18 to 25 years. Data collection involves interviews, anthropometric measurements, and questionnaire completion. The research instrument used The Night Eating Diagnostic Questionnaire (NEDQ) and The Pittsburgh Sleep Quality Index (PSQI). Overnutrition is determined by body weight divided by height in meters squared. Data analysis used the chi-square test. The study encompasses 138 participants, wherein 64.5% exhibit a penchant for midnight eating and 69.6% report suboptimal sleep durations. Outcomes manifest a discernible correlation between midnight eating habits (p = 0.017) and sleep duration (p = 0.022) with the incidence of overnutrition. Students partaking in late-night eating rituals and enduring inadequate sleep are predisposed to the risk of being overweight or obese.

1 INTRODUCTION

The state of being overweight and obese exerts a considerable impact on the well-being of adolescents in Indonesia, with direct repercussions on both health and psychosocial development. Furthermore, this condition elevates the risk of non-communicable diseases (NCDs) (Unicef, 2020). Adolescence, marked by significant changes in various life domains, encompasses a period characterized by rapid growth in both weight and height. College students, comprising a late adolescent demographic aged between 18 and 25 years, find themselves within a crucial phase of growth and development. To navigate this phase successfully, they necessitate adequate nutrition, engagement in physical activity, and sufficient sleep duration (Mufidah & Soeyono, 2021). The profound transformations inherent in late adolescence are influenced by several factors including customary values of culture, family, friendship, and socio-economy. These dynamics render adolescents particularly vulnerable to health issues associated with their nutritional status (Laurson et al., 2015).

The prevalence of nutritional challenges escalates consistently from late adolescence into adulthood. The 2018 Riskesdas findings underscore this trend, revealing an upswing in the prevalence of obesity from 14.8% at 18 years to 21.8%. Concurrently, central obesity has witnessed an increase from 26.6% to 31% in 2018 (Riskesdas, 2018). Notably, research conducted in Bosnia indicates that nutritional issues extend to students, with 18.09% of adolescents grappling with overnutrition (Delvarianzadeh et al., 2016). Within the Indonesian context, nutrition-related problems are also evident among final-year students. In Medan City, 40.8% of adolescents are classified as obese, while 56.9% fall within the overweight category. Similarly, in Semarang, the prevalence of obesity is reported at 41.3% (Irfan & Ayu, 2022; Sandy et al., 2023; Wijayanti et al., 2019). This collective evidence underscores a persistent

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upward trajectory in the prevalence of obesity issues among late adolescents.

Overnutrition status observed in adolescents is attributable an imbalance between dietary consumption and physical activity levels. The primary contributors to overnutrition encompass the selection of calorie-dense, low-fiber foods coupled with insufficient physical activity. Research conducted on college students or late adolescents substantiates this phenomenon, revealing eating behaviour characterized by diminished vegetable consumption and heightened intake of energy-dense foods (Roy et al., 2019).

Student commonly find themselves immersed in both academic and non-academic commitments, contending with numerous demanding assignments, stringent Grade Point Average (GPA) expectations, and challenges within student organizations. The exigencies of these multifaceted responsibilities can influence their eating habits. Particularly, college students in big cities usually engage in activities extending late into the night, leading to delayed sleep onset and, consequently, an extended period of wakefulness. This prolonged wakefulness tends to prompt increased food consumption. Notably, the practice of consuming food in close proximity to bedtime can have adverse health effects, including an elevated susceptibility to degenerative diseases, diabetes, obesity, and alterations in body composition (Kinsey & Ormsbee, 2015). Research findings further indicate a heightened risk of metabolic disorders, such as Type 2 Diabetes Mellitus (DM), among individuals with late meal times attributed to impaired glucose tolerance linked to elevated melatonin concentrations (Lopez-Minguez et al., 2018).

The imposition of deadlines for academic assignments and external engagements within student organizations is concomitant within reduced sleep duration. This abbreviated period of rest is intricately linked to heightened consumption of deleterious foods, including sugary beverages, fast food, and instant noodles, while concurrently contributing to diminished intake of vegetables, fruits, and milk (Min et al., 2018). According to data from the Sleep Foundation in 2020, chronic sleep disorders afflict 15-30% of adults (Suni & Debanto, 2022). Another study reported that inadequate sleep duration is associated with unhealthy eating patterns. Prior investigations have consistently demonstrated a robust association between sleep duration and the regulation of appetite-regulating hormones, thereby influencing food choices (Anindiba et al., 2022; Jansen et al., 2019).

2 METHOD

This study employed a cross sectional study design and was conducted in June 2023. The research targeted active students residing in Medan City, with the subject selection method based on the average estimation formula, resulting in a sample size of 138 students chosen through purposive sampling. Inclusion criteria encompassed students who willingly consented to participate, were illness free, and fell within the age range of 18-25 years. Conversely, exclusion criteria were applied to subjects who declined participation or were currently unwell.

Primary data served as the basis for data collection, encompassing subject characteristics (name, gender, date of birth, age, address, ethnic origin) family socio-economic status (parental education, parental income, and amount of pocket money), body mass index (height and weight), night eating habits, and sleep duration.

The acquisition of body weight data involved measurements using a digital scale with an accuracy of 0.1 kg, while body height data was obtained through measurements using a microtoise with an accuracy of 0.1 cm.

The nutritional status of subjects was assessed based on the Body Mass Index (Kemenkes, 2020). The assessment of eating habits questionnaire utilized the night eating diagnostic questionnaire (NEDQ) (Nolan & Geliebter, 2017), while sleep duration was evaluated using the Pittsburgh Sleep Quality Index (PSQI) questionnaire (Winer et al., 2021).

Data collected from the study underwent both univariate and bivariate analyses. Univariate analysis was employed to elucidate the data characteristics of the subject, while bivariate analysis utilized the chi-square test to examine the relationship between midnight eating habits, sleep duration and Body Mass Index.

This research obtained approval from the Research Ethics Committee of the Faculty of Medicine, University of Kristen Maranatha. The approval was granted through Decision Letter No: 130/KEP/VI/2023 on June 7, 2023.

3 RESULT

The characteristic data shows that the study encompassed a total of 138 people, as depicted in Table 1. The female subjects predominated, comprising 74.6% of the total cohort. All participants

were in their late teens, falling within the age range of 19-24 years old.

Table 1 further illustrates that the majority of the subjects were in semesters IV and V, constituting 55.8% of the total. A notable proportion, accounting for 60.1% of resided with their parents, as opposed to those residing in boarding houses or with relatives. Concerning family income, more than half of the subjects (58.7%) fell within the category equal to or greater than the Average Minimum Wage (UMR). In terms of parental education, a significant portion of parents had completed high school, representing a range of 55-58%. Conversely, parents with a college degree comprised a percentage ranging from 22-25.4% of the total subjects.

Table 1. Characteristics of Respondents.

Variable	Category	N	(%)
Gender	Male	35	25.4
	Female	103	74.6
Age	Middle adolescent	0	0
	Late adolescent	138	100
Semester	Early (II)	17	12.3
	Middle (IV-VI)	77	55.8
	Last (≥VIII)	44	31.9
Residence	Boarding house	47	34.1
	With parents	83	60.1
	With relatives	8	5.8
Family Income	< UMR	57	41.3
	≥ UMR	81	58.7
Father's Last Education	No school	3	2.2
	Elementary School	9	6.5
	Junior High School	15	10.9
	Senior High School	80	58
	College/University	31	22.5
Mother's Last Education	No school	1	7
	Elementary School	9	6.5
	Junior High School	16	11.6
	Senior High School	77	55.8
	College/University	35	25.4
Midnight Eating Habits	Not often	49	35.5
	Often	89	64.5
Sleep Duration	Normal	42	30.4
	Abnormal	96	69.6
Overnutrition	Not overnutrition	89	64.5
	Overnutrition	49	35.5

The findings presented in Table 1 indicate that 64.5% of students frequently engage in the midnight eating habits, encompassing the consumption of both snacks and substantial meals. Moreover, 69,6% of students exhibit abnormal nigh sleep hours,

comprising both insufficient and excessive sleep durations, while only 30.4% maintain a normal night sleep duration of 7-9 hours. Furthermore, 35.5% of students experience overnutrition, encompassing both overweight and obesity.

Examining the data in Table 2, it is evident that 27.5% of subjects frequently indulge in midnight eating habits and concurrently experience excess nutrition. Additionally, 29% of subjects with abnormal night sleep durations exhibit a higher prevalence of overnutrition. This prevalence surpasses that observed in subjects who infrequently engage in midnight eating and maintain normal night sleep durations.

Table 2. Bivariate Test Results.

Midnight Eating Habits	Overnutrition Occurrences				Total		P
	Not over nutrition		Overnutrition				
	N	%	N	%	N	%	
Not often	38	27.5	11	8	49	35.5	0.0 17
Often	51	37	38	27.5	89	64.5	
Total	89	64.5	49	35.5	138	100	

Sleep Duration	Overnutrition Occurrences				Total		P
	Not over nutrition		Overnutrition				
	N	%	N	%	N	%	
Normal	33	23.9	9	6.5	42	30.4	0.0 22
Abnormal	56	40.6	40	29	96	69.6	
Total	89	64.5	49	35.5	138	100	

Table 2 presents the outcomes of the bivariate analysis utilizing the chi-square test. The results of the chi square test indicate a statistically significant association between midnight eating habits and the incidence of overnutrition among adolescents in the city of Medan (p-value 0.017). Furthermore, the results of the bivariate analysis reveal a significant relationship between sleep duration and the incidence of overnutrition in adolescents in Medan City (p-value 0.002).

4 DISCUSSION

Contemporary research has extensively explored the correlation between eating habits and obesity. The body's metabolism at night tends to decelerate, requiring less energy compared to the morning and daytime. Therefore, individuals who frequently consume substantial amounts of food at night may experience an energy imbalance, particularly considering the reduced physical activity during night-time (Evan et al., 2017).

The study findings indicate a discernible association between the habit of eating late at night and the incidence of overnutrition in adolescents. In terms of proportion, the prevalence of overnutrition is notably higher among adolescents who frequently engage in midnight eating. Specifically, out of 49 adolescents with overnutrition, 38 exhibits a tendency to consume food late at night, while the remaining 11 fall into the category of rare midnight eating. The results of the bivariate analysis corroborate this observation, revealing a statistically significant relationship between midnight eating habits and. the incidence of overnutrition in adolescents in the city of Medan (p-value 0.017).

The consumption of meals during late-night hours has been associated with diminished energy expenditure, a consequence of reduced leptin levels, heightened hunger, increased appetite, and subsequent weight gain (Vujović et al., 2022). Additionally, eating at night has been found to significantly elevate glucose, insulin, and triglyceride levels, resulting in diminished insulin sensitivity (Kessler & Pivovarova-Ramich, 2019). Further studies, such as the one conducted by Firmanurochim et al., (2021) have reinforced the existence of a significant relationship between dinner habits and the incidence of obesity in young women.

Obese individuals classified under the Metabolic Unhealthy Obese type often exhibit night eating syndrome, a pattern characterized by the omission of breakfast, the consumption of large dinner portions after 7 pm, and compromised sleep patterns. To mitigate the risk of metabolic disorder, Leksono et al., (2022) propose reduction in the frequency and duration of dinner.

The results of the bivariate analysis further reveal a statistically significant relationship between sleep duration and the incidence of overnutrition (p=0.022). A noteworthy 81.6% adolescents with overnutrition exhibit abnormal sleep duration. According to age-based recommendations, adolescents typically require approximately 7-8 hours of sleep per day, as stipulated by the Ministry of Health guidelines (Kemenkes, 2021). Insufficient sleep can lead to various disorders, including disruption in the regulation of hormones such as leptin and ghrelin, which play crucial roles in appetite regulation and food intake (Leksono et al., 2022).

Sleep duration has been identified as a factor contributing to overweight and obesity. Over the past century, a reduction in sleep duration by 1.5 hours per day has been observed, attributed to factors such as work schedules, insufficient sleep, and exposure to artificial light at night. This reduction in sleep duration has been associated with an increased prevalence of obesity, correlating with a weight gain of approximately 5 kg and a 10% or more rise in Body Mass Index (Y.-M. M. Park et al., 2019). Numerous studies conducted in Korea affirm the elevated risk of obesity in individuals with a sleep duration of less than 7 hours per day. Additional research indicates that adolescents with lower BMI tend to have prolonged sleep duration (>9 hours/day), while those with higher BMI have shorter sleep duration (<9 hours/day) (Grandner et al., 2015; S. K. Park et al., 2018).

Insufficient sleep duration has been identified as a contributing factor to the incidence of obesity, influencing weight-related behaviours. Specifically, inadequate sleep is associated with diminished vegetable consumption, reduced frequency of breakfast consumption, decreased physical activity, and elevated sugar-sweetened beverages (Widome et al., 2019). The physiological mechanism underlying increased food intake at night involve heightened levels of the ghrelin hormone and diminished levels of the leptin hormone, culminating in heightened appetite and hunger, particularly for foods rich in calories, carbohydrates and fat (Dashti et al., 2015; Silva et al., 2018; Sutanto et al., 2020).

Additional investigations have highlighted the relationship between inadequate sleep duration and obesity through food intake, with statistically significant correlation (p = 0.000). Rachmawati et al., (2021) observed that students with short sleep duration were more likely to fall into the obese category and exhibited increased energy intake. Conversely, a study by Vania (2022) reported no discernible relationship between sleep duration and students' nutritional status (p=0.600). Despite relatively short sleep durations, the distribution of nutritional status in Vania's study remained predominantly normal (Vania & Kumala, 2022).

It is essential to acknowledge a limitation of this study, namely, the omission of an examination of macronutrient intake in adolescents.

5 CONCLUSION

The study findings showed a noteworthy association between midnight eating habits, sleep duration, and the prevalence of overnutrition among adolescents in Medan city. Students who frequently engage midnight eating habits coupled with aberrant sleep durations are more susceptible to experience overnutrition compared to their counterparts who

infrequently indulge in midnight and maintain normal sleep durations.

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