



Chronotype, Eating Habits, and Body Mass Index in First-Year Undergraduate Medical Program Students

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This cross-sectional study aimed to identify the correlation between chronotype and body mass index (BMI) in medical students, mediated by energy intake, and to explore eating habits. There were 46 participants who completed Morningness-Eveningness Questionnaire and Chrononutrition-Profile Questionnaire in the Indonesia version and a 3 days of 24-hour food record. Participants' weight and height were measured by microtoise and digital body weight scale. Additionally, univariate and correlation analyses were conducted to identify the correlation of the variables. The study found no significant difference in the correlation between chronotype preference and BMI, chronotype preference and energy intake, and BMI and energy intake. Medical students had a habit of eating breakfast, even skipping breakfast, having dinner later, consuming the highest energy at lunchtime, and consuming high-calorie, high-fat, and high-sugar foods at night. The study revealed no significant correlation between chronotype, eating habits, and BMI. However, the eveningness medical students have bad eating habits.

Keywords: Body mass index; Chronotype; Eating habits; Energy intake

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INTRODUCTION

Evening chronotype individuals prefer later bedtimes and wake-up times, leading to less activity during the mornings and afternoons [1-3]. This tendency can foster a sedentary lifestyle, which increases the risk of various health problems, including hypertension, hyperlipidemia, poor glycemic control, and, most notably, obesity [4-6].

Eveningness individuals often start their activity late, which causes them to postpone or even skip breakfast and dinner time [7,8]. Skipping breakfast can cause overcompensation of energy intake, leading to increased energy intake accumulation compared to individuals who have breakfast routinely [7]. This habit can cause an increase in sucrose, unsaturated fat, and calorie intake, leading to various diseases, especially obesity [7]. Studies have confirmed this association, finding a higher average body mass index (BMI) among individuals with an evening chrono-

type [2,7]. While the relationship between chronotype and obesity has been established, the specific variable mediating this association requires further investigation. Eating habits, mainly skipping breakfast and late-night meals and the type of food consumed, are believed to play a crucial role in this process [7,9].

This study investigated the relationship between chronotype and BMI in first-year medical students. By analyzing their eating habits, mainly first and last meal times, breakfast skipping, and meal timing with the highest calorie intake, the study seeks to identify how these factors contribute to BMI in individuals with different chronotypes.

METHODS

Study design and participants

This study aimed to investigate the dietary habits and anthropometric characteristics of first-year medical students, excluding

those on diets or taking sedative medications. The data collection involved questionnaires, 3 days of 24-hour dietary records, and subsequent weight and height measurements. This study was ethically approved by the Faculty of Medicine Ethics Committee at Tanjungpura University (Reference: 7212/UN22.9/PG/2022), and all participants agreed to participate in this study by signing the informed consent.

Materials

All participants were evaluated using a validated instrument, including the Indonesian version of the Morningness-Eveningness Questionnaire (MEQ) and Chrononutrition-Profile Questionnaire (CP-Q). The MEQ questionnaire has been modified by adding two questions about wake-up and sleep time during weekends, resulting in 21 items in this questionnaire. The modified MEQ questionnaire had been validated and reliable, showing that all items were valid and the Cronbach's alpha value was 0.828. Participants' weight and height were measured by the stature meter (GEA, Dusseldorf, Germany) and digital body weight scale (Xiaomi, Beijing, China; and Oase, Guangdong, China). The weight measurement was taken when the participant was fasting and had not consumed food to prevent measurement bias.

The 3 days of 24-hour food record energy was used to take participant's food consumption data. Energy intake was classified as above energy needs (energy intake $\geq 120\%$ recommended dietary allowances [RDA]), adequate energy needs (energy intake 90% – 119% RDA), and below energy needs (energy intake $<90\%$ RDA) [10]. In addition, the types of foods consumed by eveningness participants after 20:00 h were grouped into high-energy, high-

fat, and high-sugar foods [7].

Statistical

Participant's characteristics were analyzed using Microsoft Excel 2019. The 3 days of 24-hour food record data was analyzed using the Nutrisurvey 2007 Indonesia version to obtain energy consumption on two weekdays and one weekend. Data from eveningness individual food records were analyzed for foods consumed after 20:00 h. Correlation analysis between chronotype and energy intake, also between chronotype and BMI were conducted using Kendall's tau statistical test. Spearman's test assessed the correlation between energy needs and BMI.

RESULTS

Among the 46 participants, the prevalence of eveningness preference respondents was 93.48%. Only 6.52% of the participants exercised for at least 150 minutes per week [11]. In a week, most participants skipped breakfast two to three days a week. However, interestingly, more than half of the eveningness participants had a normal BMI.

No significant correlations emerged between chronotype, energy intake, and BMI, suggesting that additional factors beyond energy intake influence the relationship between chronotype and weight management. A detailed examination of participant eating habits, including energy intake, meal timing, and comparisons between weekdays and weekends, is presented in Figure 1. This analysis aims to elucidate how eveningness preferences impact dietary patterns and potentially influence health outcomes.

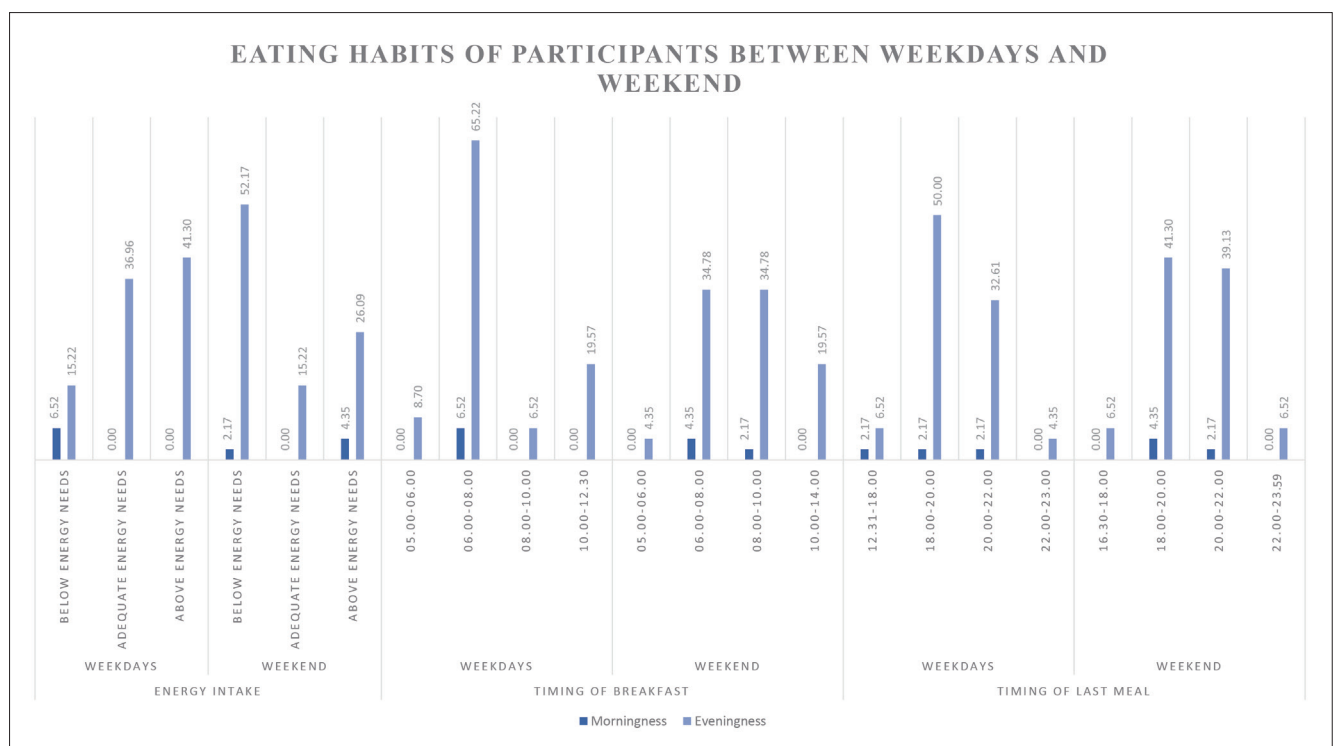


Figure 1. Eating habits of participants between weekdays and weekend.

Eveningness participants demonstrated significant shifts in their eating habits between weekdays and weekends. Notably, their energy intake patterns were reversed: exceeding needs on weekdays (41.30%) and falling below needs on weekends (52.17% below). This contrasts with morningness participants, who showed the opposite trend. Additionally, eveningness participants' meal timings significantly shifted on weekends, with first meals occurring later (after 8:00 h). Last meals consumed later (after 20:00 h), with the latest being as late as 23:59 h. These findings suggest a potential link between eveningness preferences and changes in dietary patterns and timing, which may warrant further investigation.

A review of the food consumed by eveningness participants was conducted by identifying food consumption after 20:00 h, the dinner time limit [7]. The foods consumed categorized as high in calories, fat, and sugar. The top five foods are rice, noodle, fried foods, potatoes, and sweet drinks.

DISCUSSION

The study found a high percentage of eveningness chronotypes among first-year medical students, consistent with a study conducted on Milan students in 2021 [12]. The correlation analysis of chronotype and energy intake rate variables showed no significant differences between chronotype and energy intake and between chronotype and BMI.

The study found that participants with energy intake above their needs tended to eat at popular outlets such as malls and cafes, which is related to the habit of hanging out that has become a necessity and tertiary need for teenagers [13,14]. The increase in participants with energy intake below their needs is due to low self-esteem caused by unstable income among students [15]. Skipping breakfast can lead to higher energy intake during the next meal to compensate for the energy needs [8]. Respondents in the study had a habit of skipping breakfast at least once a week, which was related to the late timing of the last meal because of the more energy from the last meal in the morning. This finding is consistent with previous research in Finland, which showed that individuals with eveningness chronotype had a habit of skipping breakfast [7]. Additionally, participants consumed snacks during breakfast, which did not fulfill their energy needs and caused them to eat more at lunch and dinner.

The timing of the last meal was assessed to evaluate the habit of eating above the average dinner time. This finding was consistent with a study in Finland that showed that calorie intake was higher between 23:00 h and 1:00 h on weekends compared to weekdays [7]. High-sugar and high-energy foods dominated the food choices of eveningness individuals for night meals, which is part of emotional eating habits that aim to counteract negative internal and external stimuli [16,17].

The study uses a validated MEQ questionnaire and analyzes the food choices of eveningness individuals. However, the study has limitations due to its cross-sectional design, which cannot directly determine the direction of correlation between variables because

the effect process only occurs slowly and because of the limitation of the number of respondents.

In conclusion, this study found no significant correlation between chronotype and BMI, and the level of energy intake did not mediate the correlation between the two variables. However, the study revealed that most individuals with an eveningness chronotype have poor eating habits, such as skipping breakfast, eating later for the first and last meal, and consuming energy above their needs.

Funding Statement

None

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.


Availability of Data and Material


The data sets are available from corresponding author upon reasonable request.


Author Contributions

Conceptualization: all authors. Data curation: Daniel Alexander Changestu. Formal analysis: Daniel Alexander Changestu. Funding acquisition: Daniel Alexander Changestu. Investigation: Daniel Alexander Changestu. Methodology: all authors. Project administration: all authors. Resources: Daniel Alexander Changestu. Software: Daniel Alexander Changestu, Agustina Arundina Triharja Tejoyuwono. Validation: Ery Hermawati, Agustina Arundina Triharja Tejoyuwono. Visualization: all authors. Writing—original draft: Daniel Alexander Changestu. Writing—review & editing: Ery Hermawati, Agustina Arundina Triharja Tejoyuwono.

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