

Association of Nutritional Pattern with Sleeping Pattern among Malaysian University Students

Zulinda Ayu Zulkipli*, Aisyah Khisamudin

Universiti Teknologi Mara, Puncak Alam Campus, Selangor, Malaysia

*Corresponding Author

DOI: <https://dx.doi.org/10.47772/IJRISS.2024.803350S>

Received: 29 September 2024; Accepted: 09 October 2024; Published: 11 November 2024

ABSTRACT

Good nutrition is crucial for overall health and well-being as well as plays a vital role in supporting growth, development, and disease prevention. Meanwhile sleep is important for maintaining good physical health, cognitive function, emotional well-being, and overall quality of life. Nutritional intake and the sleep quality are believed to be associated with each other. According to National Sleep Foundation, eating habit can be crucial to the quality of sleep. University students are the population that may be at risk for poor sleep quality and unhealthy eating habits due to few factors including the academic pressure as the major factor. Most research focused on the link between diet and sleep quality has been focused on general adults or particular gender. As a result, there has been less research focused on the relationship between sleep and nutrition among young adults and university students in particular especially in Malaysia setting of culture. Thus, this study came out with the objective to determine the nutritional pattern, sleeping pattern and the association between each other among the students of Universiti Teknologi Mara (UiTM), Puncak Alam Campus. The quantitative research design was being used in conducting this study and there were 103 (n=103) of students across faculty in UiTM Puncak Alam Campus who participated as the respondents. The study used a set of questionnaires which include few items such as Chrononutrition Profile Questionnaire (CP-Q), Dutch Eating Behavior Questionnaire (DEBQ), Morningness-Eveningness Questionnaire (MEQ) and Pittsburgh Sleep Quality Index (PSQI) as the instrument. The instruments were included in a single link of Google Form and distributed online. The data obtained then being analyzed using Statistical Package for Social Science (SPSS) software. Throughout the frequency analysis, it has been found that majority of the students developed emotional eating habit and most of the students are intermediate type which mean do not strongly lean towards being either a morning type or an evening type. Hence, chi-square test between the eating behavior and the morningness-eveningness type show a significant association (chi square = 10.788, df = 4. Sig = .029) which mean, the nutritional pattern indeed influences the sleeping pattern. This findings on the association of nutritional patterns and sleeping patterns among Malaysian university students have across-the-board implications for students, educators, and government stakeholders in the context of higher education and public health management.

Keywords: Nutritional pattern, Sleeping pattern, Circadian Rhythm, Eating Habits, Morningness-Eveningness, University Students

INTRODUCTION

Nutrition plays a fundamental role for human health and wellness growth across all stages of life course. From as early as fetal phase to old age, nutrition shapes our growth and overall healthy living. Nutrition can be defined as the biochemical and physiological process in which the organism or human consume foods to support its life. It provides human with nutrients that can be metabolize as energy or chemical structure in the body. Nutrients can be classified into six main components which are carbohydrate, protein, fat,

vitamins, minerals and water. Sleep on the other hand is a vital aspect of overall health and well-being. The quality and duration of sleep have a significant impact on physical, mental, and cognitive functioning. For young adults (i.e., 18–25 years), the National Sleep Foundation (a U.S. non-profit organization) guidelines recommend seven to nine hours of sleep per night, stating that less than six hours of sleep per night can compromise health and well-being. Lacking of sleep duration may impact an individual to get through the day especially young adult in which having compact schedule compared to other age group. Despite adequate sleep being critically important for health, and in light of the fact that adults spend more than 30% of their lives sleeping, the majority of university students do not achieve the recommended amount of sleep each night, and the overall hours of sleep in this population has continued to decrease over the past decades.

In this study, the researcher was going to discuss more on the nutritional pattern, sleeping pattern and the association with each other. This study specifically aims on the group of young adults especially among the university students. With a worldwide population of 1.8 billion people, adolescents represent the largest cohort of young people in history making it more relevant and more convenient to be studied as the sample in this research. Young adulthood is a critical period considered by significant physiological and lifestyle changes, making it essential to adopt healthy sleeping and dietary patterns. A study published in the journal *Nutrients* found that a diet high in fruits, vegetables, and whole grains was associated with better sleep quality among young adults at aged 18-25, while a diet high in fast food, sweets, and soft drinks was associated with poorer sleep quality (Liu et al., 2017). This shows how the nutritional intake could influence the sleeping pattern of an individual and the other way around. Commonly, irregular sleep habits and other sleep problems are prominent in university students. For example, over 60% of U.S. university students were categorized as poor-quality sleepers and had shortened sleep duration on weekdays, but delayed mean bedtimes (1:44 a.m.) and wakeup times (10:08 a.m.) on the weekends. In contrast, certain dietary components have been associated with disrupted sleep patterns among young adults. For instance, caffeine, normally found in coffee, tea, energy drinks, and chocolate, has a stimulant effect that can affect with sleep initiation and maintenance (Clark et al., 2017). Thus, the researcher was intended to explore more on the complex relationship between nutrition and sleeping pattern among young adults in order to look more thoroughly on its association with each other.

Circadian Rhythm

Circadian Rhythm which has been discovered since 1792 by the French astronomer Jean Jacques d'Ortous de Mairan as mentioned by Huang (2018) suggested that, sleep and wakefulness are regulated by an internal biological clock. Circadian rhythms are physical, mental, and behavioural changes that follow a 24-hour cycle (National Institute of General Medical Sciences, 2019). This theory emphasizes the importance of maintaining a regular sleep-wake schedule and highlights how disruptions in circadian rhythm, such as irregular eating patterns or consuming stimulating substances, can impact sleep quality. Sleep-wake Homeostasis on the other hand, suggest that sleep is influenced by the body's need for sleep, which accumulates over wakefulness and is gradually reduced during sleep. Nutritional patterns can influence sleep homeostasis, as inadequate nutrient intake or imbalances in macronutrients may interfere with the body's ability to regulate sleep-wake cycles. Based on the research by Deboer et al. (2018), which explores the relationship between sleep homeostasis and the circadian clock stated that sleep homeostasis and the circadian clock have reciprocal influences on each other's functioning. The circadian clock affects the timing and structure of sleep, determining the preferred timing of sleep and wakefulness based on the internal biological clock. At the same time, sleep homeostasis interacts with the circadian clock, as sleep deprivation can lead to an increased drive for sleep and alterations in circadian rhythmicity.

Nutritional pattern among young adult

Nutrient intake of university students is one of great concern due to its potential impact on health and academic performance. In order to commit with the course work and the commitment in university, it may affect their dietary pattern due to many driving factors. The transition from home to university life has been associated with unfavourable changes to food intake (Sprake et al., 2018). In addition, the same study stated

that the shift to university life may be associated with increased independence over food choice, small food budgets, and exposure to new social groups and food cultures. Numerous studies have investigated the dietary patterns of university students worldwide, revealing common trends and challenges.

METHODOLOGY

Population and Sampling

Population referred to any set of designated groups of the target individual based on the research needs. The target population for this study is the undergraduate students of UiTM Puncak Alam Campus. The sampling technique used in this research is a randomly sampling technique where the population has an equal chance of being selected. This technique is chosen to ensure that every student in the population has equal chances to be selected. This technique is normally use by researchers to obtain a smaller sample size from a larger population for the research purposes and to make generalizations about the population. According to Datta (2018), stated that a selection of participants from a population are chosen at random by the researcher using simple random sampling. Then, data is gathered from the randomly selected subgroup. Therefor data from 103 students are collected.

Instrument

The researcher used primary data for this study and personally distributed questionnaires to respondents in order to acquire more desirable data and information on the research issue. Although it can take some time, it does give a definite knowledge from the ground up. This study used a set of questionnaires in the data collection. The set of questionnaires that were used in this study other than demographic and health information status, including Chrononutrition Profile-Questionnaire (CP-Q), Dutch Eating Behaviour 27 Questionnaire (DEBQ), Pittsburgh Sleep Quality Index (PSQI) and Morningness-Eveningness Questionnaire (MEQ).

Chrononutrition Profile-Questionnaire (CP-Q) assesses six components of chrononutrition that are likely to influence health (breakfast skipping, largest meal, evening eating, evening latency, night eating, and eating window). This questionnaire is designed to assess general chrononutrition behaviours and preferred timing of food intake. The CP-Q consists of 18 items designed to evaluate general patterns of chrononutrition preferences and chrononutrition behaviours, on typical work/schooldays and free days. Specifically, the researcher asks about the time of participants' first and last eating events of the day, as well as lunchtime, to allow for assessment of eating window and evening eating. The researcher also asks them to report the time they fall asleep and wake up. Meanwhile, Dutch Eating Behaviour Questionnaire (DEBQ) is a widely used self-report questionnaire that assesses an individual's eating behaviours and attitudes towards food. It was developed by Barrada J.R., et. al. (2016) in the Netherlands. The DEBQ consists of three subscales, each addressing different aspects of eating behaviour including emotional eating, restrained eating and external eating. The DEBQ typically involves of 33 items, with each subscale containing 11 items. Participants rate the frequency of their eating behaviours and attitudes on a Likert scale, usually ranging from 1 to 5, reflecting different response options (e.g., never, seldom, sometimes, often, always). On the other hand, Pittsburgh Sleep Quality Index (PSQI) is a broadly used self-report questionnaire that evaluates an individual's sleep quality and patterns over the past month. It was established by Buysse et. al. (1989) and his colleagues at the University of Pittsburgh. The PSQI consists of 19 items that measure various aspects of sleep quality, including subjective sleep quality, sleep latency (how long it takes to fall 28 asleep), sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Participants are asked to rate their experiences and behaviors related to sleep on a Likert scale or by providing specific numerical values. The scores from different items are combined to generate seven component scores. Higher scores indicate poorer sleep quality. Moreover, Morningness-Eveningness Questionnaire (MEQ) on the other hand is a self-report questionnaire designed to assess an individual's preferred circadian rhythm or chronotype which developed by Horne and Östberg (1976). The MEQ consists of 19 items that inquire about an individual's preferred timing of various activities and behaviours throughout

the day, as well as their subjective feelings of alertness during different periods. The questionnaire is typically used to determine whether a person is a "morning type", an "evening type", or falls somewhere in between. Participants can respond to each item by selecting the option that best corresponds to their habitual preferences. The responses are then scored, and a total score is calculated, which indicates an individual's degree of morningness or eveningness. Higher scores reflect a preference for morningness, while lower scores indicate a preference for eveningness.

Data Collection

The sets of questionnaires were transformed into a Google Form then the link was generated out of it. The Google Form link was distributed online via WhatsApp mobile application. A notice message on this study that includes researcher's information, the title of the research, the objective of the study with an attachment of the Google Form link to answer the sets of questionnaires were forwarded to the WhatsApp group among the students in UiTM Puncak Alam Campus.

Data Analysis

The data collected through the questionnaires were inserted and analysed in Statistical Package for Social Science (SPSS) software. The data were analysed by multiple descriptive statistical and also inferential statistical. The test that was being used in this analyzation process are, Frequency analysis for demographic details and health information. On the other hand, the test used based on the objectives of the research are frequency, mean and standard deviation analysis test for determining the nutritional pattern and sleeping pattern among UiTM students according to first and second research question. Based on the third research question, Chi-square test was used in order to find the association between the nutritional pattern and sleeping pattern among students of UiTM Puncak Alam campus. While for a few open-ended questions in the questionnaire were analyzed qualitatively since not all the respondents filled in the response for the open-ended section

RESEARCH FINDINGS AND DISCUSSIONS

The nutritional pattern among students of UiTM Puncak Alam Campus

Table 1 shows the frequency of the breakfast taken in a week based on Chrononutrition Profile Questionnaire (CP-Q). The total of 5 (4.9%) students takes 0 to 1 day of breakfast in a week, 12 (11.7%) students take 2 days of breakfast, 20 (19.4%) of students take 3 and 4 days of breakfast, 15 (14.6%) of students take 5 days of breakfast, 7 (6.8%) of students take 6 days of breakfast and remaining 19 (18.4%) of students take 7 days of breakfast in a week.

Table 1: Frequency of the breakfast taken in a week

At average, how frequent do you take breakfast in a week?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 days	5	4.9	4.9	4.9
	1 day	5	4.9	4.9	9.7
	2 days	12	11.7	11.7	21.4
	3 days	20	19.4	19.4	40.8
	4 days	20	19.4	19.4	60.2
	5 days	15	14.6	14.6	74.8
	6 days	7	6.8	6.8	81.6
	7 days	19	18.4	18.4	100.0
	Total	103	100.0	100.0	

Table 2: Frequency of biggest meal of the day

What is your biggest meal of the day?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Breakfast	2	1.9	1.9	1.9
	Lunch	77	74.8	74.8	76.7
	Dinner	24	23.3	23.3	100.0
	Total	103	100.0	100.0	

On the other hand, table 2 shows the biggest meal of the day taken by the students. A total of 2 (1.9%) students have breakfast as their biggest meal while 77 (74.8%) of students have lunch as their biggest meal and remaining 24 (23.3%) of students have dinner as their biggest meal of the day.

Table 3: Frequency of how often the snack was taken after last meal of the day

How often do you snack after your last meal of the day in a week?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 days	10	9.7	9.7	9.7
	1 day	10	9.7	9.7	19.4
	2 days	17	16.5	16.5	35.9
	3 days	28	27.2	27.2	63.1
	4 days	12	11.7	11.7	74.8
	5 days	13	12.6	12.6	87.4
	6 days	3	2.9	2.9	90.3
	7 days	10	9.7	9.7	100.0
	Total	103	100.0	100.0	

Table 3 shows the frequency on how often the snack was taken after the last meal of the day. A total of 10 (9.7%) students have taken snacks for 0 and 1 day in a week. Following by 17 (16.5%) of students have taken snacks for 2 days, 28 (27.2%) of students have taken snacks for 3 days, 12 (11.7%) of students have taken snacks for 4 days, 13 (12.6%) of students have taken snacks for 5 days, 3 (2.9%) of students have taken snacks for 6 days and remaining 10 (9.7%) of students have taken snacks for 7 days in a week.

Table 4: Frequency of the Eating Behaviour

Eating Behaviour					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Emotional Eating Behaviour	64	62.1	62.1	62.1
	Restrained Eating Behaviour	12	11.7	11.7	73.8
	External Eating Behaviour	27	26.2	26.2	100.0
	Total	103	100.0	100.0	

In order to determine the nutritional pattern among students of UiTM Puncak Alam Campus, descriptive analysis was conducted based on the DEBQ score (FScore) by sum up the score of each type of eating behaviour including Emotional eating, Restrained eating and External eating. Based on table 4 shows the distribution of the eating behaviour of UiTM Puncak Alam Campus students. A total of 64 (62.1%) students has Emotional Eating Behaviour while 12 (11.7%) of students have Restrained Eating Behaviour and remaining 27 (26.2%) students have External Eating Behaviour.

Based on the finding, the result of frequency analysis from the Chrononutrition Profile Questionnaire (CP-Q) shows that the students of UiTM Puncak Alam Campus frequently take breakfast for three to four days in a week since the total of 20 (19.4%) out of 103 respondents ($n=103$) take breakfast for that particular number of days in a week. A study from Juliana et al., (2023) which also conducted among college students during the COVID19 pandemic similarly found that participants ate breakfast about four times a week on average. Next, the students' biggest meal of the day is lunch since the result shows a total of 77 (74.8%) students picked lunch as their biggest meal following by dinner which the total of 24 (23.3%) students and the remaining 2 (1.9%) students had breakfast as their biggest meal of the day. However, the results from Juliana et al., (2023) found that more than 24% of participants had their largest meal at night during dinner or supper. The prevalence is in accordance with the current trend worldwide seen among young adults. Swiss adults aged 18–26 years, US college students, and Turkish university students, were all found to have a similar trend of night eating (Juliana et al., 2023). These differences of the meal pattern might be due to the cultural factor or the Body Mass Index (BMI) factor. Despite the fact that night eating is associated with increased body weight, the young adults who were underweight in our sampling frame, showed a significantly higher prevalence of night eating (Okada C et al., 2019). Moreover, the result in this study also shows that the students often snacking after a meal for three days in a week since the highest total of students are 28 48 (27.2%) students at three days. There was a study conducted among undergraduate students in Malaysia by Hairudin et al., (2023) found that the chrono nutrition behaviors presented fair to good scores for all behavior patterns, including evening eating, but did not specifically report on snacking after meals. However, another study from Baghdadi et al., (2022) which was conducted among college students with overweight or obesity during the COVID-19 pandemic reported that the frequency of snacks consumed per week was 6.0 days. These differences observe were clearly due to the pandemic phase and non-pandemic phase where during pandemic phase, people tend to snacking more since most of the time were spent at home with the limitation to go outside. On the other hand, the result of analysis from the Dutch Eating Behavior Questionnaire (DEBQ) shows the students of UiTM Puncak Alam Campus has Emotional eating behaviour since 64 (62.1%) out of 103 students ($n=103$) has Emotional eating behaviour following by 27 (26.2%) students has External eating behaviour and then Restrained eating behaviour which has the least frequency number. Emotional eating refers to the tendency to eat in response to negative emotions, such as stress, anxiety, or depression. While External eating refers to the tendency to eat in response to external cues, such as the sight or smell of food and Restrained eating can be defined as the tendency to restrict food intake in order to control body weight. A study by Düz & Aytekel (2020) which conducted among university students in Turkey found that female students had higher scores on emotional eating compared to male students. The mean scores of emotional and external eating subscales of women were higher than those of men. It was believed that, when women experience the changing of emotional state, they tend to develop emotional eating pattern which make women consume too much foods.

The sleeping pattern among students of UiTM Puncak Alam Campus

The students were given the Morningness-Eveningness Questionnaire (MEQ) as one of the instruments to determine the sleeping pattern among students of UiTM Puncak Alam Campus. The score of the test (GScore) were sum up and it can be seen the descriptive analysis shown in the Table 5 that on average, the students are intermediate type (mean= 49.0874, SD= 8.04535) which mean do not strongly lean towards being either a morning type or an evening type. The lowest score is 27 which indicate evening type of person (<41) while the highest score is 67 which indicate a morning type of person (>59).

Table 5: Descriptive table for MEQ Score

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
GScore	103	27.00	67.00	49.0874	8.04535
Valid N (listwise)	103				

Table 6: Frequency of Morningness-Eveningness Type

Morningness Eveningness Type					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Evening Type	15	14.6	14.6	14.6
	Intermediate	76	73.8	73.8	88.3
	Morning Type	12	11.7	11.7	100.0
Total		103	100.0	100.0	

Based on the Table 6, it shows a total of 15 (14.6%) students are Evening Type of person while 76 (73.8%) of students are Intermediate and remaining 12 (11.7%) students are Morning Type of person.

The result of descriptive statistic for this study shows on average, the students are intermediate type (mean= 49.0874, SD= 8.04535) which mean do not strongly lean towards being either a morning type or an evening type. The score was determined through the scaling of item in DEBQ by Barrada et al. in which the sum gives the score ranging from 16 to 68. The scores of 59 indicate “morning types” and the scores between 42-59 indicate “intermediate types”. Moreover, through the frequency analysis result shows most of students which are 76 (73.8%) out of 103 (n=103) students are the intermediate type of person. A study by Lan et al. (2022) conducted in Israel during the COVID-19 lockdown found that the average MEQ score was 46.7, with the most common chronotype being neither morningness nor eveningness. This means the average score indicate the intermediate type since it was in a range of between 42-59. On the other hand, common report from past studies has stated that university students have a poor sleep quality. According to Schlarb et al. (2017), up to 60% of all college students suffer from poor sleep quality, and 7.7% meet all criteria of an insomnia disorder. Hence, this study has found some difficulties in sleeping among the students of UiTM Puncak Alam that can contribute to a poor sleep quality through an open-ended 50 question in Pittsburgh Sleep Quality Index Questionnaire (PSQI). There are the respondents who stated some of their difficulties in sleeping. Some of the statements are playing with mobile phone before sleeping, anxiety, stress due to lot of assignment submission, sweating and hotness due to Malaysia weather, roommate factors (snoring and not switch off the light at night), consuming tea or coffee before sleeping, and health problem (thyroid symptom). Based on the statements, many respondents elaborated on the anxiety the most in which the reason of being anxiety has vary including due to so many assignments, preparation for presentation, test and the coffee or tea consumption. A similar result has reported that poor sleep quality and sleep disorders are often associated with mental health issues such as chronic fatigue, depression, stress, anxiety, and lower

quality of life. In addition, Eveningness is also often associated with a poor sleep quality. Hence, it can be said that students of UiTM Puncak Alam Campus do not really show the poor sleep quality pattern since 73.8% of the students are the intermediate type.

Association between nutritional patterns and sleeping patterns of UiTM Puncak Alam Campus' students.

Table 6: Crosstabulation of Eating Behaviour and Morningness-Eveningness Type

Morningness Eveningness Type * Eating Behaviour Crosstabulation

Count		Eating Behaviour			Total
		Emotional Eating Behaviour	Restrained Eating Behaviour	External Eating Behaviour	
Morningness Eveningness Type	Evening Type	5	1	9	15
	Intermediate	50	10	16	76
	Morning Type	9	1	2	12
Total		64	12	27	103

Table 7: Chi-square result

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.788 ^a	4	.029
Likelihood Ratio	9.597	4	.048
Linear-by-Linear Association	7.114	1	.008
N of Valid Cases		103	

a. 4 cells (44.4%) have expected count less than 5. The minimum expected count is 1.40.

Crosstabulation was run between eating behaviour and morningness-eveningness type. Table 6 shows that the students who have Emotional Eating Behaviour are the most intermediate type (50) of person compared to the students who have Restrained and External Eating Behaviour. The students who have External Eating Behaviour has average total of intermediate (16) types of people while students who have Restrained Eating Behaviour is the least (10) total of intermediate type of person. Chi square test was conducted to see if there is any significant association between nutritional pattern and sleeping pattern that were identify through eating behaviour and morningness-eveningness type. The result show on Table 7 that the observed differences were significant (chi square = 10.788, df = 4. Sig = .029). This means that there is a significant association in nutritional pattern (eating behaviour) and sleeping pattern (morningness-eveningness type).

This means that there was a significant association in nutritional pattern (eating behaviour) and sleeping pattern (morningness-eveningness type). On the other hand, the nutritional pattern can influence the sleeping pattern. Throughout the crosstabulation result obtained in this study, it explained that most of the students

who has emotional eating behaviour most likely to be an intermediate type. It is also showed that the students who has restrained and external eating behaviour also most likely to be an intermediate type. Many evidences have reported that there is a significant association between nutritional patterns and sleeping patterns. According to National Sleep Foundation (2020), eating habits can be crucial for quality sleep. On top of that, a study by Garaulet et al., (2023) stated that evening type basically more emotional eaters. Evening types may be more likely to eat in response to negative emotions since they tend to consume highly energetic foods to relief their anxiety or stress. Eveningness was associated with an unhealthy eating pattern, characterized by eating later on both working and non-working days and a trend towards a decreased number of eating occasions with larger portion sizes (Lucassen et al., 2013). Back onto the present study, most of the students of UiTM Puncak Alam Campus has emotional eating habit regardless of being an intermediate type.

CONCLUSIONS

In conclusion, the students of UiTM Puncak Alam Campus most likely to take breakfast for three to four days in a week and having lunch as their largest meal of the day. Most of the students were snacking after meal for three days in a week. Thus, it can be seen that the majority of the students developed emotional eating behaviour. Regardless, the students are most likely to be an intermediate type rather than morning type or evening type which mean, do not strongly lean towards being either a morning type or an evening type. The observation of the chi square between eating behaviour and the morningness-eveningness type were significant ($\chi^2 = 10.788$, $df = 4$, $Sig. = .029$) which mean there is a significant association in nutritional pattern and the sleeping pattern. The finding of this study has brought a broad implication for students, educators, and government stakeholders.

Future research should open up towards the studies to explore the long-term effects of nutritional patterns and sleeping habits on students' academic performance, mental health, and overall quality of life. This would offer deeper insights into the sustainability of healthy behaviours and their impact on students beyond their university years. In addition, a cross-cultural study can be made by investigates the association of nutritional patterns and sleeping pattern among university students from different cultural backgrounds would contribute to a more comprehensive understanding of the topic. These cross-cultural studies can expose unique factors influencing students' health behaviours and enlighten culturally tailored interventions.

REFERENCES

1. Baghdadi, M., Prapkree, L., Uddin, R., Jaafar, J. A. A., Sifre, N., Corea, G., Faith, J., Hernandez, J., & Palacios, C. (2022). Snack intake among college students with overweight/obesity and its association with gender, income, stress, and availability of snacks during the COVID-19 pandemic. *American Journal of Non-Communicable Diseases*. <https://doi.org/10.25148/ajncd.1.1.010175>
2. Buysse, DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ (1989). The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice. *Psychiatry Research* 28:193-213.
3. Barrada, J. R., van Strien, T., and Cebolla, A. (2016) Internal Structure and Measurement Invariance of the Dutch Eating Behavior Questionnaire (DEBQ) in a (Nearly) Representative Dutch Community Sample. *Eur. Eat. Disorders Rev.*, 24: 503– 509. doi: 10.1002/erv.2448.
4. Clark, I., Landolt, H. P., & Coffee, C. J. (2017). Sleep EEG provides evidence that cortical circuits undergo asynchronous maturation starting in early adolescence. *Scientific Reports*, 7(1), 1– 11.
5. Datta, S. (2018). Sampling methods. DOI:10.13140/RG.2.2.22856.57605 Deboer T. Sleep homeostasis and the circadian clock: Do the circadian pacemaker and the sleep homeostat influence each other's functioning? *Neurobiol Sleep Circadian Rhythms*. 2018 Mar 1;5:68-77. doi: 10.1016/j.nbscr.2018.02.003. PMID: 31236513; PMCID: PMC6584681
6. Düz, S., & Tuba AYTEKELI, S. (2020). Determination the Level of Physical Activity and Eating Behaviors of University Students. *Asian Journal of Education and Training*, 6(1), 65–71. <https://doi.org/10.20448/journal.522.2020.61.65.71>

7. Garaulet, M., Vizmanos, B., Muela, T., Betancourt-Núñez, A., Maria Angeles Bonmati-Carrion, Vetter, C., Dashti, H. S., Saxena, R., & Frank A.J.L. Scheer. (2023). Evening types as determined by subjective and objective measures are more emotional eaters. 31(5), 1192– 1203. <https://doi.org/10.1002/oby.23749>
8. Hairudin, Khairunnisa & Teng, Nur & Juliana, Norsham. (2022). Adaptation and Validation of the Malay-Chrononutrition Profile Questionnaire (CPQ) to assess Chrononutrition Behavior of Young Adults in Malaysia.. *Current Developments in Nutrition*. 7. 100009. 10.1016/j.cdnut.2022.100009.
9. Huang RC. The discoveries of molecular mechanisms for the circadian rhythm: The 2017 Nobel Prize in Physiology or Medicine. *Biomed J*. 2018 Feb;41(1):5-8. doi: 10.1016/j.bj.2018.02.003. Epub 2018 Mar 29. PMID: 29673553; PMCID: PMC6138759.
10. Juliana, N., Nur, Khairunnisa Fazira Hairudin, & Das, S. (2023, February 2). Chrononutrition behavior during the COVID-19 pandemic and its relationship with body weight among college. ResearchGate; Frontiers Media SA. https://www.researchgate.net/publication/368238384_Chrononutrition_behavior_during_the_COVID-19_pandemic_and_its_relationship_with_body_weight_among_college_students
11. Lan, A., Kotler, D., Noga Kronfeld-Schor, Stukalin, Y., & Haim Einat. (2022). Changes in sleep patterns of college students in Israel during COVID-19 lockdown, a sleep diaries study. 20(2), 309–314. <https://doi.org/10.1007/s41105-021-00371-4>
12. Liu, X., Zhang, J., Wu, H., Duan, X., & Xu, X. (2017). Association between fruit and vegetable consumption and sleep quality in Chinese college students: a cross-sectional study. *BMC Psychiatry*, 17(1), 1–8.
13. Lucassen, E. A., Zhao, X., Rother, K. I., Mattingly, M. S., Courville, A. B., de Jonge, L., Csako, G., & Cizza, G. (2013). Evening Chronotype Is Associated with Changes in Eating Behavior, More Sleep Apnea, and Increased Stress Hormones in Short Sleeping Obese Individuals. *PLoS ONE*, 8(3), e56519. <https://doi.org/10.1371/journal.pone.0056519>
14. National Institute of General Medical Sciences. (2019). National Institute of General Medical Sciences (NIGMS). <https://nigms.nih.gov/education/fact-sheets/Pages/circadianrhythms.asp>
15. National Sleep Foundation. (2021). Sleep Glossary. Retrieved from <https://www.sleepfoundation.org/sleep-glossary>
16. Okada C, Imano H, Muraki I, Yamada K, Iso H. The association of having a late dinner or bedtime snack and skipping breakfast with overweight in Japanese women. *J Obesity*. (2019) 2019:2439571.
17. Schlarb, A. A., Friedrich, A., Claßen, M. (2017). Sleep problems in university students – an intervention. *Neuropsychiatry Dis Treat*. 2017; 13: 1989–2001. Published online 2017 Jul 26. doi: 10.2147/NDT.S142067
18. Sprake EF, Russell JM, Cecil JE, Cooper RJ, Grabowski P, Pourshahidi LK, Barker ME. Dietary patterns of university students in the UK: a cross-sectional study. *Nutr J*. 2018 Oct 5;17(1):90. doi: 10.1186/s12937-018-0398-y. PMID: 30290816; PMCID: PMC6172790.