

Original Research Article

Relationship between chrononutrition behaviour and mental well-being among female university students

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ABSTRACT

Background: Chrononutrition examines the interaction between meal timing and circadian rhythm in maintaining overall health. Students as youngsters adopt poor lifestyle habits and dietary patterns, contributing to a higher incidence of non-communicable diseases and mental health conditions. Hence, the study was undertaken to examine the relationship between chrononutrition behaviour and mental well-being among female university students.

Methods: The cross-sectional study was conducted among 250 students in Coimbatore between December 2024 and May 2025. Baseline information, health status, 24-hour dietary recall and physical activity were collected using a structured interview schedule, anthropometric measurements were measured by following a standardised procedure. Chrononutrition behaviour, chronotype and mental health status were assessed using validated questionnaires. An awareness video on the concepts of chrononutrition was developed and presented to 62 students of neither chronotypes and evening chronotypes with mental health issues. The impact was assessed using knowledge, attitude and practice questionnaire through pre and post assessments.

Results: The greater number of students belonged to the neither chronotype category and more than 50 per cent of students experienced mental health issues. The study revealed a significant correlation between chrononutrition behaviour and mental well-being. The assessment results indicated an increase in awareness on chrononutrition concepts among students.

Conclusions: The study highlighted that chrononutrition behaviour affects not only the physical health but also mental health. This study suggested that aligning meal timings with the circadian rhythm may help to manage the mental health status of the students.

Keywords: Chrononutrition, Chronotype, Dietary pattern, Lifestyle habits, Mental well-being, Students

INTRODUCTION

University students, as late adolescents and young adults, are a distinct group undergoing a critical life stage, experiencing physiological and psychological changes. They often adopt poor lifestyle patterns such as low levels of physical activity, excessive screen time, inconsistent sleep patterns and poor dietary patterns, including irregular meal timing, consumption of high-calorie foods, reduced intake of fruits and vegetables and they also

experience an increased amount of stress from their learning environment. This transition in their lifestyle and dietary habits increases the risk of both non-communicable diseases and mental health disorders, which may persist into adulthood and lead to serious health complications.¹

According to the World Health Organisation (WHO) mental health is defined as a state of well-being in which an individual recognises their abilities, can manage the

normal stresses of life, works productively, and contributes to their community. Mental disorders are a major global health concern, affecting 10.7% of the population. In Tamil Nadu, depression and anxiety are the most prevalent mental health issues. The prevalence of anxiety is slightly higher among females (1.7%) compared to males (1.6%), while depression is significantly higher in females (4.5%) than in males (2.8%). Compared to the general population, university students experience a higher rate of depression (12.9%), particularly those who aged 16-24 years.² Meal timing significantly influences the progression of non-communicable diseases and mental health disorders.³

Chrononutrition is the study that examines the relationship between meal timing and circadian rhythm on maintaining overall health.⁴ The chrononutrition pattern of an individual can be assessed based on six components: breakfast skipping, timing of the largest meal, time of dinner consumption, evening latency, morning latency, night eating, and eating window. Evening eating refers to the last meal consumed before sleep, which disturbs the circadian rhythm and affects the sleep quality. Evening latency is the time gap between the last meal and the onset of sleep. Eating window is the duration between the first and last meal of the day.⁵

Chrononutrition pattern will differ from one individual to another and is influenced by an individual's preference to wake, sleep and eat called chronotype. The desynchronization in this pattern is linked with the development of metabolic diseases.⁶ Based on their preference, chronotype is primarily categorised into three types: morning (M-type), intermediate, and evening (E-type) types. Morning types tend to wake up early and have peak alertness in the morning, whereas evening types exhibit delayed activity onset and peak alertness in the afternoon or evening. The intermediate chronotype, also known as the neither type, shows no distinct preference for morning or evening activities.⁷

Chrononutrition studies have suggested that irregular eating patterns cause misalignment in the body's circadian rhythm and this can be associated with mental well-being that may contribute to mood disorders such as stress, anxiety and depression, where this causes imbalance in neurotransmitter levels, especially among the evening chronotypes.

The youth population of today are exposed to myriads of transitions ranging from lifestyle, dietary patterns and social circles dragging them to compromised food choices, physical activity and psychological well-being which in turn affects their health. While research has explored the role of nutrition and mental health separately, limited studies have investigated the direct association between chrononutrition patterns and mental well-being in young female university students.

Hence the study was carried out with objectives to assess the chrononutrition behaviour of the students, identify the chronotype of the students, evaluate the mental health status of the students, examine the relationship between chrononutrition behaviour, chronotype and mental well-being among students, create an awareness video and to evaluate its effectiveness by comparing pre- and post-assessment scores among female university students. Understanding this relationship could help in developing targeted dietary interventions to align the internal clock with the external light.

METHODS

The cross-sectional study was carried out between December 2024 and May 2025 in Coimbatore, Tamil Nadu. The target group of female students aged 17-24 years of age was purposively selected from Avinashilingam Institute for Home Science and Higher Education for Women. Ethical clearance was obtained from the Institution. The sample size was calculated using Cochran's formula with a 5.5% margin of error.

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}} = \frac{318}{1 + \frac{318 - 1}{1200}}$$

$$n = \frac{318}{1 + 0.2642} = \frac{318}{1.2642}$$

n = 251.6 (which is rounded off to 252).

Inclusion criteria were female students aged 17-24 years, students currently pursuing their degree in university, undergraduate and postgraduate students and willingness to participate. Students with health issues like diabetes, hypertension and special needs were eliminated from the study.

Baseline information including age, education, occupation of the parents and income of the family was collected from 250 students through a developed interview schedule. Anthropometric measurements such as height, weight, waist circumference and hip circumference were measured through a standardised procedure, body mass index (BMI) and waist hip ratio (WHR) were calculated for all 250 selected students.

Dietary information was collected from the study students to assess their dietary patterns. The assessment includes dietary habits, frequency of consuming outside foods, food intake and nutrient intake. The nutrient and food intake were collected using the 24-hour dietary recall method and compared with the recommended dietary allowance (RDA). Physical activity was recorded from all 250 students using a developed interview schedule which includes the type of physical activity, the level of physical activity and the time duration of the physical activity they engaged in.

Chrononutrition behaviour of the study students was assessed using the chrononutrition profile questionnaire, a validated tool focusing on key factors such as skipping breakfast, timing of the largest meal, evening eating, evening latency, morning latency, night eating and eating window on both weekdays and weekends.⁵ To evaluate and calculate all the key factors of the chrononutrition behaviour was computed. Morningness-eveningness questionnaire, a validated 19 item tool was used to evaluate the chronotype of all 250 students.⁸ It is evaluated based on the individual preferences towards sleep-wake pattern, level of alertness at different times of the day. The overall MEQ score is obtained by summing the responses, with higher scores reflecting a morning chronotype and lower scores reflecting an evening chronotype.

The mental well-being, includes depression, anxiety and stress was assessed using the depression anxiety stress scale-21 (DASS-21)- shortened version of the DASS-42 for all 250 students.⁹ It comprises three subscales- depression, anxiety, and stress each containing seven items. Scores for each subscale are calculated by summing the responses to the respective items and multiplying the total by two, in accordance with the original DASS-42 scoring system.

An awareness video entitled- chrononutrition: eat smart, tune your body, was designed to educate the students based on the principles of chrononutrition, circadian rhythm and importance of meal timing for better mental health and it was presented to 62 students participated in the study experiencing depression, anxiety and stress of neither chronotypes and evening chronotypes. To assess its impact, a knowledge, attitude and practice (KAP) questionnaire was developed to evaluate the knowledge and perceptions towards chrononutrition behaviour as pre and post assessments.

Statistical analysis for this study was conducted using SPSS 21. Descriptive statistics including mean and standard deviation were used to summarise variables such as BMI, WHR, food intake and nutrient intake. The statistical methods such as correlation analysis and analysis of variance (ANOVA) were applied to determine a significant relationship between meal timing, chronotype, chrononutrition behaviour and mental health. The analysis aimed to examine the impact of meal timing, breakfast skipping, night eating, and chronotype on mental well-being.

RESULTS

Among 250 students, 155 students were in the age group of 17-20 years, 95 were in the age category of 21-24 years of age. Of these 58 per cent were undergraduates and 42 per cent were postgraduates. Thirty-four per cent had parents who are self-employed in fields like machinery, agriculture and related sectors. Thirty-two per cent of parents were professionals and four per cent of

parents were employed as clerks. Income status of the student's family shows that 32 per cent belonged to middle income group-I (Rs 6 lakhs - 12 lakhs).

Underweight was prevalent among 67 students, followed by overweight in 39 students. The data shows that the prevalence of both underweight and overweight is higher among the students aged 17-20 years. In this study 37 per cent of students aged 17-20 years and 35 per cent aged 21-24 years had a waist hip ratio above 0.80. Eighty-five per cent (N=215) did not report any health problems. Polycystic ovarian disease (PCOD) was reported in ten, followed by anemia in eight and low blood pressure in six students.

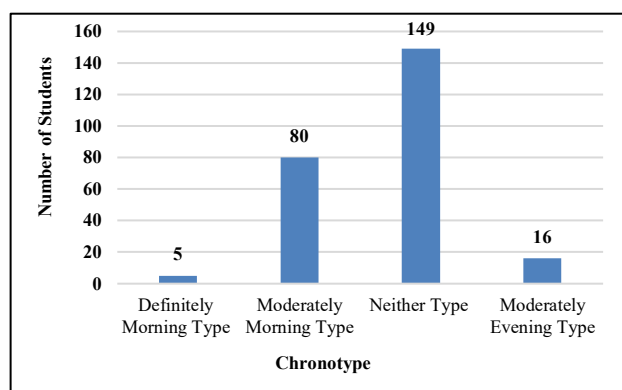


Figure 1: Chronotype of the selected students.

Chronotype of the selected students shows that 59 per cent of students fall in the neither chronotype category, 32 per cent and two per cent of students were in the moderately morning type and definitely morning type respectively, reflecting the early-rising tendency and their preference to work in the daytime among students. Seven per cent were moderately evening type, showing a preference for late-night activities (Figure 1).

Chrononutrition behaviour of the selected students depicts that 59 per cent had an eating window between 9-11 hours. A significant number of students (102) tend to consume food late at night, which may impact metabolic health and sleep quality. Morning latency refers to the time gap between waking up and the first eating event.⁵ In this study, 69 per cent of students had a morning latency of less than two hours, while 29 per cent ate within 2-4 hours after waking up. Fifty-three per cent of students slept within 2-4 hours of the interval after dinner and five per cent had an evening latency between 4-6 hours. The previous study has highlighted that the highest number of college students used to skip their breakfast at least once a week. Similarly, 34 per cent of students tend to skip breakfast at least once in a week. Evening eating refers to the last meal of the day.⁵ The results show that 64 per cent of students had their dinner between 8 pm-10 pm, while 6 per cent used to have their dinners after 10 pm. Eating with peer groups at university makes the students eat more and hence 51 per cent showed lunch as

their largest meal, but 38 per cent of students used to consume dinner as their largest meal, which may affect their sleep quality and pave the way for the development of mental health issues (Table 1).

Table 1: Chrononutrition behaviour of the selected students.

Chrononutrition behaviour	Students (n=250)	
Eating window	N	Percent
9-11 hours	148	59
12-14 hours	102	41
Morning latency		
0-2 hours	173	69
2-4 hours	72	29
4-6 hours	05	2
Evening latency		
0-2 hours	105	42
2-4 hours	132	53
4-6 hours	13	5
Evening eating		
6-8 pm	74	30
8-10 pm	161	64
After 10 pm	15	6
Breakfast skipping		
Never skip	165	66
1-3 days	62	25
4-6 days	17	7
7 days	06	2
Largest meal		
Breakfast	27	11
Lunch	128	51
Dinner	95	38

Dietary habits of the students reveal that 81 per cent of selected students followed non-vegetarian diet, while 14 per cent were vegetarians and five per cent were ovo-vegetarians. Eighty-six students used to consume outside food at least once a week. The average daily intake of cereals among the selected students was 245±69 gm which is consumed in excess compared to the recommended intake and the average pulse intake was 57±35 gm, which is slightly deficient than the daily requirements. Similarly, the data show that intake of

fruits, vegetables, milk and milk products was lower than the RDI among the students (Table 2).

Table 2: Food intake of the selected students (n=250).

Food groups	RDI gm/day*	Intake gm/day
Cereals (gm)	180	245±69
Pulses and legumes (gm)	60	57±35
Fruits (gm)	100	42±38
Vegetables (gm)	400	90±36
Meat and poultry (gm)	70	20±43
Milk and milk products (gm)	300	137±123
Nuts and oilseed	25	8±17
Fats and oils	25	62±24

*Dietary Intake

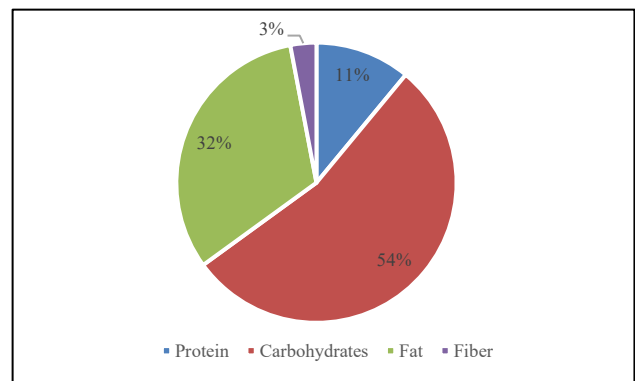


Figure 2: Energy distribution of the selected students.

Nutrient intake of students indicates that the mean energy intake of the students was 1200±299, which was deficit (460 gm) than recommended dietary allowances. Similarly, the mean protein intake and fibre intake were also deficient (12 gm and 7 gm), with an average intake of 34±10 gm and 18±7 gm, respectively. In contrast, excess intake of carbohydrates and fat in the diet contributed to the overall energy intake (Figure 2).

Out of 250 students, 126 were engaged in physical activities such as walking, stretching, etc. and 71 per cent of students engaged in physical activity for 1-4 hours a week.

Table 3: Association of chronotype with mental well-being.

Details	Chronotype				F value	P value
	DMT*	MMT*	NT*	MET*		
Depression (n=161)	01	50	101	09	2.37**	0.04
Anxiety (n=221)	04	70	133	14	0.99	0.37
Stress (n=172)	03	55	107	07	0.16	0.85

*DMT-definitely morning type, MMT-moderately morning type, NT-neither type, MET- moderately evening type, **p<0.05 level

Table 4: Correlation analysis of chrononutrition behaviour with mental well-being.

Variables	Depression		Anxiety		Stress	
	r	P	r	P	r	P
Breakfast skipping	0.21*	0.01	0.25**	0.00	0.22**	0.00
Night eating	0.15*	0.01	0.09 NS	0.13	0.16**	0.00
Largest meal	0.17**	0.00	0.11NS	0.07	0.16**	0.00

*P<0.05, **<0.01, NS- Not Significant

Mental well-being of the students shows that 126 students showed the signs of depression, anxiety and stress together. Of these, 65 per cent of students were in the neither chronotype category, 29 per cent were classified as moderately morning chronotypes, while six students were in the moderately evening chronotype category and this is more prevalent among the younger age group. Sixty-four per cent of students showed signs of depression, 221 students had anxiety and 172 students had the severity of stress.

The analysis of variance between chronotype and mental health issues revealed a statistically significant relationship, with a p value less than 0.05 ($p < 0.04$) (Table 3). The positive correlation was observed between chrononutrition behaviour (breakfast skipping, night eating and largest meal) and mental health issues (Table 4). The pre and post-assessment results show an increase in awareness on chrononutrition concepts among students.

DISCUSSION

Students are a unique group often adopt poor lifestyle and dietary habits. Most of the study students belonged to the middle-income group I, with high number of students having self-employed parents. This shows that own businesses seem to be profitable and contributes to the financial stability of the families.

The findings indicate that the prevalence of underweight is more common than overweight among female university students, especially in the age category of 17-20 years. This brings out the need to create awareness on good nutrition and maintaining ideal body weight for college-going girls. Being overweight and obese is associated with physical and mental health issues including an increased risk of developing type 2 diabetes, cardiovascular diseases and joint issues. Mental health issues include low self-esteem and body image concerns which might lead to distress, depression and anxiety. Waist-hip ratio was found to be below 0.80 for most students, indicating a relatively low risk for central obesity. The study has highlighted that among various health challenges nutritional deficiencies such as anemia and lifestyle diseases such as obesity and PCOD are more prevalent among adolescents.¹¹ Similarly in this study, PCOD and anemia were reported among students.

Figure 1 shows that a greater number of students belonged to neither chronotype category where they don't have any preference in their sleep-wake pattern. Evening chronotype individuals often follow irregular and poor eating habits and so they are prone to circadian misalignment, which increases the risk of metabolic diseases and mood disorders, compared to morning chronotype individuals.¹²

Chrononutrition behaviour of the students indicates that a greater number of students have a reduced eating window of less than 12 hours and a morning latency of less than 2 hours. These practices have beneficial effects on weight management and improve metabolic functions.¹³ Only a smaller number of students had a greater evening latency. Other studies have highlighted that consuming dinner before 4 hours before bedtime resulted in better sleep quality.¹⁴ Deprivation of sleep is seen as a negative factor among college students for better mental health. The breakfast skipping was prevalent among students and it is commonly observed in neither chronotypes and evening chronotypes. The frequent skipping of breakfast is associated with poor mental health and sleep quality, which in turn disturbs the circadian rhythm and increases the risk of developing metabolic diseases such as obesity and increased blood glucose levels.¹⁵ A study shows that consuming a late dinner after 10 pm increases glucose levels, reduces free fatty acids, oxidation of fatty acids and also increases cortisol levels in the plasma, which leads to misalignment in the circadian rhythm and affects overall health.¹⁶ Lunch is considered as the largest meal, where the metabolic function peaks in the afternoon. Consuming fewer calories in night and more calories earlier in the day improves glycaemic control and helps in weight management.

Dietary assessment revealed the poor eating practices among students including frequent intake of outside food and reduced intake of fruits, vegetables and milk contributes to low fibre intake. Excessive consumption of carbohydrates and fats increases the risk of developing metabolic diseases.

Mental health issues such as depression, anxiety and stress were prevalent, especially among neither chronotype students. Factors such as environmental change, academic pressure and difficulty in balancing academic life and personal life may contribute to the mental health concerns. The prevalence was reported to be higher among the younger age group, which may be

due to the transition from school to college, where older age group students are better able to manage academic pressure and social challenges. Chrononutrition behaviour and mental well-being were statistically significant. This indicates that chrononutrition behaviour has an impact on the mental health status.

The study has certain limitations. Firstly, the sample was limited to female students, which restricts the generalizability of the results. Secondly, the cross-sectional design of the study restricts the ability to establish causal relationships between chrononutrition behaviour and mental well-being. Additionally, the intervention was implemented over a short duration, thereby limiting the evaluation of its long-term effectiveness.

CONCLUSION

Chrononutrition behaviour and chronotype of an individual have been found to play a crucial part in maintaining overall health. A greater number of students in the study were identified as neither chronotype. The severity of mental health issues such as depression, anxiety and stress was reported among more than 50 per cent of the selected students. From the study, a significant relationship was observed between breakfast skipping, night eating, largest meal timing and mental health status. This association indicates that chrononutrition behaviour impacts both physical and mental health status. By educating the students about the importance of chrononutrition concepts, aligning with their internal biological clock with the external daylight cycle can be beneficial to reduce the risk of developing metabolic diseases and to promote the mental well-being of the students.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Human Ethics Committee

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