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Effect of morningness-eveningness chronotype on academic performance of undergraduate students

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Abstract

Background Circadian rhythms are crucial for physiological functioning, and they vary among people. There are three distinct chronotypes: morning, evening, and neither type. Morning types experience their highest level of activation during the early part of the day and tend to be more conscientious and focused on achieving their goals. Evening types, on the other hand, reach their peak performance during the latter portion of the day and exhibit a higher level of intelligence. University class schedules may occasionally clash with evening-type individuals' circadian preferences, potentially impacting their academic performance in comparison to their morning-type peers. Therefore, this study was done to investigate if morningness-eveningness can affect college students' academic performance as sleeping late or sleep deprivation can lead to disease in the young population.

Materials and methods A sample of 100 collegiate students aged 18–30 years were recruited via convenience sampling from Jamia Hamdard, Delhi, and informed consent was obtained from the subjects. The morningness-eveningness questionnaire (MEQ) was used to assess students' chronotype, and the mean of the last three academic years percentage was used to assess the academic performance of the students.

Results The total academic performance score was better in the morning category (75.53 ± 7.28) as compared to the evening (66.42 ± 10.08) and intermediate (73.72 ± 6.46) categories. There was a low degree of positive correlation between total academic performance and TMEQ (total morning-evening questionnaire) score ($\rho = 0.204$).

Conclusion The academic performance of morning chronotype students was better than that of evening chronotype students.

Keywords Academic achievement, Chronotype, Circadian preference, Evening type, Morning type, Sleep

Introduction

The rhythm of circulation affects both the physical and mental activities of the human body throughout the day, while sensory processes play a significant role in the regulation of sleep. However, environmental circumstances can have a significant impact on the timing and appearance of sleep and wakefulness [1]. Circadian rhythms are crucial for a variety of biological processes [2–4]. People strive to match their activities to their circadian preferences by doing so. These preferences are influenced by both external (such as social behaviors, light/dark cycles, and seasons) and internal (such as clock genes, cortisol, and melatonin levels) variables [5, 6]. Everyone's circadian rhythm expresses itself differently. There are three distinct chronotypes: the morning (M-type); the evening (E-type), which is further divided into extreme and moderate types; and the neither

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(N-type), which encompasses intermediate traits and accounts for around 60% of the population [7, 8].

The key distinctions between M and E types pertain to the length of sleep and sustained mental and physical activity for more than 24 h [9]. M strains have a high level of mental and physical performance in the morning and fall asleep and wake up quite early. The evening species, on the other hand, typically sleeps in and rises late, performing at their peak in the afternoon [8, 10]. Some people have problems getting out of bed in the morning, hit their peak of mental and physical activity quickly, and wake up the next morning exhausted. These people are the early risers who have trouble getting out of bed in the morning. Evening species, on the other hand, struggle to wake up in the morning and require more time to perform their full mental function. The majority of people, however, fall into the intermediate (unequal and extreme) varieties, which are located between the morning and evening varieties [11].

Early or premature chronotype has been connected to good physical and mental health, self-esteem, academic success, and intimate connections, whereas late or evening chronotype has been linked to mental illness, disease, smoking, and poor sleep quality [12]. Individual variations in circadian rhythms can affect whether someone prefers morning or evening activities, which may have implications for working time, athletic ability, and educational achievement [13]. Morningness preference increases with age in adults, and women show a stronger tendency toward morningness than men in their rhythm expressions [14].

Numerous research has been conducted to determine whether a person's chronotype may affect their academic performance. Educational attainment is recognized to be heavily influenced by intelligence and personality qualities [11] Additionally, several studies have suggested a connection between poor sleep quality and academic performance, as well as the schedule of classes and exams [15]. Studies have found that morning types perform better academically than evening types, as reflected by the higher grades morning types receive on learning evaluations [16]. Males often score higher on eveningness than females, according to certain studies, however, this difference has not been shown in other investigations [17].

The chronotype of the student was assessed by a self-assessment questionnaire. The most widely used questionnaire is the morningness-eveningness questionnaire (MEQ) which was developed by Horne and Ostberg in 1976 [8]. Trouble in maintaining sleep is generally associated with morningness and trouble in falling asleep with eveningness [18].

While there have been various studies conducted on the chronotypes of collegiate students in other countries, there is currently a lack of published research on the chronotypes of Indian university students. There is evidence indicating that human chronotype can be modified by various factors, including environmental, social, cultural, ethnic, and genetic influences [19]. Therefore, the present study was undertaken to see if morningness-eveningness can affect college students' academic performance and to find out the association between chronotype and academic performance in the Indian population as sleeping late or sleep deprivation can lead to disease in the young population.

Methods

In this cross-sectional study, a sample of 100 participants was recruited from Jamia Hamdard Delhi via convenience sampling. Subjects were assessed based on eligibility criteria. The recruiting occurred during the latter part of the semester of the academic year. Hence, we selected our sample based on the subsequent inclusion criteria: Only college students who attend colleges between the ages of 18 and 30 years are eligible. However, any student who had health issues was not included in the study. Informed consent was obtained from the participants. The purpose, methodology, and possible risks of the study were explained to the participants. A Google Form was created consisting of all the questionnaires, the link for which was shared with the subjects. The morningness-eveningness questionnaire (MEQ) was used to identify the morning-evening preference of the students. The mean of the last 3 academic years percentage was used to assess the academic performance of the students.

Instrument used

Horne and Ostberg (1976) developed the MEQ questionnaire. The MEQ is considered the gold standard measure of circadian type and has good validity and reliability [20]. The questionnaire consists of 19 mixed-format questions regarding the "get up" and "going to" bedtime. Based on the score of the MEQ questionnaire, the subjects were divided into groups according to the categories of the MEQ questionnaire. The MEQ has five chronotype categories: Definite morning type, moderate morning type, neither type, moderate evening type, and definite evening type. Scores on the MEQ range from 16 to 86, with low scores (16–41) indicating eveningness (definite evening [16–30], moderate evening [31–41]) and high scores (59–86) indicating morningness (definite morning [70–86], moderate morning [59–69]) [21].

Data analysis

Data analysis was done using SPSS version 23.0. The demographic characteristics and MEQ score were compared between the groups using ANOVA.

Table 1 Demographic data comparison between groups

Variables	*ME*	*IM*	*MM*	*DM*
Age (years)	22.40 ± 2.19	21.04 ± 1.58	20.96 ± 2.05	24.00 ± 0.00
TMEQ score	38.20 ± 2.38	51.59 ± 4.93	60.70 ± 5.06	70.00 ± 0.00

Abbreviations: *TMEQ* total morning-evening questionnaire, *ME* moderate evening, *IM* intermediate, *MM* moderate morning, *DM* definite morning

Data are presented as mean ± SD

Table 2 Result of post hoc analysis

Variable	*Group*		*Group*	*p-value*
TAP	***ME***	***vs***	***IM***	0.140
			MM	0.049*
			DM	1.000
	IM	***vs***	***MM***	1.000
			DM	0.473
	MM	***vs***	***DM***	0.273

Abbreviations: *TAP* total academic performance, *ME* moderate evening, *IM* intermediate, *MM* moderate morning, *DM* definite morning

* *p*-value < 0.05 statistically significant

Participants in all the groups were tested using one-way ANOVA for all the variables. A *p*-value of < 0.05 was considered significant.

Results

The study was conducted to test the effect of morningness-eveningness on the academic achievement of collegiate students. In this study, the subjects were divided into four groups based on their MEQ category (ME: moderate evening, IM: intermediate, MM: moderate morning, DM: definitely morning). The measures for total academy performance were measured between four groups. The demographic data for all the groups are given in Table 1.

One-way analysis of variance shows that total academic performance scores significantly differed in the moderate evening group and the moderate morning group (p-value = 0.049) (Table 2). This means that the total academic performance score was significantly higher in the morning type than in the evening type.

Descriptive analysis showed that the total academic performance score was better in the morning category (75.53 ± 7.28) as compared to the evening (66.42 ± 10.08) and intermediate (73.72 ± 6.46) categories (Table 3). Correlational analysis showed that there was a low degree of positive correlation (r = 0.204) between total academic performance and TMEQ (total morning-evening questionnaire) score (Table 4).

Table 3 Comparison of academic performance

Group	*TAP score (mean ± SD)*
ME	66.42 ± 10.08
IM	73.72 ± 6.46
MM	75.53 ± 7.28
DM	65.00 ± 5.65

Abbreviation: *TAP* total academic performance

Table 4 Correlation between morningness-eveningness and academic performance

Variables	*TMEQ*
TAP	0.204*

Abbreviations: *TMEQ* total morning-evening questionnaire score, *TAP* total academic performance

* *p*-value < 0.05 statistically significant

Discussion

The primary objective of this study was to determine the difference between the academic performance of morning and evening types students. The secondary objective of the study was to find out the association between chronotype and academic performance of the students. In this study, it was found that there was a difference between the academic performance of morning-evening type students. The academic performance of morning preference students was better than the evening preference students. Also, a significant correlation was found between the chronotype and academic performance of the students.

In this study, the analysis showed that the total academic performance score was better in morning category students as compared to evening and intermediate category students. This finding shows that the morning-oriented students are more advantaged as compared to intermediate or evening chorotypes. Some of the studies have related the academic performance of morning types with psychological traits such as consciousness, self-discipline, orientation, and rigor, which are mostly seen in students with morning preferences [18]. However, some studies hypothesized a direct relationship between academic achievement and morning preference type and suppose that it is related to the fact that the morning types are more focused and concentrated on their class and exam schedules [22]. A previous study conducted in Italy by A. Montaruli et al. (2019) showed that morning-type students achieve higher grades in exams as compared to other types. As M-types go to bed early and wake up early & time their schedule and pace their day according to lectures and exams [23].

In contrast, evening types go to bed late and get up early in the morning to match their schedule; therefore, they are prone to sleep disorders development. In some studies, it was found that the academic achievements of students depend on the length of their sleep [24]. The mechanism by which poor academic performance is seen in evening chronotype individuals is unclear. However, there can be several possible explanations for this effect. First, chronotype impacts academic performance by causing disruptions in sleep patterns and excessive daytime sleepiness[25]. Second, sleep irregularities are seen more in evening types [26]. Sleep duration has an impact on the academic performance of a student; undergraduates report decreased academic performance with shorter sleep duration [27]. Third, smartphone addiction is related to morningness and eveningness. Students who were smartphone addicted were of the evening type, whereas the students who were not addicted were of the morning type [28]. And there is a negative correlation found between academic performance and smartphone addiction; subjects with smartphone addiction have poor academic performance [29].

Hence, the morningness-eveningness chronotype is one of the important factors that can affect the academic performance of the students. The result of this study showed that the academic performance of morning chronotype is better than that of evening chronotype students. Thus, it can be said that students should sleep early and wake up early so they can perform better and achieve desirable grades in academics.The sample taken in this study was less. So, more studies with larger sample sizes were required. The restriction of conducting it at a single college prevents the assurance of generalization. Furthermore, the specific characteristics that could potentially impact one's preference for eveningness or morningness were not individually investigated. It is advisable to promote knowledge and understanding of proper sleep habits and the impact of circadian misalignment among students and the entire community. Additionally, universities should be designed to accommodate both morning and afternoon schedules.

Conclusion

The results of this study have effectively demonstrated that chronotype remains a crucial factor in education. The academic performance of morning preference students was better than the evening preference students.

Abbreviations

MEQ	Morningness-eveningness questionnaire
TMEQ	Total morning-evening questionnaire
M-type	Morning type
E-type	Evening type
SPSS	Statistical Package for Social Sciences
ANOVA	Analysis of variance
ME	Moderate evening
IM	Intermediate
MM	Moderate morning
DM	Definitely morning

Authors' contributions

HI, DS, and RB were involved in the formulation of ideas, selection procedure, and study design. HI conceived and designed the study, conducted research, provided research materials, and collected and organized data. DS and RB analyzed the data of the article. DS, HI, and RB interpreted data. HI, DS, and RB wrote the initial and final drafts of the article. HI prepared the manuscript. DS and RB supervised the study. All authors revised and edited all manuscript submission materials. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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Availability of data and materials

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Informed consent has been obtained from the patient before inclusion in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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