

Morningness-eveningness Preferences among Medical Students: A Cross-sectional Study

ANJU SHARMA¹, NAVNEET KUMAR KAUSHIK²

ABSTRACT

Introduction: Morningness and eveningness is a phenomenon which looks at the differences among the individuals regarding their diurnal preferences, sleep-wake pattern of activity and alertness in evening or morning. Morning chronotypes are individuals who exhibit morning tendencies like rising early in the morning while evening chronotypes prefer to get up later in the morning and stay awake later at night time and also perform their best during late afternoon or evening. Morning chronotypes are known to exhibit better physical and mental health, greater self-esteem and academic performance.

Aim: To estimate the prevalence of morningness and eveningness among medical students. Association of chronotype with academic performance was also determined.

Materials and Methods: The present cross-sectional study was conducted on 110 apparently healthy medical students at Shaheed Hasan Khan Mewati Government Medical College, Nalhar, Haryana, India from October 2021 to January 2022. All the participants were sent a validated Morningness-Eveningness

self-assessment Questionnaire (MEQ). Data of chronotypic preferences expressed as frequencies of participants (%) and association determined using Pearson's Chi-square test and p-value <0.05 was considered statistically significant.

Results: Study revealed that 67 (61%) students belonged to the Intermediate (I) chronotype, around one-fourth {26 (24%)} were Morning (M) type while 17 (15%) were Evening (E) type. Morningness was more frequently reported by females as compared to males in 8 (28%) vs. 18 (22%), respectively. Higher scores ($\geq 50\%$) were more prevalent among M types as compared E types in 10 (38%) vs. 3 (18%), respectively; however, association between chronotype and academic performance could not reach significant level (p-value=0.15).

Conclusion: The distribution of chronotypes in study sample provided the evidence that majority of students could be classified as intermediate type. Morningness was more frequent in females as compared to males. Further studies with large sample size are needed to explore the influence of chronotype on academic performance.

Keywords: Academic performance, Circadian typology, Intermediate type

INTRODUCTION

Circadian typology or chronotype is a concept based on an individual's predilection to exhibit morning or evening trait, a property acquired because of the inter-individual variations in organising various biological and behavioural activities in a 24-hour period. Inter-individual differences in sleep-wake pattern, peak alertness times and diurnal preferences lies behind the phenomenon of morningness-eveningness [1]. Literature investigating the morningness-eveningness dimension is scarce especially in the context of Indian population. It is a little explored entity representing a novel, interesting topic of research for researchers/clinicians/educators.

Morning chronotypes (M-types) are individuals who exhibit morning tendencies like rising early in the morning and also who are at their best both physically and mentally in the early hours of morning [2]. Evening chronotypes (E-types) are individuals who prefer to get up late in the morning and stay awake till late night and also perform their best during late afternoon or evening [2]. The aforementioned M-type and E-type categories are regarded as the two extremes of a continuum, on which Intermediate type (I-type) or Neutral type (N-type) individuals represent the largest category. The sleep-wake pattern, preferred times of physical and mental performance and subjective alertness after arising and before going to bed of intermediate type persons are in between M-type and E-type. A combination of internal- (e.g., clock genes, cortisol and melatonin levels) and external factors (e.g., social habits, light/darkness cycle, season) are the primary determinants of these diurnal preferences. These preferences are assumed to have unique genetic, biological, contextual and psychosocial components [3].

Various studies have revealed the influence of chronotype on attitude, lifestyle, cognitive functioning, motor skills and personality traits [4-6]. People often attempt to align activities with their circadian preference. Synchronisation of work schedule and sleep-wake pattern with one's diurnal preference is essential to ensure adequate cognitive performance and optimal sleep health. Misalignment may impact the work output by impairing cognitive functioning and sleep quality. Work schedule often imposes an early wake up in evening types that run in-counter to their innate circadian preference [1,7]. This mismatch may result in the incurrance of sleep debt, poor performance and various disease conditions in them as compared to morning types whose work schedule is comparatively in synchronisation with their chronotype [8].

Literature suggests better physical and mental health, greater self-esteem and better academic performance in morning chronotypes. On the other hand, evening chronotypes have been reported to have higher prevalence of several mental disorders, more prone to infection and have poor sleep quality [9,10]. Furthermore, diurnal preferences have shown association to various issues such as eating behaviour, sleep pattern and usage of recreational drugs [8,11].

Paucity of data regarding morningness-eveningness in Indian population indicates need of the attention of researchers towards this area. No Indian study has been conducted hitherto which has evaluated the morningness-eveningness preferences of medical students. Hence, the present study was conducted with the aim to estimate the prevalence of morningness and eveningness among medical students. In addition, the association between chronotypes and academic performance was also determined. It was hypothesised that morning types will perform better than evening types in academics.

MATERIALS AND METHODS

This cross-sectional study was conducted in Shaheed Hasan Khan Mewati Government Medical College, Nalhar, Haryana, India from October 2021 to January 2022. Informed written consent was obtained and study protocol was approved by the Institutional Ethics Committee (reference number SHKMGMC/IEC/21/09/14 dated: 24/09/2021).

Sample size calculation: Sample size was calculated taking 40% as expected frequency, precision level $\pm 8\%$, 95% confidence level and 10% drop out rate [2,11]. The same size was calculated to be 105.

Inclusion criteria: Students of either gender who were willing to participate in the study within in the age group 18-25 years were included in the study.

Exclusion criteria: Students who were not interested to participate, aged 18 years or >25 years, and having any chronic illness, central nervous system (CNS) pathology, sleeping disorder were excluded from the study.

A total of 118 students who were pursuing MBBS enrolled in the study; however, eight were excluded because of incomplete questionnaire or not fitting within the inclusion criteria, yielding final sample of 110. Participants were informed about the nature and goal of the study. Study procedures/assessments were explained to all participants.

Morningness-Eveningness Questionnaire (MEQ)

Morningness-eveningness was determined by means of the validated Morningness-Eveningness self-assessment questionnaire (MEQ), given by Horne and Ostberg, 1976 [12]. It was written in English language. Several versions translated in different languages and validated (Cronbach's α coefficient for some are: Korean (0.77), Japanese (0.8), Kannada (0.8)) are also available. Briefly, MEQ questionnaire (Horne and Ostberg 1976) comprises 19 questions/items (close-ended), selected to assess morningness/eveningness. An orientation meeting was held for the participants to explain the questionnaire items and clarify their queries, if any. Then, the participants were invited to respond to the questionnaire shared using google forms. Study participants completed the validated English version of the MEQ. Each response is assigned a score between 0 and 6. The total score for the 19 items ranges from 16-86 and defines the chronotype, where lower scores indicate eveningness and higher scores morningness. More specifically, scores ranging from 16-41 indicate evening preference (E-type), scores ranging from 59-86 indicate morning preference (M-type), scores from 42-58 indicate neither accentuated morning or evening preference; and people with scores in this range are categorised as being intermediate (I) or neutral (N) type. Responses of all the participants were collected and analysed.

Study sample was arbitrarily categorised into two groups for testing the association between chronotype and academic achievement.

- **Group I:** Students scoring the aggregate score of more than or equal to 50% in the preuniversity examination
- **Group II:** Students scoring the aggregate score of less than 50% in the preuniversity examination.

Strictness of the marking in the preuniversity examination and performance of the previous batches were taken into consideration on deciding the cut-off between the two groups.

STATISTICAL ANALYSIS

Data analysis was performed using Statistical Package for the Social Sciences (SPSS) software version 22.0. (SPSS Inc., Chicago, IL, USA). Results were presented in frequencies and percentages for categorical variables while measures of central tendency and dispersion were used for continuous variables. One-way Analysis of Variance (ANOVA) and post-hoc test (Tukey HSD) were used for comparison of groups mean and Pearson's Chi-square test

was used to determine the association between chronotypes and academic performance. The level of significance considered was with p-value <0.05.

RESULTS

The study sample of 110 healthy medical undergraduates comprised of 82 (75%) males and 28 (25%) females. The study participants were in the age group 18-25 years and having mean Body Mass Index (BMI) 22.68 ± 3.93 kg/m². Other anthropometric characteristics of the participants are listed in [Table/Fig-1]. About two-third of the students were normal weight while rest were either underweight or overweight.

Variables	Value
Gender n (%)	
Males	82 (75%)
Females	28 (25%)
Age (Years)	20.49 \pm 1.20*
Height (m)	1.68 \pm 9.60*
Weight (kg)	63.85 \pm 12.12*
Body mass index (kg/m²)	22.68 \pm 3.93*

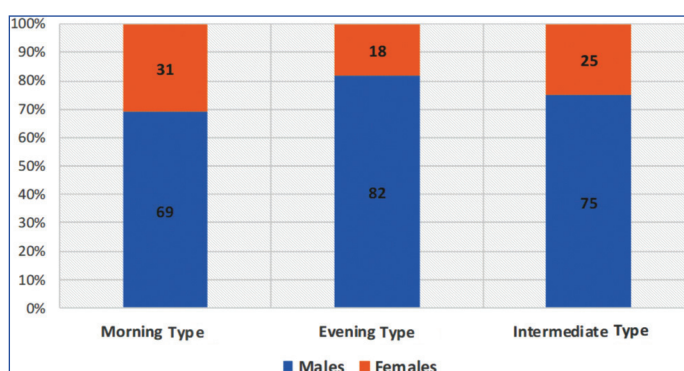
[Table/Fig-1]: Anthropometric characteristics of the study participants (N=110).
*Data expressed in mean \pm standard deviation

Prevalence of chronotypes among study participants: Study of distribution of subjects based on chronotype revealed that 67 (61%) students belonged to the Intermediate (I) type. 26 (24%) were M-type while 17 (15%) were E-type.

Distribution of participants into different chronotypes with respect to gender showed that morningness was preferred more frequently by females as compared to males {8 (28%) vs. 18 (22%), respectively} [Table/Fig-2]. There were greater proportion of females than males in M and I type as compared to E type [Table/Fig-3].

Chronotype	Males (N=82) n (%)	Females (N=28) n (%)
Morning type	18 (22)	8 (28)
Evening type	14 (17)	3 (11)
Intermediate type	50 (61)	17 (61)

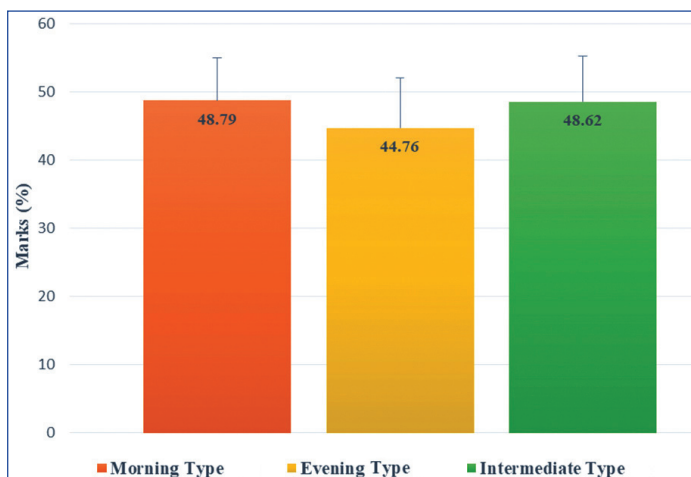
[Table/Fig-2]: Distribution of subjects into chronotypes in relation to gender.



[Table/Fig-3]: Distribution of subjects in each chronotype based on gender.
Data expressed in frequencies of participants (%)

Association between chronotype and academic performance: Analysis of academic performance in relation to chronotype showed that Morning type and Intermediate type performing better as compared to the Evening type [Table/Fig-4]; however, statistical significance could not be reached (p-value=0.089).

Higher scores (aggregate marks (%) $\geq 50\%$) were found to be more frequent in M-types as compared to E-types {10 (38%) vs. 3 (18%), respectively}; however, the association between academic achievement and chronotype did not reach significant level (p-value=0.15) [Table/Fig-5].



[Table/Fig-4]: Comparison of academic performance in relation to chronotype. *Values expressed as mean±standard deviation (±1 SD error bars); Statistical significance tested using one-way ANOVA (p-value=0.089)

Academic performance	Chronotype		p-value
	Morning type (n=26)	Evening type (n=17)	
Group I (Score ≥50%) (n=13)	10 (38%)	3 (18%)	0.15
Group II (Score <50%) (n=30)	16 (62%)	14 (82%)	

[Table/Fig-5]: Association of chronotype and academic performance. *Data expressed in frequencies of participants (%); p-value obtained with Pearson Chi-square test

DISCUSSION

Light darkness cycle is one of the strongest external circadian “Zeitgeber” (any external or environmental cue that entrains or synchronises an organism’s biological rhythms) for human beings. Pervasiveness of technology in modern day lifestyle, academic pressure and rising mental stress are some of the factors which lead to misalignment of synchronisation of biological rhythms and favour acquisition of evening type circadian typology. Previous literature has reported an association between eveningness and adverse physical and mental health [4, 11]. Hence, the present study was conducted to assess morningness-eveningness preferences among undergraduate medical students.

The present study revealed that majority {n=67 (61%)} of students could be classified as intermediate or neutral type while the two extreme topologies (morning and evening type) accounted for around two-fifth {n=43 (39%)} of the participants. These findings are in coherence with previous literature. Adan A et al., 2012 concluded in their review that intermediate type accounts for the major fraction of the population and about 40% of the population belonging to the two extreme circadian types [3]. Montaruli A et al., stated that N-type was the most common chronotype (65.5%), followed by E-type (24.3%) and M-type (10.2%) for both the male and the female subgroups [11]. Similar findings were also reported by Adan A et al., 2002 [13]. On the contrary, Arifuddin MK et al., reported very high prevalence of evening type (47%) and only 9% were intermediate type [4].

Morningness was more prevalent among female students as compared to male students (28% vs 22%, respectively) in the present study. These results are in agreement with Montaruli A et al., who observed that the percentage of N-type (72.90%) and M-type (11.3%) was higher among the females than the males (N-type=62.10%, M-type=9.7%) and the percentage of E-type was lower among females (15.80% vs. 28.30%) [11, 14].

Researchers have always shown a keen interest in exploring the relationship between chronotypes and academic performance. It represented a new, interesting field of research especially for educators involved in planning and evaluation of various teaching-learning programmes [1, 15]. Various studies over the years have

documented an effect of human chronotypes on physiological and psychological processes known to affect learning process [6, 8]. Hence, chronotype could influence the academic performance of students. Current literature suggests that morning chronotypes have an academic advantage over evening chronotypes [15, 16].

Present study also explored the association of chronotypes with academic performance and found that higher scores (≥50%) were more frequently reported in Morning types as compared to the Evening types. However, statistical significance could not be reached which might be because of small sample size available for comparison (n=43, power ~48%), thus there existed around 50% likelihood of the association being falsely non significant. It should be noted that due to stringent marking in the preuniversity exam at this institute, less than half the study sample (40%) scored less than 50% marks; which also accounts for the mean scores being less than 50% in the M, E and I-types. In a study done by Mirghani H it was seen that average grade students were more oriented towards eveningness than the students who scored excellent grades [2]. With respect to morningness and eveningness, a study done by Preckel F et al., also showed significant positive and negative relationships of academic performance with both, respectively [8]. A study done by Montaruli A et al., showed that M-types achieve higher grades on theoretical and practical exams than either N or E-types [11, 16]. There was statistically significant differences only between M and E-types and between M and N-types, whereas no differences were found between N- and E-types. These findings are in accordance with the fact that the morning-oriented students are somehow advantaged with respect to intermediate and evening chronotypes. Varied hypothesis have been proposed the academic advantage of M-types over other chronotypes. A few studies have suggested that the academic success of M-types could be due to psychological traits such as conscientiousness, achievement-orientation, self-discipline, and diligence, which are more prevalent in individuals with morning preferences [10, 11].

Studies conducted by Enright T and Refinetti R and Beşoluk S et al., attempted to meet E-type student preferences in their study protocols by evaluating academic results when lessons and/or exams were scheduled later in the day but the E-type students did not match the M-type in academic performance probably because of sleep debt weighing on E-types in exam sessions scheduled early and late in the day [17, 18]. Sleep debt and poor sleep quality contribute to daytime sleepiness in evening types who have to strive hard to remain attentive in class and keep up attendance [17, 19].

Limitation(s)

The main limitation of this study was the small size of the study cohort recruited from a single-centre. It is recommended for future research that chronotypic preferences be determined on large scale involving subjects from varied age groups and disciplines. Relationship of chronotypes be explored with multiple parameters of physiologic/clinical relevance using a multi-variate approach which will provide better insights about the correlation.

CONCLUSION(S)

The present study suggests that majority of the students were classified as intermediate type while the two extremes (morning and evening type) accounting for about two-fifth of the sample. Since, there is existing evidence which suggest morning types being better performers than evening types; therefore, scheduling teaching-learning activities based on chronotype could help in improving the academic performance.

Acknowledgement

Authors express their gratitude towards students for their co-operation and participation in this study.

REFERENCES

- [1] Akram N, Khan N, Ameen M, Mahmood S, Shamim K, Amin M, et al. Morningness-eveningness preferences, learning approach and academic achievement of undergraduate medical students. *Chronobiol Int.* 2018;35(9):1262-68.
- [2] Mirghani H. The effect of chronotype (morningness/eveningness) on medical students' academic achievement in Sudan. *J Taibah Univ Med Sci.* 2017;12(6):512-16.
- [3] Adan A, Archer SN, Hidalgo MP, di Milia L, Natale V, Randler C. Circadian typology: A comprehensive review. *Chronobiol Int.* 2012;29(9):1153-75.
- [4] Arifuddin MK, Shashiraj HK, Kavitha BS. Morningness-eveningness preferences among first year medical students. *Sch Int J Anat Physio.* 2021;4(3):32-34.
- [5] Kerkhof G. Inter-individual differences in the human circadian system: A review. *Biol Psychol.* 1985;20(2):83-112.
- [6] Fleig D, Randler C. Association between chronotype and diet in adolescents based on food logs. *Eat Behav.* 2009;10(2):115-18.
- [7] Borbely A, Daan S, Justice AW, Deboer T. The two-process model of sleep regulation: A reappraisal. *J Sleep Res.* 2016;25(2):131-43.
- [8] Preckel F, Lipnevich AA, Schneider S, Roberts RD. Chronotype, cognitive abilities, and academic achievement: A meta-analytic investigation. *Learn Individ Differ.* 2011;21(5):483-92.
- [9] Urbán R, Magyaródi T, Rigó A. Morningness-eveningness, chronotypes and health-impairing behaviors in adolescents. *Chronobiol Int.* 2011;28(3):238-47.
- [10] Natale V, Cicogna PC. Morningness-eveningness dimension: Is it really a continuum? *Personality and Individual Differences.* 2002;32(5):809-16.
- [11] Montaruli A, Castelli L, Galasso L, Mulè A, Bruno E, Esposito F, et al. Effect of chronotype on academic achievement in a sample of Italian University students. *Chronobiol Int.* 2019;36(11):1482-95.
- [12] Horne JA, Östberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *Int J Chronobiol.* 1976;4(2):97-110.
- [13] Adan A, Natale V. Gender differences in morningness-eveningness preference. *Chronobiol Int.* 2002;19(4):709-20.
- [14] Parajuli M, Thapa A. Gender differences in the academic performance of students. *Journal of Development and Social Engineering.* 2017;3(1):39-47.
- [15] Goldin AP, Sigman M, Braier G, Golombek DA, Leone MJ. Interplay of chronotype and school timing predicts school performance. *Nat Hum Behav.* 2020;4(4):387-96.
- [16] Lack LC, Wright HR. Chronobiology of sleep in humans. *Cell Mol Life Sci.* 2007;64(10):1205-15.
- [17] Enright T, Refinetti R. Chronotype, class times, and academic achievement of university students. *Chronobiol Int.* 2017;34(4):445-50.
- [18] Beşoluk Ş, Önder I, Deveci I. Morningness-eveningness preferences and academic achievement of university students. *Chronobiol Int.* 2011;28(2):118-25.
- [19] Bakotic M, Radošević-Vidacek B, Koscec Bjelajac A. Morningness-eveningness and daytime functioning in university students: The mediating role of sleep characteristics. *J Sleep Res.* 2017;26(2):210-18.

PARTICULARS OF CONTRIBUTORS:

1. Demonstrator, Department of Physiology, Shaheed Hasan Khan Mewati Government Medical College, Nalhar, Haryana, India.
2. Assistant Professor, Department of Physiology, Shaheed Hasan Khan Mewati Government Medical College, Nalhar, Haryana, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Navneet Kumar Kaushik,
Flat No-101, C1 Block, Shaheed Hasan Khan Mewati Government Medical College
Campus, Nalhar, Haryana, India.
E-mail: navneetkk24@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: May 11, 2022
- Manual Googling: Sep 27, 2022
- iThenticate Software: Oct 03, 2022 (19%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **May 06, 2022**

Date of Peer Review: **Jun 23, 2022**

Date of Acceptance: **Oct 05, 2022**

Date of Publishing: **Jan 01, 2023**