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RESEARCH ARTICLE

Chronotype and academic performance of adolescents

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ABSTRACT

Background: Performance of an individual at physical and mental level depends on many factors and chronotype is one among them. **Aims and Objectives:** To categorize the subjects into different chronotype groups based on Horne-Ostberg's morningness-eveningness questionnaire. To illustrate the academic performance of the subjects by recording their scores obtained in the physiology internal assessment theory examination. To observe the relation between chronotype group and their academic performance. **Materials and Methods:** After making them to understand the methods and objectives of the study, written informed consent was obtained from 150 adolescents of aged between 17 and 19 years; both the genders were included in the study. Horne-Ostberg's morningness-eveningness questionnaire has 19 questions and points against each of them. All the points are added and then the total scores are obtained. Scores can range from 16 to 86; scores ≤41 indicate evening type and scores ≥59 indicate morning type, and scores between 42 and 58 are intermediate type. Physiology internal assessment theory examination was conducted for maximum 50 marks; obtained marks were entered. **Results:** Mean scores obtained in the physiology theory examination by moderate evening, intermediate, and moderate morning chronotypic groups are 23.2 (8.5), 25.2 (6.8), and 25.6 (6.3), respectively (P = 0.649). **Conclusion:** Academic performance of the students is independent of their chronotype.

KEY WORDS: Morningness-eveningness; Chronotype; Performance; Adolescent; Physiology

INTRODUCTION

Chronotypic behavior is different in men and women; it can also change in the same individual with advancing in age. Men are evening type during their younger age, and their chronotype is shifted to morning type as they advance in age. Until, the age of 30 women are more morning type, and after 45 years, they are more evening type than men.[1] High-calorie food intake is dependent on the quality of sleep but not on chronotype of an individual.[2] Morningness-eveningness questionnaire was translated and modified into different languages, which is also highly reliable and valid for example in Korean language.[3] In athletes, wake-up time can be a reliable predictor for the optimal physical performance.[4] Fatigue and depression are related with the chronotype, independent of their working hours.[5,6] During the day time, working memory performance is dependent on thalamic and frontal lobe activity that are, in turn, dependent on the chronotype.[7] Attention increased as the day progressed in both morning and evening type of girls and boys, though evening type of boys attention is best, next is evening type of girls. Chronotype, sex, and time of the day are all important when the school children are familiar with the task, for better performance.[8] Morning type is related to higher life satisfaction irrespective of different culture and geographical locations.[9] Regularity

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in daily lifestyle appeared to be more in morning types when compared to evening types.[10]

Objectives

1. To categorize the subjects into different chronotype groups based on Horne-Ostberg's morningness-eveningness questionnaire
2. To illustrate the academic performance of the subjects by recording their scores obtained in the physiology internal assessment theory examination
3. To observe the relation between chronotype group and their academic performance.

MATERIALS AND METHODS

It is a simple, randomized cross-sectional study. Institutional Ethical Committee approved the study. After making them to understand the methods and objectives of the study, written informed consent was obtained from 150 adolescents of aged between 17 and 19 years; both the genders were included in the study.

Exclusion Criteria

Students who were absent on the day of administration of the test, who did not turn up for the physiology internal assessment theory examination, and who did not complete the questionnaire test properly like encircling two answers for one question or left one or more questions unanswered.

Methodology

Horne-Ostberg's morningness-eveningness questionnaire was administered on the subjects after giving proper instructions. Horne-Ostberg's morningness-eveningness questionnaire has 19 questions and points against each of them. All the points are added and then the total scores are obtained. Scores can range from 16 to 86; scores ≤41 indicate evening type and scores ≥59 indicate morning type, and scores between 42 and 58 are the intermediate type. Among the evening type, scores between 16 and 30 are definite evening type, and scores between 31 and 41 are moderate evening type. Moreover, among the morning type, scores between 59 and 69 are moderate morning type, and scores between 70 and 86 are definite morning type.[11] Physiology internal assessment theory examination was conducted for maximum 50 marks; obtained marks were entered.

Statistical Analysis

Data were analyzed with GraphPad Prism 6.01 version software. Comparison of the normal continuous data between moderate evening, intermediate, and moderate morning type of chronotypic groups was carried out with one-way "ANOVA" test. Kruskal–Wallis test is performed followed by Bonferroni's/Dunn's Multiple Comparisons test. Unpaired Student's *t*-test was carried out between male and female participants. $P < 0.05$ are considered as significant.

RESULTS

Findings of the present study are depicted in Tables 1-3.

DISCUSSION

Tables 1 and 2 shows comparison and multiple comparisons of marks obtained in theory examination by moderate evening, intermediate, and moderate morning chronotypic groups. Definite morning and definite evening chronotypes are not present in this particular study. Differences in chronotypes

Table 1: Comparison of marks obtained in theory examination by moderate evening, intermediate, and moderate morning chronotypic groups (one-way analysis of variance test)

Groups	*N*	Range	Mean (SD)	*P* value
Moderate evening	9	8 to 35	23.2 (8.5)	
Intermediate	102	9 to 42	25.2 (6.8)	0.649
Moderate morning	31	12 to 35	25.6 (6.3)	

P<0.05 is significant. SD: Standard deviation

Table 2: Multiple comparisons of marks obtained in theory examination by moderate evening, intermediate, and moderate morning chronotypic groups (Bonferroni's multiple comparison test)

Multiple comparison	Mean difference	Summary
Moderate evening versus Intermediate	1.94	NS
Moderate evening versus Moderate morning	2.39	NS
Intermediate versus Moderate morning	0.46	NS

NS: Non-significant

Table 3: Comparison of marks obtained in theory examination by moderate evening, intermediate, and moderate morning chronotypic groups between male and female (unpaired *t*-test)

Parameter	Groups	*N*	Range	Mean (SD)	*P* value
Moderate evening	Male	2	15-23	19.0 (5.7)	0.460
	Female	7	8-35	24.4 (9.1)	
Intermediate	Male	34	9-32	23.9 (6.2)	0.172
	Female	68	10-42	25.8 (7.0)	
Moderate morning	Male	9	12-34	24.6 (6.4)	0.556
	Female	22	14-35	26.1 (6.3)	

P<0.05 is significant. SD: Standard deviation

are related to social components like engaging with specific work at a specific time of the day,[12,13] and this could be one of the reasons why there are no definite morning or evening chronotypes in the present study. Risky, aggressive, negative emotional and drunken driving are all associated with evening type.[14] Evening-type of individuals are prone for joint and spinal cord diseases than the morning type.[15] In the present study, there is no significance in the academic performance of the students with different chronotypes. Reports suggest that the quality of sleep is poor among the evening type.[16,17] Morning-type individuals have better reading skills, self-motivation to study, and overall better achievements[18,19] that are not the case in the present study. Adaptation to night shift schedule is related to the behavioral sleep strategies in the hospital working nurses.[20] Compensation of sleep can be a protective mechanism for academic performance in sleep-deprived adolescents.[21] Psychosocial aspect is more associated with the quality of sleep rather than the chronotype of the individual, but it is opposite in the case of alcoholics.[22] Maximum number of people with left cerebral hemisphere dominance in thinking are morning type, and they have high levels of subjective achievements. Most of the people with right cerebral hemisphere dominance are evening type and have low levels of subjective achievements.[23] High risk taking behavior was observed among evening type individuals, with respect to decision-making in financial, ethical, and recreational domains.[24] Table 3 shows non-significant results between male and female subjects in all the three chronotypic groups. In the present study, evening type of individuals has also performed on par with the morning and intermediate type; this finding is contradicting with the earlier research reported.[25,26] Tendency towards morningness decreased in adolescence and again returned in adulthood, eveningness being more prevalent in males than in female counterparts.[27]

CONCLUSION

The academic performance of the students is independent of their chronotype.

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REFERENCES

1. Duarte LL, Menna-Barreto L, Miguel MA, Louzada F, Araújo J, Alam M, et al. Chronotype ontogeny related to gender. Braz J Med Biol Res. 2014;47(4):316-20.
2. Lai PP, Say YH. Associated factors of sleep quality and behavior among students of two tertiary institutions in Northern Malaysia. Med J Malaysia. 2013;68(3):195-203.
3. Lee JH, Kim SJ, Lee SY, Jang KH, Kim IS, Duffy JF. Reliability and validity of the Korean version of morningness-eveningness questionnaire in adults aged 20-39 years. Chronobiol Int. 2014;31(4):479-86.
4. Facer-Childs E, Brandstaetter R. The impact of circadian phenotype and time since awakening on diurnal performance in athletes. Curr Biol. 2015;25(4):518-22.
5. Furusawa M, Okubo Y, Kuroda R, Umekage T, Nagashima S, Suwazono Y. Relationship between morningness-eveningness typology and cumulative fatigue or depression among Japanese male workers. Ind Health. 2015;53(4):361-7.
6. Bielen J, Melada A, Markelic I. Depression and circadian typology. Psychiatr Danub. 2015;27(2):190-2.
7. Schmidt C, Collette F, Reichert CF, Maire M, Vandewalle G, Peigneux P, et al. Pushing the Limits: Chroznotype and time of day modulate working memory-dependent cerebral activity. Front Neurol. 2015;6:199.
8. Escribano C, Díaz-Morales JF. Daily fluctuations in attention at school considering starting time and chronotype: An exploratory study. Chronobiol Int. 2014;31(6):761-9.
9. D´Az-Morales JF, Jankowski KS, Vollmer C, Randler C. Morningness and life satisfaction: Further evidence from Spain. Chronobiol Inter. 2013;30(10):1283-85.
10. Monk TH, Buysse DJ, Potts JM, DeGrazia JM, Kupfer DJ. Morningness-eveningness and lifestyle regularity. Chronobiol Int. 2004;21(3):435-43.
11. Horne JA, Ostberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. Int J Chronobiol. 1976;4(2):97-110.
12. Aledavood T, López E, Roberts SG, Reed-Tsochas F, Moro E, Dunbar RI, et al. Daily rhythms in mobile telephone communication. PLoS One. 2015;10(9):e0138098.
13. Korczak AL, Martynhak BJ, Pedrazzoli M, Brito AF, Louzada FM. Influence of chronotype and social zeitgebers on sleep/wake patterns. Braz J Med Biol Res. 2008;41(10):914-9.
14. Qu W, Ge Y, Xiong Y, Carciofo R, Zhao W, Zhang K. Dangerous driving in a Chinese sample: Associations with morningness-eveningness preference and personality. PLoS One. 2015;10(1):e0116717.
15. Merikanto I, Lahti T, Seitsalo S, Kronholm E, Laatikainen T, Peltonen M, et al. Behavioral trait of morningness-eveningness in association with articular and spinal diseases in a population. PLoS One. 2014;9(12):e114635.
16. Rique GL, Fernandes Filho GM, Ferreira AD, de Sousa-Muñoz RL. Relationship between chronotype and quality of sleep in medical students at the Federal University of Paraiba, Brazil. Sleep Sci. 2014;7(2):96-102.
17. Ong JC, Huang JS, Kuo TF, Manber R. Characteristics of insomniacs with self-reported morning and evening chronotypes. J Clin Sleep Med. 2007;3(3):289-94.
18. Duarte J, Nelas P, Chaves C, Ferreira M, Coutinho E, Cunha M. Sleep-wake patterns and their influence on school performance in Portuguese adolescents. Aten Primaria. 2014;46 Suppl 5:160-4.
19. Besoluk S, Onder I, Deveci I. Morningness-eveningness preferences and academic achievement of university students. Chronobiol Int. 2011;28(2):118-25.
20. Petrov ME, Clark CB, Molzof HE, Johnson RL Jr, Cropsey KL, Gamble KL. Sleep strategies of night-shift nurses on days off: Which ones are most adaptive? Sleep Chronobiol. 2014;5:277:1-8.

21. Mak KK, Lee SL, Ho SY, Lo WS, Lam TH. Sleep and academic performance in Hong Kong adolescents. J Sch Health. 2012;82(11):522-7.
22. Tavernier R, Willoughby T. Are all evening-types doomed? Latent class analyses of perceived morningness-eveningness, sleep and psychosocial functioning among emerging adults. Chronobiol Int. 2014;31(2):232-42.
23. D´Az-Morales JF, Escribano C. Circadian preference and thinking styles: Implications for school achievement. Chronobiol Int. 2013;30(10):1231-9.
24. Ponzi MD, Wilson C, Maestripieri D. Eveningness is associated with higher risk-taking, independent of sex and personality. Psychological reports. Soc Issues Psychol. 2014;115(3):932-47.
25. Preckel F, Lipnevich AA, Boehme K, Brandner L, Georgi K, Könen T, et al. Morningness-eveningness and educational outcomes: The lark has an advantage over the owl at high school. Br J Educ Psychol. 2013;83(1):114-34.
26. Liaghatdar MJ, Ashoorion V. Investigating morningness-eveningness typology of medical students and its relationship with their academic merits and course difficulty. Iran J Med Educ. 2011;10(5):1-10.
27. Randler C. Age and gender differences in morningness-eveningness during adolescence. J Genet Psychol. 2011;172(3):302-8.

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