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Association between sleep quality and habits of electronic media use among young adults with different circadian typology

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ABSTRACT

Background: Circadian preference refers to individual differences for mental and physical activity in the morning and evening. We hypothesized, that inadvertent use of electronic media can cause circadian misalignment that influences sleeping habits and sleep quality of young adults. **Aims and Objectives:** The aim of the study was to investigate the effect of circadian preferences on sleeping habits and the association of electronic media use with sleep quality and sleep disturbances. **Materials and Methods:** A total of 188 subjects were enrolled and divided into three groups: Evening, intermediate, and morning chronotype based on the Morningness-Eveningness score. Electronic media use at bedtime and duration of use were assessed subjectively. Sleep quality and subjective sleep disturbances, daytime sleepiness, and chronotype were assessed by the Pittsburgh Sleep Quality Index, Epworth Sleepiness Score, and Morningness-Eveningness Questionnaire Self-assessment version, respectively. **Results:** The majority of subjects with the evening chronotypes suffered from poor sleep quality compared to other chronotypes and the difference was statistically significant. In evening-type subjects, electronic media use at bedtime, long sleep latency, short sleep duration, and daytime sleepiness were significantly associated with poor sleep quality with odds ratios of 2.34 (1.08–5.08), 11.42 (4.98–26.19), 8.54 (1.01–68.24), and 1.68 (1.03–2.73), respectively. **Conclusion:** The majority of evening-type subjects had poor sleep quality, altered sleeping habits, and electronic media use at bedtime is significantly associated with poor sleep quality. Hence, history regarding sleep habits and lifestyle, especially electronic media use, should be taken from young adults, who are coming to the outpatient department for other than sleep disorders, to prevent the development of health-related problems.

Key words: Morningness-Eveningness; Chronotype; Sleep quality; Electronic media

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INTRODUCTION

Circadian preference refers to individual differences in mental and physical activity in the morning and evening. Three types of circadian typology have been described in human beings: Morning (larks), evening (owls), and intermediate according to diurnal preference for mental and physical activity.[1] This variation in circadian preference among individuals may be due to various biological, genetic, and psychosocial components.[2] Morning-type individuals are more physically and mentally active in the early hours of the day compared to evening-type individuals, who are more physically and mentally active in the evening hours of the day.[3] Sufficient and strong evidence now exists for the association between chronotype and well-being.[4] The evening-type individuals have a poor quality of sleep when compared with the morning types,[5,6] and lack of adequate sleep is associated with multiple negative consequences for health and well-being[7] such as metabolic and endocrine[8,9] and psychological disorders. Hence, the sleep–wake cycle should

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be synchronized in every individual to minimize the health-related issues arising due to circadian misalignment. The main question of this research is: Does chronotype demonstrate an association with the quality of sleep, sleeping habits, and electronic media use among young adults? The hypothesis of this study was that individual circadian preference can influence the sleeping habits of young adults due to the inadvertent use of electronic media. Thus, the aim of this study was to investigate the effect of circadian preferences on sleeping habits and the association of electronic media use with sleep quality and sleeping habits.

Aims and objectives

To see the effect of circadian preferences on sleeping habits and to investigate the association of electronic media use with sleep quality and sleeping habits.

MATERIALS AND METHODS

In this cross-sectional study, a total of 188 subjects were enrolled based on inclusion and exclusion criteria. Subjects with any known sleep problem, oro-nasal disease, head injury, and not willing to participate in the study were excluded from the study. Subjects with any chronic illness, such as diabetes mellitus, hypertension, and chronic respiratory disease, were also excluded from the study. All subjects were divided into three groups: Group 1 (definite evening chronotype, n=67), group 2 (intermediate chronotype, n=82), and group 3 (definite morning chronotype, n=39) based on the Morningness-Eveningness score.[10] Informed written consent was taken from all subjects after ethical clearance by the Ethical Committee of King George's Medical University (KGMU), Lucknow, India. A complete clinical evaluation of subjects was done based on a preformed pro forma. Anthropometric measurements, such as height, weight, and body mass index, were taken by trained nursing staff. The type of electronic media used, whether used at bedtime or not, and duration of electronic media use (hours per week) were assessed on a subjective basis. Sleep quality and sleeping habits, daytime sleepiness, and chronotype were assessed by the Pittsburgh Sleep Quality Index (PSQI),[11] Epworth Sleepiness Score,[12] and Morningness-Eveningness Questionnaire Self-assessment version,[10] respectively. The Statistical Package for Social Sciences (SPSS) (IBM SPSS Statistics, Armonk, NY), version 21 was used for data analysis. Data were summarized as the mean±standard deviation and the crude odds ratios (OR) of the demographic and lifestyle factors of all study subjects were calculated for poor sleep quality.

RESULTS

Baseline characteristics of groups 1, 2, and 3 are summarized in Table 1. No statistically significant difference was observed in baseline characteristics among subjects of the three groups.

Analysis of PSQI components and daytime sleepiness was carried out within the three groups based on their circadian typology. Then their result is tabulated as shown in Table 2. It was found that the majority of subjects of group 1 have experienced a fairly bad quality of sleep that is 49.3%. When compared with others, 73.2% of subjects of group 1 have experienced an overall bad quality of sleep. The data were found to be statistically significant ($P<0.001$). On comparing sleep latency within different groups, it was found that the majority of subjects (41.8%) of group 1 have higher sleep latency. The majority of subjects (70.1%) of group 1 have short sleep duration compared to subjects of group 2 (28%) and 3 (10.3%). Poor sleep efficiency was also common in subjects of group 1 and 2. It was also found that a higher number of subjects of group 1 suffered from poor sleep quality (68.7%) and abnormal daytime sleepiness (25.4%) compared to subjects of groups 2 and 3. Hence, we can say that evening-type subjects suffered from bad subjective sleep quality, higher sleep latency, short sleep duration, poor sleep quality of sleep, and abnormal daytime sleepiness as compared to intermediate and morning-type subjects. A statistically significant difference was present for subjective sleep quality, Sleep latency, total sleep duration, habitual sleep efficiency, sleep quality, and daytime sleepiness among subjects of groups 1, 2, and 3 (Table 2).

Table 3 shows that subjects of groups 1 and 2 use electronic media at bedtime in higher percentages compared to subjects of group 3 and this difference was statistically significant.

Analysis of the association of PSQI components and electronic media use for poor sleep quality is shown in Table 4. Subjects who had bad subjective sleep quality, higher sleep latency, short sleep duration, low habitual sleep efficiency, and abnormal daytime sleepiness showed statistically significant association for poor sleep quality with an OR of 22.69 (10.11–50.90), 11.42 (4.98–26.19), 8.54 (1.01–68.24), 2.43 (1.07–5.51) and 1.68 (1.03–2.73), respectively. The habit of electronic media use at bedtime showed a statistically significant association for poor sleep quality with an OR of 2.34 (1.08–5.08) rather than the total duration of electronic media use (Table 4).

DISCUSSION

On comparison of the three groups according to circadian typology, we found that the majority of evening-type subjects suffered from poor sleep quality compared to

Table 1: Baseline characteristics according to circadian typology

Parameters	Group 1 (n=67)	Group 2 (n=82)	Group 3 (n=39)	P-value
Age (yrs)	20.57±1.70	20.27±2.23	20.87±1.64	0.264
Weight (kg)	64.84±8.64	63.61±8.41	62.77±8.04	0.245
Height (cm)	167.52±8.39	168.11±8.084	169.03±8.36	0.665
BMI				
<23	30	48	25	0.103
>23	37	34	14	

yrs: Years, kg: Kilogram, cm: Centimetre; Group 1: Evening type; Group 2: Intermediate type; Group 3: Morning type, BMI: Body mass index

Table 2: Analysis of PSQI components and daytime sleepiness according to circadian typology

Parameters	Group 1		Group 2		Group 3		P-value
	n	%	n	%	n	%	
Subjective sleep quality							
Very good	0	0.0	32	39.0	1	2.6	<0.001*
Fairly good	18	26.9	48	58.5	14	35.9	
Fairly bad	33	49.3	2	2.4	23	59.0	
Very bad	16	23.9	0	0	1	2.6	
Sleep latency (minutes)							
≤15	4	6.0	21	25.6	11	28.2	0.0005*
16–30	32	47.8	42	51.2	23	59.0	
31–60	28	41.8	19	23.2	5	12.8	
>60	3	4.5	0	0	0	0	
Sleep duration (hours)							
>7	4	6.0	6	7.3	3	7.7	<0.001*
6–7	16	23.9	53	64.6	32	82.1	
<6	47	70.1	21	25.6	4	10.3	
<5	0	0	2	2.4	0	0	
Habitual sleep efficiency							
>85	32	47.8	21	25.6	25	65.8	0.014*
75–84	33	49.3	55	67.1	13	34.2	
65–74	2	3.0	6	7.3	0	0	
<65	0	0	0	0	0	0	
Sleep disturbances							
Not during the past month	7	10.4	13	15.9	3	7.7	0.377
< once in a week	60	89.6	69	84.1	36	92.3	
Once or twice a week	0	0	0	0	0	0	
≥3 times in a week	0	0	0	0	0	0	
Use of sleep medications							
Not during the past month	67	100	82	100	39	100	-
Less than once a week	0	0	0	0	0	0	
Once or twice a week	0	0	0	0	0	0	
≥3 times a week	0	0	0	0	0	0	
Daytime dysfunction							
Not during the past month	16	23.9	30	36.6	4	10.3	0.0002*
Less than once in a week	21	31.3	32	39.0	26	66.7	
Once or twice a week	16	23.9	13	15.9	9	23.1	
≥3 times in a week	14	20.9	7	8.5	0	0	
Global PSQI score (Sleep quality)							
Good sleep quality (PSQI score <5)	21	31.3	39	47.6	19	48.7	0.087
Poor sleep quality (PSQI score ≥5)	46	68.7	43	52.4	20	51.3	
Daytime sleepiness							
Normal	40	59.7	68	82.9	39	100	0.0002*
Borderline	10	14.9	6	7.3	0	0	
Abnormal	17	25.4	8	9.8	0	0	

*significant (P<0.05); n: number; PSQI: Pittsburgh sleep quality index; Group 1: evening type; Group 2: Intermediate type; Group 3: Morning type

morning-type subjects. Similar results were also found in other studies.[5,13] In the present study, evening-type subjects showed long sleep onset latency, short total sleep time, lesser sleep efficiency, and abnormal daytime sleepiness compared to morning-type subjects. Several previous studies have confirmed that evening-type subjects are associated with sleep disturbance.[13-18] Poor sleep quality and sleep disturbances in the evening chronotype may be due to substance abuse such as alcohol,[19] and misalignment between social time and internal circadian clock. Young

Table 3: Analysis of electronic media use according to circadian typology

Parameters	Group 1 (n=67)	Group 2 (n=82)	Group 3 (n=39)	P-value
Duration of EM use (hrs/week)	19.76±5.23	19.95±6.02	18.28±5.88	0.301
Used at bedtime				
Not use	16 (23.9%)	16 (19.5%)	39 (100%)	<0.001*
Use	51 (76.1%)	66 (80.5%)	0 (0.0%)	

*significant (P<0.05); n: Number; hrs: Hours; EM: Electronic media, Group 1: evening type; Group 2: Intermediate type; Group 3: Morning type

Table 4: Crude odds ratios of PSQI components and electronic media use for poor sleep quality

Parameters	Poor sleep quality frequency (%)	OR (CI)	P-value
Subjective sleep quality			
Good	18.18	Ref	Ref
Bad	80.49	22.69 (10.11–50.90)	<0.001*
Sleep latency (minutes)			
≤15	5.56	Ref	Ref
16–30	59.79	25.28 (5.74–111.37)	<0.001*
31–60	88.46	11.42 (4.98–26.19)	<0.001*
>60	100	-	1.00
Sleep duration (hours)			
>7	7.69	Ref	Ref
6–7	41.58	8.54 (1.01–68.24)	0.043*
<6	88.89	9.80 (3.31–28.97)	
<5	100	-	1.00
Habitual sleep efficiency			
>85%	37.118	Ref	Ref
75–84%	72.28	4.41 (2.24–8.30)	
65–74%	77.78	2.43 (1.07–5.51)	0.033*
<65%			
Daytime sleepiness			
Normal	53.74	Ref	Ref
Borderline	68.75	1.89 (0.63–5.72)	0.258
Abnormal	76.92	1.68 (1.03–2.73)	0.038*
Use of EM (Hrs/week)			
7	42.86	Ref	Ref
7–14	50.0	0.75 (0.12–4.62)	0.757
>14	60.25	1.23 (0.55–2.78)	0.617
EM used at bedtime			
No	40.63	Ref	Ref
Yes	61.54	2.34 (1.08–5.08)	0.032*

*Significant (P<0.05); PSQI: Pittsburgh sleep quality index; OR: Odds ratios; CI: Confidence interval; EM: Electronic media; hrs: Hours; ref: Reference; Group 1: evening type; Group 2: Intermediate type; Group 3: Morning type

adults are also vulnerable to sleep disturbances due to the presence of curricular load and school schedule without considering their morningness–eveningness balance.[20] It was also found in the present study that the majority of evening-type subjects use electronic media at bedtime compared to morning-type subjects and the habit of electronic media use at bedtime was significantly associated with poor sleep quality. Previous studies have found that sleep duration and sleep quality were associated with the habit of electronic media use but these studies were done on the middle-aged and elderly population.[21,22] Electronic media use at bedtime reduces total sleep time[23] and bright light emitted by them may delay circadian rhythm.[24] Chronic inversion in sleep habits among young adults due to inappropriate use of electronic media can lead to circadian rhythm misalignment, which can cause significant reductions in sleep duration, architecture, and quality. In childhood, sleep–wake cycle during weekdays and weekends is generally constant but when children enter into adolescence and the young adult age group major change in sleep–wake habit occurs. Adolescents and young adults tend to stay up later in the night and have to wake up early in the morning.[25] Various studies confirmed that alteration in sleep–wake habits can lead to poor sleep quality.[6,8,9] Disrupted sleep–wake cycle and poor sleep quality can predispose to psychiatric disorders, cardiovascular disorders, impaired glucose metabolism, insulin resistance, and diabetes disorders.[26-29] Hence, poor sleep quality and sleep disturbances in early adult life will lead to various multiple health-related problems in human beings.[7] Therefore, healthy sleep habits like timing of electronic media use and restricted use of electronic media are necessary for the primordial prevention of these disorders. The present study also highlighted that

evening chronotype young adults have unhealthy sleep habits. It may be due to low perception, poor knowledge, and lack of awareness about sleep disorders and their health-related adverse consequences. The present study was not without limitations: (a) It had a cross-sectional design and only a subjective method was used to evaluate circadian preference, sleep quality, and sleep architecture, (b) The present sample was limited to an urban population, and therefore, its generalization to a rural population is restricted and (c) This study was based only on self-report measures, which might be prone to memory and response biases.

Limitations of the study

The present study was not without limitations: (a). It had a cross-sectional design and only subjective method is used to evaluate the circadian preference, sleep quality and sleep architecture, (b). Present sample was limited to urban population, and therefore, its generalization to a rural population is restricted and (c). This study was based only on self-report measures, which might be prone to memory and response biases.

CONCLUSION

The present study has demonstrated that the majority of evening-type subjects had poor sleep quality, altered sleeping habits, and abnormal daytime sleepiness. It was also found that the majority of evening-type subjects use electronic media at bedtime compared to morning-type subjects and the habit of electronic media use at bedtime is significantly associated with poor sleep quality. The findings of the present study suggest that history regarding sleep habits and lifestyle, especially regarding the use of electronic media, should be taken from young adults who are coming to the outpatient department (OPD) for other than sleep disorders to prevent the development of health-related problems. The sleep health of an individual can be screened in OPD by asking a few questionnaires. Unhealthy sleep habits may also be due to a lack of awareness about sleep hygiene. This necessitates promoting awareness in society and educating health-care providers, regarding the importance of sleep hygiene, sleep–wake habits, and the harmful effects of challenging our internal clock.

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DATA AVAILABILITY

The authors agree all data and statistical information essential to this article will be made available for review if required.

COMPLIANCE WITH ETHICAL STANDARDS

The procedures followed in the study were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 1983.

ETHICS APPROVAL

The study was approved by the Institutional Ethical Committee of KGMU (79th ECM II B-Ph.D./PI). All procedures performed in the study were in accordance with the 1964 Helsinki Declaration and its later amendments.

CONSENT TO PARTICIPATE

Written informed consent was obtained from all patients.

CONSENT FOR PUBLICATION

The participants gave consent for the results to be publicized.

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AR- Definition of intellectual content, literature survey, prepared the first draft of the manuscript, implementation of the study protocol, data collection, data analysis, manuscript preparation, and submission of the article; **AKG-** Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **SS-** Design of study, statistical analysis, and interpretation; **AV-** Review manuscript and literature survey; **S-** Coordination and manuscript revision.

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