

FULL PAPER

Medical students' knowledge of circadian neuroscience in relation to sleep disorders: A cross-sectional study

Asma Alanazi^{a,b,*} | Haifa Alhawas^{a,b} | Munirah Aldossar^a | Dana Almutairi^a | Dana Almatroudi^a | Afnan Alenazi^a | Leen Almadh^a | Maram Albalawi^c

^aCollege of Medicine, King Saud bin Abdulaziz University for Health Sciences (KSAU-HS), Riyadh, Saudi Arabia

^bKing Abdullah International Medical Research Center, Riyadh, Saudi Arabia

^cDepartment of Biostatistics and Bioinformatics, King Abdullah International Medical Research Center, Riyadh, Saudi Arabia

A critical, two-way link exists between sleep-related issues and a person's mental and physical well-being. Despite sleep medicine being an established field, there's a shortage of widespread understanding, leading to potential missed diagnoses of sleep conditions. In the present study, we examine the awareness of medical students on the topic of circadian neuroscience and sleep disorders. To gauge both the understanding and viewpoints of students concerning sleep disorders and medicine, a total of 296 medical students -142 males and 154 females- in their third to sixth years participated in a self-conducted Assessment of Sleep Knowledge in Medical Education (ASKME) survey. This questionnaire combined items on socio-demographic information and sleep science. Statistical analyses were performed using Fisher's exact/chi-squared tests and the Wilcoxon two-sample test. A total of 296 students took part in the research, and the findings indicate that an overwhelming 96.62% had insufficient knowledge about sleep medicine, with a mere 3.28% showing adequate understanding. On a positive note, a high percentage of students (85.47%) expressed a favourable view of sleep medicine, while only 14.53% held a negative outlook. Notably, there was a statistically meaningful correlation between attitudes toward sleep medicine and gender ($p=0.0057$). Interest in sleep medicine also showed a significant connection with both knowledge ($p=0.0552$) and attitude ($p=0.0059$). In summary, while there's a knowledge gap among the surveyed medical students in the area of sleep medicine, the bulk of them have a positive disposition toward the subject.

***Corresponding Author:**

Asma Alanazi

Email: Anazia@ksau-hs.edu.sa

Tel.: N/A

KEYWORDS

Circadian neuroscience; sleep disorder; biomedical diagnosis; sleep medicine.

Introduction

The reciprocal link between sleep and mental well-being is critically important. Sleep can shape an individual's psychological condition, while mental health issues can lead to sleep-related problems [1,2]. Moreover, sleep-

related problems can negatively affect mental health [3]. Sleep disorders are described as irregularities in a person's sleep pattern, which can arise from various factors, including environmental ones [4]. Sleep disorders (SDs) can take many forms from, narcolepsy, sleep paralysis, sleep anxiety, and upset circadian

rhythms including restless leg syndrome, sleep apnoea, and shift-work sleep disorder [5].

Sleep disorders tend to be more common in people whose work hours are not consistent, particularly changing shift-workers [5]. In the Kingdom of Saudi Arabia (KSA) sleep disorders are common in the medical professions, including, most often female, medical students [6]. According to a study, the incidence of SDs in the Saudi populace is on the rise [7]. This implies that there will be an increasing need for sleep specialists. However, the general populace and healthcare professionals alike lack awareness about sleep disorders and sleep medicine, perhaps due to its emerging status as a medical specialty [8]. In collaboration with many organizations, such as American Sleep Disorders Association (ASDA), the International Classification of Sleep Disorders (ICSD) was formed in 1990 and updated in 2005 (ICSD-2, 2005) in which over seventy types of sleep disorders are classified according to seven main categories [9]. Despite the availability of diagnostic and treatment tools, there is a worldwide shortage of sleep healthcare experts [10].

Despite the frequency of sleep disorders, little research has been conducted on the disorder in KSA [11]. They identified two main challenges: a scarcity of specialists and inadequate funding or insurance coverage. Even general healthcare providers do not consider sleep medicine as a specialized field [8].

In a study on Qassim University, they found that even though knowledge about sleep medicine was lacking, the medical students generally had a positive attitude towards it [12]. In Riyadh, an earlier study reported that 80% of medical students felt their knowledge on the subject was insufficient [13]. This was partly because sleep medicine was not prioritized in the medical curriculum. Physicians' lack of knowledge in this area impacts the quality of care they can provide [8].

In one of the studies, they emphasized that the lack of knowledge among physicians leads to undiagnosed sleep disorders, creating additional health problems [14]. In KSA, individuals working in the Primary Health Care (PHC) sector also lack knowledge about the condition. A 2017 survey found that approximately one-fourth did not inquire about sleep when taking medical histories, and about 40% did not think that sleep problems were a medical disease [15]. Another study found health care professionals' (HCPs) knowledge of one type of SDs, Obstructive Sleep Apnoea (OSA) was limited and that nearly two thirds of all physicians were not aware of its association with accidents when driving [16].

Multiple studies have shown that PHC physicians often encounter OSA, a common condition [16-19]. The shortage of specialists and the lack of knowledge about SDs in general and OSA in particular, make it difficult to diagnose OSA and other sleep disorders [8,11]. Given the high proportion of the population affected, the limited number of specialists cannot diagnose all cases. One study argues that educating PHC physicians could alleviate this problem [20]. The purpose of this study is to investigate the attitudes and knowledge of King Saud bin Abdulaziz University for Health Sciences medical students in Riyadh towards sleep medicine.

Methods

An online survey was conducted among students at (KSAU-HS) Riyadh Branch to gather information about medication used for SDs and the attitudes towards this kind of medication among medical students. The study included medical students of any gender who were in their third to sixth year of study. The study removed data that were not complete. A non-probability convenience sampling technique was used to calculate the study's sample size, resulting in a total of 292 participants.

The self-administered questionnaire comprised entirely of closed-ended questions. It consisted of three sections, 1) sociodemographic information (such as grade point average (GPA), gender, and age), speciality, interest in SDs, study year), 2) attitudes toward sleep medicine (assessing perspectives on its importance), and 3) the understanding of sleep and sleep disorders among students. A questionnaire developed by Zozula *et al.* (2001), Knowledge of SDs was assessed using the Assessment of Sleep Knowledge in Medical Education (ASKME) [21]. The reliability of the questionnaire was piloted and its validity confirmed by specialists.

The questionnaire comprised 30 questions covering topics that included basic sleep principles, the circadian rhythm, normal sleep patterns, type of SD, and knowledge of drug- and alcohol-related effects on SDs. Respondents were provided with four answer options for each question. Only one of the four options was correct, while the other two were incorrect, and the fourth option allowed respondents to indicate that they did not know the answer. Correct responses were coded as "1", while the other responses were coded as "0".

The possible score range ranged from 0 to 30. Adequate knowledge was defined as exceeding a threshold of 60%. Students were categorized as having adequate knowledge if they provided 18 or more correct responses and as having inadequate knowledge if they provided 17 or fewer correct responses.

Students' opinions regarding SDs and regular sleep were measured using ten questions that were modified from the ASKME survey [21]. The questions used a 5-point Likert scale, with 1 indicating strongly disagree, 2 disagree, 3 neutral, 4 agree, and 5 strongly agree. The attitude assessment had a maximum possible score of 50, with a threshold of 30 out of 50 representing a good

attitude. People with negative opinions were those who scored fewer than thirty.

The analysis was carried on SAS 9.4 with categorical (qualitative) factors scored by frequencies and percentages and descriptive statistics (mean, standard deviations) for continuous factors. Associations between the factors were assessed using Chi-square (or Fishers Exact test for low frequencies) and Wilcoxon two-sample t tests for testing group differences on the continuous data. *P*-values less than 0.05 were considered significant and mean group differences compared using 95% confidence intervals.

Ethical clearance was given by the King Abdullah International Medical Research Center (KAIMRC) (Ref: SP21R\168\04). Informed consent was obtained from all participants taking the questionnaire. Students were not required to disclose any personal information to participate in the study, and they did not receive any form of compensation or benefit for their participation. All data collected in the study were kept confidential and accessible only to the research team.

Results

A total of 296 fully completed questionnaires were collected from medical students in their 3rd, 4th, 5th, and 6th years of study. Participant demographics are displayed in Table 1. The majority of respondents ($n = 280$; 94.5%) were below the age of 25, with a slight majority being female ($n = 154$; 52%). Most medical students were in their fourth year of study. In addition, most respondents ($n = 272$; 91.89%) had a GPA score of ≥ 4.1 , and 169 students (57.07%) expressed a preference for a career in medicine. Interestingly, despite the recognition of the importance of sleep medicine by many students, the majority ($n = 240$; 81.08%) indicated a lack of interest in this specialty.

TABLE 1 Participant demographics (N=296)

Sociodemographic variable		n (%)
Age	More than 25	16 (5.41%)
	Less than 25	280 (94.5%)
Sex	Female	154 (52%)
	Male	142 (47.97%)
Years of college	3 rd	70 (23.65%)
	4 th	93 (31.42%)
	5 th	65 (21.96%)
	6 th	68 (22.97%)
Preferred speciality	Medicine	169 (57%)
	Surgery	88 (30%)
	Other	39 (13%)
Interest in the field of sleep medicine	No	56 (19%)
	Yes	240 (81%)
	Not at all	7 (2.36%)
Importance of sleep medicine	Low importance	10 (3.38%)
	Averagely	76 (25.68%)
	Moderately	104 (35.14%)
	Highly	99 (33.45%)
GPA	2.4-4.0	24 (8.11%)
	4.1-5.0	272 (91.89%)

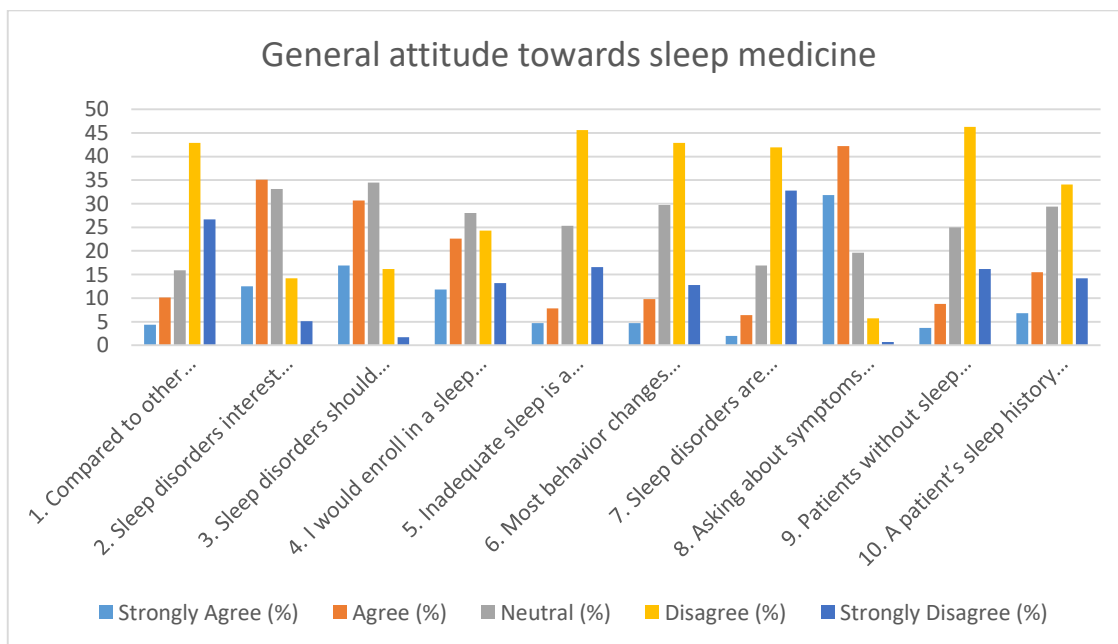
**FIGURE 1** Attitude of medical students toward sleep medicine

Table 2 The results from the ASKME scale used in the questionnaire data (as frequencies (and %) of correct responses). Among the questions, the one with the fewest correct answers from students was "What is recommended in patients with difficulty in initiating sleep?" Just 17 students, or 5.74%,

provided an accurate response to this question. Alternatively, 229 students (77.36%) correctly answered the question, "When does the body increase the secretion of melatonin?", 227 students (76.69%) correctly answered the question, "How much time do newborn infants spend sleeping per 24

hours?", and 182 students (61.49%) correctly answered the question, "What can increase the incidence of sleepwalking in children"?

TABLE 2 Questionnaire items assessing the understanding of medical students in of SDs and the neuroscience of circadian rhythms (N=296)

Knowledge questions	Number of correct responses
Q1. When does the need for sleep decrease in a person?	124 (41.86%)
Q2. When does the secretion of melatonin increase by the body?	144 (48.65%)
Q3. When does rapid eye movement sleep (REM) or dream sleep occur?	168 (56.76%)
Q4. During the work week, how to make up for loss of sleep?	179 (60.47%)
Q5. How much time do new-born infants spend sleeping in 24 hours?	227 (76.69%)
Q6. How prevalent is insomnia between older women and men?	229 (77.36%)
Q7. What should we do to a young (pre-adolescent) person who regularly struggles to get to sleep at night?	35 (11.82%)
Q8. What is the age for narcolepsy symptoms' onset?	35 (11.82%)
Q9. When does a person experinece an increase in his ability to sleep?	43 (14.53%)
Q10. What is the peak of slow-wave sleep?	48 (16.22%)
Q11. When does the level of slow-wave sleep start to increase?	52 (17.57%)
Q12. On which third of the night do episodes of sleep-walking occur	59 (19.93%)
Q13. When does the lengthiest episode of REM sleep tend to get lengthened?	74 (25%)
Q14. What happens to periodic limb movements, during REM sleep?	77 (26.01%)
Q15. Which of the following is exacerbated as a consequence of inadequate sleep in children?	86 (29.05%)
Q16. How long of alcohol cessation does an alcoholic in recovery take to normalize his sleep?	24 (8.11%)
Q17. What is recommended for a patient who is having problems in initiating sleep?	17 (5.74%)
Q18. Which of the following is commonly an indicator in treating mild obstructive sleep apnea or primary snoring?	116 (39.19%)
Q19. What is enhanced slow-wave sleep?	63 (21.28%)
Q20. Which of the following drugs could possiibly cause chronic bedwetting in pediatrics.	120 (40.54%)
Q21. During which time period of sleep are nightmares more common?	49 (16.55%)
Q22. During which phase of the sleep cycle are respiration, blood pressure, and heart rate are more variable?	100 (33.78%)
Q23. Can sleep difficulties be caused by antihypertensive drugs as side effects	50 (16.89%)
Q24. Which of the following is correct in regards of early morning awakening in elderly?	99 (33.45%)
Q25. What is true regarding alcohol benefits?	159 (53.72%)
Q26. What is the correct statement?	158 (53.38%)
Q27. At which stage of the sleep cycle does sleep-walking commonly occur?	49 (16.55%)
Q28. Which one of the following has an increased risk of developing sleep apnoea symptoms?	146 (49.32%)
Q29. Which of the following could increase the occurrence of sleep-walking in the paediatric population?	182 (61.49%)
Q30. Which one of the following symptoms commonly correlate to narcolepsy?	75 (25.34%)

The majority of respondents disagreed with most statements, particularly 1 and 7. However, statement 8 found widespread acceptance, with 125 students (42.23%) in agreement and 94 (31.76%) strongly agreeing with it. Statement 4 garnered mixed responses, with "disagree," "neutral," and "agree" responses being fairly evenly distributed (28.04%, 24.32%, and 22.64%, respectively).

Medical students' attitudes and knowledge about sleep medication are presented within Table 3. The average knowledge score was 10.09 (± 4.15) (the maximum score total = 30). The study reveals that the vast majority of

students have inadequate knowledge, as only 10 (3.38%) of the surveyed students achieved the 60% threshold, while 286 (96.62%) fell short of it.

In contrast, a positive attitude towards sleep medicine was demonstrated by most students, with 253 (85.47%) expressing positive attitudes and only 43 (14.53%) holding negative attitudes. The maximum possible score for attitudes was 50 (high scores indicating strongly positive attitudes) and 35.56 (± 5.61) was the mean attitude score that was obtained.

TABLE 3 Medical students' attitudes and knowledge (N=296)

Predictor	n (%)
Level of knowledge	Adequate 10 (3.38%)
	Inadequate 286 (96.62%)
Attitude	Positive 253 (85.47%)
	Negative 43 (14.53%)
Knowledge score (mean \pm SD)	10.09 \pm 4.15
Attitude total score (mean \pm SD)	35.56 \pm 5.61

Table 4 presents an analysis of the association between the sociodemographic characteristics of the students' scores for both attitude and knowledge. Notably, there is not statistically significant relationship observed between gender and knowledge scores. However, in contrast, a statistically significant relationship is evident between being female and having a positive attitude ($p < 0.01$).

Furthermore, the results of the Wilcoxon test indicate that having a specific interest in the field yields statistically significantly higher mean knowledge and attitude scores compared to those students whose interests are in other areas. Specifically, the differences in mean scores were marginally significant, ($p = 0.0522$) for knowledge and attitude ($p = 0.0059$).

TABLE 4 Attitudes and knowledge by socio-demographic factors

Sociodemographic characteristic	Knowledge		Attitude		
	Adequate n (%)	Inadequate n (%)	Positive n (%)	Negative n (%)	
Sex	Female	6 (3.9%)	148 (96.1%)	140 (90.01%)	14 (9.09%)
	Male	4 (2.82%)	138 (97.18%)	113 (79.58%)	98 (20.48%)
	P-value	.7518		.0057*	
GPA	2.4-4.0	1 (4.17%)	23 (95.83%)	19 (79.17%)	5 (20.83%)
	4.1-5.0	9 (3.31%)	263 (96.69%)	234 (86.03%)	38 (13.97%)
	p-value	.5765		.3651	

Year of Study	3 rd year	1 (1.43%)	69 (98.57%)	52 (82.86)	12 (17.14%)
	4 th year	2 (2.15%)	91 (97.85%)	77 (82.80%)	16 (17.20%)
	5 th year	4 (6.15%)	61 (93.85%)	59 (90.77%)	6 (9.23%)
	6 th year	3 (4.41%)	65 (95.59%)	59 (86.76%)	9 (13.24%)
	<i>P</i> -value		.4059		.4785
Specific interest	Yes	3 (5.36%)	53 (94.64%)	49 (87.50%)	7 (12.50%)
	No	7 (2.92%)	233 (97.08%)	204 (85%)	36 (15%)
	<i>P</i> -value		.0522*		.0059*

* Denotes statistically significant $p \leq 0.05$

Discussion

The main aim of the current study is to evaluate medical students' awareness and understanding of SDs and of the neuroscience of circadian rhythms. Participants were medical students in the health sciences at King Saud bin Abdulaziz University. The analysis of the gathered evidence reveals that a significant majority, specifically 96.92% (286 out of 296) of the students, possess inadequate knowledge in this domain. A similar study by Alghamdi *et al.* (2020) conducted at King Abdulaziz University in Jeddah, which involved 568 students, reported that 97.7% of participants had low scores, with an average score of 9.89 (± 4.89) [5]. Unlike our findings, Alghamdi *et al.* did not observe a statistically significant difference in knowledge based on gender.

A previous study on medical students using the ASKME questionnaire and carried out at Qassim University found approximately 95% had positive attitudes but low knowledge levels [12]. This aligns with the outcomes of our study. Further evidence for medical students' low awareness/knowledge comes from another larger study of 726 students in Egypt (Zaki *et al.*, 2016) in which most students were in the 6th grade [22]. Similar to Alghamdi *et al.* (2020), but in contrast to our results, Zaki *et al.* (2016) found no evidence that knowledge levels were correlated with gender [5,22].

Conclusion

The results of the study highlight the medical students at KSAU-HS in Riyadh's inadequate understanding of sleep medicine and sleep disorders, highlighting a notable gap in the university's medical curriculum that warrants attention. It is noteworthy that positive attitudes about sleep medication were found in most students, which implies that students would be willing to learn if proper educational resources were made available. To bridge this knowledge gap, it is recommended that educators who deliver this content possess adequate knowledge of sleep medicine and its importance to overall health. Although the current study finds no correlation between medical students' level of knowledge about sleep medication and students' year of study or GPA, it did establish statistically significant relationships between knowledge and attitudes concerning having a specific interest in sleep medicine and between attitude and gender.

As with all research, this study had limitations and the potential for misinterpretation of questionnaire questions, the study's cross-sectional design and dependence on self-reported data, which may not capture changes in the population over time. To address the shortage of research in this field, further studies with larger sample sizes encompassing diverse medical specialties and institutions throughout Saudi Arabia are recommended.

Acknowledgments

The authors wish to express their gratitude towards Rawan Alharbi, Shoug Alshowaier, Hussam Al Hathloul, and Khalid Al Taleb for their assistance in data collection.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the manuscript and agreed to be responsible for all the aspects of this work.

Conflict of Interest

No potential conflict of interest was declared by the authors.

Orcid:

Asma Alanazi*:

<https://orcid.org/0000-0002-6401-9347>

Haiifa Alhawas:

<https://orcid.org/0009-0004-8645-1175>

Munirah Aldossar:

<https://orcid.org/0009-0003-9598-9017>

Dana Almutairi:

<https://orcid.org/0009-0003-4426-6310>

Dana Almatroudi:

<https://orcid.org/0009-0003-4949-5163>

Afnan Alenazi:

<https://orcid.org/0009-0005-1212-2157>

Leen Almadh:

<https://orcid.org/0000-0002-0830-4995>

Maram Albalawi:

<https://orcid.org/0000-0002-2035-7408>

References

- [1] Harvard Health Publishing, *Sleep and mental health*, (2021, August 17). [[Publisher](#)]
- [2] Y. Liu, A.A. Ghafoor, M. Hajipour, N. Ayas, Role of precision medicine in obstructive sleep

- apnoea, *Journal of BMJ Medicine*, **2023**, 2. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [3] J.H. Deng, X.L. Huang, X.X. Liu, J. Sun, L. Lu, The past, present and future of sleep medicine in China, *Beijing da xue xue bao. Yi xue ban= Journal of Peking University, Health Sciences*, **2023**, 55, 567-567. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [4] M.E. Wells, A. Overton, Circadian rhythm sleep disorders, *Primary Health Care*, **2014**, 4, 2167. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [5] D.M.A. Alghamdi, F.K. Albugami, W.A. BinHumaidan, O.A. Alharthi, K.A. Yaghmour, Assessment of the knowledge toward sleep medicine among medical students at King Abdulaziz University, Jeddah, Saudi Arabia, *International Journal of Medicine in Developing Countries*, **2020**, 4, 1679-1679. [[Google Scholar](#)], [[Publisher](#)]
- [6] H.M. Abdulghani, N.A. Alrowais, N.S. Bin-Saad, N.M. Al-Subaie, A.M. Haji, A.I. Alhaqwi, Sleep disorder among medical students: relationship to their academic performance, *Medical Teacher*, **2012**, 34, S37-41. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [7] A.S. Almeneessier, A.S. BaHammam, Sleep medicine and sleep disorders in Saudi Arabia and the Arab world, *In Handbook of Healthcare in the Arab World Cham: Springer International Publishing*, **2021**, 1693-1707. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [8] A.S. BaHammam, Sleep medicine in Saudi Arabia: Current problems and future challenges, *Annals of thoracic medicine*, **2011**, 6, 3-10. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [9] M.J. Sateia, International classification of sleep disorders, *Chest*, **2014**, 146, 1387-1394. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [10] T. Lee-Chiong, Why sleep medicine is essential. *Sleep Medicine Clinics*, **2020**, 15. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [11] A. BaHammam, B. Aljafen, Sleep medicine service in Saudi Arabia, *Saudi Medical Journal*, **2007**, 2. [[Google Scholar](#)], [[Publisher](#)]

- [12] Y.M. Alrebdi, A.K.I. Awadh, M.S. Alfahaid, A.A. Alsindi, A. Alaraj, Knowledge and attitude regarding sleep medicine among medical students at Qassim University, Saudi Arabia, *Open Access Macedonian Journal of Medical Sciences*, **2019**, *7*, 2895. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [13] A. Almohaya, A. Qrmli, N. Almagal, K. Alamri, S. Bahammam, M. Al-Enizi, A. Alanazi, A.S. Almeneessier, M.M. Sharif, A.S. BaHammam, Sleep medicine education and knowledge among medical students in selected Saudi Medical Schools, *BMC Medical Education*, **2013**, *13*, 1-7. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [14] J.D. Thornton, K. Chandriani, J.G. Thornton, S. Farooq, M. Moallem, V. Krishnan, D. Auckley, Assessing the prioritization of primary care referrals for polysomnograms, *Sleep*, **2010**, *33*, 1255-1260. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [15] A.H. Saleem, F.A. Al Rashed, G.A. Alkharboush, O.M. Almazyed, A.H. Olaish, A.S. Almeneessier, A.S. BaHammam, Primary care physicians' knowledge of sleep medicine and barriers to transfer of patients with sleep disorders: a cross-sectional study, *Saudi Medical Journal*, **2017**, *38*, 553. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [16] A.S. BaHammam, Knowledge and attitude of primary health care physicians towards sleep disorders, *Saudi Medical Journal*, **2000**, *21*, 1164-1167. [[Google Scholar](#)], [[Publisher](#)]
- [17] M. Hodibi, Z. Aljubran, A. Sattar, Knowledge and attitude of primary health care physicians in Al-Hasa towards obstructive sleep apnea, *Hypertension*, **2020**, *77*, 114. [[Google Scholar](#)], [[Publisher](#)]
- [18] A.S., BaHammam, M.S. Alrajeh, H.H. Al-Jahdali, A.A. BinSaeed, Prevalence of symptoms and risk of sleep apnea in middle-aged Saudi males in primary care, *Saudi Medical Journal*, **2008**, *29*, 423. [[Google Scholar](#)], [[Publisher](#)]
- [19] A.S. BaHammam, M.S. Al-Rajeh, F.S., Al-Ibrahim, M.A. Arafah, M.M. Sharif, Prevalence of symptoms and risk of sleep apnea in middle-aged Saudi women in primary care, *Saudi Medical Journal*, **2009**, *30*, 1572. [[Google Scholar](#)], [[Publisher](#)]
- [20] R. Zozula, R.C. Rosen, E.G. Jahn, Recognition of sleep disorders in a community-based setting following an educational intervention, *Sleep Medicine*, **2005**, *6*, 55-61. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [21] R. Zozula, M. Bodow, D. Yacilla, R. Cody, R.C. Rosen, Development of a brief, self-administered instrument for assessing sleep knowledge in medical education: "the ASKME Survey", *Sleep*, **2001**, *24*, 227-233. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]
- [22] N.F.W. Zaki, R. Marzouk, I. Osman, H.Y. Alamah, W.S. Zaied, A. Haggag, A. Hassan, M. Allam, O. Saadeldeen, R. Rosenberg, H. Reiny, A.S. BaHammam, Sleep medicine knowledge among medical students in seven Egyptian medical faculties, *Journal of Sleep Disorders & Therapy*, **2016**, *5*, 1000239. [[Crossref](#)], [[Google Scholar](#)], [[Publisher](#)]

How to cite this article: Asma Alanazi, Haifa Alhawas, Munirah Aldossar, Dana Almutairi, Dana Almatroudi, Afnan Alenazi, Leen Almadh, Maram Albalawi, Medical students' knowledge of circadian neuroscience in relation to sleep disorders: A cross-sectional study. *Journal of Medicinal and Pharmaceutical Chemistry Research*, 2024, 6(7), 981-989. [Link: https://jmpcr.samipubco.com/article_190840.html](https://jmpcr.samipubco.com/article_190840.html)