ORIGINAL ARTICLE

Association of sleep hygiene–related factors and sleep quality among university students in Hong Kong

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Objective To examine whether sleep hygiene–related factors are associated with sleep quality among university students.

Design Cross-sectional survey.

Setting A university in Hong Kong.

Participants Full-time university students recruited by convenience sampling.

Main outcome measures Responses to a sleep questionnaire containing the Pittsburgh Sleep Quality Index and obtaining sleep hygiene knowledge and practice, as well as knowledge on caffeine were used for data collection.

Results Regression analysis with stepwise selection procedure revealed that sleep hygiene practice was significantly associated with the Pittsburgh Sleep Quality Index score after adjusting for age, gender, year of study, and type of residence (b= –0.08, P<0.001).

Conclusions Our study's results indicated that sleep hygiene practice was significantly associated with sleep quality. Appropriate measures and sleep hygiene education need to be emphasised among university students in order to increase their awareness on the importance of adopting healthy sleep hygiene practices.

Introduction

A good quality of sleep is essential to enable university students to comprehend, analyse, and absorb enormous amounts of information during the study process, yet they commonly endure sleep problems.[1] In a recent survey conducted on 1462 university students, 1038 (71%) expressed dissatisfaction with their sleep.[2] Inadequate duration as well as poor quality of sleep negatively affect their concentration, leading to tardiness or even absence from classes. Knowledge about sleep hygiene is related to sleep practices, which in turn is related to overall sleep quality.[3] Sleep hygiene is a term used to describe a collection of behaviours related to the promotion of good sleep.[4] These behaviours include: consumption of caffeine, nicotine, and alcohol; an emphasis on the regularity of sleep-wake patterns; the extent of sleep medication use and daytime napping; relaxation exercises; and the cultivation of a positive and comfortable sleep environment. Most students with undesirable sleep habits, however, have poor awareness of the behaviours that promote sleep. It is even suggested that lack of knowledge on proper sleep hygiene contributes to poor sleep practices, which subsequently affects the health and well-being adversely.[5,6]

Only a few studies have empirically examined how sleep hygiene knowledge, sleep hygiene practice, and knowledge about caffeine use affect overall sleep quality. The aim of the current study therefore was to examine how well sleep hygiene–related factors are associated with sleep quality among university students by means of a cross-sectional survey. The results of the survey could then be used by educators as a guide to promoting appropriate measures to improve the sleep of university students.

Methods

Participants and procedures

Four hundred questionnaires were distributed to full-time students at a university in Hong Kong. These questionnaires were distributed by student helpers to other students in the campus and residential halls by convenience sampling. Those who were part-time or short-term (<3 months) exchange students were excluded. According to statistical data

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reported by the target university in June 2006, it had 9424 full-time undergraduate students, of whom 4434 resided in hostels.[7] Therefore, the recruited population represented 4.2% of all students in that university.

The time taken to complete the questionnaire was approximately 20 minutes; the student helpers subsequently collected the questionnaires. A HK$10 cash coupon in a local cafeteria chain was offered to each survey participant upon return of a signed questionnaire with a name.

Study instrument

Data collection entailed use of a sleep questionnaire. The content validity index (CVI) of the questionnaire was determined by distributing the modified questionnaire to three experts with substantial experience and knowledge in the area of sleep and school health. The entire questionnaire, with a CVI of 90%, consisted of five sections. Section 1 contained the Pittsburgh Sleep Quality Index (PSQI), which was used for collecting data related to the sleep patterns of the respondents. This Index is an internationally recognised instrument used to evaluate sleep behaviours in the preceding month.[8] It entails 19 items and has a reliability coefficient (Cronbach's alpha) of 0.83 for its seven components.[9] Numerous studies using the PSQI have supported its high validity and reliability.[10-12] The total PSQI score ranges from 0 to 21; higher scores reflect poorer quality of sleep. In general, a PSQI score of higher than 5 is considered to indicate poor sleep quality.[9,10]

Items in Sections 2 and 4 examined sleep hygiene knowledge (17 items) and sleep hygiene practice (22 items), respectively, and were chosen on the basis of information found in the literature.[3,13,14] The knowledge section measures the respondents' familiarity with specific activities that are helpful (drinking a glass of milk before bedtime, or going to bed at the same time each night), disruptive, or have no effect on sleep. The total scores for this section ranged from 0 to 17, with higher scores indicating better sleep hygiene knowledge. The practice section of the scale contains 22 items that ask how many nights per week the respondents engage in activities known to promote or disrupt sleep. Of 22 items, 18 were negatively phrased, and their scores were then reversed for analysis. The responses ranged from 0 to 7, so the total hygiene practice scores could range from 0 to 154, with higher scores indicating a more favourable sleep hygiene practice.

The items in Section 3 listed 16 common beverages sold in the local markets, and the respondents were asked whether these beverages contained caffeine. The caffeine contents in these types of beverages were tested by the Consumer Council.[15] The total score for this section ranged from 0 to 16. A higher score indicated better knowledge about caffeine. The last section of the questionnaire collected demographic data, including: age, gender, and year of study in the university. The test-retest reliability of the questionnaire was established using an intraclass correlation coefficient (ICC) for each of its instruments, by administering it repeatedly to 10 students at 2-weekly intervals. The respective ICCs of the PSQI global score, sleep hygiene knowledge, caffeine knowledge, and sleep hygiene practice components were: 0.66 (95% confidence interval [CI], 0.10-0.90), 0.63 (0.48-0.93), 0.95 (0.78-0.99), and 0.75 (0.27-0.93), respectively.

Ethical considerations

Permission to conduct the study was obtained from the Ethics Committee of the university. Each questionnaire was accompanied by an information sheet that described the nature and purpose of the study, and explained that participation was voluntary. The respondents remained anonymous and were assured that their responses would remain confidential.

Data analysis

The quantitative data were analysed using the Statistical Package for the Social Sciences (Windows version 16.0; SPSS Inc, Chicago [IL], US). Descriptive statistics were obtained individually from the responses to the items on sleep hygiene knowledge, sleep hygiene practice, and knowledge on caffeine.

香港大學生的睡眠質素與他們睡眠衛生習慣的關係

目的 探討香港大學生的睡眠質素是否與其睡眠衛生習慣有關。

設計 橫斷面調查。

安排 香港一所大學。

參與者 便利抽樣大學全日制學生。

主要結果測量 受訪者對一份睡眠調查問卷的回應，包括使用匹茲堡睡眠品質量表（PSQI），以及了解受訪者對睡眠衛生的知識及習慣和對咖啡因的知識。

結果 逐步迴歸分析顯示，在調整年齡、性別、就讀年級和居住地方類別後，受訪者的睡眠習慣與PSQI得分明顯相關（b= –0.08，P<0.001）。

結論 研究結果顯示睡眠質素與其睡眠習慣有顯著關係。要採取適當措施及加強有關睡眠習慣的教育，讓大學生知道培養健康的睡眠衛生習慣的重要性。

TABLE 1. Sleep hygiene knowledge among university students (n=400)

Items	No. (%)	
	Correct	Wrong
1. Take a nap during daytime	116 (29)	284 (71)
2. Smoke within 4 hours of bedtime	310 (78)	90 (23)
3. Use sleep medications (prescription or over-the-counter)	185 (46)	215 (54)
4. Take beer (or other drinks with alcohol) within 4 hours of bedtime	205 (51)	195 (49)
5. Eat heavy night snack before bedtime	227 (57)	173 (43)
6. Drink beverages containing caffeine after 2pm	303 (76)	97 (24)
7. Drinking a glass of milk before bedtime†	262 (66)	138 (35)
8. Perform active exercise within 2 hours of bedtime	185 (46)	215 (54)
9. Go to bed hungry	329 (82)	71 (18)
10. Go to bed thirsty*	336 (84)	63 (16)
11. Engage in demandingly high levels of concentration or emotionally upsetting activities close to bedtime	125 (31)	275 (69)
12. Use the bed for things other than sleep	159 (40)	241 (60)
13. Maintain a comfortable temperature during sleep†	362 (91)	38 (10)
14. Perform relaxing exercise before bedtime†	336 (84)	64 (16)
15. Sleep approximately the same length of time each night†	337 (84)	63 (16)
16. Go to bed at the same time each day†	346 (87)	54 (14)
17. Wake up at similar time each day†	334 (84)	66 (17)
Mean % of students giving correct answers	68	

* Missing data in one student
† Correct hygiene knowledge

TABLE 2. Knowledge about caffeine among university students (n=400)

Items	No. (%)	
	Correct	Wrong
1. Chinese tea*	333 (83)	67 (17)
2. Western tea*	338 (85)	62 (16)
3. Milk	390 (98)	10 (3)
4. Cola soft drink*	353 (88)	47 (12)
5. Chocolate milk*	129 (32)	271 (68)
6. Soya bean milk	393 (98)	7 (2)
7. Fresh juice	395 (99)	5 (1)
8. Lucozade*	109 (27)	291 (73)
9. Regular coffee*	397 (99)	3 (1)
10. Energy drink*	343 (86)	57 (14)
11. Sport drink	299 (75)	101 (25)
12. Honey green tea*	135 (34)	265 (66)
13. Lemon tea*	175 (44)	225 (56)
14. Live bactobacillus drink	393 (98)	7 (2)
15. Cream soda	346 (87)	54 (14)
16. Tonic vitaminised drink*	168 (42)	232 (58)
Mean % of students giving correct answers	73	

* Containing caffeine

Multivariate regression was used to examine the relation between PSQI score and other covariates and included: sleep hygiene knowledge, sleep hygiene practice, and caffeine knowledge after adjusting for age, gender, year of study, and type of residence (home or university residential hall). A stepwise procedure was used to choose the best model.

Results

The 400 respondents were comprised of 150 (38%) males and 250 (63%) females. The mean age of the respondents was 20.7 (standard deviation [SD], 1.6) years, and 199 (50%) of them were hostel residents. There were 230 (58%) students with PSQI scores of higher than 5, implying that they had poor sleep quality. As to the year level of the respondents when the questionnaire was administered, there were 121 (30%), 134 (34%), 119 (30%), and 26 (7%) students in years 1, 2, 3, and 4 or above, respectively.

The mean knowledge score of the participants exceeded half of the total obtainable score (mean, 11.5; SD, 3.3; 68%), though many myths related to sleep hygiene prevailed among these students. Over half of the participants gave incorrect answers to items related to taking a nap during daytime and the use of sleep medications. They also erroneously believed that performing active exercise or engaging in emotionally upsetting activities close to bedtime did not disrupt sleep. More than 60% of the students did not think that using the bed for purposes other than sleep induced a negative impact on sleep behaviour (Table 1).

Knowledge on caffeine was generally satisfactory, with an average of 73% giving correct answers. Many respondents were aware that beverages such as Chinese or western tea, cola soft drinks, and coffee contain caffeine. However, over half of the respondents did not know that chocolate milk, honey green tea, lemon tea, and tonic vitaminised drink also contain considerable amounts of caffeine (Table 2). The average total sleep hygiene practice score was 107.2 or approximately 4.9 per item, implying that on average the students performed such sleep hygiene practices on 4.9 days per week (Table 3).

Regression analysis revealed that only the sleep hygiene practice score was significantly associated with sleep quality; an increase of 1 resulted in a drop of 0.08 in the PSQI score after adjusting for age, gender, year of study, and type of residence. The explanatory variables in the final model accounted for 19.4% (R^2=0.194) of the variability in sleep quality (Table 4).

Discussion

The findings of the current study indicate that many university students suffer from a suboptimal level of overall sleep quality. Over half of the respondents

could be classified as poor sleepers according to the PSQI criteria. Our findings are also in agreement with another study that at least two thirds of college students reported occasional sleep disturbances, and about one third regularly endured severe sleep difficulties.[16]

Previous studies on students claimed that poor sleep quality is associated with significant psychological distress, depression, confusion, and generally lower life satisfaction.[3,17] Problems associated with poor sleep can result in excessive daytime sleepiness, which is severe enough to interfere with daily activities, especially those that involve recall, logic, and learning.[6] Insufficient sleep (<6 hours per night) can lead to a 50% reduction in T cells, which may compromise the immune system.[18]

The level of sleep hygiene knowledge among university students was relatively inadequate. Most respondents failed to recognise that taking a nap during daytime and the use of sleep medications may be disruptive to sleep. Notably, compensatory sleep practices such as daytime napping may be associated with prolonged insomnia.[4]

Many respondents were also not aware that using the bed for purposes other than sleep induced negative impacts on sleep. Therefore, students should be advised to use the bed only for sleeping, lie down only when sleepy, and if unable to sleep within 10 minutes, they should do something else but not do work or other school-related activities, until they become sleepy.[5]

Many students are aware that coffee contains caffeine. However, over half did not know that drinks such as chocolate milk, honey green tea, lemon tea, or tonic vitaminised drink also contain considerable amounts of caffeine. Indeed, drinking coffee to improve alertness, taking naps to compensate for lost sleep, and drinking alcohol to promote sleepiness are common strategies students use to counter their varying problems with sleep.[3]

TABLE 3. Mean score and standard deviation (SD) of each item in sleep hygiene practice (n=400)

Items	Mean (SD)
1. Take a nap during daytime	4.8 (2.0)
2. Smoke within 4 hours of bedtime	6.9 (0.7)
3. Use sleep medications (prescription or over-the-counter)	7.0 (0.1)
4. Take beer (or other drinks with alcohol) within 4 hours of bedtime	6.8 (0.7)
5. Eat heavy night snack before bedtime	6.0 (1.4)
6. Drink beverages containing caffeine after 2pm	6.1 (1.7)
7. Drinking a glass of milk before bedtime	0.5 (1.1)
8. Perform active exercise within 2 hours of bedtime	6.6 (1.1)
9. Go to bed hungry	6.0 (1.3)
10. Go to bed thirsty	6.5 (1.0)
11. Go to bed and replay the day's events over and over in your mind	4.6 (2.0)
12. Go to bed and think about things you need to do the next day	4.1 (2.1)
13. Bring with worry(ies) when you go to bed	4.6 (2.0)
14. Engage yourself in demandingly high levels of concentration or emotionally upsetting activities close to bedtime	5.3 (1.8)
15. Use my bed for things other than sleep	4.6 (2.4)
16. Maintain a comfortable temperature during sleep	4.9 (2.5)
17. Fall asleep in a bedroom which is too bright/too light	5.6 (1.8)
18. Sleep in a noisy bedroom	6.1 (1.5)
19. Set aside time to relax/perform relaxing exercise before bedtime	0.9 (1.5)
20. Sleep approximately the same length of time each night	3.2 (2.1)
21. Go to bed at the same time each day	3.3 (2.0)
22. Wake up at similar time each day	3.2 (2.0)
Overall mean scores	107.2 (13.1)

The results of regression analysis indicated that

TABLE 4. Models of regression analyses*

Model	Variables entered	Regression coefficient (b)	95% Confidence interval	R^2	F value, degrees of freedom (df) (P value)
Full model	Age	-0.06	-0.22 to 0.09	0.197	F=13.771, df=7,392, (<0.001)
	Gender	0.39	-0.06 to 0.85		
	Type of residence	0.32	-0.12 to 0.77		
	Year of study	-0.13	-0.39 to 0.14		
	Sleep hygiene knowledge	0.04	-0.03 to 0.11		
	Sleep hygiene practice	-0.08	-0.10 to -0.06		
	Caffeine knowledge	-0.03	-0.15 to 0.10		
Best model	Age	-0.07	-0.22 to 0.09	0.194	F=18.964, df=5,394, (<0.001)
	Gender	0.42	-0.03 to 0.87		
	Type of residence	0.34	-0.10 to 0.78		
	Year of study	-0.11	-0.38 to 0.15		
	Sleep hygiene practice	-0.08	-0.09 to -0.06		

* Dependent variable: sleep quality (Pittsburgh Sleep Quality Index)

undesirable sleep hygiene practice had a significant association with poor sleep quality. This agrees with the findings of LeBourgeois et al[19] that sleep hygiene is an important predictor of sleep quality in Italian and American adolescents. No associations were found for sleep hygiene and caffeine towards sleep quality. In fact, Brown et al[3] reported that knowing about proper habits did not necessarily influence sleep quality, whereas practising proper habits were strongly related to a good overall sleep quality.

Poor sleep hygiene practices are associated with a higher prevalence of insomnia and chronic difficulties in initiating or maintaining sleep.[3] Our study also supports the use of sleep hygiene strategies as an intervention to improve university students' sleep practices. Therefore, sleep hygiene guidelines relating to activities that can either help or hinder sleep should be determined and listed. It is also clear that some behaviours are easier to change than others. Maintaining a regular sleep–wake up schedule and avoiding eating a heavy night snack before bedtime are relatively easy habits to change. Putting aside worries before going to bed, however, is more difficult for some people, and may benefit from counselling or psychotherapy. Minimising environmental disturbances while trying to sleep can be particularly challenging, especially in university dormitories.[3] This may necessitate negotiation with resident wardens or revision of policies regarding dormitory quiet hours.

Inclusion of an educational programme in university orientation classes may significantly reduce student's sleep difficulties and improve sleep habits.[5,20,21] In this regard, university counsellors should learn and offer cognitive and behavioural sleep interventions and make these services known. Students may not be aware that such interventions exist and are superior to medications for improving sleep.[5] Campus administrators may also want to evaluate course schedules, allowing some to be offered later in the day for those who experience morning sleepiness. This could maximise the learning abilities, without the interference from sleep disturbance.[22]

Limitations and recommendations

The data used in this study were obtained from respondents in a university in Hong Kong who were recruited by convenience sampling, thus limiting the internal validity of the findings. Moreover, they were generated via self-report, so they might not accurately reflect sleep habits or the nature of the difficulties students were actually experiencing. Further studies are therefore suggested to compare the sleep hygiene practices and sleep quality of university students during school days and non-school days, as well as between hostel residents and non-residential students.

Conclusions

Our results indicate that undesirable sleep hygiene practice was significantly associated with poor sleep quality. Meanwhile, the non-significant effects of knowledge on sleep hygiene and caffeine indicate that knowing about proper habits do not necessarily influence sleep quality, whereas practising proper habits is strongly related to an overall improvement of sleep. Appropriate measures and sleep hygiene education should therefore be emphasised in order to increase university student awareness on the importance of adopting healthy sleep hygiene practices. An improvement in overall sleep conditions has the potential to improve student's quality of life and academic performance.

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