Full Length Research Paper

Evaluation of the sleep quality in medical students from Ribeirão Preto, SP / Brazil

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Traditional curricula medical students exhibit poor sleep quality, high sleep deprivation and high incidence of daytime dysfunctions, which impairs academic and professional performances. By the other hand, problem-based learning (PBL) curricula has been correlated to improved leaning abilities in medical students, and to enhanced clinical reasoning and diagnostic ability in medical professionals. Thus, the present study was aimed to evaluate the sleep quality in PBL curricula medical students from the University of Ribeirão Preto (Brazil), and to point the potential implications of PBL on students sleep quality, and its consequences on academic learning. Sleep quality was evaluated by filling out the Pittsburgh Sleep Quality Index PSQI (PSQI), which was applied in 236 medical students grouped into different stages (1st to 8th Stages). The median values of the most frequent score obtained for each PSQI component were analyzed by the Chi-squared test ($\chi^2$ test), to investigate the statistical differences among the stages and the correlation between the stage and its respective score. Our findings showed that PBL curricula medical students from the University of Ribeirão Preto (Brazil) presented a fairly poor subjective sleep quality, a slight sleep deprivation and a fairly high incidence of daytime dysfunctions. When compared to the very poor sleep quality, the higher sleep deprivation and the higher incidence of daytime dysfunctions in traditional curricula medical students, our findings allow us to suggest that the PBL educative approach in Medical Schools may contribute to avoid further damages in students sleep quality and in their academic performance.

Keywords: Disorders of excessive somnolence – Education, medical – Students, medical – Sleep – Sleep disorders – Pittsburgh Sleep Quality Index

INTRODUCTION

Sleep is an active process which is functionally related to the wakefulness and the rhythmic alternation between these two states (Moore, 1972). The metabolic cycle consisting of sleep, wakefulness, digestion, hormone production, thermal regulation and other daily processes is called circadian rhythm. An optimal wakefulness state is reached when an adult sleeps 7 to 8h within a period of 24h, with nocturnal awakenings up to 5% of the total sleep time. Therefore, the adult sleep pattern should include 30% of dreams, 20% of deep sleep and 50% of light sleep. These sleep cycles can be observed in electroencephalographic traces, in which the electrical, behavioral and functional characteristics are used to classify the sleep into two stages: (1) REM (Rapid Eyes Movement) sleep; and (2) NREM (No Rapid Eyes Movement) slow waves (Aserinsky and Kleitman, 1953; Aserinsky and Kleitman, 1955).

In the absence of environmental perception, the joint action of several nervous structures regulates this sleep state, which is also affected by environmental and endogenous factors. Among them, the social factors seem to be most important, such as work schedules and
recognition. Besides this environmental synchronization, the sleep-wakefulness cycle is endogenously generated and regulated by the suprachiasmatic nucleus in the hypothalamus, which is considered the biological clock in mammalian (Aschoff, 1979).

Sleep quality can be estimated by some quantitative or subjective components from the Pittsburgh Sleep Quality Index (PSQI), such as sleep duration, sleep latency, sleep disturbances and daytime dysfunctions (Buysse et al., 1989). The PSQI is commonly applied in medical students, who use to exhibit a poor sleep quality due to the crescent course load in the course of the Medicine School (Cardoso et al., 2009).

The reduced sleep duration in medical students triggers an irregular pattern of the sleep-wakefulness cycle, which is characterized by large sleep latency on weekends and by short sleep duration on weekdays. This irregular cycle usually increases the incidence of sleep disturbances and daytime dysfunctions, such as excessive daytime sleepiness (Rodrigues et al., 2002; Cardoso et al., 2009). Both sleep disturbances and daytime dysfunctions evoke negative effects on the activities carried out during the day by the students and contribute to impair their school performance (Furlani and Ceolim, 2005).

Sleep disturbances have significant implications for the individual, the family and the society. They are related to poor life quality, autonomic dysfunction, poor academic or professional performance, increased incidence of psychiatric disorders and decreased wakefulness, with further damages in the personal security and subsequent increase in accidents. Also, sleep disturbances may become risk factors for clinical and psychiatric disorders (Aschoff, 1979). In medical students with traditional curricula, some sleep disturbances, such as insomnia and arousal, have been associated with clinical depression and minor psychiatric disorders (Chang et al., 1997; Hidalgo and Caumo, 2002), attention deficit and poor learning development (Nojomi et al., 2009).

Excessive daytime sleepiness has been described as the main daytime dysfunction in medical students with traditional curricula. Daytime sleepiness was prevalent among 18.9% of the medical students from the University of Brasilia (Brazil) (Rodrigues et al., 2002), 22.4% of the medical students from the King Saud University (Saudi Arabia) (Bahammam et al., 2005), 51.5% of the medical students from the Federal University of Goiás (Brazil) (Cardoso et al., 2009), and 35.5% of the medical students from the International Medical University (Malaysia) (Zailinawati et al., 2009). Moreover, excessive daytime sleepiness in medical students has been correlated with short sleep duration (Aloé et al., 1997), poor academic performance (Rodrigues et al., 2002), minor psychiatric disorders (Hidalgo and Caumo, 2002), sleep disorders (Veldi et al., 2005), depressive symptoms (Eller et al., 2006) and poor sleep quality (Cardoso et al., 2009).

Problem based learning (PBL) is a pedagogical method in which students learn by studying a framework of case scenarios or problems in facilitated small-group learning sessions (Maudsley, 1999a; Subramaniam, 2006). In order to acquire knowledge, PBL students identify learning aims on their prior knowledge, and research these objectives between sessions. Then, the students synthesize and evaluate new and prior knowledge, intermittently reflecting on group and individual learning processes (Maudsley, 1999b; Subramaniam, 2006). When compared to the traditional educative approaches, PBL curricula improve the academic performance of medical students, as well as the clinical reasoning and diagnostic ability of medical professionals (Colliver, 2000; Subramaniam, 2006). Considering the poor sleep quality in medical students with traditional curriculum (Rodrigues et al., 2002; Cardoso et al., 2009), its harmful effects on the student mental functions (Chang et al., 1997; Hidalgo and Caumo, 2002; Furlani and Ceolim, 2005; Eller et al., 2006) and learning ability (Rodrigues et al., 2002; Nojomi et al., 2009), as well as the positive effects of PBL approach on the academic performance (Colliver, 2000; Subramaniam, 2006), the aim from the present study was to evaluate the sleep quality in medical students with PBL curricula, from the University of Ribeirão Preto (Brazil). Also, we pointed the potential implications of PBL on the sleep quality of the medical students, and its consequences on student concentration and academic learning.

**METHODS**

A prior approval was granted by the Research Ethics Committee from the University of Ribeirão Preto (Brazil) (approval reference number: 044/2010).

**Subjects**

A number (n) of 236 students of both genders, aged over 18 years, were randomly chosen among the 500 students enrolled in the first to the fourth year from the School of Medicine from the University of Ribeirão Preto (UNAERP, Brazil). The students were grouped into different stages, so that each stage corresponds to one half year. The first stage was composed by 30 students, the second one by 30 student, the third one by 27 student, the fourth one by 32 student, the fifth one by 30 student, the sixth one by 30 student, the seventh one by 27 student and the eight one by 30 student. All the students included in the present study have signed an Informed Consent.

**Evaluation of sleep quality**

Sleep quality was evaluated by filling out the PSQI (Appendix A), which consists in nineteen (19) self-rated questions that are grouped into seven components, as follows: (I) subjective sleep quality; (II) sleep latency; (III)
Figure. 1: Evaluation of subjective sleep quality in medical students. Data represent the mean ± S.D. of the most frequent score obtained for PSQI Component I in each Medical School Stage. Score 0 = “very good”, score 1 = “fairly good”, score 2 = “fairly bad”, and score 3 = “very bad”.

RESULTS

Subjective sleep quality (PSQI component I)

The median score with maximum frequency from the PSQI component I in medical students from the 1st Stage was equal to 2.00 ± 0.525 (Figure 1). The median score values from this PSQI component, obtained in the 2nd (2.13 ± 0.776), the 3rd (2.29 ± 0.724), the 4th (2.16 ± 0.884), the 5th (1.73 ± 0.521), the 6th (2.27 ± 0.980), the 7th (2.22 ± 0.751) and the 8th (2.07 ± 0.704) Stages did not differ from each other or from the value obtained in the 1st Stage (Figure 1). For the PSQI component I, the χ² value was equal to 33.58 (P<0.05, χ² test, n = 236).

Sleep latency (PSQI component II)

The median score with maximum frequency from the PSQI component II in medical students from the 1st Stage was equal to 2.10 ± 0.803 (Figure 2). The median score values from this PSQI component, obtained in the 2nd (2.33 ± 0.994), the 3rd (2.37 ± 0.926), the 4th (2.36 ± 0.942), the 5th (1.87 ± 0.730), the 6th (2.40 ± 0.855), the 7th (2.15 ± 1.099) and the 8th (1.97 ± 0.889) Stages did not differ from each other or from the value obtained in the 1st Stage (Figure 2). For the PSQI component II, the χ² value was equal to 24.41 (P>0.10, χ² test, n = 236).

Sleep duration (PSQI component III)

The median score with maximum frequency from the
Figure 2: Evaluation of sleep latency in medical students. Data represent the mean ± S.D. of the most frequent score obtained for PSQI Component II in each Medical School Stage. Score 0 = “very good”, score 1 = “fairly good”, score 2 = “fairly bad”, and score 3 = “very bad”.

Figure 3: Evaluation of sleep duration in medical students. Data represent the mean ± S.D. of the most frequent score obtained for PSQI Component III in each Medical School Stage. Score 0 = “very good”, score 1 = “fairly good”, score 2 = “fairly bad”, and score 3 = “very bad”.

PSQI component III in medical students from the 1st Stage was equal to 2.00 ± 0.525 (Figure 3). The median score values from this PSQI component, obtained in the 2nd (2.43 ± 0.679), the 3rd (2.29 ± 1.031), the 4th (2.28 ± 0.729), the 5th (1.90 ± 0.759), the 6th (1.93 ± 0.785), the 7th (2.11 ± 0.751) and the 8th (2.27 ± 0.868) Stages did
Figure 4: Evaluation of habitual sleep efficiency in medical students. Data represent the mean ± S.D. of the most frequent score obtained for PSQI Component IV in each Medical School Stage. Score 0 = "very good", score 1 = "fairly good", score 2 = "fairly bad", and score 3 = "very bad".

Figure 5: Evaluation of sleep disturbance in medical students. Data represent the mean ± S.D. of the most frequent score obtained for PSQI Component V in each Medical School Stage. Score 0 = "very good", score 1 = "fairly good", score 2 = "fairly bad", and score 3 = "very bad".

not differ from each other or from the value obtained in the 1st Stage (Figure 3). For the PSQI component III, the $\chi^2$ value was equal to 46.23 ($P<0.005$, $\chi^2$ test, $n = 236$).

**Habitual sleep efficiency (PSQI component IV)**

The median score with maximum frequency from the
PSQI component IV in medical students from the 1st Stage was equal to 1.10 ± 0.403 (Figure 4). The median score values from this PSQI component, obtained in the 2nd (1.10 ± 0.305), the 3rd (1.22 ± 0.577), the 4th (1.28 ± 0.683), the 5th (1.13 ± 0.571), the 6th (1.17 ± 0.461), the 7th (1.00 ± 0.000) and the 8th (1.13 ± 0.346) Stages did not differ from each other or from the value obtained in the 1st Stage (Figure 4). For the PSQI component IV, the χ² value was equal to 19.25 (P>0.10, χ² test, n=236).

Sleep disturbances (PSQI component V)

The median score with maximum frequency from the PSQI component V in medical students from the 1st Stage was equal to 1.97 ± 0.414 (Figure 5). The median score values from this PSQI component, obtained in the 2nd (2.17 ± 0.379), the 3rd (2.11 ± 0.320), the 4th (2.22 ± 0.553), the 5th (2.00 ± 0.455), the 6th (2.27 ± 0.521), the 7th (2.11 ± 0.506) and the 8th (2.20 ± 0.407) Stages did not differ from each other or from the value obtained in the 1st Stage (Figure 5). For the PSQI component V, the χ² value was equal to 21.33 (P>0.10, χ² test, n=236).

Use of sleeping medication (PSQI component VI)

The median score with maximum frequency from the PSQI component VI in medical students from the 1st Stage was equal to 1.00 ± 0.000 (Figure 6). The median score values from this PSQI component, obtained in the 2nd (1.17 ± 0.531), the 3rd (1.11 ± 0.424), the 4th (1.19 ± 0.592), the 5th (1.13 ± 0.571), the 6th (1.23 ± 0.679), the 7th (1.37 ± 0.926) and the 8th (1.17 ± 0.592) Stages did not differ from each other or from the value obtained in the 1st Stage (Figure 6). For the PSQI component VI, the χ² value was equal to 20.26 (P>0.10, χ² test, n=236).

DISCUSSION

The major new findings from the present study show that medical students with PBL curricula, enrolled in the University of Ribeirão Preto (Brazil), present a fairly bad subjective sleep quality, sleep duration and daytime dysfunction.
dysfunction, according to the non-parametric statistical analysis of the scores obtained in each component form the PSQI. Since the statistical analysis did not point significance level for the sleep latency, habitual sleep efficiency, sleep disturbances and use of sleeping medication, we cannot correlate the Medical School Stage with its respective scores obtained for these PSQI components.

Medical students with traditional curricula generally exhibit very poor sleep quality (Cardoso et al., 2009; Brick et al., 2010), which has been associated to insomnia and other sleep disturbances, to the high course load (Cardoso et al., 2009) and to demographic and hygiene behaviors (Brick et al., 2010). In the present study, medical students from the University of Ribeirão Preto (Brazil) reported a fairly poor subjective sleep quality, since this PSQI component presented a score near from 2 points. When compared to the very poor sleep quality described for traditional curricula medical students (Cardoso et al., 2009; Brick et al., 2010), these findings allow us to suggest that the PBL educative approach may have contributed to avoid reaching the maximum score in the PSQI scale for the subjective sleep quality in medical students.

Sleep deprivation had been previously described for medical students with traditional curricula (Medeiros and Araujo, 2002; Cardoso et al., 2009). According to these studies, the reduced sleep duration in medical students (i.e., a total sleep duration of 5 to 6 hours on average) is related to the class schedules (Medeiros and Araujo, 2002) and the high course load (Cardoso et al., 2009). Moreover, sleep deprivation in medical students and residents is a preoccupant factor in Medical Education, since it impairs the academic and professional performances (Danda et al., 2005). In the present study, medical students from the University of Ribeirão Preto (Brazil) sleep 6 to 7 hours on average, which yielded a score near from 2 points in the PSQI scale. Considering that the maximum score (3 points) of the PSQI scale means the worst sleep quality (Buysse et al., 1989), and that medical students with traditional curricula presents a higher sleep deprivation (Medeiros and Araujo, 2002; Cardoso et al., 2009) than the medical students with PBL curricula from the present study, we can suggest that PBL approach also may have contributed to avoid further sleep deprivation and poor sleep quality, which can positively affect the academic performance.

Daytime dysfunctions, mainly excessive daytime sleepiness, has been described for medical students with traditional curricula (Rodrigues et al., 2002; Bahammam et al., 2005; Cardoso et al., 2009; Zailinawati et al., 2009). Moreover, excessive daytime sleepiness in medical students has been correlated with short sleep duration (Alóe et al., 1997), poor academic performance (Rodrigues et al., 2002), minor psychiatric disorders (Hidalgo and Caumo, 2002), sleep disorders (Veldi et al., 2005), depressive symptoms (Eller et al., 2006) and poor sleep quality (Cardoso et al., 2009). According to our
findings, daytime dysfunctions also affect the medical students from the University of Ribeirão Preto (Brazil). However, since this PSQI component (VII) reached the score of 2 points on average, we can also suggest that PBL curricula may have contribute to avoid reaching the maximum score in the PSQI scale. As daytime dysfunctions impair the student daytime activities and academic performance (Furlani and Ceolim, 2005), applying an educative approach that attenuates the occurrence of these disorders, such as PBL, may improve the student learning abilities.

In brief, the present study showed that medical students with PBL curricula from the University of Ribeirão Preto (Brazil) presented a fairly poor subjective sleep quality and a slight sleep deprivation, and reported a fairly high incidence of daytime dysfunctions. When compared to the very poor sleep quality, the higher sleep deprivation and the higher incidence of daytime dysfunctions described for traditional curricula medical students (Medeiros and Araujo, 2002; Rodrigues et al., 2002; Bahammam et al., 2005; Cardoso et al., 2009; Zailinawati et al., 2009; Brick et al., 2010), our findings allow us to suggest that the PBL educative approach in Medical Schools may contribute to avoid further damages in students sleep quality and thus, in their academic performance.

REFERENCES


Appendices

Appendix A: Pittsburgh Sleep Quality Index (PSQI)

Instructions:
The following questions related to your usual sleep habits during the past month only. Yours answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.
1. During the past month, when have you usually gone to bed at night?
   USUAL BED TIME ______________
2. During the past month, how long (in minutes) has it usually take you to fall asleep each night?
   NUMBER OF MINUTES ______________
3. During the past month, when have you usually gotten up in the morning?
   USUAL GETTING UP TIME ______________
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed).
   HOURS OF SLEEP PER NIGHT ______________
For each of the remaining questions, check the one best response. Please answer all questions.
5. During the past month, how often have you had trouble sleeping because you...
   (a) Cannot get to sleep within 30 minutes
      Not during the past month ______
      Less than once a week ______
      Once or twice a week ______
      Three or more times a week ______
   (b) Wake up in the middle of the night or early morning
      Not during the past month ______
      Less than once a week ______
      Once or twice a week ______
      Three or more times a week ______
   (c) Have to get up to use the bathroom
      Not during the past month ______
      Less than once a week ______
      Once or twice a week ______
      Three or more times a week ______
   (d) Cannot breathe comfortably
      Not during the past month ______
      Less than once a week ______
      Once or twice a week ______
      Three or more times a week ______
   (e) Cough or snore loudly
      Not during the past month ______
      Less than once a week ______
      Once or twice a week ______
      Three or more times a week ______
   (f) Feel too cold
      Not during the past month ______
      Less than once a week ______
      Once or twice a week ______
      Three or more times a week ______
   (g) Feel too hot
      Not during the past month ______
      Less than once a week ______
      Once or twice a week ______
      Three or more times a week ______
   (h) Had bad dreams
      Not during the past month ______
      Less than once a week ______
      Once or twice a week ______
Three or more times a week ______
(i) Have pain
Not during the past month ______
Less than once a week ______
Once or twice a week ______
Three or more times a week ______
(j) Other reason(s), please describe ______________________________________________
__________________________________________________________________________

6. During the past month, how would you rate your sleep quality overall?
Very good _____
Fairly good _____
Fairly bad _____
Very bad _____

7. During the past month, how often have you taken medicine (prescribed or “over the counter”) to help you sleep?
Not during the past month ______
Less than once a week ______
Once or twice a week ______
Three or more times a week ______

8. During the past month, how often you had trouble staying awake while driving, eating meals, or engaging in social activities?
Not during the past month ______
Less than once a week ______
Once or twice a week ______
Three or more times a week ______

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?
Not problem at all _____
Only a very slight problem _____
Somewhat of a problem _____
A very big problem _____

10. Do you have a bed partner or roommate?
No bed partner or roommate _____
Partner/roommate in other room _____
Partner in same room, but not same bed _____
Partner in same bed ______
If you have a roommate or bed partner, ask him/her how often in the past month you have had…
(a) Loud snoring
Not during the past month ______
Less than once a week ______
Once or twice a week ______
Three or more times a week ______
(b) Long pauses between breaths while asleep
Not during the past month ______
Less than once a week ______
Once or twice a week ______
Three or more times a week ______
(c) Legs twitching or jerking while you sleep
Not during the past month ______
Less than once a week ______
Once or twice a week ______
Three or more times a week ______
(d) Episodes of disorientation or confusion during sleep
Not during the past month ______
Less than once a week ______
Once or twice a week ______
Three or more times a week ______
(e) Other restlessness while you sleep, please describe ____________________________________
__________________________________________________________________________
Not during the past month ______
Less than once a week ______
Once or twice a week ______
Three or more times a week ______