CHANGES IN SLEEP HABITS OF MEDICAL STUDENTS ACCORDING TO CLASS STARTING TIME: A LONGITUDINAL STUDY

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Running title: Sleep habits and class starting time

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ABSTRACT

Good quality sleep and adequate amount of sleep are important in order to have better cognitive performance and avoid health problems and psychiatric disorders. Sleep-related disturbances affect a large percentage of university students and may cause impairments in their academic performance. Among the wide range of factors that can influence the sleep habits, university schedules are strongly related with sleep deprivation in students. This longitudinal study aims to investigate the effect of university schedules on medical students' sleep-wake cycle by means of the analysis of the Pittsburgh Sleep Quality Index (PSQI), a Sleep Habits Questionnaire and a sleep diary in three university semesters with different class starting times. The results demonstrated that when classes started earlier in the morning, the students had shorter sleep duration during weekdays, greater difference between weekday and weekend sleep duration (restriction-extension pattern) and worse sleep quality, showing the influence of class starting time on students´ sleep habits.

Keywords: sleep habits, class starting time, sleep deprivation, sleep quality

INTRODUCTION

Sleep is a physiological process essential to life. Its quality is strongly related to psychological and physical health and other measures of well-being (Pilcher and Ott, 1998). Individuals who report poor sleep quality and other sleep-related disturbances may be at higher risk for depression and other psychiatric disorders throughout their lifetime (Ford and Cooper-Patrick, 2001; Loayza et al., 2001).

The amount of sleep is also very important and is positively correlated with alertness and psychomotor vigilance (Jewett et al., 1999). A number of studies were conducted to measure the consequences of insufficient sleep. It is known that one night of sleep loss impairs innovative thinking, flexible decision-making, and several forms of cognitive performance (Harrison and Horne 1999; Jacques et al., 1990). One of the major consequences of sleep deprivation is daytime somnolence and its inevitable outcomes. One author observed excessive sleepiness prevalence of 93.2% in a population of medical students (Santibañez, 1994). Daytime sleepiness may result in mood disturbances and increased vulnerability to substance use (Jean-Louis et al., 1998). Another study showed that employees with subjective daytime sleepiness lose more working days due to health reasons than their more alert colleagues (Philip at al., 2001).

Sleep-related disturbances affect a huge part of the population, regardless of age, gender and ethnic group. However, there are certain population groups that are more susceptible to sleep disorders. University students, for instance, usually exhibit irregular sleep-wake cycles, with short sleep duration on weekdays and bedtime delays on weekends,

which can lead to daytime sleepiness, depressive mood, and sleep-wake behavior problems (Wolfson and Carskadon, 1998). Medical students, in particular, are often overloaded with classes and hospital activities. In addition, they have to cope with anxiety and stress due to academic demands and the constant contact with patients' suffering and death.

Academic performance is one of the major goals of university students. One study reported the relationship between sleep habits, particularly wake-up times, and grade point average in university students (Trockel et al., 2000). Another study demonstrated that students with irregular sleep-wake cycles and sleep deprivation show worse academic performance than those with regular sleep-wake cycles and sufficient sleep duration (Medeiros et al., 2001). And, most alarming of all, university students are not aware of the extent to which sleep deprivation negatively affects their cognitive performance (Pilcher and Walters, 1997).

Multiple factors influence the sleep-wake cycle. Along with endogenous factors (chronotype, circadian timing system, core body temperature, and hormones), there is a wide range of environmental cues, including the light-dark cycle, professional activities, and social interaction, which can affect sleep habits. In a study with university students, for example, about one third of the sample that reported insufficient sleep indicated visual media, particularly computers, as the primary reason (Ban and Lee, 2001). Several other researchers have pointed out to study and work schedules as the underlying causes of sleep deprivation (Andrade et al., 1993; Machado et al., 1998; Valdez et al., 1996).

Aiming to investigate the effect of university schedules on medical students' sleep-wake cycle, we chose to carry out a longitudinal study and analyze sleep quality and sleep-wake habits of the same group of students during three school semesters. In addition to class starting time differences between the semesters, during the last analyzed period most of the students were involved in extra-curricular night work in hospitals. Thus, we also analyzed the interference of this factor in the sleep-wake cycle of the future physicians.

METHODS

Participants

Our subjects were 31 medical students (19 male and 12 female) from Universidade Federal do Rio Grande do Norte, Brazil. The mean age was 20.54±2 years at the beginning of the study and they attended classes according to a regular schedule from Monday through Friday. Informed consent was obtained from all volunteers.

Instruments

During the survey, we used the following protocols: an identification form with questions about personal information, health status and schedule of their curricular and extra-curricular activities; a Portuguese version of the Horne and Östberg Morningness/Eveningness Questionnaire to identify the subjects' chronotype (Benedito-Silva et al., 1990); the Pittsburgh Sleep Quality Index (PSQI) (Buysse, 1989); a sleep diary, in which the students recorded their bedtime and wake-up time for two consecutive weeks; and a questionnaire about sleep habits, also including, among other issues, their average bedtime, wake-up time, and sleep duration, on weekdays and weekends.

Procedure

In our University, the medical course is completed in six years. The first two years are part of the basic cycle. After that, the students go to the professional cycle and have classes at the university hospital, being in contact with patients, and most of them engage in volunteer night work in hospitals. Data collection took place in three different periods. The first one occurred during the third semester of the medical course, when classes started at 07:00h on Tuesdays and Thursdays and 08:00h on Mondays, Wednesdays and Fridays. The students filled out the identification form, the Morningness/Eveningness Questionnaire, the PSQI and the sleep diary. On the following semester, with classes starting at 10:00h from Monday through Friday, the participants completed the same protocols of the previous semester plus the Sleep Habits Questionnaire. The last part of the research was carried out during the professional cycle, on the seventh semester of the course, when classes started at 07:00h everyday of the week. Once more, the students filled out all protocols, except for the Morningness/Eveningness Questionnaire and the sleep diary.

Data analyses

With the results from the Morningness/Eveningness Questionnaire, we built a normal distribution curve, and, in order to correlate the chronotype scores with the sleep onset, a linear regression test with ANOVA was used. The bedtime, sleep duration, and PSQI scores were compared between the semesters with the One-way Within-Subjects (repeated measures) ANOVA. The level of significance was established at $p<0.05$.

RESULTS

According to the Morningness/Eveningness Questionnaire, 71.4% of the students were classified as indifferent type, 14.3% as moderate morning type, 11.4% as moderate evening type, and 2.9% as extreme evening type. The linear correlation between bedtime (based on sleep diary) and chronotype scores ($p<0.04$) is evidence that the subjects' answers were coherent on both questionnaires.

Based on the sleep diary, the students' average bedtime during the first period was 23:47h±57min on weekdays and 00:18h±77min on weekends. Sleep duration was 397min±52min and 459 min±59min, on weekdays and weekends, respectively. During the second period, the students delayed their bedtime to 00:25h±58min on weekdays and 01:14h±65min on weekends. During the weekdays, the sleep duration increased to 437min±50min, but the weekend duration remained the same. In the third data collection, the bedtime and sleep duration data were obtained from the Sleep Habits Questionnaire. We had already found a strong correlation between the data from the sleep diary and the Sleep Habits Questionnaire during the second period and chose not to use the sleep diary during the third period. The results revealed that weekdays and weekend bedtimes were 23:38h±53min and 00:29h±88min, respectively, and sleep duration of 385min±56min and 519min±91min (Figure 1).

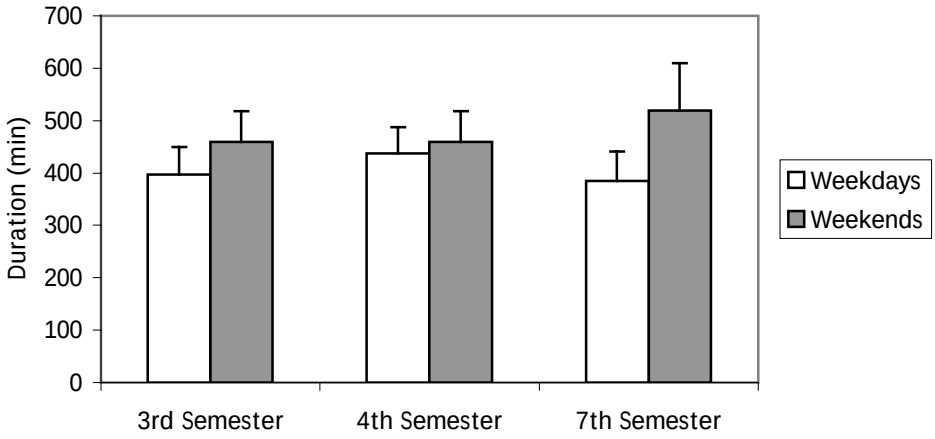

Figure 1. Sleep duration on weekdays and weekends, showing the "restriction-extension" pattern. Data are presented as mean ± s.d.

PSQI scores range from 0 to 20 and a value above 5 indicates bad sleep quality. During the first period analyzed, the average PSQI score was 5.00±1.5, with 42.3% of the students presenting bad sleep quality. During the second period, this percentage decreased to 11.5% and PSQI mean score was 3.86±1.5. During the third period, PSQI increased to 5.57±2.8 and bad sleep quality was detected in 60% of the students (Figure 2). ANOVA comparison between the PSQI scores revealed a statistically significant difference between the first and second periods (p=0.044) and between the second and third periods (p=0.002), but no significant difference was found between the first and third periods.

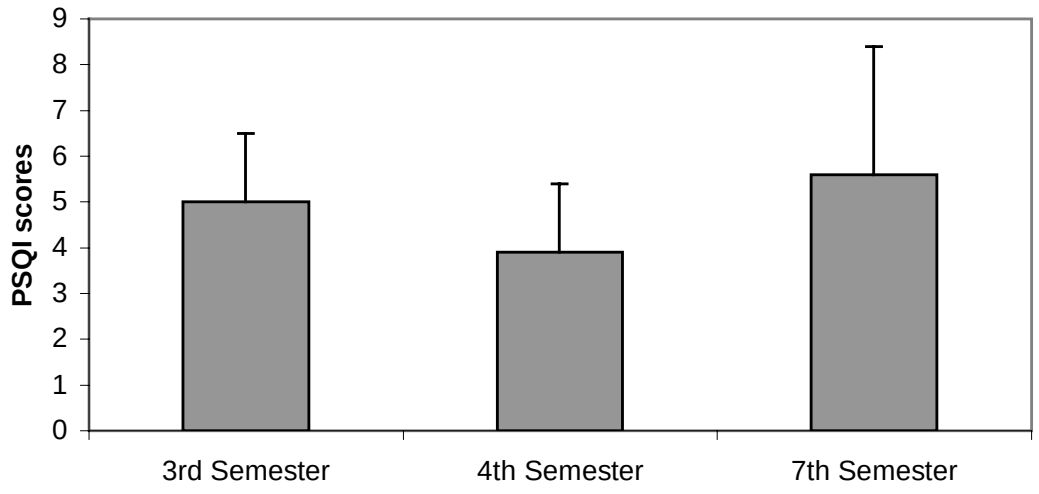

Figure 2. Pittsburgh Sleep Quality Index on the 3rd, 4th and 7th semesters

DISCUSSION

The normal distribution of chronotype frequencies revealed that the studied group is a homogeneous representation sample of the general population, with no significant predominance of morning or evening types.

Evaluation of the same group of students throughout the entire experimental period allowed us to use One-way Within-Subjects (repeated measures) ANOVA, and thus, we were able to consider the subjects' individual characteristics, such as personality and chronotype, as constant variables with little effect on the comparisons.

When the students went from the first analyzed period to the second, their morning classes starting time was delayed by 2 hours on Mondays, Wednesday and Fridays and by 3 hours on Tuesdays and Thursdays. This allowed them to delay their wake-up time by about

78min during college mornings. But they also delayed their bedtime, which seems to be associated with a tendency of the human circadian system to maintain a delayed phase (Valdez et al. 1996). Despite this delay in bedtime, the students were able to increase their sleep duration by 40 minutes. During the third period, their class starting time went back to 07:00h and the students were forced to adopt a wake-up time, as well as a bedtime and sleep duration, similar to the first period. These results suggest that the class starting time affected the sleep-wake cycle and that the students slept less when classes started earlier in the morning.

When we compared the sleep onset on weekdays with that of weekends, we observed a delay of 31, 49 and 51 minutes on weekends for the third, fourth and seventh semesters, respectively. This was probably due to the already mentioned tendency of human beings to delay their sleep wake cycle (Valdez et al, 1996) in addition to their engagement in social activities, such as parties.

We also found an increase in sleep duration on weekends compared to weekdays. During the third semester, the students slept approximately one hour more on the weekends and on the seventh semester, the difference between weekdays and weekends exceeded two hours. During the fourth semester, on the other hand, sleep duration during the weekend increased only 22 minutes. The reduced sleep length during weekdays and extended sleep length during weekends is denominated restriction-extension pattern and indicates partial sleep deprivation (Figure 1). During the third semester, 88.9% of the students presented this pattern. This percentage decreased to 66.7% during the fourth semester and reached 93.5% during the seventh semester. These results confirm the link between class starting time and sleep deprivation.

Even though the difference in weekdays sleep duration between the third and seventh semesters was subtle, the greater percentage of restriction-extension pattern found for the seventh semester indicated that the students were more sleep deprived at this time, which suggests that night work in hospitals during the professional cycle of the medical course could be another interfering factor on the sleep-wake cycle of students. Studies have demonstrated that fatigue in medical students and professionals is due to long hours of study and work and the associated sleep deprivation is the main factor that influences performance as reviewed by Gaspar et al., (1998).

Sleep quality was also affected by class starting time. When classes started later in the morning, i.e., during the fourth semester, the students reported better sleep quality than during the third and seventh semesters, when classes started earlier. But, once again, we

cannot rule out the possible influence of hospital night work on sleep quality since it was slightly worse on the seventh semester compared to the third.

It is essential for students and health professionals to understand the importance of sleep deprivation and other sleep disorders and their consequences. Loayza and colleagues (2001) showed an association between sleep disturbance and suspicion of psychiatric disorders in medical students. As demonstrated, sleep-related disorders affect not only the individuals' health and well-being (Pilcher and Ott, 1998), but also their performance. The effect of sleep loss on cognitive performance of resident physicians is well documented by Jacques and co-workers (1990) in a study that demonstrated a decline in composite test score with decreasing sleep on the night before the examination.

Sleep medicine is an important field in the medical study and allows medical students and professional to diagnose their own sleep disorders as well as their patients'. Despite the numerous publications regarding the subject, students and professionals tend to ignore the sleep disorders and their possible consequences (Pilcher and Walters 1997; Roth et al, 2001).

Medical students suffer high levels of stress due to academic demands, particularly during examination periods, and the constant contact with patients' suffering. Stress, associated with insufficient sleep and excessive daytime sleepiness (Santibañez, 1994) can lead to difficulties in interpersonal relationship, depression, anxiety (Almondes, 2001), and alcohol and drug abuse (Jean-Louis et al., 1998). Even though a number of studies have supported the need of stress-management programs for medical trainees (Shapiro et al., 2000), most of these programs do not take sleep habits into account. One way to improve sleep quality, avoid sleep disorders, and decrease stress is to have good sleep habits, which include regular bedtimes and wake-up times, sufficient sleep duration, appropriate sleep environment, and, particularly for students, better organization of their study schedule.

In this study we investigated the influence of class starting time on sleep deprivation and the effect of hospital night work on sleep. These are only two of the numerous causes of disruption of sleep habits. The identification and analyses of these factors contribute to an increased understanding of their relationship with the sleep-wake cycle and, most importantly, to the elaboration of intervention methods to avoid sleep-related disorders and their consequences.

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