

# Evening chronotypes experience poor sleep quality when taking classes with early starting times

## Estudantes com cronótipo vespertino apresentam pior qualidade do sono quando as aulas iniciam mais cedo

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### ABSTRACT

**Background and objective:** The sleep-wake cycles of medical students are affected by their academic demands and class starting times. Despite their different sleep needs and characteristics (such as chronotype), all students must follow the same schedule. Therefore, it is necessary to know whether chronotype is related to sleep quality and daytime sleepiness. **Methods:** A study was carried out with the assessment of 234 students in their 1<sup>st</sup> through 4<sup>th</sup> years of medical school at the Federal University of Rio Grande do Norte. The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate subjective sleep quality. Values below 5 indicated good sleep quality, while values above 5 indicated poor sleep quality. The Epworth Sleepiness Scale (ESS), in which values above 10 indicate extreme daytime sleepiness, was used to evaluate daytime sleepiness. A Portuguese version of a questionnaire for the “eveningness-morningness” dimension developed by Horne and Östberg (1976) was used to classify participants with regard to their chronotypes. **Results:** Chronotype had a normal distribution. Students of second through fourth years of medical school had sleep quality values above 5, while students of the first year had sleep quality values below 5. Daytime sleepiness was homogenous across groups, with an average of 8.9 (SD=3.55). Chronotype and sleep quality had a linear relationship ( $p<0.001$ ); evening types had worse sleep quality than morning types. The relationship between chronotype and daytime sleepiness was not statistically significant. **Conclusions:** The medical students evaluated in this study had low sleep quality, particularly those of extreme evening type.

**Keywords:** Sleep; Students, medical; Sleep stages; Chronobiology phenomena

### RESUMO

**Introdução e objetivo:** O ciclo sono-vigília dos estudantes de Medicina é afetado por suas demandas acadêmicas e pelo horário de início das aulas. Apesar de suas diferentes necessidades e características do sono (como o cronótipo), todos os alunos devem seguir o mesmo calendário. Portanto, é necessário saber se o cronótipo está relacionado à qualidade do sono e à sonolência diurna. **Métodos:** O estudo foi realizado com 234 estudantes, desde o primeiro até o quarto ano da faculdade de Medicina da Universidade Federal do Rio Grande do Norte.

O Índice de Qualidade de Sono de Pittsburgh (IQSP) foi utilizado para avaliar a qualidade subjetiva do sono. Valores abaixo de 5 indicam boa qualidade de sono, enquanto os valores acima dos 5 indicam qualidade ruim. A escala de Epworth (ESE), em que valores acima de 10 indicam sonolência extrema, foi utilizada para avaliar a sonolência diurna. Uma versão em Português de um questionário para a avaliação do cronótipo desenvolvida por Horne e Östberg (1976) foi utilizada para classificar os participantes em seus respectivos cronótipos. **Resultados:** O cronótipo apresentou uma distribuição normal. Os alunos do segundo ao quarto ano do curso de medicina apresentaram uma média no IQSP acima de 5, enquanto os estudantes em seu primeiro ano tiveram no IQSP uma média inferior a 5. A sonolência diurna foi homogênea entre os grupos, com uma média de 8,9 (DP=3,55). Cronótipo e qualidade de sono apresentaram uma relação linear ( $p<0,001$ ); cronótipos vespertinos apresentaram qualidade de sono pior do que os matutinos. A relação entre cronótipo e sonolência durante o dia não foi estatisticamente significativa. **Conclusões:** Os estudantes de Medicina avaliados neste estudo apresentaram baixa qualidade do sono, particularmente aqueles classificados como vespertinos extremos.

**Descritores:** Sono; Estudantes de Medicina; Fases do sono; Fenômenos cronobiológicos

### INTRODUCTION

Several studies have shown that sleep quality is important for the normal functioning of individuals. Epidemiological studies have shown that approximately 30% of adults suffer from sleep disorders <sup>(1)</sup>. Sleep disorders cause deficits of cognition, attention and memory, thus impairing performance in daily tasks and increasing the propensity for psychiatric, cardiovascular and metabolic disorders, as well as other health problems <sup>(2)</sup>. In addition, we know that irregularities in the sleep-wake cycle pattern affect sleep quality.

Among the general population, university students are a group that frequently presents sleep disorder complaints. These complaints have been reported mainly by students in programs with high academic demands, such as medicine,

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Received: January 8, 2010; Accepted: March 30, 2010

in which sleep-wake cycle regularity is compromised as a result of academic requirements, causing a delay in sleep onset. Individual chronotypes are also relevant, as those with evening chronotypes show difficulty in waking up early.

In addition to individual chronotype characteristics, one should take into account the fact that people have different sleep needs. Studies have shown extremes of people who need a maximum of 6 hours 30 minutes of sleep<sup>(3)</sup> or a minimum of 8 hours 30 minutes of sleep<sup>(3)</sup>, called short and long sleepers, respectively.

This study aimed to evaluate the sleep quality of medical students relative to these students' chronotypes. Our hypothesis is that the evening chronotype has an increased tendency to suffer from worse sleep quality and greater daytime sleepiness. Furthermore, we evaluated if sleep quality and daytime sleepiness differ according to the semester of attendance.

## METHODS

This was an observational, cross-sectional, individualized study.

We evaluated 234 medical students at the Federal University of Rio Grande do Norte (UFRN). The students were attending their first four years of medical school. For the analysis, we divided the students according to the semester of attendance: 50 in the first, 41 in the second, 26 in the fourth, 36 in the fifth, 29 in the sixth, 31 in the seventh and 21 in the eighth. After a brief presentation of the study, they were invited to participate in the project voluntarily. Students who were in the third semester could not participate in the study because they changed schedules class during the data collection phase. As exclusion criteria, we used the presence of a previously diagnosed sleep disorder and the use of medications that alter sleep architecture. Incorrectly or partially completed data were not analyzed. Thereby, we excluded the questionnaires, not the participants, therefore the total sample is different in each questionnaire. A total of 224 students reported their gender (114 males and 110 females).

To evaluate subjective sleep quality, we used the Pittsburgh Sleep Quality Index (PSQI)<sup>(4)</sup>, which consists of 19 questions, analyzed in seven components: subjective quality, latency, duration, habitual efficiency, sleep disturbances, use of medications for sleep and daytime dysfunction. Each component is given a score from 0 to 3, resulting in a total score ranging from 0 to 21. Ratings between 0 and 5 indicate good sleep quality, while those above 5 indicate poor sleep quality.

The ESS<sup>(5)</sup>, used to assess daytime sleepiness, consists of eight questions that evaluate the possibility, on a scale of 0 to 3, that an individual will fall asleep in various everyday situations. After applying the scale, the values given to each situation are summed, and a total value is obtained, quantifying daytime sleepiness. The scale has a maximum of 24 points, and a total value greater than 10 is considered excessive sleepiness.

To classify the students' chronotypes, we used a Portuguese version of the questionnaire developed by Horne and Östberg<sup>(6)</sup> (1976), under which individuals are classified according to their score: extreme evening type (EE), 16 to 30; moderate evening type (ME), 31 to 41; intermediate (I), 42 to 58; moderate morning type (MM), 59 to 69; or extreme morning type (EM), 70 to 86.

The independent variables analyzed were 'semester' and 'chronotype'; the dependent variables were 'daytime sleepiness' and 'sleep quality'. For data analysis, we used the SPSS program, version 8.0 (SPSS Inc., Chicago, IL, USA) and one-way ANOVA for non-repeated measures with Bonferroni verification and the linear analysis between chronotype and sleep quality. P-values < 0.05 were considered significant.

The study was conducted after approval by the Ethics Committee of the Federal University of Rio Grande do Norte (UFRN) and signature of the informed and free consent statements by the students.

## RESULTS

The chronotype distribution pattern was normal both in the total sample and in terms of gender and semester of attendance. In the classification, we found 12 (5.33%) extreme evening types, 32 (14.22%) moderate evening types, 133 (59.11%) intermediate types, 45 (20%) morning types and 3 (1.33%) extreme morning types.

The average PSQI obtained in the sample was  $5.58 \pm 2.58$ . Considering the entire sample, 130 (57.2%) had good sleep quality, and 98 (42.98%) had poor sleep quality. We observed the best scores on two components of this index: subjective sleep quality ( $1.17 \pm 0.74$ ) and sleep duration ( $0.81 \pm 0.91$ ). With regard to the semester of attendance, only students in the first and second semesters had good sleep quality ( $4.00 \pm 2.02$  and  $4.70 \pm 1.71$ , respectively). Students in their fifth semester had the worst sleep quality, with an average of  $7.25 \pm 3.04$  (Figure 1, Table 1).

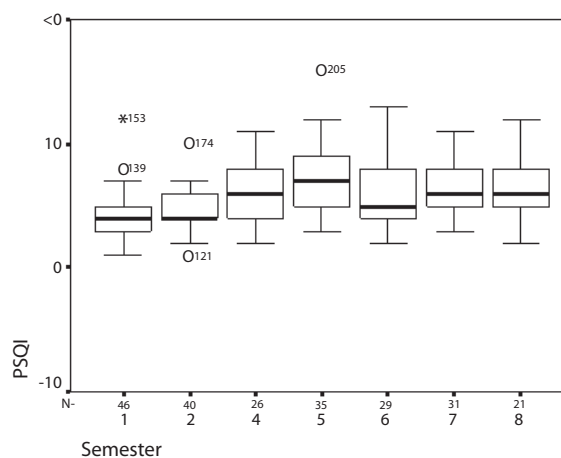


Figure 1: PSQI by semester.

**Table 1:** PSQI and ESS distributions by semester

Semester	1	2	4	5	6	7	8
PSQI	4±2.02	4.7±1.71	5.96±2.52	7.26±3.04	5.83±2.83	6.29±2.07	6.14±2.37
ESS	7.97±3.02	9.05±3.54	9.38±3.83	9.8±3.75	8.51±3.69	8.64±3.66	9.38±3.51

PSQI: Pittsburgh Sleep Quality Index; ESS: Epworth Sleepiness Scale.

**Table 2:** PSQI and ESS distributions according to chronotype

Chronotype	EM	MM	I	ME	EE
PSQI	4.67±2.52	4.96±2.55	5.38±2.29	6.52±2.61	8.5±3.5
ESS	10.33±6.43	8.96±3.23	8.5±3.54	9.09±3.46	11.92±3.58

EM: extreme morning; MM: moderate morning; I: intermediate; ME: moderate evening; EE: extreme evening; PSQI: Pittsburgh Sleep Quality Index; ESS: Epworth Sleepiness Scale.

A regression analysis between chronotype and sleep quality showed a linear correlation ( $R=0.296$ ,  $p<0.001$ ). Individuals with a tendency toward eveningness presented poorer sleep quality (Table 2). A more detailed analysis showed that this relationship depended on the components C1 (subjective quality of sleep,  $p=0.02$ ) and C3 (sleep duration,  $p<0.001$ ).

Data analysis of the Epworth Sleepiness Scale (ESS) showed a mean score of  $8.9\pm 3.55$ , suggesting that this population experiences little daytime sleepiness. Considering the whole sample, 71 students (31.14%) had excessive daytime sleepiness, while 157 (68.86%) did not have it. However, when evaluating the ESS scores, we found that the medical students classified as extreme evening and extreme morning types showed extreme sleepiness ( $11.92\pm 3.58$  and  $10.33\pm 6.43$ , respectively) (Table 2). With regard to the semester of attendance, we found no statistically significant differences in ESS scores between semesters.

## DISCUSSION

In these studies, we found that the assessed medical students had poor sleep quality beginning in their fourth semester of attendance. Students in their fifth semester had worse sleep quality and PSQI scores significantly higher than students in other semesters. In terms of daytime sleepiness, we found no differences between students attending different semesters. When we analyzed sleep quality in relation to chronotype, we found an inverse linear correlation between chronotype scores and sleep quality scores; in other words, individuals with a tendency toward eveningness presented poorer sleep quality.

In our study, the average ESS score ( $8.9\pm 3.55$ ) was close to that obtained in another study with medical students, which showed an average score of  $9.38\pm 4.06$  at the beginning of the semester and  $10.72\pm 4.03$  at the end of the semester<sup>(7)</sup>.

Concerning the PSQI, 42.98% of the students showed poor sleep quality. This result confirmed what was found

in two previous studies with medical students in Brazil, in which approximately 40% of respondents experienced poor sleep quality<sup>(8,9)</sup>. In one of these studies, the statistical analysis revealed large contributions of components 1 (subjective sleep quality) and 3 (sleep duration) of the PSQI, a result that corroborates the data obtained in our study. However, a study assessing North American university students showed that over 60% had poor sleep quality<sup>(10)</sup>. The higher prevalence of students with poor sleep quality in that study may be related to different cultural habits.

In our study, the two first semesters, during which classes started one hour later than in other semesters, were the only ones with average PSQI values compatible with good sleep quality ( $PSQI<5$ ). In a study from the Chronobiology Laboratory of the UFRN, 42.3% of students with a class schedule that began earlier showed poor sleep quality, whereas only 11.5% of those with later class start times showed poor sleep quality<sup>(9)</sup>. This result shows that daily class start times are extremely important in determining the sleep quality of students.

The correlation between chronotype and sleep quality scores found in our study was in accordance with a study relating chronotype to sleep quality in nurses working in shifts, highlighting chronotype as a strong predictor in the determination of sleep quality, where evening type individuals had worse sleep quality<sup>(11)</sup>.

Concern with the regularity of the sleep-wake cycle, as well as with sleep hygiene, is not well established yet in medical schools. However, several studies have emphasized this problem, which seems to be a far more serious problem than originally considered by medical schools. For example, a survey conducted in our university found that students with greater irregularities in their sleep-wake cycles and shorter sleep durations had poorer academic performance<sup>(10)</sup>. Furthermore, experimental evidence of the importance of biological rhythm regularity led the World Health Organization to consider shift jobs, which cause disturbances in circadian rhythms, carcinogenic factors<sup>(12)</sup>.

Those who are responsible for organizing activities in medical schools should take into account the individual characteristics (such as chronotype) and design an activity schedule that does not lead to sleep deprivation or irregularity.

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