

# *The Effect of School Schedule on Sleep Quality, and Emotional State on High -School Adolescents*

## Efeito dos turnos de estudo na qualidade do sono, no emocional e no desempenho escolar de adolescentes

Gema Mesquita\* Rubens Reimão\*\*

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### ABSTRACT

**OBJECTIVE:** For the first time in Brazil the influence on study schedules, considering sleep quality, emotional status and scholastic performance in adolescents. **METHOD:** Two high schools in the city of Alfenas, southern Minas Gerais state, were selected for this study. The cohort consisted of 160 students between 15 and 18 years of age with a larger number of females (65.63%) than males. The following instruments were applied for collection of data and for quantification of sleep quality the Pittsburg Sleep Quality Index, the Lipp Inventory of Stress Symptoms for adults, which objectively identifies the symptoms of stress, and the students' report cards to obtain their grades. **RESULTS:** A reduction of 2h30m in sleep was observed in students with morning schedules; 71.3% of the morning students and 35.00% of the afternoon students were classified as stressed. The value of  $p$  was 0.0001 (Chi-square). Regarding academic achievement based on averages presented, 0.697 for morning students and 0.561 for those with afternoon schedules Mann-Whitney ( $p < 0.0001$ ). **CONCLUSION:** The data suggest that pupils on morning schedules respond with greater stress symptoms and better scholastic performance compared to those on afternoon schedules.

**Keywords:** Sleep; Sleep Disorders; Stress, Psychological; Sleep Deprivation; Adolescent.

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\*Psychologist, Sleep Medicine Advanced Research Group, Department of Child and Adolescent Health, School of Medical Sciences, State University of Campinas (UNICAMP), Campinas, SP, Brazil.

\*\*Neurologist, M.D, PhD, Sleep Medicine Advanced Research Group, Division of Clinical Neurology, Hospital das Clinicas, University of Sao Paulo Medical School (HCFMUSP), São Paulo, SP, Brazil.

From the State University of Campinas (UNICAMP) and the University of São Paulo Medical School (HCFMUSP).

**Name and mailing address of corresponding author:** Rubens Reimão Rua dos Bogarís, 38 - 04047-020 São Paulo, SP – Brazil - Tel. (11) 2276-3199 - FAX (11) 5589-7422 - E-mail: reimaorubensneuro@yahoo.com

## RESUMO

**OBJETIVO:** O objetivo desta pesquisa é avaliar a influência dos turnos de estudo na qualidade do sono, no emocional e no desempenho escolar em adolescentes. **MÉTODO:** Para o desenvolvimento desta pesquisa foram escolhidas duas instituições educacionais de ensino médio, na cidade de Alfenas, sul de Minas Gerais, Brasil. A amostra foi composta por elementos do gênero feminino e masculino de tamanho  $N = 160$  havendo predomínio do feminino (65,63%). A faixa etária estudada foi de 15 a 18 anos. Para a coleta de dados aplicou-se: Índice de Qualidade de Sono de Pittsburgh utilizado para quantificar a qualidade do sono; Inventário de Sintomas de Estresse para Adultos de Lipp que identifica de modo objetivo a sintomatologia de stress e os boletins dos alunos por meio dos quais foram recolhidas as notas dos alunos. **RESULTADOS:** Observou-se uma redução de 2h30min de sono nos participantes do turno da manhã; 71,35% dos alunos do turno da manhã e 35,00% dos alunos do turno da tarde foram classificados como estressados ( $p = 0,0001$  Qui-quadrado). E quanto ao aproveitamento escolar pelas médias apresentadas foram de 0,697 para os alunos que estudam de manhã e de 0,561 para alunos do turno da tarde ( $p < 0,0001$  Mann-Whitney). **CONCLUSÃO:** Os dados sugerem que os adolescentes que estudam no turno da manhã estão respondendo com maiores sintomas de stress e melhor aproveitamento escolar em comparação com aos alunos do turno da tarde.

**Palavras-chave:** Sono; Distúrbios do Sono; Stress, Psicológico; Privação de Sono; Adolescente.

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## INTRODUCTION

Sleep characteristics are directly influenced by the maturing of the central nervous system in infancy and in later aging. Duration of sleep gradually and substantially diminishes with age. Newborn babies sleep 16 hours a day; this rate and reduced to almost 10 hours by age ten, dropping during adolescence, so that the adolescent sleeps about 8.5 hours a day. The adolescent needs an average of nine to ten hours of sleep each night for an optimal state of wakefulness<sup>1</sup>.

Sleep stages 3 and 4 display a progressive reduction of sleep in the first two decades of life. They are longer in infancy and occupy most of the night. There is a reduction of 40% of stage 4 in adolescence, occupying only 9% of total sleep time. This gradual decline becomes stronger in the young adult. In the elderly, stages 3 and 4 are no longer observed, therefore, with time, sleep becomes more superficial. In adolescence stage 2 increases and the first episode of REM sleep decreases. Wakefulness at

night is also altered with age. In infancy, between ages five and ten, wakefulness occurs once a night for a short period. In adolescence, the average is 1.5 to 2 arousals each night. Wakefulness increases in number and duration in adulthood and in the elderly.

The index of sleep efficiency (relationship between hours spent in bed and number of hours really asleep) in adolescence is on average about 95%. There is also an average reduction in sleep latency in adolescence, in which the teenager takes 10 minutes to begin to sleep.

In puberty and during adolescence a displacement of the phase occurs, increasing the evenings' quality<sup>2</sup>. This dislocation of phase is influenced by the sociocultural environment. The author compared the sleep-wake cycle of adolescents living in different parts of Brazil. She observed that adolescents from rural environment do not exhibit a phase delay or if they do, it is less pronounced than that observed in urban adolescents. However, for Carskadon et al.<sup>3</sup> adolescents go to sleep much later, not due to daily

activities, but because of the changes in sleep patterns inherent to the adolescent stage<sup>1,3</sup>.

An increase in daytime sleepiness is verified in adolescence. It is believed that it is caused by a progressive reduction of stages 3 and 4 and by the partial and constant deprivation of sleep. This privation is motivated by external factors such as school hours, abuse of the Internet at night and television<sup>1</sup>. Since adolescents do not sleep the necessary number of hours, the result is chronic sleep deprivation and consequently daytime sleepiness<sup>4</sup>.

In youngsters, daytime sleepiness appears to make up for lack of sleep, confirming a real need for more sleep. This is often manifested by naps during the day, which in common sense suggest, episodes of light sleep. This could be due to tiredness and fatigue of sleep deprivation<sup>5,6</sup>.

Lack of sleep can be due to various organic factors of physiological origin, effect of medications, chronic psychiatric and psychological illnesses, and environmental factors. But for adolescent, environmental factors have been the permanent cause of chronic sleeplessness. In adolescence maintaining regularity of the sleep-wake cycle, satisfying sleep necessities and at the same time, keeping up with academic and social demands are conflicting situations.

According to Giannotti et al.<sup>7</sup> sleep deprivation has a broad negative effect on the control of emotional behavior and is crucial for competent social and scholastic development. Lack of sleep can especially affect cognitive functions linked to the pre-frontal cortex<sup>8</sup>. Many behavior problems in adolescents can be directly associated with insufficient sleep<sup>9</sup>.

Considering changes in sleep patterns in adolescence and the delay in going to bed and rising are the objectives of this study, also including stress affected by morning and afternoon school schedules of a group of adolescent high school students. This is part of a larger research project evaluating child's and adolescents' sleep disorders that will be published elsewhere<sup>10, 11, 12, 13</sup>.

## METHOD

This is a transverse descriptive study, favoring the quantitative method. The study was performed in Alfenas, a city of southern Minas Gerais, Brazil, with 80.000 inhabitants. Two high schools in the center of the city permitted us to conduct the study, one was a public school and other a private one. The public school was morning and afternoon class schedules and the students came from low and middle class families. The private school held only morning classes attended by middle class pupils.

The population in the present study consists of 160 adolescents of both sexes ranging in age from 15 to 18 years. Including in the study were: High school students with ages ranging from 15 to 18, who were enrolled in these two schools; Students who voluntarily accepted to take part in the study and who brought the Informed Consent Form signed by their legal guardian.

## MATERIAL:

1 – Pittsburgh Sleep Quality Index (PSQI)<sup>14</sup> is utilized to quantify sleep quality; it is properly standardized for retrospective use and validity in Portuguese, certified, and employed internationally. The PSQI questionnaire evaluates sleep quality over the last month and is composed of 19 (nineteen) self-evaluation items, its overall score ranges from 0 to 20 (zero to twenty), the lower the scores, the better the sleep quality. Good sleepers are those individuals with scores of less than 5 (five) and poor sleepers those with scores higher than 5 (five).

The PSQI evaluates the following items: subjective sleep quality, sleep latency, duration of sleep, habitual efficiency of sleep, sleep disorders, use of medication and daytime sleepiness.

2 – The Lipp Inventory of Stress Symptoms<sup>15</sup>

The scope of the Lipp Inventory is to objectively identify the symptoms of stress presented by the subject, evaluating the existing symptom, whether somatic or psychological; and the stage it is in, (the alert stage; resistance; close to exhaustion;

and the exhaustion). Presented in a four-part model, validated by Lipp<sup>15</sup>.

The questionnaires were administered to groups in the school classrooms and libraries.

## ETHICAL ASPECTS

The study did not expose the participants to any risks. The parents or guardians of the students participating in the study were informed of the objectives and the methods utilized by the Informed Consent Form.

The project # 152/2004 initiating the study was approved by the Ethics Committee of the Medical Sciences Division of the University of Campinas (UNICAMP), obeying all the provisions of Resolution 196/96 and supplements and was approved at the Ordinary Meeting, on July 20, 2004.

## STATISTICAL METHOD

The data obtained in this investigation was tabulated, organized and stored on an Excel electronic spreadsheet program. The data was

submitted to statistical analysis by the Research Sector of the Medical Sciences Division of the UNICAMP. The descriptive analysis was established by measurements of position and dispersion for continuous variables and tables of frequencies for categorical variables. The Chi-Square ( $X^2$ ) Test or Fisher Exact Test were utilized when necessary to confirm association or to compare proportions. The Mann-Whitney Test was employed by comparison of continuous of ordered measurements between the two groups, and the Kruskal-Wallis Test was used among three or more groups. The level of significance for all the analyses was set at 5%.

## RESULTS

Regarding age, the subjects were distributed as follows: 43.13% were 15; 33.75% were 16; 16.88% were 17 and 25% were 18 years old;

Regarding gender, 65.63% were female and 34.38% were male;

Regarding time schedule, 40% of those interviewed study in the morning and the other 50% in the afternoon (Table 1);

**Table 1** – Descriptive analysis of students' bed-times and wake-up times.

	Average (h)	Sd (h)	Minimum (h)	Mean (h)	Maximum (h)
<u>Morning schedule</u>					
Bed-time	22:38	01:03	20:00	22:30	02:30
Wake-up time	06:09	00:36	04:00	06:00	08:30
<u>Afternoon schedule</u>					
Bed-time	22:56	01:50	20:00	23:30	05:00
Wake-up time	09:04	01:29	05:00	09:00	12:00

**Sd= standard deviation.**

Regarding classification of the school as private or public, 30.63% of those interviewed study in the private school and 69.38% in the public school.

Regarding the scores of the Pittsburgh Sleep Quality Index (PSQI) the average was 6.1 for pupils who study in the morning and 5.5 for those who study in the afternoon, with a standard deviation of 3.2 for pupils with morning schedules and 2.6 for

those with afternoon schedules. The mean value was 5.0 for both schedules, and the minimum value of 1.0 also for both groups and a maximum value of 18.0 for students in the morning classes and 14.0 for those in the afternoon classes. Based on the application of the Mann-Whitney test the populations did not differ in regard to these scores analyzed ( $p = 0.2355$ ).

In regard to the absolute and relative frequency in (%) adolescents by class schedule based on the subjective sleep quality score of the PSQI, it was noted that 15 (18.75%) students in the morning classes and 22 (27.50%) in afternoon classes judged their sleep as very good; 50 (62.50%) in the morning classes and 44 (55.0%) in afternoon classes think their sleep is good; 10 (12.50%) in morning classes and 10 (12.50%) in afternoon classes estimate their sleep as poor; 5 (6.25%) in morning classes and 4 (5.00%) in afternoon classes think it very bad ( $p = 0.6011$  Fisher Test).

Evaluating the absolute and relative frequency of adolescents by class schedule and sleep latency, it was observed that 16 (20.00%) in the morning classes and 17 (21.25%) in afternoon classes fall asleep in less than fifteen minutes; 33 (41.25%) in morning classes and 26 (35.00%) in afternoon classes take 16 to 30 minutes to fall asleep; 22 (27.50%) in morning classes and 26 (32.50%) in afternoon classes take more than 60 minutes to fall asleep ( $p = 0.8558$  Chi-Square).

In regard to absolute and relative (%) of adolescents by class schedule in relation to the PSQI duration of sleep score, 31 (38.75%) students in morning classes and 60 (75.00%) in afternoon classes stated a sleep duration greater than 7h; 37 (46.25%) in morning classes and 17 (21.25%) in afternoon classes presented sleep duration between 6 and 7h; 7 (8.75%) in morning classes and 1 (1.25%) in afternoon classes presented sleep duration between 5 and 6h; 8 (6.25%) in morning classes and 2 (2.50%) in afternoon classes presented sleep duration of less than 5h ( $p < 0.0001$  Fisher Test).

Regarding the absolute and relative frequency (%) of adolescents by class schedule in relation to PSQI habitual sleep efficiency score it was observed that 72 (90.00%) pupils in morning classes and 67 (83.75%) in afternoon classes present a habitual sleep efficiency score greater than 85%; 6 (7.50%) in morning classes and 8 (10.00%) in afternoon classes display a habitual sleep efficiency score between 75% and 84%; 1 (1.23%) in morning classes and 4 (5.00%) in afternoon classes displayed sleep efficiency score under 65% ( $p = 0.3957$  Fisher Test).

The absolute and relative frequency (%) of adolescents were evaluated by class schedule in relation to PSQI sleep disorders score and reveal that 5 (6.25%) students in morning classes and 1 (1.25%) in afternoon classes exhibited no sleep disorders score; 50 (62.50%) in morning classes and 57 (71.25%) in afternoon classes exhibited occasional sleep disorders score; 24 (30.00%) in morning classes and 20 (25.00%) in afternoon classes exhibited persistent sleep disorders score; 1 (1.25%) in morning classes and 2 (2.25%) in afternoon classes exhibited chronic and severe sleep disorders score ( $p = 0.2784$  Fisher Test).

Regarding the absolute and relative frequency (%) of adolescents by class schedule and the use of sleep medication score it was found that 74 (92.50%) students in morning classes and 76 (95.00%) in afternoon classes did not take any medicine to sleep; 2 (2.50%) in morning classes and 76 (95.00%) in afternoon classes did not take any medicine to sleep; 2 (2.50%) in morning classes and 0 (0.00%) in afternoon classes used sleep medication less than once a week; none in morning classes and 3 (3.75%) in afternoon classes used once or twice a week; 4 (5.00%) in morning classes and 1 (1.25%) in afternoon classes used 3 or more times a week ( $p = 0.5136$  Chi-Square).

Absolute and relative frequency (5) of adolescents was evaluated by class schedule in relation to daytime sleepiness score, it was detected that 11 (13.75%) students in morning classes and 12 (15.00%) in afternoon classes had no difficulty in performing daily tasks and did not feel indisposed

(sleepy) during the day; 35 (43.75%) in morning classes and 44 (55.00%) in afternoon classes had difficulties in performing daily tasks and slight indisposition during the day, less than once per week; 24 (32.00%) in morning classes and 20 (25.00%) in afternoon classes had difficulties in performing daytime tasks and moderate indisposition during the day once or twice a week; 10(12.50%) in morning classes and 4 (5.00%) in afternoon classes had difficulties in performing daily

tasks and much sleepiness during the day three or more times a week ( $p = 0.2610$  Chi-Square Test).

Application of the Chi-Square Test led to the conclusion that there is a statistically significant difference between the proportion of pupils on afternoon schedule that claim they are not stressed ante the proportion studying in the morning who state the same thing (Tale 2) and (Table 3).

**Table 2** – Absolute and relative frequency (%) adolescents by class schedule base don their assertion of whether or not they felt stressed.

Class schedule	Morning		Afternoon	
	n	%	n	%
Stress				
Yes	57	71,25	28	35,00
No	23	28,75	52	65,00
TOTAL	80	100,00	80	100,00

( $p < 0.0001$ )

**Table 3** - Absolute and relative frequency (%) of adolescents by class schedule based on whether or not they slept well.

Class schedule	Morning		Afternoon	
	n	%	n	%
Good sleep				
Yes	22	27,50	32	40,00
No	58	72,50	48	60,00
TOTAL	80	100,00	80	100,00

( $p = 0.0945$ )

Application of the Chi-Square Test led to the conclusion that there is a statistically difference between the proportion of students who studying the

morning and assert they doze and the proportion that study in the afternoon and assert the same thing (Table 4).

**Table 4** – Absolute and relative frequency (%) of adolescents by class schedule based on their statement of whether or not they doze.

Class schedule	Morning		Afternoon	
	n	%	n	%
Doze				
Yes	50	63,29	38	48,10
No	29	36,71	41	51,90
TOTAL	79	100,00	79	100,00

( $p = 0.0546$ )

## DISCUSSION

The analysis of our data referring bed-times showed a decrease of 2h30min of sleep time associated with morning school schedule group providing support to show the sleep deprivation that is present in the morning class students. This is similar to the studies of Hansen et al.<sup>16</sup> and Millman<sup>1</sup> who found that adolescents lost 120 minutes of sleep each week night during the school year. They verified that sleep time on week-ends was markedly longer. The results of these authors demonstrate that during the week school hours contribute to sleep deprivation and to a constant delay in circadian rhythm among adolescents consequently, the adolescents appear sleepier during the morning.

Another study which can also be compared to the one presented is by Sorensen and Ursin<sup>17</sup>. They evaluated the average sleep of adolescents during the week and on week-ends, and determined that they slept 7.3 hours per night during the week but 10.1 hours on week-ends. None of the adolescents in this group seemed satisfied regarding sleep and they complained bitterly about sleep in the morning.

Similarly, Salcedo et al.<sup>18</sup> upon determining the relationship between sleep habits and high school pupils composed a sample of students from 11 to 18 years of age. They verified that during the week the students went to bed at 23:17h and woke up at 7h46min (average time = 8 hours and 18 minutes) On week ends they went to bed at 1h02min and woke up on the average at 10h42min (average sleep time = 9 hours and 40 minutes); 45.4% of the students said they slept poorly<sup>18</sup>.

Dinges et al.<sup>5</sup> and Van Dongen et al.<sup>19</sup> mention that lack sleep predisposes to emotional changes. On analyzing the effect of sleep restriction on behavior these authors were able to conclude, after evaluating healthy youngsters, that a 33% reduction in habitual sleep over 7 to 14 days initiates daytime sleepiness, followed by fatigue, mental confusion, tension, behavioral disorders,

memory lapses and mental stress that increased proportionally to sleep limitation.

In the present investigation among the data comparing schedules and stress we noticed a percentage of significantly major stress symptoms among the students on the morning school schedule compared to those on the afternoon one. We can consider that reduction of sleep duration is accompanied by an increase in stress symptoms.

In the segment referring to sleep duration, the students on the morning schedule show significantly reduced sleep duration compared to those on the afternoon schedule. These facts suggests that students who have shorter sleep duration are responding with more stress symptoms. We can suggest that the decrease in sleep time is influencing student behavior, leading to the subsequent stress response, to a greater value of the stress symptoms.

According to Van Cauter<sup>20</sup>, the first response to partial loss of sleep, under various circumstances, is the nightly increase of the stress hormone, cortisol. The present study supports the analysis of Fredriksen et al.<sup>21</sup>, who related sleep deprivation to emotional states. Their study was made up of a sample with students ranging in ages from 11 to 14 years. The authors concluded that students who slept less exhibited greater emotional changes. Some of these students mentioned hours of sleep as a strong factor in their condition. The research also emphasizes the importance of sleep function in adolescent psychosocial development.

The analysis of our data that refers to dozing and school students identified a greater tendency to doze in the students in morning classes. The analyses demonstrated consistent differences between the two groups – morning and afternoon classes – in agreement with the studies of Carskadon et al.<sup>3,4</sup> and others<sup>22,25,26</sup>.

## CONCLUSION

The scores obtained in the sample studied, display that adolescents that attend the morning

school schedules present major reduction in the number of hours slept, greater frequency of daytime naps, and higher indexes of stress symptoms compared to students on the afternoon schedule.

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