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## Sleep and academic performance of Portuguese Teenagers

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### Abstract

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**Problem Statement:** Sleep has numerous important functions in the body, such as consolidation of memory, concentration and learning. Changes in sleep cycles in adolescents lead to sleep deprivation with consequences to academic performance. **Research Questions:** What are the sleep habits that influence school performance (study environment, study planning, study method, reading skills, motivation to study, overall school performance) in adolescents? **Purpose of the Study:** To identify sleep habits predictors of the quality of school performance in adolescents. **Research Methods:** Cross-sectional analytical study. Data were collected through a self-administered questionnaire with sociodemographic questions, sleep habits and school performance scale. The sample consisted of 380 students between 7th and 9th grade, with an average age of  $13.56 \pm 1.23$  years in the school year 2011/2012, from a 2nd and 3rd Cycle Basic School of the municipality of Viseu, Portugal. **Findings:** School performance in adolescents was associated with better subjective quality of sleep ( $p=0.000$ ), with longer sleep duration ( $p=0.000$ ), with watching tv/video before sleep ( $p=0.000$ ), with the habit of studying before bedtime ( $p=0.012$ ), with no computer use ( $p=0.013$ ) and with reading habits before bed ( $p=0.000$ ). School performance was also associated with adolescents who reported not feeling sleepy during class. **Conclusions:** The teenagers who sleep more and better, and who watch tv/video, study, do not use computers, and who read before going to bed, have a better school performance.

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**Keywords:** School performance, adolescence, sleep, and rest.

### 1. Introduction

Sleep deprivation is associated with other health conditions that are determinants of quality of life of the individual and family, being related to the level of attention/concentration and school performance. The best sleep thermometer lies in the recognition of symptoms of the following day, checking the



degree of drowsiness, irritability and fatigue, among others (Fonseca, 2005). According to this author the teenager who does not get enough sleep will have lower school performance and may present an irritable or depressive mood, reveal problems in interpersonal relationships, difficulty in decision-making and school absenteeism. In addition, the adolescent's physical appearance/image also undergoes changes and, when playing sports, exhibits a greater risk of an accident. A sleepy teen can be a risk to himself and others (Fonseca, 2005).

Changes in sleep habits, common in adolescents, seem to be reflected in the wake up hour, willingness to get up and work, in the daytime concentration on tasks that the teen should perform, in the wellbeing and cognitive performance. In fact, the quality of sleep is recognized as an important factor to consider in the context of public health. Human beings spend a third of their life sleeping, so sleep disorders such as insomnia, hypersomnia and changes of sleep-wake rhythms are common reason for medical consultation because school performance is affected by the quality of sleep (Duarte, 2008). Of the essential biological functions, to satiate hunger, thirst and sexual activity, sleep is the only withdrawal which cannot be maintained for more than five or six days without behavioural and physiological changes appearing, with risk to life itself. From this point of view, sleep deprivation results in decreased psychomotor performance; in lapses of attention and concentration difficulties; in decreased memory for recent events, prolonged reaction times, being in bad mood, feelings of fatigue, irritability and even states of confusion (Paiva, 2008). The hours of sleep are reflected in the physical and mental health of students, and students who sleep less than eight hours a night have a higher body mass index. On the other hand, sleeping less than eight hours seems to be reflected in a higher incidence of inactivity even if they are students who register a higher school performance, with the best marks on Maths and Portuguese (FMH / UTL, 2012).

There are significant cultural influences (having TV and/or computer in the bedroom, frequent use of texting, habits of going to nightclubs, consumption of shots and other stimulant drinks) likely to potentiate worse sleep quality and worse school performance and, taking these into account FMH/UTL (2012) states that young people need to sleep properly to ensure good cognitive functioning, necessary to academic achievement and a joyful and adjusted pathway of their lives.

Duarte (2008) adds that "thus, a good sleep hygiene is an important element in learning. It aims to mobilize personal, social and environmental resources to promote a restful and quality sleep with direct implications in the school performance of teenagers".

## **2. Research Methods**

A quantitative, cross-sectional analytical study was conducted. Data were collected through a self-administered questionnaire consisting of sociodemographic questions on sleep and school performance scale validated for the Portuguese population by Fermin, 2005. The scale developed by Fermin and adapted to the Portuguese population by Duarte (2008) consists of 40 items, drawn as a Likert type ordinal scale from one (1) to five (5), wherein (1) corresponds to never, (2) almost never, (3) sometimes, (4) almost always, and (5) forever. The items are spread over five subscales with eight items each, namely the subscale Study Environment (items 1 to 8); Study Planning (items 9 to 16);

Study Methods (from 17 to 24 items); Reading Skills (items 25-32) and the Motivation for Study (items 33-40 range). In each subscale the minimum and maximum rates vary between 8 and 40. The total sum results in the academic performance index that fluctuates with a minimum of 40 and maximum 200. The higher the index in each factor and the global scale, the better school performance.

A non-probabilistic convenience sampling was used, consisting of a total of 380 students (193 female) and aged between 11 and 17 years. They attend the 7th (36.3%), 8th (31.1%) and 9th grades (32.6%). The entire sample resides in urban areas and the majority (66.1%) takes less than 15 minutes to travel to the school. Data collection was carried out in the school year 2011/2012, from a 2nd and 3rd Cycle Basic School of the municipality of Viseu, Portugal. Most students (81.3%) feel they sleep well.

The duration of sleep is the difference between the hours of going to bed and getting up. The average duration of sleep should around eight hours, which is why the variable was split in adolescents who sleep eight hours and who sleep more than eight hours either during the week or the weekend.

Authorization to apply the questionnaires was requested to the General Directorate of Curriculum Innovation and Development (DGIDC) and the Executive Board of the selected schools. The respective consent by the Directors and Parents/Guardians was also asked for, as suggested by those entities; the coordinators of the Education Program for Health, other middle management and executive bodies were contacted, and explained the study context, objectives, the scientific reasons behind the research and the implications of it, in practical terms. The statistical analysis was processed using SPSS (Statistical Package for Social Sciences) version 21.0 for Windows, and calculated measures of central tendency - mean and median - and measures of dispersion – range of variation, coefficient of variation and standard deviation. For comparison of two groups we used the Student t-test or Mann-Whitney U test (UMW).

### **3. Findings**

#### *3.1 School performance and subjective sleep quality*

For the analysis of Table 1, adolescents who reported “good sleep quality” show better academic performance in all dimensions of scale and overall factor, with significant differences, which confirms the dependency relationship between the subjective quality of sleep and school performance.

**Table 1.** Subjective sleep quality and academic performance in adolescents.

Sleeping well habits	No	Yes	UMW	p
School performance	Sort average	Sort average		
Study Environment	156.69	196.71	7475.000	0.010
Study Planning	141.12	199.58	6556.000	0.000
Study Method	158.17	196.44	7562.000	0.014
Reading Skills	163.47	195.47	7874.500	0.039
Motivation to study	163.09	195.54	7852.500	0.036
Overall School Performance	155.28	196.97	7391.500	0.007

### 3.2 School performance and sleep duration

Teenagers who sleep more than 8 hours a week have better overall school performance and in all dimensions ( $p < 0.001$ ), which leads us to infer that school performance is affected by the duration of sleep during the week (Table 2).

**Table 2.** Duration of sleep during the week and school performance

School performance	Total hours of sleep per week		UMW	p
	$\leq 8$ hours	$> 8$ hours		
Study Environment	116.90	178.00	29.370	0.000
Study Planning	118.92	177.16	26.515	0.000
Study Method	122.84	175.52	21.728	0.000
Reading Skills	121.15	176.23	23.825	0.000
Motivation to study	122.68	175.59	22.024	0.000
Overall School Performance	117.62	177.71	28.152	0.000

### 3.3 School performance and habits before bed

Table 3 allows to investigate the relationship between school performance and activities/habits that adolescents have before bed and - considering only the overall school performance - it is evident that the ones who watch tv/dvd/video before sleep ( $p < 0.001$ ), who have study habits before bedtime ( $p = 0.012$ ), have reading habits before bed ( $p < 0.001$ ), do not use the computer to play games or surf the internet before bedtime ( $p = 0.013$ ) have better school performance.

**Table 3.** Leisure activities before bedtime and school performance

School performance	Leisure activities	Yes sort	No sort average	UMW	p
Watch tv/dvd/video		204,11	156,78	11691,000	0,000
Study		217,47	182,77	9680,000	0,012
Computer use (games, internet, and so		177,43	205,33	15338,000	0,013
Listen to music		180,98	197,20	16010,500	0,156
Reading		234,50	180,74	7693,500	0,000
Going out with friends		167,03	194,15	7976,500	0,083
Play sports		162,88	193,13	4814,000	0,131
Have a hot drink		191,33	190,26	12571,000	0,937

### 3.4 School performance and daytime dysfunction

When asked about whether they usually feel sleepy during class, 54.4% of girls and 50.8% of boys said yes. Crossing this variable with school performance, it is observed that adolescents who did not feel sleepy during classes have higher average rates consistent with better school performance for most dimensions of the scale except for the dimension 'motivation to study.' thus inferring that students who identify themselves as feeling sleepy during classes have lower school performance.

Table 4. Sleepiness in class and school performance

Perception of sleepiness in class	No		Yes		Levene's p	t	p
	Average	Sd	Average	Sd			
School performance							
Study Environment	33.78	8.99	31.22	8.16	0.610	2.904	0.004
Study Planning	29.64	7.98	26.94	8.12	0.509	3.266	0.001
Study Method	29.53	8.41	27.60	8.70	0.394	2.194	0.029
Reading Skills	29.26	8.49	27.32	9.64	0.270	2.073	0.039
Motivation to study	29.41	8.42	28.07	9.58	0.388	1.450	0.148
Overall School Performance	151.6471	38.63	141.1813	39.63	0.573	2.606	0.010

#### 4. Discussion

On average a teenager should sleep about nine hours but the hormonal eruption causes changes in the biological clock making them fall asleep and wake up later. There is no doubt that there is an association between a good sleep hygiene and academic success, and there are studies attesting that teenagers who sleep more have better ratings, being safe to say that early to bed and early to rise is good for learning (Antunes, 2009). Every teenager has its own rhythm of sleep, and on average they require to sleep nine hours a night.

Most teenagers do not sleep as much as they should, revealing the following sleep deprivation signs: difficulty in getting up in the morning; waking up with headaches that remain for much of the day, fatigue; irritation; sleepiness during class; fighting drowsiness during the study hours; difficulty in focusing and remembering. Several studies indicate that adolescents who do not get enough sleep will have lower academic achievement and may begin to present mood instability or depressive moods, problems in interpersonal relationships and difficulty in making decisions (Gomes, 2008; Ferro e Pimentel, 2006; González-Pienda, 2003; Duarte, 2008). Also, when driving or practicing sports, they present a greater risk of accident (Antunes, 2009).

In the present study, most young people feel that they sleep well. Among those who reported having trouble sleeping, one third reported having personal problems, with anxiety identified as the cause for one third of the teenagers. In the study by Ansari and Stock (2010) about a fifth of the sample, revealed experiencing sometimes or often sleep disorders or insomnia.

The tiredness mentioned by one-fifth of the youngsters of this investigation was more felt by the boys than the girls. Some teenagers, more boys than girls, highlight excess study, and it is also the boys who refer concerns about school, together with illness and pain as most likely causes of sleeplessness. Relating subjective sleep quality with schoolwork performance, teens who reported good sleep quality show better academic performance overall and in all dimensions of scale, with significant differences, which confirms

Also according to the school year, there are differences in bedtime on weekdays, with the 9th graders going to bed slightly later compared to the 7th and 8th graders. The 9th graders are also who rise slightly later, but those who sleep more hours on average are attending the 7th grade. There is a common trend for teenagers going to bed later at the weekend and compensate the sleep period by rising later. The boys go to bed and rise slightly later, although they have a lower average time of sleep than girls, with significant differences for bedtime hours and total hours of sleep. As regards the grade adolescents attending the 7th year who go to bed and rise earlier and those in the 9th grade who go to bed and rise later. The biggest

sleepers are those attending the 8th year with an average of hours of sleep located at 10.48 hours. In support of our research are the results of the study by Matos et al. (2012) in which about one third of youngsters reports sleeping less than 8 hours during the week, and in the weekend more than half of the surveyed sleep more than 8 hours. When comparing gender results, it is observed that boys sleep less than 8 hours during the weekend while girls sleep more than 8 hours during the weekend. There were no statistically significant differences between the sexes for the hours of sleep during the week.

When comparing between school year, one can see that 6th year teens sleep more than 8 hours during the week and weekend. As for older students, more than half of sleep less than 8 hours during the week, and most sleep more than 8 hours during the weekend (Matos et al., 2012). Another study, also in Viseu with teenagers from 12 to 18 years has shown that on average the teens slept during the week for  $8:04 \pm 1:13$  hours and the prevalence of insufficient sleep ( $<8$  hours) was 29% (Amaral, Pereira, Martins, Serpa, & Sakellarides, 2013). Corroborating these results, Kelly and Sacker (2013) refer to a research with wide national representation, a prospective study of population-based cohort to see if the number of hours of sleep during childhood is related to cognitive performance markers. They concluded that young people with delays in bedtime hours and irregular sleep schedules were more likely to have unfavourable routines, as for example to skip breakfast, and tend to have associated lower academic results on cognitive tests, with a very significant influence on reading and math skills, with lower levels of performance. Associations between bedtime and inconsistent aspects of social, family and affective development of the youth affect the quality of health and development capability throughout the life cycle. The authors concluded also that families more prone to time requirements have a negative impact on the important routines for healthy development in young people.

The current study shows that school performance is affected by the duration of sleep during the week and that adolescents who sleep longer have better school performance. Correlated to these results, the study by Plank et al. (2008) which consisted in the "identification of chronotype and evaluation of high school students' attention level, with average age of 16 years (...). Half of the teenagers presented an intermediate chronotype, i.e. wide time flexibility to perform the daily tasks, with 17% -18% of youngsters as morning types (those that perform better in their daily activities by morning), while 30-37% were identified as evening types, performing better their duties in the afternoon or evening.

Studies conducted under the PESSOA Programme, involving more than 3,000 students and 60 teachers of the 2nd and 3rd cycle Schools of Oeiras (Portuguese municipality close to Lisbon), are in contradiction to our results as they report that sleeping less than eight hours seems to be reflected in a higher incidence of a sedentary lifestyle concomitant with better educational achievement, with the best ratings in Mathematics and Portuguese (FMH/UTL, 2012). In this line of analysis, the study carried out by Plank et al. (2008) proves that perception, attention and memory are related to development and learning, so young people attending school in periods inconsistent with their chronotype are possibly being compromised in their school performance, so knowledge of the chronotype may help to understand and guide individuals in adjusting the schedule of social activities, such as study, work and leisure, providing an opportunity to maximize performance and productivity in everyday activities, promoting improved quality life.

Concerning the behaviour observed before bedtime, as watching television, videos and DVD's, 7 out of 10 teenagers have this habit before falling asleep. The youngest, aged up to 14 years, watch more TV,

video and DVD's (7 in 10) than the 15 year-olds or more (5 in 10). The girls were who reported more studying before bed. A fifth of young 7th and 8th graders also refer it and the 9th graders are the ones studying less. The younger students ( $\leq 12$  years) are who study more (one in four) followed by 14 year-olds, with the older students ( $\geq 15$  years) doing the least studying before bed (1 in 10). More than half of the teenagers use the computer before sleeping with a higher prevalence in boys, in the 9th grade students and the older ones. The ones who play more sports are boys (12.8%), more frequently the 9th graders (10.5%) and 14 year-olds (10.5%). More than half of the girls listen to music before going to sleep, while only a third of the boys do it. The 8th graders and 13 years old are those who hear more music. The girls have more reading habits before sleep (1 in 5). The custom of having a hot drink before bed is manifested by one in three girls and one in six boys; these attend the 8th grade and are between 13 years and 14 years; the older ones report less this habit. Other activities that teenagers reported doing before bed are: drawing, writing, thinking, and skateboarding, sending text messages to friends, using the cell phone, watching movies on the computer or TV.

These results are corroborated by Duarte (2008) who demonstrated that the habit of watching TV/DVD/video and hang out with friends before bedtime are more common in young people aged over 19, while adolescents aged up to 16 have more habits of computer use, listening music, study, read, play sports and having a hot drink. In our study, we noticed significant differences for those who watch tv/video, study, do not use computer, and read before falling asleep, for the benefit of a better school performance. One in two girls in our study feel sleepy during classes, just like the boys. These results are not validated by Duarte (2008) to the extent that girls refer feeling more sleepy than boys. We found that most young 7th graders mentioned they did not feel sleepy during classes and, on the contrary, the 9th graders refer feeling sleepy during class

Differences according to age are situated in youngsters aged under 13 who reported not feeling sleepy and 14 year-olds and older teens who feel sleepy during class. These results are validated by Duarte (2008) as the older students are who present higher percentages for the category feeling sleepy several times a day. Another study conducted with a sample of 6919 adolescents revealed that the majority reported daytime sleepiness (64.7%), 53.3% of adolescents reported having felt sleepy during classes and 3.7% of the teens admitted to have fallen asleep (Amaral et al., 2013). This study revealed that those who do not feel sleepy during classes have higher average rates consistent with better school performance overall and in all dimensions of scale. This is confirmed by Kelly and Sacker (2013) who report studies in which results show that if the sleep amount and wake-sleep hours are changed, it interferes with the learning ability and has profound influences on the health and well-being throughout the life cycle.

Antunes (2009) states that if the biological clock is not at the right time, especially on the weekend, the teenager goes to school sleepy, accumulating sleep deprivation, with predictable results in learning. This idea is widely supported by several experts who agree that bedtime routine is important, upholding the hours and the activities carried out before bedtime. In our study there was a strong association between the use of TV/DVD/video before going to sleep and school performance in all dimensions (study environment, study planning, study method, reading skills and motivation to study), with the time spent doing this being not significant, at less than an hour. Thus, students who do not use these technologies, or use them for less than an hour have better school performance. The use of computer (games, internet, etc.) also reveals a

strong association, and those who do not use it have a better school performance in all dimensions except for the item related to the motivation to study. It should be highlighted the strong association between not using the computer or up to a maximum of 1 hour and the category of study planning, for better school performance, that is, those who do not use the computer plan their study better and achieve a better school performance.

The custom of listening to music before bedtime does not influence school performance but the habit of reading before bedtime, as a leisure time occupation, relates positively with better school performance significantly in all dimensions. The time occupied with games up to a maximum of one hour favours academic performance, except for the category reading skills. Results of the research carried out by Silva, EL (1995), on the impact of computer technology in Basic Education concluded, after a year of working with the Educational Computing program, that there seemed to be a significant improvement in school performance. On the other hand school dropouts decreased in schools where computer labs were installed, with an increase of registration requests in schools that joined the educational program with computers, even compared with private schools in the same locations where the research took place; teachers used the student support as an incentive to improve classroom work, inciting change in the students' attitude about keeping working hours, with the support of teachers in computer rooms. Antunes (2009) states that falling asleep with TV, console games, or major stresses before bedtime does not seem sensible; the bet on more regular activities of daily routines and end of day hygiene, teeth brushing, reading or tell a story, or if appropriate a prayer and goodnight kiss, is more coherent. The author also points out that there is no doubt of the existence of an association between good sleep hygiene and academic success. Ansari and Stock (2010) report that concerning health complaints, sleep disorder or insomnia, during the year preceding the survey, was negatively associated with three educational outcomes (health, health behaviours and school performance compared with its peers), presenting a very significant relationship with school performance.

## **5. Conclusions**

Sleep variables - subjective sleep quality, sleep duration and behaviour observed before bed - watch TV/video, study, computer use and reading - are determinants of adolescent school performance. Teens with good sleep quality, longer duration of sleep, those who watch tv/video, study, do not use computer and have reading habits for one hour before bedtime, show better academic performance.

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