

## The effect of sleep duration and quality on academical success of the elementary school children in Kayseri Turkey

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### Abstract

**Objective:** To assess the sleeping habits of primary school children and establish link between sleeping hours and academic achievement.

**Methods:** The cross-sectional study was conducted between April and June 2007, involving 2422 students of 6-8th grades in 12 primary schools located in Kayseri, Turkey. A questionnaire was presented to the students on the basis of probability sampling method. Academic performance was evaluated with regard to their school grades. SPSS 20 was used for statistical analysis.

**Results:** Of the total 2422 questionnaires distributed, 1966 (81.2%) were used for further evaluation. The mean sleeping period of the students during school days was  $8.86 \pm 1.10$  hours. The number of students having difficulty in waking up in the morning was 940 (47.8%), while 910 (46.3%) were confused when they woke up during the night, and the 886 (45.1%) had nightmares, while 609 (31.0%) were sleepy all day long. As the sleeping period increased, the probability of a mediocre achievement in science lessons increased by 1.33 fold and poor achievement increased by 1.57 fold. Besides, the probability of a mediocre achievement in mathematics lessons increased by 1.36 fold, and poor achievement increased by 1.67 fold. For Turkish language lessons, these increases were found to be 1.40 and 1.60 respectively. Correlation analysis showed a significant negative relationship between sleeping time and successful scores in Turkish ( $r = -0.65$ ,  $p < 0.025$ ) and science ( $r = -0.061$ ,  $p < 0.036$ ) lessons.

**Conclusion:** As the sleeping period increased, the academic achievement of the students was negatively affected. The academic success was low in children who felt sleepy throughout the day.

**Keywords:** Students, Academic achievement, Sleeping hours. (JPMA 63: 576; 2013)

### Introduction

Sleeping is indispensable and vital for human beings. It has a number of significant effects upon body renewal and growth, protection of metabolic energy and intellectual performance, neuronal maturation, learning skills and memory.

In literature, the rates of sleep disorders during childhood and adolescence have been reported to be 25-30%.<sup>1,2</sup> One study stated that children should sleep for 10 hours on an average during their school ages,<sup>3</sup> while another stated that adolescents should sleep for at least 8.5 hours.<sup>4</sup> Insufficient sleep leads to irritability and attention deficit in children, resulting in a poor academic performance. There are substantial proofs that sleep disorders in adolescents cause substantial impairments in learning skills, apprehension and memory.<sup>5</sup> Sleep is a fundamental component of physical growth and academic performance. Therefore, sleep is a very important factor in health promoting efforts in school children. A study found that 10% of the students have a sleep

span of less than 8 hours a day.<sup>6</sup>

Success is a measure or an indicator of how much an individual is benefiting from a class or an academic programme. Academic success, on the other hand, can be evaluated by grades or average scores a child achieves in the academic programme.<sup>7</sup>

There are many variables affecting the academic performance of a student. These variables, also called 'learning variables,' are mostly associated with physiological, psychological and social circumstances. These learning variables affect the students' 'learning state,' and therefore have a positive or negative effect upon academic achievement.<sup>8</sup>

Academic success is also substantially affected from many other 'non-intellectual' factors: achievement motive, anxiety, family qualities, socio-economic conditions, school conditions and insufficient education, overall environmental conditions, nutritional and health conditions can be listed among these factors.<sup>7</sup>

A good night's sleep is accepted to be an important factor in the daily performance of a child. It is suggested that children go to bed early in order to promote a better concentration

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and attention. A multi-centered study in Europe found that children aged 11-12 stayed in bed for 9-10 hours a day.<sup>9</sup>

Early school hours cause sleep deprivation and an urge for daytime sleep. In a study performed to identify the effect of sleeping spans on cognitive and motor performances, it was found that former was affected more than the latter.<sup>10</sup> This adverse effect was more prominent in partial sleep deprivation (less than 5 hours' sleep within 24 hours). It was observed that a night's sleep deprivation in children aged 10-14 caused impairment in verbal creativeness and in abstract thinking, and that less complex cognitive functions were not impaired.<sup>11</sup> Researchers reported that they found a significant relation between sleep and school performance.<sup>12</sup> In studies investigating the effect of sleep delay or postponement on academic performance in children, it was reported that the children with a low performance slept less, went to bed late and had more irregular periods of being asleep/awake.<sup>13</sup>

Literature review revealed no studies investigating the relationship between the academic achievements of 6th 7th, 8th grade students and their sleep span and sleeping habits. Therefore, in our opinion, this study will bring a new perspective to the topic and provide an important contribution.

The study was planned to identify the sleeping habits of 6th, 7th, 8th grade school children in the primary schools of Kayseri province of Turkey, and to determine the relationship between sleeping habits and academic achievements.

## Subjects and Methods

The cross-sectional study was conducted from April to June 2007, and comprised students of 6th, 7th, and 8th grades, studying in the primary schools of Kayseri province, Turkey.

In Kayseri City Centre, a total of 93108 students study in the three grades of 132 elementary schools. Of these students, 41899 (45%) are in Kocasinan while the remaining 51209 (55%) are in Melikgazi Central provinces. The study sample size was calculated as 2422, considering the literature frequency reference for sleeping disorders (25%), and  $\alpha=0,05$ , power  $(1-\beta) = 0,80$  and influence quantity  $(0,25*0,10= 0,025)$ . The number of the students reached was 1966 (81.2%). By weighing the number of students in Kayseri central provinces, 1090 students from Kocasinan Central Province and 1332 students from Melikgazi Central Province were intended to be included. Probability sampling method was employed in the study. Each grade (6.,7.,8.) to be included in the study was identified as a layer. The study comprised two phases. In the first phase, a total of 12 schools out of 132 schools (62 in Kocasinan and 70 in Melikgazi) were chosen by random sampling method after weighing them according to their socio-economical status. How many students would be

included from each school was determined by weighing the students in the selected schools by their numbers, grades and genders. In the second phase, these students were chosen by random sampling method from school records. The questionnaire consisted of 35 multiple-choice and open-ended questions, of which 27 had to be answered by the student, and 8 by one of the parents. Academic performance was evaluated according to the school reports. The inclusion criteria comprised students in grade 6,7 and 8 in the elementary schools in Kayseri City Centre.

The Ethics Committee of the Erciyes University Medical School approved the study protocol, and informed consent was obtained from each participant prior to the study.

Chi-square test was employed for the analysis of qualitative variables. For the evaluation of the students' feeling sleepy all day long and its relation to their success in science, mathematics and Turkish literature classes, single-direction variance analysis was used. In order to find out from which of the groups the difference originated, (post hoc) Turkey and/or Dunn's tests were applied. In evaluating the relationship between variables, the Pearson correlation coefficient was calculated. Academic performance was accepted as; grades 1-2: bad; 3: mediocre; 4-5: good. In measuring the effect of the sleeping span on the success in science, mathematics and Turkish classes (good, mediocre, bad) multinomial logistic regression analysis was applied. In evaluating the risk factors that might affect being sleepy all day long, univariate and multivariate logistic regression analysis was applied. Statistical analysis was calculated by SPSS 20. Values of  $p < 0.05$  were accepted as significant.

## Results

Of the 2422 questionnaires distributed, 1966 (81.2%) were returned duly filled and were included in the study. Of them, 811 (41.3%) were studying in the 6th grade, 706 (35.9%) in the 7th grade, and 449 (22.8%) in the 8th grade. Among the students, 697 (35.5 %) were 12 years old, 711 (36.2 %) were 13 years old, 558 (28.3%) were 14 years old (mean age was  $12.2\pm 0.5$ ,  $13.1\pm 0.5$ ,  $14.2\pm 0.5$  years respectively); and 1042 (53.0%) were female. The number of those who went to school in the mornings was 1714 (87.2%); and the number of the people in the household was  $>3$  for 1813 (92.2 %). The success levels for 958 (48.7%) of the students were high in Science, 883 (44.9%) in Maths, and 1066 (54.2 %) in Turkish classes.

Among the students, 1432 (72.8%) decided their time to go to bed by themselves, 1819 (92.6%) went to bed by themselves, and 401 (20.4%) stated that they preferred to go to bed earlier, and 442 (22.5%) much later. There was some kind of activities performed before going to bed (washing, tooth-brushing, playing with a toy, etc.) for 1406 (71.5 %) of the students.

Table-1: The evaluation of the students' success in science, mathematic and Turkish lessons.

| Variables                                 | Multinomial logistic regression analysis    |                   |
|---|---|-------------------|
|   | Academic achievement<br>Mediocre<br>OR (CI) | Bad<br>OR (CI)    |
| Mean sleeping span for science lessons    | 1.33 (1.22-1.45)*                           | 1.57 (1.31-1.87)* |
| Mean sleeping span for mathematics lesson | 1.36 (1.25-1.49)*                           | 1.67 (1.42-1.98)* |
| Mean sleeping span for turkish lesson     | 1.40 (1.29-1.53)*                           | 1.60 (1.27-2.02)* |

Reference category: Good, OR: Odds Ratio, CI: Confidence Interval, \*p<0.001.

The number of the children turning off the light as soon as they went to bed was 1124 (57.2%), and among those that did not turn off the light, 1009 (51.5%) read a book, and 107 (5.5%) played games. The number of students sleeping immediately after going to bed, with the lights

off, was 671 (34.1%), and 949 (48.3%) stayed awake for a while, and 346 (17.6%) stayed awake for a long time and had difficulty in falling asleep. The number of the students waking up in the morning on their own was 562 (28.6%), and 458 (23.3%) woke up with the help of an alarm clock, and 944 (48.1%) were woken up by someone else.

The number of students having difficulty in falling asleep due to leg and arm pain was 468 (23.9%); for 663 (33.7%) of them there was a need for moving legs and arms before falling asleep; 1534 (78.1%) woke up for toilet; 886 (45.1%) had nightmares; 657 (33.4%) were asleep talking; 93 (4.7%) were sleepwalking; 910 (46.3 %) were confused when waking up at night; 1103 (56.1 %) had restlessness during the sleep; 940 (47.8 %) had difficulty in waking up in the morning; 609 (31.0 %) were sleepy all day long and there was a need for sleep during the day.

Table-2: The evaluation of the risk factors that might affect the state of being sleepy all day long.

| Risk factors                             | Univariate logistic regression |             | Multivariate logistic regression (Backward Wald) |             |
|--|--------------------------------|-------------|--|-------------|
|  | OR*                            | 95% CI**    | OR*  | 95% CI**    |
| Gender (Male)                            | 1                              |             |  |             |
| Female                                   | 1.515                          | 1.248-1.839 | 1.44   | (1.17-1.77) |
| Waking up at night(No)                   | 1                              |             |  |             |
| Always                                   | 1.406                          | 1.092-1.810 | -  | -           |
| Sometimes                                | 2.504                          | 1.641-3.822 |  |             |
| Sleeping restless (Yes)                  | 1                              |             |  |             |
| No                                       | 1.32                           | 1.086-1.603 | -  | -           |
| Arm and leg movements during sleep (Yes) | 1                              |             |  |             |
| No                                       | 1.657                          | 1.358-2.020 | 1.49   | (1.21-1.84) |
| Mean sleeping span/hour                  | 0.891                          | 0.816-0.972 | -  | -           |
| Confused when waking up at night (Yes)   | 1                              |             |  |             |
| No                                       | 1.635                          | 1.349-1.982 | 1.31   | (1.07-1.61) |
| Sleepwalking (Yes)                       | 1                              |             |  |             |
| No                                       | 0.893                          | 0.574-1.390 | -  | -           |
| Teeth grinding (Yes)                     | 1                              |             |  |             |
| No                                       | 0.888                          | 0.645-1.221 | -  | -           |
| Sleeping well at night (No)              | 1                              |             |  |             |
| Yes always                               | 2.177                          | 1.767-2.680 | -  | -           |
| Sometimes                                | 2.04                           | 1.040-3.999 |  |             |
| Snoring (Yes)                            | 1                              |             |  |             |
| No                                       | 0.939                          | 0.700-1.259 | -  | -           |
| Waking rested in the morning (Yes)       | 1                              |             |  |             |
| No                                       | 3.009                          | 2.467-3.670 | -  | -           |
| Age                                      | 1.002                          | 0.903-1.112 | -  | -           |
| Scared of sleeping alone (Yes)           | 1                              |             |  |             |
| No                                       | 1.752                          | 1.327-2.312 | 1.41   | (1.05-1.91) |
| Nightmares (Yes)                         | 1                              |             |  |             |
| No                                       | 1.667                          | 1.375-2.021 | 1.37   | (1.12-1.69) |
| Difficulty in getting up (Yes)           | 1                              |             |  |             |
| No                                       | 2.622                          | 2.151-3.196 | 2.78   | (2.26-3.41) |
| Sleep talking (Yes)                      | 1                              |             |  |             |
| No                                       | 1.321                          | 1.082-1.612 | -  | -           |

\*OR: Odds Ratio, \*\*CI: Confidence Interval.

Table-3: The relationship between being sleepy all day long and academic achievement.

| Lesson           | Feeling sleepy all day long |             |                    | Statistical analysis |
|------------------|-----------------------------|-------------|--------------------|----------------------|
|                  | Yes<br>X ±SD                | No<br>X ±SD | Sometimes<br>X ±SD |                      |
| Science          | 3.20±1.18                   | 3.45±1.17   | 4.00±0.74          | F = 11.510, p<0.001  |
| Mathematics      | 3.14±1.22                   | 3.35±1.22   | 3.83±1.11          | F=7.123, p<0.001     |
| Turkish language | 3.43±1.11                   | 3.60±1.05   | 4.00±0.85          | F=6.413, p<0.002     |

The mean sleeping span of the students during week days was 8.86±1.10 hours; median 9 (5-12.45) hours. Male students slept for 8.92±1.08 hours, and female students 8.80±1.12 hours, and the difference was statistically significant ( $p < 0.05$ ). While the rate of students who slept for more than 10 hours a day was 406 (20.8%); those who slept for 9-10 hours was 372 (19%); 8-9 hours 751 (38.4%); and less than 8 hours 426 (21.8%). It was found that 201 (21.8%) of the male students and 205 (19.8%) of the female students slept for more than 10 hours.

On average, the time to go to bed for the students was 10pm and the time to wake up was 7am. As the students' mean sleeping span increased, their academic achievements in science ( $r = -0.179$ ,  $p < 0.001$ ), mathematics ( $r = -0.204$ ,  $p < 0.001$ ) and Turkish lessons ( $r = -0.202$ ,  $p < 0.001$ ) decreased.

As the sleeping span increased, the chances of a mediocre performance in science lesson increased by 1.33 fold, and a poor performance by 1.57 fold; mediocre performance in mathematics increased by 1.36 fold, and poor performance by 1.67 fold; and a mediocre performance in Turkish literature lessons increased by 1.40 fold, and a poor performance by 1.60 fold (Table-1).

According to the results of univariate ordinary logistic regression analysis, gender, waking up at night, restless sleep, arm-leg movements during sleep, being confused when waking up at night, not sleeping well at night, waking rested in the morning, being scared of sleeping alone, nightmares, difficulty in waking up in the morning, sleep-talking, and the mean sleep span were all found to be risk factors affecting the state of being sleepy all day long. When multivariate ordinary logistic regression analysis was applied to the results of the univariate ordinary logistic regression analysis, the most effective risk factors in being sleepy all day long were found to be; gender, arm-leg movements during sleep, being confused when waking up at night, difficulty in getting up in the morning, fear of sleeping alone, and nightmares (Table-2).

The analysis of the relationship between the state of being sleepy all day long in students and their academic achievements in science, mathematics and Turkish literature lessons showed a statistically significant difference between groups ( $p < 0.005$ ). This difference was due to the group of

students that were sleepy throughout the day (Table-3).

## Discussion

In our study the mean sleeping span was found to be 8.9 hours a day. In a study from Europe, the average period of staying in bed in children was reported to be 9 hours and 40 minutes.<sup>9</sup> The longest period of staying in bed, in children aged 9-14, was reported from Holland as 10 hours and 15 minutes.<sup>14</sup> The time a person needs to sleep changes depending on age, the newborn period is the time when sleep is needed the most, this decreases as age increases and in an elderly person, 4-5 hours sleep is usually enough. It is stated that school children need to sleep for 10 hours on an average.<sup>3</sup>

In previous studies, no relationship was found between the periods of staying in bed and concentration-attention deficit.<sup>15</sup> Also, academic performance was not found to be related to the time spent in bed.<sup>14</sup> However, the motivation for success and academic performance is related to sleep quality. A positive relationship between feeling rested and academic performance, and a negative relationship between getting up early and motivation for success have been reported.<sup>14-16</sup> Sleeping in general is evaluated by criteria such as; being able to sleep when going to bed, whether or not sleep is interrupted, and if it is, whether or not there is difficulty in falling asleep again, waking up feeling rested, and the sleeping span. In some studies, sleep quality was evaluated by morning tiredness and difficulty in getting up, and it was related to a poor academic performance.<sup>9,14,17</sup> In our study as well, there was a relationship between difficulty in waking up and academic performance.

In this study, as the sleeping span increased, a bad academic achievement in science, mathematics and Turkish literature lessons increased as well. As sleep provides a physical and emotional renewal in human beings, it has an effect on attention, concentration, productivity and spiritual wellbeing during the following day. From this point of view, the fact that the period of staying in bed does not have an effect on concentration and attention deficit can be explained by the fact that the period of staying in bed is not the only determining factor. According to these results, either sleep time or other factors apart from sleep itself affect the academic performance.

In a study performed with 11-12 year old Finn children, difficulty in falling asleep was reported at a rate of 33%.<sup>9</sup> In our study, it was 17.6%. Though, difficulty in falling asleep is significant, it should be evaluated along with other components of sleep. For example, even if the process of falling asleep is difficult, a restful sleep following this process will still enable the necessary spiritual and psychological renewal. In a study performed with Dutch children,<sup>14</sup> the rate of difficulty in getting up was found to be 43%, while in our

study it was 47.8%. Although no relationship was found between difficulty in getting up and academic performance, a decrease in school motivation was a common finding in such children. The relationship between sleep components and academic achievement, attention, concentration and other activities may not have a direct cause-and-effect relationship. In other words, as some psychological factors and stressful events may cause both sleep disorders and impairment in other fields such as concentration, attention and academic success, there might be some common etiological factors.

In our study, 609 (31.0%) of the students were found to be feeling sleepy all day long. This rate was 9% in Hungary, 21% in Finland, and 37% in Norway.<sup>9,18</sup> The predictors of daytime sleepiness were investigated in the studies. In these earlier studies, unhealthy lifestyle, smoking, alcohol use, little physical activity, drug abuse, sleep disorders such as sleepwalking, insomnia and snoring, gender, obesity, psychosocial problems, cultural factors have all been identified as important factors in daytime sleepiness. In our study, while waking up at night, restless sleep, arm-leg movements during sleep, being confused when waking up at night, not sleeping well at night, snoring, waking rested in the morning, being scared of sleeping alone, nightmares, sleep-talking, and the mean sleep span were not found related to daytime sleepiness, female gender, arm-leg movements during sleep, being confused when waking up at night, difficulty in getting up in the morning, fear of sleeping alone, and nightmares were found as the determining factors in daytime sleepiness. The academic achievement in children with day sleepiness was significantly lower compared to other students.

The current study is the most extensive study performed on this age group of students in Turkey. The findings of our study are limited to 6th, 7th and 8th grade school children in the primary schools of Kayseri. The determination of whether the sleeping conditions and environment is appropriate for the students' sleep hygiene depended on the statements by the family and it also depended on their assumingly subjective perceptions. This decreases the significance level of the study. This case is a limitation for the study. Another limitation of the study is the exclusion of some other parameters that may have an effect on success as the academic achievements were based only on school marks.

## Conclusion

There was a negative relation between the sleeping span of the students and their academic success. The latter

decreased as the former exceeded the average time. The excess of the sleeping span over the expected sleep time for this age group may present a pathology (hypersomnia), and this excessive sleep may result in failures in academic achievement and school functions by revealing itself as day-time sleepiness.

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