Chronobiological types, duration of sleeping and psycho-emotional condition of teenagers

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Sleep is a biological process that operates according to day and night cycles. This self-regulatory system is universal in all organisms, including humans and mammals. For this reason, the topic is widely analysed in the existing literature; however, no studies about chronobiological types of teenagers have been conducted in Lithuania before.

253 schoolchildren, 13 to 18 years of age, were surveyed in schools of Vilnius and Panevėžys, Lithuania. Responses were gathered during the period from September 2013 to February 2014.

The survey consists of four parts: demographical data, Morningness-Eveningness Questionnaire, PedsQL 4.0 survey of life quality, and HADS – Hospital Anxiety and Depression Survey.

In total, 115 (45.5%) boys and 138 (54.5%) girls participated in the survey. On average, boys sleep 7.10 (±1.27) hours, compared to 6.79 (±1.20) ($p = 0.05$) hours for girls. 94 (37.2%) survey participants feel sleepy and/or very sleepy at school. 133 (52.6%) respondents find it difficult/very difficult to wake up in the morning. 218 (86.2%) respondents use the computer before going to sleep: 96 (83.5%) boys and 122 (88.4%) girls. Based on a subjective evaluation, 187 (73.9%) respondents categorize themselves as the evening type and 66 (26.1%) as the morning type. 13 (5.1%) respondents exhibit symptoms of depression.

The majority of the respondents categorize themselves as evening/middle chronotypes. The average duration of sleep is 6.93 (±1.24) hours. 86.2% of the respondents use the computer before going to sleep. Half of the children may have difficulties waking up in the morning. One out of three children feels sleepy at school.

Keywords: teenagers, chronobiological types, life quality

INTRODUCTION

Sleep is a biological process that operates according to day and night cycles. This self-regulatory system is universal in all organisms, including humans and mammals, and depends on day and night shifts. Melatonin is one of the main hormones that regulate leisure-activity periods; its secretion is characterized by peaks in the middle of the night. Variation in the emission of the melatonin hormone is related to changes in daytime (1). Studies related to chronobiological types of sleep are becoming widely discussed in academic literature.

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It has been observed that changes in the circulation of the melatonin hormone from the pineal gland are largely related to the development of sexual maturity. The concentration of this hormone decreases sharply during the night – sleep time of teenagers (2). This could explain the potential disorders in sensitivity of the circadian sleep rhythm of teenagers (3). Hence, the risk of sleep disorders is higher for this particular age group.

It has been observed that the average physiological sleep duration of children and teenagers has shortened significantly during the last century (4). Several hypotheses are raised to explain such changes. One of them is related to the intensive use of information technologies before going to sleep. The beginning of sleep is disturbed due to non-natural lighting. This causes significant changes in the system of the melatonin hormone from the pineal gland (5). According to literature, one could expect 40% of all teenagers to have disorders in the rhythm of circadian sleep (6). Also, it is observed that parents have less influence in determining the beginning and the end of the teenagers' sleep, that is, children have more control over their own sleep time (7).

Lack of sleep is related to physical and psychological disorders. Short sleeping time correlates with poor learning results (8) and various addictions (9–10), an increasing risk of obesity and diabetes (11–13), and more frequent signs of anxiety and depression (14). Various academic papers confirm that a lack of sleep time might cause disorders of a given organism's immune system (15). Related literature once again supports the strong influence of correct sleeping habits. Proper duration of sleep and sleep quality may improve physical and psychological health of schoolchildren (16). However, society often underestimates the possible negative influence of sleeping disorders and people rarely address these issues in appropriate institutions.

There have not been any research papers that analyse chronobiological types of schoolchildren before. The results supplement academic literature on sleeping habits of schoolchildren in our population.

RESEARCH PURPOSE

The main aims of this research were to understand and analyse the chronobiological types (morning, middle, evening) of teenagers from 13 to 18 years of age, to obtain information about the average sleep duration, and to identify the causes of sleeping disorders, including their types. Finally, it was necessary to evaluate the changes in the physical and psychological condition of teenagers caused by the decrease in the duration of night sleep.

MATERIALS AND METHODS

The study was approved by the Bioethics Committee of Lithuania (Registry 2004 12–22 Nr. 69). Participation in the study was voluntary, and the subjects agreed to participate after receiving written and oral information. In accordance with the Declaration of Helsinki, a written informed consent had been obtained from the parents and an assent from the children.

Responses were gathered during autumn and winter time (from September 2013 to February 2014). 253 schoolchildren aged from 13 to 18 years were enrolled in this study. The children had been selected according to the following inclusion criteria: (1) they did not have chronic diseases, (2) they could be surveyed in schools of Vilnius and Panevėžys (Lithuania).

Exclusion criteria: (1) not all questions are answered (2) awareness of having a chronic disease (epilepsy, bronchial asthma, issues with kidney or rheumatism) and constant use of medication.

The children had been interviewed using the standardised questionnaires: Part 1 – Demographic data; Part 2 – Morningness-Eveningness Questionnaire, Self-Assessment Version (MEQ – SA); Part 3 – PedsQL 4.0 survey of life quality (to evaluate physical and psychological health); Part 4 – HADS (Hospital Anxiety and Depression Survey).

The Morningness-Eveningness Questionnaire, Self-Assessment Version (MEQ – SA). Morningness-Eveningness Questionnaire consists of 19 multiple choice questions. It requires evaluating one's sleep during the last few weeks. The survey was created by Horne and Östberg in 1976 (17). Different variations of this survey, which usually considers peak moment of a person being awake, are applied extensively in academic literature.

PedsQL 4.0 survey of life quality (to evaluate physical and psychological health). The author of this survey provided a formal approval to

use their methodological approach for research purposes. A Lithuanian version of this survey, which is used in this study, was provided upon signing the license of usage. The survey consists of 23 questions split into four separate components. The first part incorporates questions about health and activities, the second is about feelings, the third part deals with communication with peers, and the fourth part has questions about issues at school. The general index of life quality is calculated by adding scores from each component.

HADS – Hospital Anxiety and Depression Survey. This scale has been introduced by Zigmont and Snaith in 1983 (18) and was translated into Lithuanian in 1991. The HADS consists of 14 questions. Each of them includes four different options to choose from. This questionnaire was not used to diagnose anxiety and depression (19).

Statistical analysis was performed with SPSS 17.0 and Microsoft Excel packages. Differences were agreed to be statistically significant if *p*-value is lower than 0.05 (based on two-sided t-test, analysis of variance (ANOVA), Scheffe and Tukey methods). Results are presented as an expected (average) value together with plus/minus standard deviation (±SD).

RESULTS

In total, 115 (45.5%) boys and 138 (54.5%) girls were included in this study. The average age of the respondents was 16.21 (±1.43) years.

The duration of sleep is 6.93 (±1.24) hours. The lowest value is 4 hours of sleep, the highest is 10 hours. On average boys sleep 7.10 (±1.27) hours, compared to 6.79 (±1.20) ($p = 0.05$) hours for girls (Figure).

For 81 (32%) respondents the average duration of sleep during night is 4-6 hours, 151 (59.7%) respondents sleep 6–8 hours, and 21 (8.3%) sleep 8–10 hours. Table 1 presents the duration of sleep split by age groups (group 1 is 13–14 years, group 2 is 15–16 years, group 3 is 17–18 years).

94 (37.2%) survey participants feel sleepy and/ or very sleepy at school. Consumption of products with caffeine or other products with stimulating effect: 61 (24.11%) – never, 63 (24.90%) – hardly ever, 76 (30.04%) – sometimes, 39 (15.42%) – of-
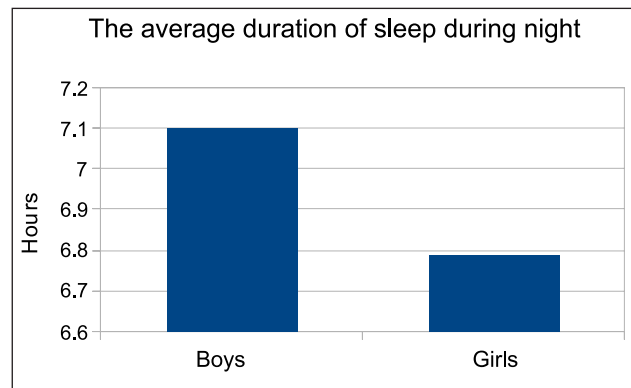

Figure. The average duration of sleep during night

ten, 14 (5.53%) – very often. 133 (52.6%) respondents find it difficult/very difficult to wake up in the morning. 70 (27.7%) survey participants ask family members to wake them up in the morning.

Respondents spend 3.1 (±1.77) hours at the computer every day on average. There is a statistically significant difference for the time spent at the computer for boys and girls (3.39 (±1.85) hours for boys and 2.86 hours (±1.66) ($p = 0.04$) for girls). 218 (86.2%) respondents use the computer before going to sleep: 96 (83.5%) boys and 122 (88.4%) girls.

According to the existing chronotypes, 19 (7.5%) survey participants are classified as the morning type, 179 (70.8%) as the middle type, and 55 (21.7%) as the evening type. Based on a subjective evaluation, 187 (73.9%) respondents attributed themselves to the evening type, 66 (26.1%) to the morning type.

Symptoms of anxiety were identified for 52 (20.6%) of survey participants: 12 (23.1%) boys and 40 (76.9%) girls. 13 (5.1%) respondents had symptoms of depression: 4 boys (30.8%) and 9 girls (69.2%).

The comparison of physical and psychological health of the children is given in Table 2.

Table 1. Sleep duration by age groups

Age groups	Sleep duration
13–14 years (N = 42)	7.32 hours
15–16 years (N = 84)	6.86 hours
17–18 years (N = 127)	6.84 hours

Table 2. Sleep duration, physical and psychological health of children

Sleep duration	Physical health of children	Psychological health of children
4–6 hours (N = 81) / (32%)	80.98	72.85
6–8 hours (N = 151) / (59.7%)	80.84	72.79
8–10 hours (N = 21) / (8.3%)	80.92	72.80

DISCUSSION

The results of this study confirm the hypothesis that sleep distortions occur often in our population of schoolchildren. The duration of sleep of survey participants is too short, i. e. recommendations in academic literature suggest sleeping two hours longer. Only 8.3% of study participants dedicate enough time for sleep. A similar study conducted in the USA from 1991 to 2012 analysed sleeping habits of schoolchildren and revealed that the duration of sleep decreased significantly over the last twenty years (20). An increase in the workload at school and extracurricular activities could be the reason for such a change, based on results of this research (21). This also relates to the technological revolution, which had an enormous effect on the pace of life. On average, boys sleep longer than girls, which has been shown to be statistically significant in this sample. It was observed in previous studies that girls tend to sleep less (20). On average, younger schoolchildren sleep longer than their older peers according to the split-by-age groups. The largest decrease in the duration of sleep is observed for the age groups of 13–14 years and 15–16 years. Therefore, parents and doctors should put more focus on these two age periods.

Short duration of sleep has an impact on the general feeling during the daytime. One out of every three children who participated in the survey felt sleepy at school. In his research conducted in 2009, Calamaro and his colleagues identified that 33% of all schoolchildren between 12 and 18 years of age felt sleepy at school (22). Hence, the results of the present study correspond to the findings in related academic literature. Although forbidden, consumption of caffeine is rather common among survey participants. This is one of the indicators of children's sleeping disorders.

The usage of the computer increases the risk of sleeping disorders. According to this particular research, children spend three hours at the computer on average. Also, boys tend to spend more time at the computer on average compared to girls. On the other hand, a slightly larger number of girls than boys use the computers before going to sleep. The population research (Hysing et al. 2015) was conducted in Norway, where authors analysed the usage of technologies among schoolchildren between 16 and 19 years of age. The negative relationship between the usage of technology, the sleeping duration, and the time of falling asleep was revealed in this study (23). It would be possible to conduct a similar research study into the usage of mobile phones in Lithuania. Empirical results of the study (Van den Bulck, 2007) performed in Belgium reveal that 62% of schoolchildren use their mobile phones even when the light in room is turned off (24). Academic literature urges parents to avoid having a television set in the children's room. Also, it would be appropriate to limit the time spent at the computer and on the mobile phone during the evening, especially before going to sleep.

The majority of chronobiological studies are usually conducted with adults. There is still a shortage of information about schoolchildren. Of course, the morning-type personalities (known as larks) prefer having intellectual and physical activities in the morning. The evening-type people (owls) feel better in the late afternoon or evening. It is observed that schoolchildren of the evening chronobiological type tend to go to sleep later, need more time to fall asleep and to wake up in the morning, and the duration of their sleep is shorter when compared to the schoolchildren of the middle or morning type (25). The results of this research suggest that the majority of survey participants belong to the middle chronobiological type. The chronobiological type does not only influence the sleeping pattern, but also affects the specific behaviour of schoolchildren (26). It is argued that personalities of the evening type have a greater risk of physical and/or psychological diseases (27). Various studies identify that personalities of the evening type are more often males with the risk of having some excessive usage of the internet (28).

Academic negligence, independence from parents, and interest in nightlife increase during the period of sexual development. However, lessons at school usually start relatively early in the morning (29). The results of the study by Wahlstrom advertise potential benefits of delaying school start time for schoolchildren. The study suggests that delaying the start time of lessons from 7:15 a. m. to 8:40 a. m. (that is, by 1 hour and 25 minutes) leads to increased concentration and participation during lessons, and lower sleepiness and fewer symptoms of depression (30). Despite the delay of the beginning of lessons having some positive effects, there are some disagreements within the system. The start of school time is often understood as being predetermined.

It is false to believe that the duration of sleep will not increase due to such changes. In Vilnius (Lithuania) it was proposed to delay the beginning of lessons for higher grade schoolchildren in 2014. The main argument was to reduce the flows of people during rush hours. Hence, it could be beneficial to carry out a similar survey and to determine whether or not there would be changes in sleep time and quality for schoolchildren in Vilnius. Also, this study could be repeated in other cities of Lithuania. After collecting the results, it would be possible to provide arguments for the rationale of shifting the start time of lessons in these cities.

Symptoms of anxiety and depression are more common in girls than in boys. Also, it was confirmed that the duration of sleep is shorter among girls as well. This may lead to the conclusion that a longer duration of sleep could decrease the occurrence of anxiety and depression.

No significant differences were observed when evaluating the duration of sleep and the condition of psychological health among schoolchildren. As the sample is relatively small, it might be beneficial to conduct a similar research on a larger scale.

CONCLUSIONS

The study demonstrates that the majority of teenagers classify themselves as the evening/middle chronotypes. The average duration of sleep is 6.93 (±1.24) hours for children of 13 to 18 years of age. 86.2% of these schoolchildren use the computer before going to sleep and it is difficult for half of the children to wake up in the morning. One out of three teenagers feels sleepy at school.

PRACTICAL VALUE OF THE STUDY

The beginning of lessons in schools could be delayed for the above reasons. It would be beneficial to conduct the same research in schools of Vilnius, where the beginning of lessons was shifted in 2014.

Improved cooperation between doctors, teachers, and parents with regard to circadian sleeping disorders of schoolchildren is recommended, as well as earlier diagnostics and treatment.

It is recommended to avoid bright lighting, watching television or working with the computer, consuming caffeine and other stimulating drinks before going to sleep.

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DISCLOSURE

The authors have no conflicts of interest to declare regarding the study presented in this paper and preparation of the manuscript. We confirm that we have read the journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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PAAUGLIŲ CHRONOBIOLOGINIAI TIPAI, MIEGO TRUKMĖ IR PSICHOEMOCINĖ BŪKLĖ

Santrauka

Miegas – biologinis procesas, kuris funkcionuoja pagal dienos ir nakties ciklą. Ši reguliacijos sistema universali tiek žmonių, tiek žinduolių organizmuose. Tema plačiai aptarta mokslinėje literatūroje, vis dėlto iki šiol Lietuvoje nebuvo atlikta paauglių chronobiologinio tipo tyrimų.

Vilniaus ir Panevėžio miestų mokyklose apklausti 13–18 metų 253 mokiniai. Apklausa atlikta 2013 m. rugsėjo–2014 m. vasario mėnesiais.

Anketą sudarė IV dalys: demografiniai duomenys, ryto–vakaro klausimynas (angl. Morningness-Eveningness Questionnaire, Self-Assessment Version (MEQ–SA)), PedsQL 4.0 gyvenimo kokybės klausimynas, Depresijos ir nerimo vertinimo klausimynas (angl. HADS – Hospital Anxiety and Depression Survey).

Dalyvavo 115 (45,5 %) berniukų ir 138 (54,5 %) mergaitės. Vidutinė miego trukmė – 6,93 val. (±1,24). Berniukų miego trukmė – 7,10 val. (±1,27), mergaičių – 6,79 val. (±1,20) ($p = 0,05$). Mokykloje jaučiasi mieguistai ir / ar labai mieguistai 94 mokiniai (37,2 %). Prabusti rytais sunku ir / ar labai sunku 133 (52,6 %) mokiniams. Prieš miegą kompiuteriu naudojasi 218 (86,2 %) apklaustųjų: 96 (83,5 %) berniukai ir 122 (88,4 %) mergaitės. Subjektyviai vertindami paaugliai save priskiria vakariniam tipui – 187 (73,9 %), rytiniam tipui – 66 (26,1 %). Depresijos simptomai nustatyti 13 (5,1 %) mokinių.

Išvados. Didesnė dalis apklaustųjų save priskiria vakariniam / tarpiniam chronotipui. Vidutinė nakties miego trukmė – 6,93 val. (±1,24). Prieš miegą kompiuteriu naudojasi 86,2 % paauglių. Ryte prabusti sunku kas antram mokiniui. Mokykloje mieguistas jaučiasi kas trečias vaikas.

Raktažodžiai: paaugliai, chronobiologiniai tipai, gyvenimo kokybė