

Chapter # 4

TIME ALLOTTED FOR NIGHTTIME SLEEP AND THE PRESENCE OF FATIGUE IN PUPILS FROM THREE HIGH SCHOOLS IN BOTOȘANI COUNTY

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ABSTRACT

Fatigue is a physiological phenomenon that occurs after sustained effort and disappears through active and passive rest. The studied group consists of 246 pupils from the 9th and 11th grades from three high schools in Botoșani county – a theoretical high school, a national college and sports high school. Most pupils say they sleep for 6-7 hours (37.80%) or 7-8 hours (33.73%). Fatigue is often present in 46.34% of cases. When they wake up in the morning, 44.30% of pupils feel tired. The majority of pupils from the 11th grade feel tired at the end of the week, while those from the 9th grade feel tired at the beginning of the week. During the day, fatigue appears mostly in the middle of the school day (36.17%) with insignificant differences between grades or schools, but significant when correlating night sleep with the time of day when fatigue appears ($p < 0.01$). Napping is rarely present in the majority of pupils (46.74%). Most of the surveyed pupils have headaches or eye pain when fatigue occurs. Fatigue is present especially in pupils who recognize a short time spent sleeping at night. Recovery through sleep during the day is rarely present.

Keywords: fatigue, insufficient sleep, napping, school.

1. INTRODUCTION

Fatigue is a physiological phenomenon that occurs when the body exceeds effort capacity. Special attention should be paid to this phenomenon in young people who are undergoing the processes of growth and development, but who must also adapt to school demands (Albu, Hodorcă, Onose, Negrea, & Crăcană, 2016).

Fatigue disappears after passive rest (sleep) or after active rest (recreational activities). Passive rest is represented by sleep during the day and especially during the night. Issues related to sleep duration, its variability, efficiency and falling asleep must be addressed. (Albu, Dima, Abdulan, & Carausu, 2018). Sleep duration (expressed in hours per day) is the time between going to bed and waking up. The National Sleep Foundation recommends 8-10 hours of sleep for people over 14 years old (Hirshkowitz et al., 2015). Sleep variability is assessed by the differences between the number of hours slept on weekdays and on weekends. Sleep efficiency is assessed by the actual time spent asleep. High efficiency occurs when most of the time is spent sleeping and not trying to fall asleep. In teenagers a special problem is the trend of a late bedtime. Falling asleep after 10:00 p.m. and waking up at 7:00 am does not ensure 8 hours of sleep per night (Kracht et al., 2019; Rasouli et al., 2021).

Unfortunately, recreational activities can become a problem if the time allotted for them is too long – for example time spent on the computer can reach several hours per day.

Obviously, in this context, active rest leads to a reduction in the number of hours of sleep and to the appearance of chronic fatigue - it can also lead to computer addiction which is dangerous (Baciu, 2020). There is currently much discussion about addictive phenomena, especially those related to overeating associated with reduced interest in physical activity and changes in sleep-related behavior. People who do not have food addiction rarely experience moments of sudden sleepiness during the day (3.8 ± 5.0 days in the last month) while those with severe eating problems frequently have such moments (6.4 ± 7.7 days in the last month) (Tan Ee Li, Pursey, Duncan, & Burrows, 2018).

Other situations are those where young people have eating problems manifested by insufficient intake. These imbalances are associated with slow growth, high stress, and impaired sleep. There are pupils who, due to an unbalanced diet, have problems with sleep quality (55.7% of students have such problems) (Rasouli et al., 2021).

Parents should pay attention to these issues and intervene when needed. A study carried out on a group of teenagers from Iasi shows a modest level of parents' interest for pupils' leisure activities (rarely - 38.00%) or even an absence (never - 20.36%) so it is unlikely that there is special concern towards sleep time (Albu et al., 2018).

Educational programs should also focus on understanding the importance of nighttime sleep and napping in maintaining good health and ensuring good school performance. Programs that teach meditation exercises have increased the time allocated to sleep in pupils from 6.92 hours to 8.08 hours, an important element because it can be used in the therapy of patients with various addictions (Soriano-Ayala, Amutio, Franco, & Mañas, 2020).

There are aspects that need to be carefully monitored even for young people who do not have addictions because as they get older, the sleep time decreases, which is concerning. This trend is clear in Ecuador's pupils. Children sleep on average 8.96 hours per day, young adolescents 7.96 hours and older adults 7.08 hours with statistically significant differences. Unfortunately, in 72.1% of situations the time allotted for sleep is insufficient (Villa-González, Huertas-Delgado, Chillón, Ramirez-Vélez, & Barranco-Ruiz, 2019).

The objectives of the study:

- the differentiated evaluation by grades and schools, of the time allotted for nighttime sleep;
- establishing the correlation between the time allocated to night sleep and the appearance of fatigue;
- assessment of the moment during the day and week when the fatigue manifests itself;
- identifying the clinical signs that appear in the fatigued pupils observed during the study;
- assessing the frequency of naps in surveyed pupils.

2. METHOD

The study was carried out in 2019 on a group of 246 pupils from three high schools in Botoșani County. There are 123 pupils in the 9th grade and 123 in the 11th grade. There are 69 pupils from a theoretical high school, 100 pupils from a national college and 77 pupils from sports high school.

These three types of schools were chosen in order to assess if there is any difference based on effort levels and academic programs.

The theoretical high school is located in a small town with 10,000 inhabitants. Theoretical high schools generally demand an average level of intellectual effort, with more mathematics, science and language classes (for a total of 14-17 hours per week) and low level of physical effort (1 hour of Physical Education per week).

The national college is a high school in Botoșani city. National colleges are theoretical high schools so they have the same academic programs, but there are higher expectations on school performance. Children who study at national colleges tend to, on average, get better marks than those who study in other types of schools and win more national and international school-related contests (in mathematics, physics, biology, foreign languages etc.). High academic performance is one of the prerequisites in order for a high school to obtain the title of “Colegiu Național” (National College) in Romania (Ministry of National Education Order no. 3732, May 20, 2013).

A sports high school demands below average level of intellectual effort (a total of 9-12 hours of mathematics, science and language classes) and high level of physical effort (a total of 10-12 hours of practical P.E. every week) (Ministry of Education, Research and Innovation Order no. 3410, March 16, 2009).

The 9th and 11th grades were chosen because there are clear differences between overall levels of school demands. The 9th grade is the start of high school, there are fewer classes per day and the subjects taught are not as difficult. By contrast, in the 11th grade there are more classes, the subjects are more difficult and there is generally more homework. This is also the period where many pupils start preparing for the end-of-high-school Baccalaureate exam.

A survey was conducted about the time allotted for nighttime sleep, the presence of fatigue, the time of day / week when it occurs and the presence of sleep during the day. The pupils were handed a questionnaire and verbal instructions were given on how to answer the questions. The questionnaire was anonymous and voluntary.

Nighttime sleep was estimated based on the question:

- “How many hours do you sleep on average per night?” – the possible answers were: “6-7 hours; 7-8 hours, 8-9 hours; over 9 hours”.

Fatigue was assessed with the help of four questions:

- “Do you feel tired?” – “often, rarely, never”;
- “How do you feel when you wake up in the morning?” – “rested, tired, very tired”;
- “During the week, when do you feel tired?” – “at the start, in the middle, at the end”;
- “During the day, when do you feel tired?” – “in the morning, during the day, in the evening”.

The presence of sleep during the day was also studied:

- “Do you sleep in the afternoon?” – “every day, often, rarely, never”.

The clinical signs that appear in conditions of fatigue were assessed: “Do you have a headache; Do your eyes hurt; Do you have insomnia; Do you feel anxious; Do you have a hard time falling asleep”. The results were interpreted insisting on the correlations between nighttime sleep and the presence of fatigue. They were processed using the Pearson’s chi-squared test.

3. RESULTS

High school students need 9 hours of sleep per day (Kracht et al., 2019; Hansen, Hanewinkel, & Galimov, 2022). Unfortunately, this result is present in only less than 30% of pupils (Table 1).

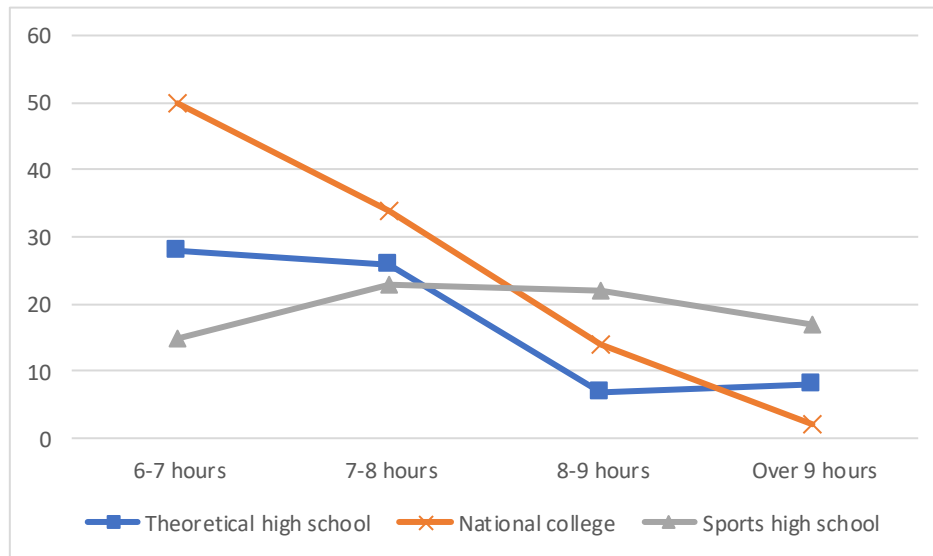
Table 1.
Time spent sleeping at night.

	6-7 hours	7-8 hours	8-9 hours	Over 9 hours	Total
9 th grade	52	38	23	10	123
11 th grade	41	45	20	17	123
Total	93	83	43	27	246
%	37.80	33.73	17.47	10.97	

The calculated differences are statistically insignificant ($p > 0.05$, $f = 3$, $\chi^2 = 3.912$) so this is a habit that exists in most pupils.

When looking at the different schools, there are interesting results because half of the students at the national college admit to having a reduced amount of time allocated to nighttime sleep. The calculated differences are statistically significant ($p < 0.001$, $f = 6$, $\chi^2 = 35.510$) (Figure 1).

Figure 1.
Time allotted for nighttime sleep among the three schools.



In this context, it is essential to assess the presence of fatigue. It is often recognized in 46.34% of cases. Out of the entire group we see that 6.50% of teenagers are never tired (Table 2).

Time allotted for nighttime sleep and the presence of fatigue in pupils from three high schools in Botoșani county

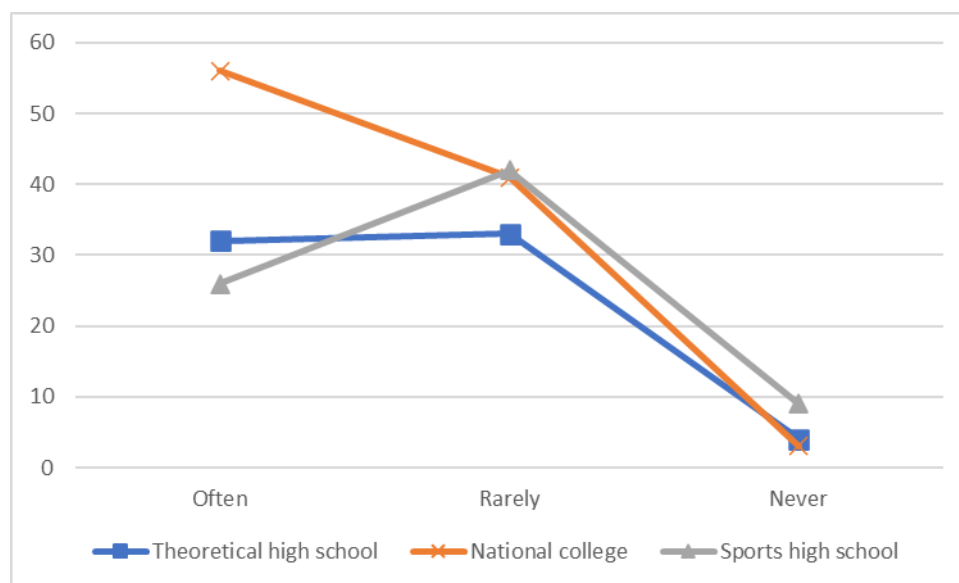
Table 2.
Frequency of fatigue.

	Often	Rarely	Never	Total
9 th grade	58	60	5	123
11 th grade	56	56	11	123
Total	114	116	16	246
%	46.34	47.15	6.50	
Correlation between nighttime sleep and fatigue				
6-7 hours	57	32	4	93
7-8 hours	32	44	7	83
8-9 hours	17	22	4	43
Over 9 hours	8	18	1	27

The calculated differences between the two grades are statistically insignificant ($p > 0.05$, $f = 2$, $\chi^2 = 2.420$). The correlation between the time allocated to night sleep and fatigue shows significant differences ($p < 0.05$, $f = 6$, $\chi^2 = 15.775$) which indicates the existence of a high percentage of students who sleep little and feel marked fatigue. There are also pupils who sleep more than 9 hours and who in most cases rarely feel tired.

In terms of schools, the situation is also worrying at the national college, where more than half of the students often feel tired. The differences obtained are statistically significant ($p < 0.05$, $f = 4$, $\chi^2 = 11.522$) (Figure 2).

Figure 2.
The presence of fatigue among the three schools.



After sufficient sleep, when waking up in the morning the pupil must feel well rested. Unfortunately, this response occurs only in 44.30% of situations (Table 3).

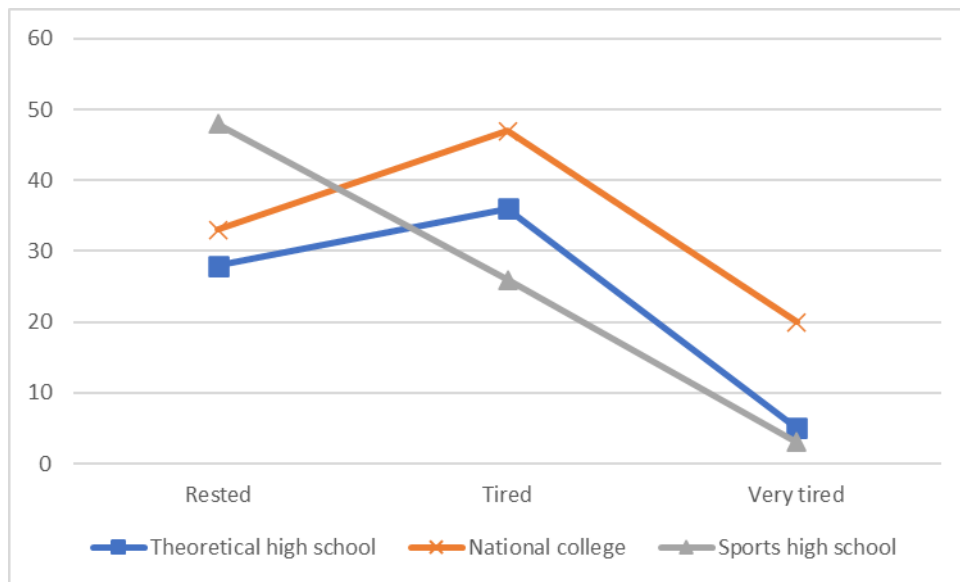
Table 3.
The presence of morning fatigue.

	Rested	Tired	Very tired	Total
9 th grade	41	66	16	123
11 th grade	68	43	12	123
Total	109	109	28	246
%	44.30	44.30	11.38	
Correlation between nighttime sleep and morning fatigue				
6-7 hours	24	53	16	93
7-8 hours	45	34	4	83
8-9 hours	21	16	6	43
Over 9 hours	19	6	2	27

The differences between grades are significant ($p < 0.01$, $f = 2$, $\chi^2 = 12.110$) and draw attention to the pupils in the ninth grade who often feel tired. The correlation between night sleep and morning fatigue shows statistically significant differences ($p < 0.01$, $f = 6$, $\chi^2 = 22.011$) which draws attention towards the pupils who sleep little and wake up tired and even very tired in the morning.

When waking up in the morning, many students from the national college feel very tired, an aspect that must be known and carefully evaluated. The differences calculated by schools are obviously statistically significant ($p < 0.001$, $f = 4$, $\chi^2 = 23.180$) (Figure 3).

Figure 3.
The presence of fatigue in the morning.



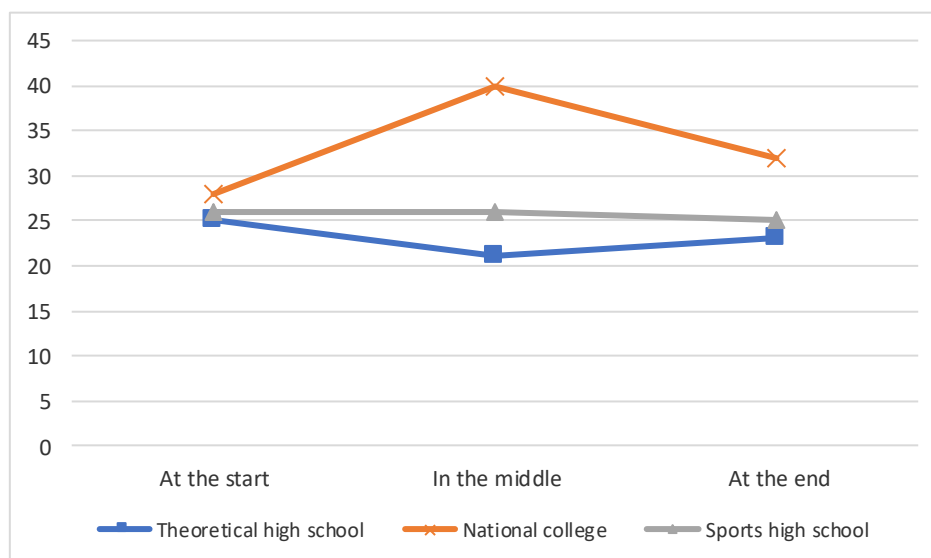
We should expect to see signs of fatigue at the end of the school week. In the studied group, signs of fatigue also appear at the beginning and middle of the week (Table 4).

Table 4.
The time of week when fatigue occurs.

	At the start	In the middle	At the end	Total
9th grade	48	43	32	123
11th grade	31	44	48	123
Total	79	87	80	246
%	32.11	35.36	32.52	
Correlation between nighttime sleep and fatigue during the time of the week				
6-7 hours	35	38	20	93
7-8 hours	24	28	31	83
8-9 hours	12	13	18	43
Over 9 hours	8	8	11	27

The differences between the two grades are statistically significant ($p < 0.05$, $f = 2$, $\chi^2 = 6.868$) and draw attention to students in the ninth grade who often feel tired. The correlation between sleep and the time of the week when fatigue appears shows statistically insignificant differences ($p > 0.05$, $f = 6$, $\chi^2 = 8.670$). When looking at schools, fatigue appears at the beginning, middle or end of the week without a specific pattern, so the calculated differences are statistically insignificant ($p > 0.05$, $f = 4$, $\chi^2 = 2.089$) (Figure 4).

Figure 4.
Fatigue during the week



Physiological fatigue normally occurs in the evening. In the surveyed students, fatigue is also manifested in the morning and during the day (Table 5).

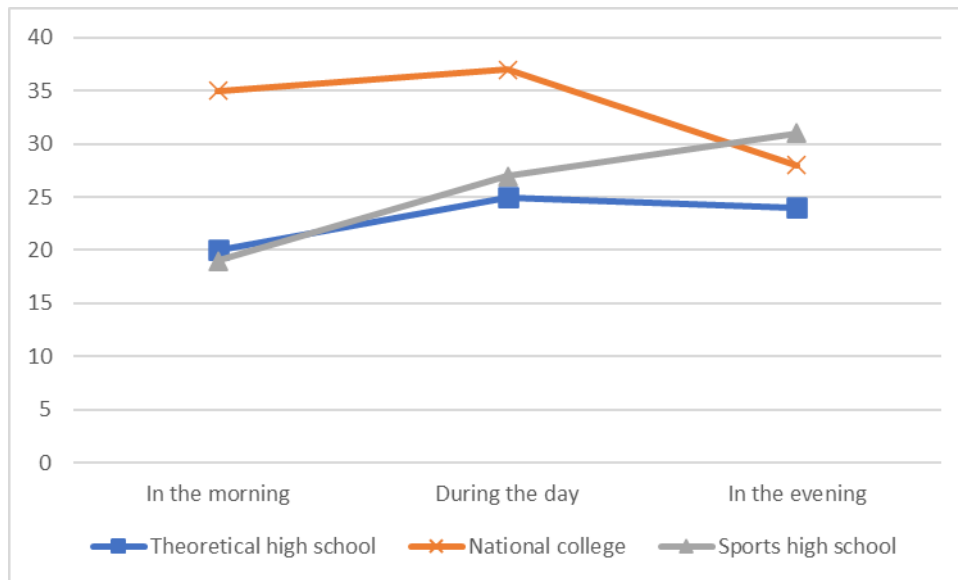
Table 5.
The time of day when fatigue occurs.

	In the morning	During the day	In the evening	Total
9 th grade	44	43	36	123
11 th grade	30	46	47	123
Total	74	89	83	246
%	30.08	36.17	33.73	
Correlation between nighttime sleep and fatigue during the time of day				
6-7 hours	33	41	19	93
7-8 hours	22	30	31	83
8-9 hours	15	11	17	43
Over 9 hours	4	7	16	27

Between the two grades the differences are insignificant ($p > 0.05$, $f = 2$, $\chi^2 = 4.204$) but the correlation between nighttime sleep and fatigue during the day shows statistically significant differences ($p < 0.01$, $f = 6$, $\chi^2 = 18.349$).

In all three schools, students feel tired in the morning, in the middle of the day or in the evening without a dominant situation, the calculated differences being statistically insignificant ($p > 0.05$, $f = 4$, $\chi^2 = 3.590$) (Figure 5).

Figure 5.
Fatigue during the day.



Theoretically, the problem of fatigue and insufficient nighttime sleep can be solved by sleeping during the day. This is present “often” or “every day” only in less than 20% of cases (Table 6).

Time allotted for nighttime sleep and the presence of fatigue in pupils from three high schools in Botoșani county

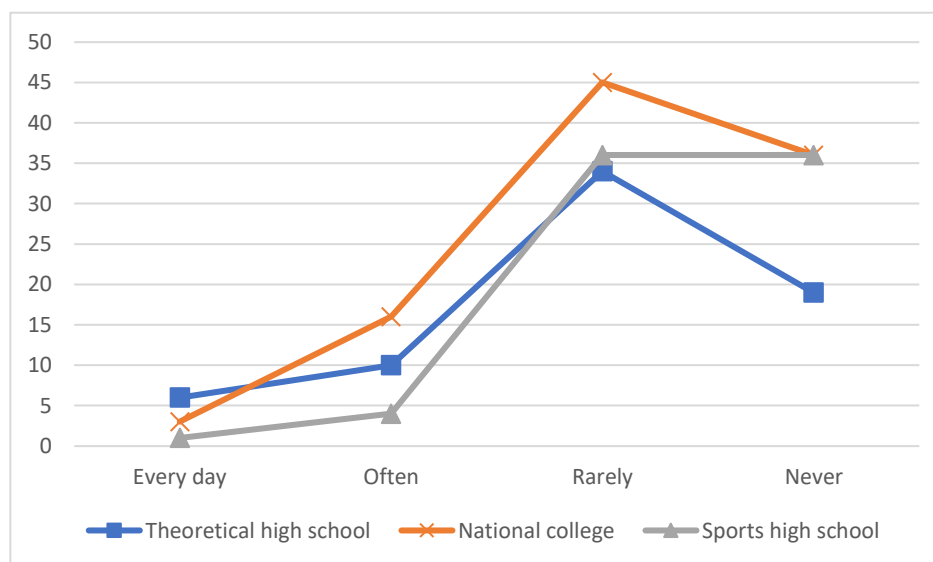
Table 6.
Napping (by grade).

	Every day	Often	Rarely	Never	Total
9 th grade	3	14	66	40	123
11 th grade	7	16	49	51	123
Total	10	30	115	91	246
%	4.06	12.19	46.74	36.99	
Correlation between nighttime sleep and daytime sleep					
6-7 hours	4	9	43	37	93
7-8 hours	5	15	34	29	83
8-9 hours	1	6	22	14	43
Over 9 hours	0	0	16	11	27

Between the two grades the calculated differences are insignificant ($p > 0.05$, $f = 2$, $\chi^2 = 5.572$). When looking at the correlation between nighttime sleep and daytime sleep we see statistically significant differences ($p > 0.05$, $f = 6$, $\chi^2 = 10.740$).

Sleeping during the day solves the problem of marked fatigue, but this is a modest concern for high school students with a sports program where most of the answers are rarely or never, so the calculated differences are statistically significant ($p < 0.05$, $f = 6$, $\chi^2 = 14.732$) (Figure 6).

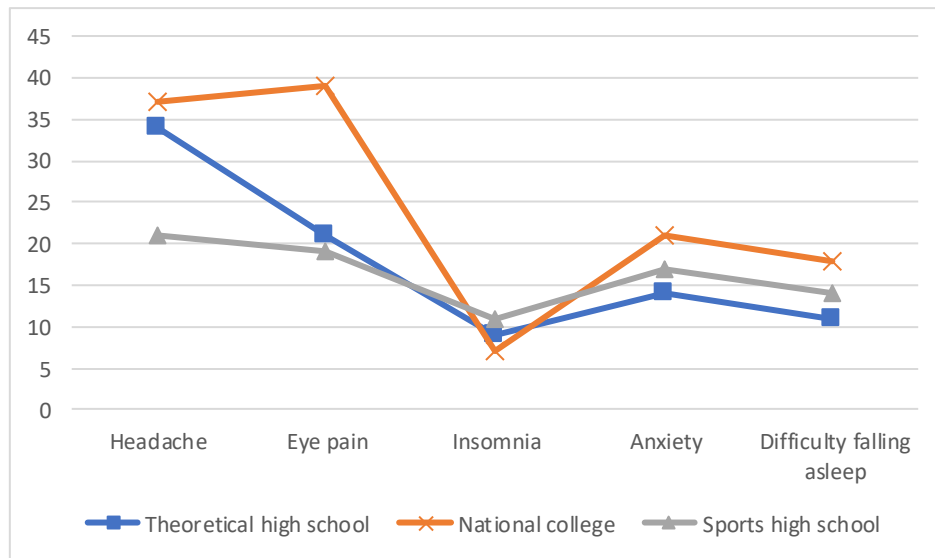
Figure 6.
Napping (by school).



From a medical point of view, special attention must be paid to the clinical signs that appear in conditions of major fatigue. There are students who mark two or three clinical signs, an aspect that becomes worrying. The dominant symptoms are headaches and eye

pain, probably generated by high intellectual effort associated with a high time spent in front of the computer. The differences among schools are insignificant except for headaches which are dominant in the high school students from the theoretical high school ($p < 0.05$, $f = 2$, $\chi^2 = 7.542$).

Figure 7.
Clinical signs of fatigue.



4. DISCUSSION

The study is oriented on two directions represented by the assessment of the results by grade and school. Assessing the differences between the two grades is important because the body's physical and mental effort capacity gradually increases with age.

Special attention must be paid to the different types of schools because in elite high schools the demands are much higher. Teaching staff are oriented towards stimulating the ability to innovate, in order to improve on one's own talents. There is a desire for self-improvement, for competitiveness that is frequently associated with intense demands and fatigue (Ma, Liang, Liu & Li, 2018).

Even if the curriculum is the same in all high schools, the demands are different due to the different teaching methods of the teaching staff and especially their varied requirements (Sousa, 2019).

Specialists recommend 9-11 hours of sleep per day for teenagers under 14 years old, and 8-10 hours of sleep a day for those over 14 years old or 9-12 hours for those aged 9-12 years and 8-10 hours for 13-18-year-olds (Kracht et al., 2019; Hansen et al., 2022). Unfortunately, in the studied group such an answer is present only in a quarter of cases. In a study carried out on adolescents in Iasi, similar results to those in the studied group appear, which indicates the existence of a habit pupils develop related to an insufficient number of hours slept per night (Albu et al., 2016).

In adolescents in the United States of America, insufficient sleep is present in only 25% of responses, being recognized by 24.98% of boys and 32.2% of girls (Jacobs, 2019).

Adolescents in urban parts of Mexico experience an average sleep time of 10 hours, a response that occurs in both sexes, in public and private schools and that is adapted to the age requirements (Galván et al., 2017)

Teens' unhealthy living habits often persist or worsen even after high school. In a group of young people aged 18-20 from Japan, there are cases where the number of hours of sleep per night is 4 or less (6.3% of responses) or 5 hours (22.4% of responses) with the dominant response being 6 hours in 45.0 % of cases, which is totally insufficient even for a young adult (Nakanishi et al., 2018). The situation is even more worrying in the case of students who are preparing for a medical career and who often recognize a sedentary lifestyle and a small number of hours of sleep per night. Future specialists will need to advise adolescents on a healthy lifestyle that they themselves do not practice (Saiyida, Afshan, Abdul, & Syeda, 2019). The different results obtained highlight the importance of the correct orientation of educational programs. Unfortunately, in Romania there is little interest directed towards learning and implementing a healthy lifestyle, which has repercussions on the health of young people and their future development.

Marked fatigue is present in 46.34% of cases, with 55.68% of pupils waking up tired and even very tired in the morning. The percentage is similar to that of the study conducted on adolescents in Iasi, which is a cause for concern (Albu et al., 2016). Physiological fatigue occurs in the evening after a day of intense activity or at the end of the week. In our group, fatigue occurs in the evening only in a third of cases and it appears at the end of the week with the same frequency. Similar results are present in the study carried out in Iasi, so this is an issue that should be in the attention of specialists.

Many problems arise because the lack of parental supervision leads adolescents in the studied group to an unhealthy lifestyle that can have serious repercussions on their health and their school results (Albu et al., 2018). Parents need to be actively involved in students' lives even if they are older and want to be independent. Parental involvement means, among other things, taking an interest in school performance and school activities, spending quality free time together, talking to teachers and the establishment of rules with clear consequences (Erdener & Knoepfel, 2018). The family environment is essential for the development of healthy living habits and this implies avoiding excessive alcohol consumption, smoking, unsafe sexual practices, drug abuse or engaging in antisocial behaviors. Unfortunately, in many families these elements are considered the obligation of the school and not the parents so they are neglected (Harris et al., 2017; Richardson, McCarty, Radovic, & Ballonoff Suleiman, 2017). It is necessary to develop an adequate relationship between the school and the family, that is, a true partnership. Unfortunately, the educational system is not prepared for such an endeavor, and parents often do not understand the recommendations of teachers related to the need to develop students' independence (Palmieri & Palma, 2017).

When fatigue arises, adolescents turn to various stimulants that briefly remove the feeling of fatigue, but which are not recommended. Adolescents in rural and urban schools in Rhode Island sleep an average of 8.8 hours per night. Only a third of young people (38%) feel comfortable during the day. There are small problems of staying awake during the day in 49% of young people or even bigger problems of doing so in 10% of cases, which they try to solve by drinking alcohol, smoking or even by taking drugs (Miller, Janssen, & Jackson, 2017). Adolescence is a difficult period during which young people can create a healthy way of living. However, this type of lifestyle is something that adolescents rarely want.

The clinical signs present in fatigue conditions are an alarm signal related to the possibility of evolution towards chronic fatigue which is associated with the onset of

serious health problems. It is necessary to carefully evaluate this problem and the health status of adolescents, especially those who recognize marked fatigue (Salam, Das, Lassi, & Bhutta, 2019).

5. CONCLUSION

The study is oriented on two directions represented by the evaluation by grade and school. The evaluation among the three types of school is essential because at elite high schools the demands are high, thusly insufficient sleep and the appearance of fatigue symptoms are common and worrying aspects. The time allotted for nighttime sleep is, in most cases, insufficient; therefore, it is not possible to remove the fatigue that appeared during the day and the previous week. Fatigue is felt intensely by half of the teens in the group. They wake up tired and even very tired in the morning. Physiological fatigue occurs in the evening and at the end of the work week, but such answers appear in only a third of cases. The correlation between hours slept and the presence of fatigue often indicates significant differences that underline the risk of progression towards chronic fatigue or overwork. The problem can be partially solved by sleeping during the day but young people are not interested in this way of relaxation. In many cases naps are rarely present or are missing entirely.

Such studies are essential for adolescents' health and for the formation of a healthy lifestyle that can be maintained throughout life. Future studies should focus on school programs and demands, especially in elite schools where the level of competition is higher.

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