

**6<sup>th</sup> icCSBs 2017**  
**The Annual International Conference on Cognitive - Social,  
and Behavioural Sciences**

**SLEEP QUALITY AND CHRONOTYPE OF PORTUGUESE  
SCHOOL-AGED CHILDREN**

A. M. Gomes (a)\*, S. Figueiredo (b), C. Rocha (c), E. Ferreira (d), B. Silva (e), A. Castro  
Caldas (f)

\*Corresponding author

- (a) Post-Doctoral Researcher and Assistant Professor at Universidade Autónoma de Lisboa, Rua Santa Marta, 56 - Palácio dos Condes do Redondo, 1169-023 Lisbon, Portugal, ana.m28.gomes@gmail.com  
(b) Post-Doctoral Researcher and Assistant Professor at Universidade Autónoma de Lisboa, Rua Santa Marta, 56 - Palácio dos Condes do Redondo, 1169-023 Lisbon, Portugal, sfigueiredo@ual.pt  
(c) Master in Psychology, Universidade Autónoma de Lisboa, Rua Santa Marta, 56 - Palácio dos Condes do Redondo, 1169-023, Lisbon, Portugal, carinerocha8@gmail.com  
(d) Master Degree Researcher, Universidade Autónoma de Lisboa, Rua Santa Marta, 56 - Palácio dos Condes do Redondo, 1169-023, Lisbon, Portugal, coelhoept@netcabo.pt  
(e) Master Degree Researcher, Universidade Autónoma de Lisboa, Rua Santa Marta, 56 - Palácio dos Condes do Redondo, 1169-023, Lisbon, Portugal, beatrizltsilva@gmail.com  
(f) Neurologist and Institute of Health Sciences Director of the Portuguese Catholic University, Palma de Cima, 1649-023 Lisbon, Portugal, acaastrocaldas@ics.lisboa.ucp.pt

***Abstract***

Is the perception of school-aged children and parents about the children's sleep quality and chronotype consistent with their real sleep quality and effective chronotype? The research questions for this study were 1) Do children's sleep perceptions and chronotype differ from real sleep quality and chronotype? 2) Are there differences in sleep quality between genders? 3) What will be the effective quality of sleep and chronotype? The purpose of the study was to analyse the perceptions of children and parents about the children's sleep quality and chronotype and compare them with effective sleep quality and chronotype, to study sleep quality and chronotype considering gender, and to analyse the perceptions of Portuguese parents about children's sleep in a migrant context. The research method was a cross-sectional study, quantitative methodology. The data from three questionnaires were analysed with regard to the three study aims: the Pittsburgh Sleep Quality Index (PSQI) (n=1109 children), the Children's Sleep Habits Questionnaire (CSHQ) (n=883 parents), and the Children's Chronotype Questionnaire (CCTQ) (n=58 parents, Portuguese emigrants in Luxembourg). The samples were collected from 8 Portuguese schools and 2 Luxembourg schools. The PSQI showed high sleep quality, which contradicts the results for CSHQ. Children from state schools (n=538) revealed higher diurnal dysfunction levels compared to the children from private schools (n=571). Females showed best sleep latency and duration. The CSHQ presented general negative sleep quality. The CCTQ demonstrated that parents' perceptions did not fit with the effective children's chronotype. The children's perception showed a well-balanced sleep quality but the results revealed a high incidence of sleep disturbance. There were no statistical differences for gender. Portuguese emigrant parents revealed low awareness of their children's chronotype and there was significant contrast between parents' perceptions and the real chronotype of children.

© 2017 Published by Future Academy [www.FutureAcademy.org.UK](http://www.FutureAcademy.org.UK)

**Keywords:** Children, sleep disturbance index (SDI), chronotype.



## 1. Introduction

Sleeping is a homeostatic need, essential in health terms and for proper organic functioning. Above all, it is a physiological need with implications on the psychological, emotional and behavioural domain, very visible in children, particularly school-aged children. However, sleeping is a phenomenon that is not impervious to cultural and social factors, so we find that some cultures value a good night sleep more than others, the necessary sleeping time being undervalued in certain cultural and social contexts (Buxton, Chang, Spilsbury, Bos, Emsellem, & Knutson, 2015).

Research in Europe and the United States shows that most parents value the importance of sleep very positively, yet 90% of children sleep less than what is recommended (Buxton et al., 2015). Therefore, we found it pertinent to analyse the quality of sleep and chronotype characteristics of European school-aged children.

This study is organized in two parts. In the first part, we examine the perception of sleep quality evaluated by the school-aged children themselves and compared to the sleep evaluation made by their parents in a native context, and considering different variables such as type of school (private or state) and gender. In the second part, the parents' perceptions of the children's chronotype are studied, in an emigrant context. Here we will analyse the comparison between the parents' perception and the children's sleep characteristics in terms of chronotype. In both studies, we analyse the sleep characteristics of school-aged children to understand the implications that sleep characteristics have on school performance and on their psychological balance. The high prevalence and negative consequences of daytime drowsiness have generated renewed interest in the sleep habits of school-aged children. Therefore, the two pieces of research conducted and presented here seek to be a relevant contribution to a better understanding of the characteristics of children's sleep and children's cognitive functioning.

### 1.1. The perceptions of children's sleep quality and effective sleep quality

The first part of this paper comprises a small part of a cross-sectional study on the sleep quality of Portuguese children, and examines the sleep quality perception that school-aged children have. The Pittsburgh Sleep Quality Index (PSQI) was administered to a total of 1109 Portuguese children aged 6 to 11 years. Subsequently, the parents' evaluation of the quality of their children's sleep was analysed. To this end, the Children's Sleep Questionnaire (CSHQ-PT) was used and a total of 883 parents answered. Our study also analysed different variables such as differences between state schools (n= 403) and private schools (n= 480) and between boys (n= 437) and girls (n= 446).

Our study is based on the concept of sleep quality. However, we have to differentiate it from sleep hygiene, since the latter includes a variety of different practices and habits that are necessary in order to have good quality of nocturnal sleep and allow daytime alertness. Sleep quality and sleep duration are two different domains of sleep, although both overlap and differentiate themselves. Sleep quality refers to the subjective indexes of how sleep is experienced, including the feeling of satisfaction and feeling rested upon awakening. The quality of sleep influences more the possibility of daytime drowsiness, changes in the emotional and behavioural states and in the cognitive functions (Dewald, Meijer, Oort, Kerkhof, & Bogels, 2010).

The adequate sleep duration for healthy individuals and for those who do not suffer from any sleep disorder varies greatly in terms of the developmental cycle; for new-borns, the adequate sleep duration is between 14 and 17 hours, for small children it is between 12 and 15 hours, for pre-school age children it is between 10 and 13 hours and for school-age children it is between 9 and 11 hours. For adolescents, the adequate sleep duration ranges from 8 to 10 hours and this is considered appropriate; for adults and young adults it is between 7 and 9 hours and for older adults it is 7 to 8 hours (Hirshkowitz, Whiton, Steven, Alessi, Oliviero, DonCarlos, Hazen, Herman, & Katz, 2015). Thus, sufficient sleep duration requirements vary throughout the life span and from person to person. Individuals who usually sleep out of the normal pattern may be exhibiting signs or symptoms of serious health problems and this may compromise their well-being (Hirshkowitz et al. 2015).

Children generally have a better quality of sleep when there are domestic rules and regular sleep-wake routines. The adequate sleep quantity and quality will only exist if well-established sleep hygiene rules (no caffeine consumption and regular bedtime hours) are applied (Buxton et al., 2015). On the other hand, poor sleep quality is more likely to exist when parents and children assume the presence of electronic gadgets in the bedroom. Therefore, it is very important to concentrate efforts on reducing the invasion of technology in the children's bedroom (Brockmanna, Diaza, Damianic, Villarroeld, Núñezc, & Brunie, 2016).

Good sleep hygiene practices are associated with better sleep in various age groups. Some authors recommend that children of all ages should go to bed before 9:00 pm, have an established bedtime routine, including reading, sleep in rooms without televisions and abstain from caffeine intake (Mindella, Meltzerb, Carskadonc, & Chervind, 2009).

In the research conducted by Silva, Barbosa, Silva and Neto (2014), the Children's Sleep Habits Questionnaire (CSHQ-PT) was adapted and validated for Portuguese culture, and a broad characterization of sleep habits in children aged 2 to 10 years was made. The results show that during the week children go to bed on average at 9:44 pm. The total daily sleep time decreases with age, and on weekends children sleep an extra hour. The need to fall asleep or sleep with the parents decreases with age. The parents' sleep quality assessment indicates that children have a prevalence of sleep problems of 10.4%, with no significant differences between age groups, parental educational subgroups, nor between mid-high and low population density (Silva, Barbosa, Silva, & Neto, 2014). The sleep problems identified by these authors refer to insufficient sleep duration, resistance to going to bed, difficulty in falling asleep alone, frequent nocturnal awakenings, and occurrence of parasomnias. The Sleep Disturbance Index (SDI) was higher in children from families with lower educational levels. This study also revealed the relationship between school performance and sleep problems. The existence of a high incidence of daytime drowsiness and sleep deprivation is also prominent in these children (Silva, Barbosa, Silva, & Neto, 2014).

The research carried out by Arriaga, Brito, Gaspar and Luz (2015) with the Children's Sleep Habits Questionnaire (CSHQ-PT) showed results with a SDI mean well above the cut-off point and the average of other studies that also used the CSHQ. It is noteworthy that both boys and girls presented a SDI above 44, with a higher mean value in females. This study also reports that there is a disparity between the effective sleep quality in children and the perception of the sleep quality that parents have of

their children. These authors conclude that the studied population has a high incidence of sleep disorders. In the evaluation of the different items there are also age-related differences, showing that the disorders vary according to the stages of development (Arriaga, Brito, Gaspar, & Luz, 2015). However, more robust research is needed to better understand the causal contributions of healthy sleep practices to the onset and maintenance of children's sleep problems (Allena, Howletta, Coulomb, & Corkuma, 2016).

## **1.2. The perceptions of children's chronotype and effective cognitive preferences**

The second part of this paper presents an excerpt from other cross-sectional study with Portuguese emigrant population in schools in Luxembourg with the aim of first evaluating, using one of the chronotype scales of the Children's Chronotype Questionnaire (CCTQ), the perception that Portuguese parents (residing in Luxembourg) have as to the chronotype of their children; second, it compares the perceived perception with the real chronotype of children descending from Portuguese families and inserted in school contexts with differentiated schedules. Regarding the concept of chronotype, in the areas of Psychology and Chronobiology, there is some disagreement about its designation because of the near terminology - diurnal type.

However, in our study we use the term chronotype and first we define it. Chronotype refers to the preference of individuals regarding certain periods of the day to perform specific activities, and this preference is biologically determined and not related to social impositions or conveniences. Thus, during the day it is common to note a fluctuation of cognitive performance, which influences the performance and mood of individuals (Rocha, 2017; Schmidt, Collette, Cajochen, & Peigneux, 2007; Yoon, May & Hasher, 2000). According to how we biologically react to the organization of time, we cannot separate it from health, either biologically or psychologically, so we find time in the development and maturity of biological functions, in their internal and external expression. Understanding these aspects that are present in the occurrences lived during the 24 hours of the day is essential to be able to analyse each individual and identify his/her chronotype examined through the circadian rhythm (Rocha, 2017).

Each circadian rhythm has a profile that is genetically shaped and there are some genes responsible for the different sleep-wake rhythms, so there are people who sleep more and others who sleep less, some who prefer to go to sleep later while others prefer to go to sleep early, differentiating preferences from sleeping and waking hours (Almeida, 2013; Randler, 2009; Menna-Barreto, 2003). The term "circadian rhythmicity" differs among individuals, and it is a personality trait that shows interdependent biological correlations and appears to correlate with various types of performance. Individual differences in circadian rhythms, commonly referred to as morningness and eveningness types, indicate preferences associated with morning or night activities. The literature identifies three chronographic types or chronotype: morning, intermediate or evening (Adan, Archer, Hidalgo et al., 2012). Morning individuals prefer to go to bed and get up early, peaking before noon, and evening people, in turn, prefer to go to bed and wake up later, and perform better at the end of the day (Hines, Feng, Emmett et al., 2013; Adan et al., 2012). Since the chronotype differs in sleep-wake patterns, we consider that it is extremely important to verify the perception of parents and schools about the children's chronotype to understand academic underachievement at specific times of the school day. It is also important that this study contributes to

scientific research on the performance rhythms and their educational and psychological implications, specifically in relation to school-aged populations of Portuguese ancestry or native Portuguese.

The results will be discussed based on the recent literature and reflect on the educational and psychological implications: are the school schedules adjusted according to the migrant school minorities, in this case the Portuguese minorities, in foreign schools? Moreover, the data points to a worrying lack of knowledge about the children's diurnal preferences and the inferred cognitive implications, which shows a direct correlation with aspects of their academic performance and their adaptation to the social habits of the countries where they live.

## **2. Problem Statement**

Is the perception of school-aged children and parents about the children's sleep quality and chronotype consistent with their real sleep quality and effective chronotype?

- The perception that school-aged children have of the quality of their sleep is expected to be different from effective quality of their sleep.
- The actual chronotype of the children is expected to correspond to the chronotype assigned by the parents.

## **3. Research Questions**

This study has two parts: (1) first, it examines the perceptions of parents and children about the quality of sleep in a sample of Portuguese school-aged children; (2) secondly, it analyses the perception and identification of chronotype in a sample of emigrated and/or descending from emigrated Portuguese parents (Luxembourg) Portuguese children. From these two study components, three questions were raised:

- Do children's sleep perceptions and chronotype differ from real sleep quality and chronotype?
- Are there differences in sleep quality between genders and between state and private schools?
- What will be the effective quality of sleep and chronotype?

## **4. Purpose of the Study**

This study has the following objectives:

- To examine the children's and parents' perceptions about the children's sleep quality and chronotype and compare them with effective sleep quality and chronotype.
- To study the sleep quality and the chronotype in terms of gender.
- To analyse the perceptions of Portuguese parents on the sleep of children and on their daily activities' preferences, in a migrant context.

## 5. Research Methods

### 5.1. Participants

Participants are divided into two major groups; one of these groups consists of the children who responded to the Pittsburgh Sleep Quality Index (PSQI) (n= 1109), divided into 546 girls and 563 boys from state schools (n=538) and private schools (n=571). The other group comprises the parents who responded to the Children's Sleep Habits Questionnaire (CSHQ-PT), totalling 883, given that not all parents of the 1109 children returned the questionnaires. These 883 children assessed by their parents for sleep quality are divided into 437 (49.5%) boys and 446 girls (50.5%). The mean age is 8 years  $\pm$  1.241 and 99.5% of the participants are between 6 and 10 years of age. Table 1 shows the descriptive statistics for children: gender, school and year of schooling.

**Table 01.** Characterization of the sample: gender, school and year of schooling

<b>Gender</b>		
Girls	446	50.5%
Boys	437	49.5%
<b>School</b>		
State	403	45.6%
Private	480	54.4%
<b>Year of Schooling</b>		
Year 1	214	24.2%
Year 2	200	22.7%
Year 3	219	24.8%
Year 4	250	28.3%

### 5.2. Instrument and Procedures

The Pittsburgh Sleep Quality Index (PSQI) developed by Buysse, Reynolds, Monk, Berman and Kupfer (1989) and adapted in the Portuguese version by Ramalho (2008) was used to study the quality of sleep evaluated by the children. Its translation into Portuguese was done by Bertolazi also in 2008. It is considered to be stable to evaluate sleep quality, since it is accessible and identifies whether the studied individuals sleep well or poorly (Córdoba & Schmalbach, 2005). Structurally, it consists of 19 questions, with 15 multiple choice items that refer to the frequency of sleep disturbances and subjective quality of sleep, and 4 items that refer to bedtime and wake up hours and sleep latency and duration. It is considered an easy-to-use reliable instrument for clinical research in different age groups (between 6 and 90 years of age), including clinical and non-clinical populations (Duarte, 2007).

The instrument used to study the children's effective sleep quality was the Children's Sleep Habits Questionnaire (CSHQ-PT), which was filled by their parents. A total of 883 parents returned the questionnaires. Silva, Barbosa, Silva and Neto (2014) adapted and validated the Children's Sleep Habits Questionnaire (CSHQ) for the Portuguese population, making a broad characterization of sleep habits in children from 2 to 10 years of age. The CSHQ-PT internal consistency (Cronbach's  $\alpha$ ) was 0.78 for the total scale and ranged from 0.44 to 0.74 for subscales. The reliability test-retest for subscales (Pearson's

correlations, n= 58) ranged from 0.59 to 0.85. The CSHQ-PT showed psychometric properties that are comparable to the versions of other countries and suitable for the screening of sleep disorders in children (Silva, Barbosa, Silva, & Neto, 2014).

The processing and analysis of the statistical data was made using the SPSS programme, version 23. Descriptive statistics with mean, standard deviation, asymmetry and kurtosis of the 7 components and overall PSQI in the global sample were made. For the comparison between the two groups, the non-parametric Mann-Whitney U test was performed. The Kruskal-Wallis non-parametric test was used to compare more groups; 3 degrees of freedom. In order to analyse the Children's Sleep Habits Questionnaire (CSHQ-PT), descriptive statistics were also used, with mean, standard deviation, asymmetry and kurtosis of the 33 CSHQ-PT items in the global sample. To compare the two groups, the non-parametric Mann-Whitney U test was used. The Kruskal-Wallis non-parametric H test was used again to compare more groups; 3 degrees of freedom. However, it should be noted that in this paper we only present a small part of the data analysis conducted.

### 5.3. Participants

Three groups of participants: Portuguese, Luxembourgish and "mixed". The group of Portuguese whose parents (mother and father) were born in Portugal, the dual nationality group whose parents are Portuguese and were born in Luxembourg and, finally, the group of Luxembourgers whose parents are Luxembourgers and born in Luxembourg. For this specific study only the first two groups were considered. Regarding the place of birth of the mothers, 71 (41.7%) were born in Luxembourg, 55 (32.3%) were born in Portugal and 44 (26%) were born in another country. As for fathers, 73 (43%) were born in Luxembourg, 58 (34%) in Portugal and 39 (23%) in another country. All children (3-12 years old) attend two schools in Northern Luxembourg. Table 2 shows the descriptive statistics of age and year of schooling for the children.

**Table 02.** Characterization of the sample: age and year of schooling

<b>Age (years)</b>		
	3-5	24 (14%)
	6	19 (11%)
	7	22 (13%)
	8	44 (25%)
	9	21 (12%)
	10	13 (8%)
	11-12	30 (17%)
<b>Total</b>		173
<b>Year of schooling*</b>		
	Pre-school (1st cycle)	34 (20%)
	Year 1 (2.1 cycle)	20 (12%)
	Year 2 (2.2 cycle)	51 (29%)
	Year 3 (3.1 cycle)	23 (13%)
	Year 4 (3.2 cycle)	16 (9%)
	Year 5 (4.1 cycle)	17 (10%)
<b>Total</b>	Year 6 (4.2 cycle)	12 (7%) 173

\* The education system used was the education system in Luxembourg. Compulsory schooling consists of 2 years of pre-school education, followed by 6 years of primary education, equivalent to the 1st and 2nd cycles of basic education in Portugal and 3 years of secondary education (years 7, 8 and 9). Basic education (primary education) consists of 4 cycles. The 1st cycle corresponds to preschool from 4 to 5 years of age; the 2nd cycle corresponds to years 1 and 2 from 6 to 7 years of age; the 3rd cycle corresponds to years 3 and 4 from 8 to 9 years of age; and finally, the 4th cycle, years 5 and 6, from 10 to 11 years of age (Rocha, 2017).

#### 5.4. Instrument and Procedures

The Children's Chronotype Questionnaire (CCTQ), previously published in 2009 by Werner, LeBourgeois, Geiger et al., was adapted to French and administrated to population of Luxembourg. It is an instrument intended to be answered by the parents of children aged between 4 and 11 years. It consists of 27 items, based on the works that developed and used the Munich Chronotype Questionnaire and the Morningness and Eveningness Scale for Children by Carskadon, Vieira and Acebo (1993). A Portuguese version of the CCTQ was also developed (Couto, 2011; Couto, Gomes, de Azevedo et al., 2013) for native population. The CCTQ measures sleep-wake parameters: bedtime, time when the individual feels sleepy, sleep latency, wake-up time, get up time, and the time when the individual is fully awake, on days with schedules (school activities, for example) and on non-schedule days, i.e. free days, such as holidays or weekends.

The CCTQ has three chronotype measures represented in three scales. For each measure, there is a given calculation. In this paper, we only focus on one of the three measures/scales of the adapted questionnaire:

- Chronotype scale (CT) based on the measure of Question 27 (parents' knowledge of their children's chronotype). Parents were instructed on the concept and variability of the chronotype by reading an informative text. They then defined the child as to the chronotype using the options in Question 27, i.e. "More early morning than night type". The score varies from 1 (undoubtedly morning) and 5 (undoubtedly the evening type).

As for the protocol, the adapted French version of the Questionnaire was used after the authorizations of the authors of the original version (Werner et al., 2009) and of the authors of the Portuguese version (Couto, Gomes, de Azevedo et al., 2013) were obtained. First, an initial adaptation to the French language was made, followed by the mandatory back translations. In a first phase, the back translations were made from Portuguese into French, and a French version from the German questionnaire (original). Then, a final version was made, which was tested in a pilot group (n=35) in Luxembourg during the first quarter of 2016. The retest was made with the same group (n=35) three weeks later in the same quarter. After linguistic corrections, the questionnaire was formalized in its French version. To operationalize the study, this protocol involved the selection of students in Luxembourg schools (through authorizations requested to the Ministère de l'Éducation nationale, de l'Enfance et de la Jeunesse of Luxembourg, and representatives of schools and school groups).

The SPSS programme, version 23, was used to process and analyse the data. The means between the groups were compared using the univariate analysis of variance (ANOVA) tests and the Kruskal-



Wallis non-parametric test in the analysis of cases with non-homogeneous samples regarding variance (verified with Levene's test). In the specific case of the Chronotype Scale (CT), the Spearman correlation coefficient was analysed following the procedure of the authors of the original version. We also used *t*-tests for independent samples in the cases comparing categorical variables means with two groups. However, in this paper we only report part of the data analysis conducted.

## 6. Findings

The summary of the results obtained for each part of the study is presented in the following sections, in order to answer the three main research questions.

### 6.1. Part I - Results

As regards the results of the Pittsburgh Sleep Quality Index (PSQI) ( $n=1109$ ), the mean value of the overall PSQI is 4.14, which is significantly below the cut-off point of 5.00,  $t(1108)=-10.03$ ,  $p<.001$  indicating that, on average, children in this sample have good sleep quality. Compared to boys, girls report significantly better sleep latency and sleep duration ( $p=.001$  and  $p<.001$ , respectively). There are no significant differences between girls and boys regarding overall PSQI. Among children in private schools and children in state schools, the latter have a significantly higher level of daytime dysfunction ( $p=.005$ ). In general terms, the sleep quality (overall PSQI) of state school children is significantly worse than that of private school children ( $p=.026$ ). The majority of the children (691) have a clear positive perception of the quality of their sleep (62.3%) compared to 418 children who manifested a poor perception about the quality of their sleep (37.7%).

The results of the Pittsburgh Sleep Quality Index (PSQI) indicate that children generally have a very positive perception of their sleep quality. However, these results do not compare with the Children's Sleep Habits Questionnaire (CSHQ-PT) relative data. This proves that the children in this sample have poor sleep quality.

For the Children's Sleep Habits Questionnaire (CSHQ-PT), only 883 complete responses were received, representing 77% of the total sample. In this instrument, the mean value of the Sleep Disturbance Index (SDI) is 46.12, which is significantly above the cut-off point of 44.00,  $t$ , indicating that these children generally have poor sleep quality. There are no significant differences between girls and boys regarding the SDI, with 46.9% of boys reporting sleep disturbances and 54.2% of girls also having sleep disturbances. However, boys wet the bed more often ( $p=.016$ ). There is a significant difference regarding the level of daytime drowsiness ( $p=.018$ ), girls wake up moodier ( $p=.011$ ), have more difficulty getting out of bed in the morning ( $p=.019$ ), and take longer to be well awake than boys ( $p=.004$ ). In state schools, 179 children (41%) did not have sleep disturbances and 224 (50%) had sleep disturbances. In private schools, 257 children do not have sleep disturbances (58.9%), but 223 children do (49.9%).

**Table 03.** Differences between State Schools and Private Schools regarding the 33 CSHQ items and the SDI

Item	Description	State		Private		Mann-Whitney U		
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>U</i>	<i>Z</i>	<i>p</i>
<b>Resistance in going to bed</b>		<b>8.27</b>	<b>2.75</b>	<b>7.82</b>	<b>2.41</b>	<b>87814.00</b>	<b>-2.460</b>	<b>.014**</b>
CSHQ_1R	Always goes to bed at the same time	1.24	0.45	1.21	0.44	93432.00	-1.229	.219
CSHQ_3R	Falls asleep alone in own bed	1.49	0.78	1.41	0.71	93270.50	-1.142	.254
CSHQ_4	Falls asleep in parents' or brothers' bed	1.36	0.65	1.25	0.54	89993.00	-2.445	.014*
CSHQ_5	Needs parents to fall asleep	1.45	0.74	1.43	0.71	96649.50	-0.023	.982
CSHQ_6	"Fights" at bedtime	1.24	0.57	1.16	0.46	92708.50	-1.761	.078
CSHQ_8	Afraid to sleep alone	1.50	0.71	1.36	0.63	86520.50	-3.296	.001
<b>Onset of sleep</b>								
CSHQ_2R	Takes up to 20 minutes to fall asleep	2.02	0.85	1.88	0.90	88199.50	-2.417	.016*
<b>Duration of sleep</b>		3.78	1.17	3.79	1.18	95925.50	-0.238	.812
CSHQ_9	Sleeps little	1.23	0.50	1.25	0.47	93594.00	-1.162	.245
CSHQ_10R	Sleeps what is necessary	1.19	0.47	1.25	0.49	91422.50	-2.049	.040*
CSHQ_11R	Sleeps the same number of hours	1.35	0.54	1.29	0.50	91911.00	-1.603	.109
<b>Anxiety associated with sleep<sup>1</sup></b>		<b>6.04</b>	<b>2.10</b>	<b>5.71</b>	<b>2.01</b>	<b>87359.50</b>	<b>-2.562</b>	<b>.010**</b>
CSHQ_7	Is afraid of sleeping in the dark	1.77	0.85	1.66	0.84	89539.00	-2.104	.035*
CSHQ_21	Finds it difficult to sleep outsider home	1.33	0.65	1.26	0.59	92671.50	-1.527	.127
<b>Night-time awakenings</b>		<b>3.76</b>	<b>1.11</b>	<b>3.66</b>	<b>1.15</b>	<b>89710.50</b>	<b>-2.155</b>	<b>.031**</b>
CSHQ_16	Goes to parents' or brothers' bed	1.30	0.57	1.24	0.51	93264.50	-1.263	.207
CSHQ_24	Wakes up once at night	1.37	0.56	1.31	0.56	90355.50	-2.121	.034*
CSHQ_25	Wakes up more than once at night	1.09	0.33	1.11	0.34	95204.50	-0.807	.420
<b>Parasomnias</b>		<b>8.76</b>	<b>1.82</b>	<b>8.42</b>	<b>1.65</b>	<b>85289.00</b>	<b>-3.125</b>	<b>.002**</b>
CSHQ_12	Wets the bed at night	1.11	0.38	1.07	0.28	93627.00	-1.798	.072
CSHQ_13	Talks in his/her sleep	1.48	0.63	1.34	0.53	87054.50	-3.055	.002*
CSHQ_14	Restless sleep, stirs too much	1.59	0.70	1.49	0.62	90492.00	-1.863	.062
CSHQ_15	Sleepwalking	1.04	0.21	1.03	0.20	96420.00	-0.266	.790
CSHQ_17	Grinds teeth while asleep	1.27	0.57	1.25	0.53	96571.50	-0.056	.956
CSHQ_22	Wakes up screaming, sweating, inconsolable	1.05	0.23	1.06	0.26	96583.00	-0.097	.922
CSHQ_23	Wakes up scared with nightmares	1.23	0.44	1.17	0.41	91618.50	-1.999	.046*

<b>Respiratory sleep disorder</b>		<b>3.48</b>	<b>0.90</b>	<b>3.38</b>	<b>0.90</b>	<b>88422.00</b>	<b>-2.852</b>	<b>.004**</b>
CSHQ_18	Snores out loud	1.30	0.54	1.22	0.48	89910.00	-2.505	.012*
CSHQ_19	Seems to stop breathing during sleep	1.06	0.25	1.05	0.25	95531.50	-0.874	.382
CSHQ_20	Snores or has difficulty breathing	1.12	0.37	1.11	0.36	95681.50	-0.527	.598
<b>Daytime drowsiness</b>		<b>13.59</b>	<b>3.19</b>	<b>13.72</b>	<b>3.01</b>	<b>94122.00</b>	<b>-0.692</b>	<b>.489</b>
CSHQ_26 R	In the morning, wakes up on his/her own	2.15	0.79	2.29	0.73	87755.00	-2.557	.011*
CSHQ_27	Wakes up grumpy	1.42	0.62	1.40	0.63	95034.00	-0.539	.590
CSHQ_28	Is awakened by parents or brothers/sisters	2.53	0.73	2.61	0.66	92042.00	-1.525	.127
CSHQ_29	Difficulty getting out of bed in the morning	1.81	0.76	1.76	0.73	93424.50	-0.941	.346
CSHQ_30	Takes a long time to be well awake	1.52	0.68	1.47	0.66	92714.00	-1.226	.220
CSHQ_31	Seems tired	1.40	0.63	1.32	0.54	91875.50	-1.596	.110
CSHQ_32	Falls asleep while watching TV	1.26	0.58	1.31	0.67	95981.50	-0.286	.775
CSHQ_33	Falls asleep in the car	1.49	0.74	1.57	0.83	94140.00	-0.813	.416
<b>Sleep Disturbance Index</b>		<b>46.76</b>	<b>8.00</b>	<b>45.59</b>	<b>7.56</b>	<b>87564.00</b>	<b>-2.429</b>	<b>.015</b>

Note.  $N = 883$ .  $M =$  mean;  $SD =$  standard deviation. Comparison between the 2 groups using the Mann-Whitney U (non-parametric) test. Cell with \* = Statistically significant difference at the item level. Cell with \*\* = Statistically significant difference at the level of dimension.

<sup>1</sup> The value for each group includes 4 items: 5, 7, 8, e 21.

There are significant differences between children in state schools and children in private schools regarding 5 out of 8 dimensions. The SDI for state school children is significantly higher than that of private school children ( $p = .015$ ). In contrast to private school children, state school children fall asleep more often in their parents'/brothers' bed ( $p = .014$ ), take longer to fall asleep ( $p = .016$ ), are more afraid of sleeping in the dark ( $p = .035$ ), wake up more often scared of nightmares ( $p = .046$ ), snore loudly more frequently ( $p = .012$ ), and wake up less often on their own in the morning ( $p = .011$ ).

## 6.2. Part II - Results

For the Chronotype Scale (scale 3 of the Questionnaire - question 27), parents indicate more prominently that their children are more of the 'early' morning type than 'nocturnal' (18 parents indicate that children are of the early morning type versus 9 that say they are nocturnal). The morning type is the most perceived by parents regarding the sleeping and wakefulness behaviours of the children. Through a series of univariate analyses, the perception of the parents in relation to the chronotype of the children showed significant differences regarding the children's real chronotype:  $F(7,479) = 5$ ,  $p = .000$ ,  $\eta^2 = .184$ . Later differences were found between the groups of parents pointing to the early-morning type and the remaining groups (i.e. 'more nocturnal than early-morning') and, for the real chronotype identified, the differences were between morning and evening types. It is more acceptable for parents to identify their children as being more of the morning type than of the evening type.

**Table 04.** Testing effects between subjects

Origin	Type III			Z	Sig.	Partial Eta squared	Observed Power
	Sum of Squares	Df	Mean Square				
Corrected Model	22,729	5	4,546	7,479	,000	,184	,999
Interception	488,892	1	488,892	804,331	,000	,829	1,000
Parents' perception of the chronotype	22,729	5	4,546	7,479	,000	,184	,999
Error	100,899	166	,608				
Total	844,000	172					
Corrected Total	123,628	171					

The sample of children presents, in an effective way, greater variability than expected with regard to the chronotype: 58 (31.5%) morning type, 48 (26.1%) intermediate, 66 (36%) evening type. Differently from the original study and the Portuguese validation study, the morningness measure (scale 3) was significantly associated ( $p < .05$ ) with age. The scale referred to here is part of a complete three-scale context, and the first scale – Morningness/Eveningness - showed good validity (Cronbach's alpha: .70) after using the adapted French version.

## 7. Conclusions

Regarding the first part of this study, the children of the global sample ( $n=1109$ ) show a positive perception of the quality of their sleep, but in reality, the opposite is true. School-aged children show a high incidence of sleep disturbance index (SDI). There are no differences between boys and girls with regard to the SDI. Even in terms of children's perception of the quality of their sleep in general terms, the sleep quality of state school children is significantly worse than that of private school children. And there are no significant differences between girls and boys in perceiving the quality of their sleep.

With regard to the 33 items of the Children's Sleep Habits Questionnaire (CSHQ-PT), the SDI is  $46.12 \pm 7.78$  and well above the cut-off point (44, t). These results are closer to those presented by Silva, Barbosa, Silva, & Neto (2014). The CSHQ-PT total score was  $47.0 \pm 7.2$ . Nor were there differences between boys and girls. As described by Silva, Barbosa, Silva, & Neto (2014), the total CSHQ-PT result in Portuguese children was higher than that described in other samples, such as North American, Chinese, Dutch, and German. Our findings in the Children's Sleep Habits Questionnaire (CSHQ-PT) are also closer to the findings by Arriaga, Brito, Gaspar & Luz (2015), who consider that on average Portuguese children have a sleep disturbance index of  $47.59 \pm 6.43$ , with the SDI being found in 74% of the sample, therefore, well above the cut-off point, with no difference according to gender or age.

In our study, daytime drowsiness is the dimension that has more items with differences between genders, with girls waking up moodier, having more difficulty getting out of bed in the morning and

taking longer to stay awake than boys ( $p=.011$ ;  $p=.019$ ;  $p=.004$ ). This is consistent with the results found by Arriaga et al. (2015). However, in our study, boys wet the bed more often at night than girls ( $p=.016$ ).

It is pertinent to point out the disparity between the identification of behaviours suggestive of sleep disturbances found in the CSHQ-PT and the acknowledgement of this fact by the children. The incidence of SDI in Portuguese schoolchildren is very worrying, which suggests that more research on the sleep issue in Portuguese children should be carried out.

We have identified some limitations in our work. The samples used are of convenience which, although heterogeneous and balanced, may not be fully representative of the population studied.

In childhood, it is essential to sleep properly, because sleep hours influence the physical and psychological health of children. It is known that sleep influences mood, behaviour, cognitive skills, academic performance, body weight maintenance dynamics, and it influences behavioural regulation, allowing more or less risk of accidents (Mindella, & Leec, 2015). Since the children in our study have a high Sleep Disturbance Index (SDI) and are not aware of this fact, it would be interesting to see to what extent these children have problems with mood behaviour regulation, aggressiveness, cognitive skills, and even academic achievement. This will be further analysed within this sample and published in future papers.

Sleep is governed by the circadian sleep-wake rhythm, which undergoes the natural synchronization resulting from the environmental dynamics of each individual in the 24 hours of the day. A determining factor for this synchronization is the oscillation between day-night (lightness-darkness), such as environmental factors like working hours, schooling, leisure, and family habits (Cardoso et al. 2009). Thus, it is crucial that parents of school-aged children become aware of the implications that the rhythms that they themselves place on their children as parents determine the quality of their children's sleep, and, as such, influence an immensity of children's psychological and behavioural variables that are fundamental to their well-being and quality of life.

Regarding the second part of the study, it was not confirmed as expected. In fact, the real chronotype of the children (seen in greater numbers in the morning type, but very close to the evening type) is different from the chronotype indicated by the parents, and there is no agreement (there is a tendency to overestimate the morning type), which can represent the parents' lack of knowledge about the children's need to sleep and adjust their rest and wakefulness activities. Children's sleep and wakefulness are part of a context - sleep and family (Meltzer & Montgomery-Downs, 2011). Likewise, this lack of knowledge can be shared with the school management authorities. Given this result and the lacklustre literature in this field, this specific aspect should be studied to understand how the parents' representations of their children's chronotype are organized. Without this knowledge, habits and schedules cannot be changed (Rocha, 2017).

The evidence on the variability of cut-off points according to populations should also be noted, which is probably due to their culture and geography, as well as to other factors, such as those found in recent studies about European populations (Caci, Deschaux, Adan et al., 2012; Jankowski, 2015). Regarding the chronotype identified by this questionnaire, studies in cultural and linguistically distinct populations (Ishihara, Doi & Chiyama, 2014) have corroborated the importance of the Chronotype

Questionnaire to detect differences in sleep behaviour according to the previous identification of chronotype in children. However, in this study's population, a very similar number of morning, intermediate and evening children with few significant differences were identified, which is not common according to the previous assumption that children are mainly morning type population (Díaz-Morales, León & Sorroche, 2006; Randler et al., 2009). This explains the other relationships of variables analysed during the study, such as the influence of chronotype associated with age and school results.

## 8. Implications

In general, this study is a contribution to the international sleep research in children populations, since it is a population that has only recently been studied and involving their families. It should also be noted that this is the first adapted French version of the questionnaire (here only one of the three scales that make up the questionnaire is presented) with good validity, which can be replicated in other populations in low altitude countries with different nationalities, but French speaking. Especially at a historical time when European populations and schools are receiving refugee children from countries with different time zones, household and school time habits. This is one of the pedagogical implications of the general study this paper is part of. It should also be noted that a population that is more evening oriented than expected may constitute a risk group with regard to personal and academic development. There is equally the fact that here there are more indicators of the parents' lack of knowledge of the chronotype and sleeping and waking habits of the entire family. Reviewing school schedules or placing groups with different diurnal types at appropriate schedules may be a successful educational policy in these contexts.

## Acknowledgments

This study was sponsored by the Centre for Psychology Research of the Department of Psychology, Universidade Autónoma de Lisboa, Portugal and by the Foundation for Science and Technology (FCT).

## References

- Adan, A., Archer, N., Hidalgo, P., Di Milia, L., Natale, V., & Randler, C. (2012). Circadian Typology: A Comprehensive Review. *Chronobiology International*, 29(9), 1153-1175. doi:10.3109/07420528.2012.719971.
- Allena, S. L., Howletta, M. D., Coulomb, J. A., & Corkum, P. V. (2016). ABCs of Sleeping: A review of the evidence behind pediatric sleep practice recommendations. *Sleep Medicine Reviews*, 29(10) 1-14
- Almeida, A. (2013). Relação entre Ritmo Circadiano, Turno e Rendimento Escolar de Alunos do Ensino Fundamental. *Revista de Neurociência*, 21 (2), 171-172. doi:10.4181/RNC.2013.21.805ed.2p.
- Arriaga, C., Brito, S., Gaspar, P., & Luz, A. (2015). Hábitos e Perturbações do Sono: Caracterização de uma Amostra Pediátrica na Comunidade. *Acta Paediatr*, 4, 367-75
- Bagleya, E., Kellyb, E. R., Buckhaltc, J. A., & El-Sheikhc, M. (2015). What keeps low-SES children from sleeping well: the role of presleep worries and sleep environment. *Sleep Medicine*, 16(4), 496-502.
- Becker, S., P., Isaacson, A., P., Mateu, S., & Belém, G., L., (2017). Mother-father agreement and one-year stability of children's sleep functioning. *Sleep Medicine*, 36, 29-34

- Bellesi, M., Bushey, D., Chini, M., Tononi, G., & Cirelli, C. (2016). Contribution of sleep to the repair of neuronal DNA double-strand breaks: evidence from flies and mice. *Nature Scientific Reports*, *6*, 36804.
- Brockmanna, P. E., Diaza, B., Damianic, F., Villarroeld, L., Núñezc, F., & Brunie, O. (2016). Impact of television on the quality of sleep in preschool children. *Sleep Medicine*, *20*(2), 140–144
- Buxton, O. M., Chang, A., Spilisbury, J. C., Bos, T., Helene Emsellem, H., & Knutson, K. L. (2015). Sleep in the modern family: protective family routines for child and adolescent sleep. *Sleep Health*, *1*(1), 15–27.
- Caci, H., Deschaux, O., Adan, A., & Natale, V. (2009). Comparing three morningness scales: age and gender effects, structure and cut-off criteria. *Sleep medicine*, *10*(2), 240-245.
- Cain, N. & Gradisa, M. (2010). Electronic media use and sleep in school-aged children and adolescents: A review. *Sleep Medicine*, *11*, 735-742
- Cardoso, H., Bueno,F., Mata, J., Alves, A., Jochims, I., Filho, I. & Hanna, M. (2009). Avaliação da qualidade do sono em estudantes de Medicina. *Revista Brasileira de Educação Médica*, *33* (3), 349 -355
- Carskadon, M. A., Vieira, C., & Acebo, C. (1993). Association between puberty and delayed phase preference. *Sleep*, *16*(3), 258-262.
- Couto, D. (2011). *Questionário de Cronótipo em crianças: Adaptação portuguesa do Children's Chronotype Questionnaire*. Dissertação de Mestrado. Universidade de Aveiro.
- Couto, D., Gomes, A., De Azevedo, P., Clemente, V., Bos, C., & Silva, C. (2013). Diurnal type in children: Preliminary results about the European Portuguese version of the CCTQ. *Sleep Medicine*, *14*, e139.
- Dewald, F. J., Meijer, M. A., Oort, J. O., Kerkhof, A., G. & Bogels, M.S. (2010). The influence of sleep quality, sleep duration and sleepiness on school performance in children and adolescents: A meta-analytic review. *Sleep Medicine Reviews*, *14*, 179–189
- Diaz-Morales, J. F., de León, M. C., & Sorroche, M. G. (2007). Validity of the morningness-eveningness scale for children among Spanish adolescents. *Chronobiology international*, *24* (3), 435-447.
- Grønli, J., Byrkjedal, I., K., Bjorvatne, B., Nødtvedtd, O., Hamreg, B. & Pallesend, S. (2016). Reading from an iPad or from a book in bed: the impact on human sleep. A randomized controlled crossover trial. *Sleep Medicine*, *21*(5) 86–92
- Hines, Z., Feng, D., Emmett, M. J., Everett, L. J., Loro, E., Briggs, E. R. & Lazar, M. (2013). The Nuclear Receptor Rev-erb $\alpha$  Controls Circadian Thermogenic Plasticity. *Nature*, *503*(7476), 410–413. <http://doi.org/10.1038/nature12642>.
- Hirshkowitz, M., Whiton, K., Steven, M. A., Alessi, C., Oliviero, B., Don Carlos, L., Hazen, N., Herman, J., Eliot S., & Katz, M., D. (2015). National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health*, *1*(1), 40–43.
- Ishihara, K., Doi, Y., & Uchiyama, M. (2014). The reliability and validity of the Japanese version of the Children's ChronoType Questionnaire (CCTQ) in preschool children. *Chronobiology international*, *31*(9), 947-953.
- Jankowski, K. S. (2015). Composite Scale of Morningness: Psychometric properties, validity with Munich ChronoType Questionnaire and age/sex differences in Poland. *European Psychiatry*, *30*(1), 166-171.
- Meltzer, J., & Montgomery-Downs, E. (2011). Sleep in the family. *Pediatric Clinics of North America*, *58*(3), 765-774.
- Menna-Barreto, L. (2003). O tempo na Biologia. In N. Marques and L. Menna-Barreto (Eds.), *Cronobiologia: princípios e aplicações* (pp. 26-29). São Paulo: Edusp.
- Mindella, A. J., Meltzerb, J. L., Carskadonc, A. M. & Chervind, D.R. (2009). Developmental aspects of sleep hygiene: Findings from the 2004 National Sleep Foundation Sleep in America Poll. *Sleep Medicine*, *10*(7), 771-779
- Mindella, J.A., & Leec, C. (2015). Sleep, mood, and development in infants. *Infant Behavior and Development*, *41*(11) 102–107

- O'Brien, L., Lucas, N., Guire, K., Felt, B., Chervin, R., Hoban, T. & Ruzicka, D. (2011), Aggressive behavior, bullying, snoring, and sleepiness in schoolchildren, *Sleep Medicine* 12, 652–658
- Randler, C. (2009). Validation of the full and reduced Composite Scale of Morningness. *Biological Rhythms Research*, 40, 413-423.
- Rocha, C. (2017). *Tipo diurno de crianças portuguesas e luxemburguesas em horários escolares: Adaptação do Children's Chronotype Questionnaire*. Dissertação Mestrado. Universidade Autónoma de Lisboa.
- Sarıciya, H., Tellib, O., Ozgurc, B. C., Demirbasc, A., Ozgurd, S., & Karagozc, M. A. (2016). Prevalence of nocturnal enuresis and its influence on quality of life in school-aged children. *Journal of Pediatric Urology*, 12(3), 159.e1–159.e6
- Schmidt, C., Collette, F., Cajochen, C., & Peigneux, P. (2007). A time to think: Circadian rhythms in human cognition. *Cognitive Neuropsychology*, 2, 755–789. doi:10.1080/02643290701754158.
- Silva, F., Barbosa, B. L., Silva, R. C. & Neto, S., A. (2014). Portuguese Children's Sleep Habits Questionnaire - validation and cross-cultural comparison Questionário de Hábitos de Sono das Crianças em Português – validação e comparação transcultural. *Jornal de Pediatria*, 90(1), 78-84
- Spilsbury, C. J., Storfer-Isser, C. J., & Drotar, D. (2014). Sleep Behavior in an Urban US Sample of School-aged Children. *Arch Pediatr Adolesc Med*. 158(10):988-994. doi:10.1001/archpedi.158.10.988
- Thorpy, J., M. (2012). Classification of Sleep Disorders. *Neurotherapeutics*, 9(4), 687–701
- Yoon, C., May, C. P., & Hasher, L. (2000). Aging, circadian arousal patterns, and cognition. In D. C. Park & N. Schwarz (Eds.), *Cognitive aging: A primer* (pp. 151-171). USA: Psychology Press.
- Werner, H., Molinari, L., Guyer, C., & Jenni, O. (2008). Agreement Rates between Actigraphy, Diary, and Questionnaire for Children's Sleep Patterns. *Archives Pediatric Adolescent Medicine*, 162(4), 350-358. doi:10.1001/archpedi.162.4.350.