Perception of quantity and quality of sleep and their association with health related quality of life and life satisfaction during adolescence

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Abstract

Objectives: This study aims to analyse differences between sleep duration and sleep quality and their association with health related quality of life and life satisfaction during adolescence.

Methods: The Health Behaviour in School-Aged Children (HBSC) survey is based on a self-completed questionnaire. The participants in the present study were 3631 students (53.1% were girls) in the 8th and 10th grades at school; the mean age was 14.8 years (range 13-18).

Results: The present results add to previous ones that both the duration and the perceived quality of sleep have impact upon the perception of quality of life and the perception of life satisfaction.

Conclusions: These results are substantially important for sleep hygiene and for recommendations for adolescents, parents, health and education professionals and public policies. It is now widely recommended that adolescents must sleep at least 8 hours per night, what this study allow to recommend is that the perception of quality of that sleep is equally important, and this leads to another set of recommendations to increase sleep quality, that include not exercising or practising sports in the evenings, avoiding conflicts at home in the evenings, no going to bed worried, no having caffeine and other energetic drinks in the evening, not abusing screen time after dinner or in bed. These recommendations are important to assure sleep duration and perceived quality and therefore the perception of wellness and life satisfaction, having an additional impact on health and on school achievement.

Introduction

This study aims to analyse the differences between sleep duration and sleep quality and their association with health related quality of life and life satisfaction during adolescence. A brief revision of the concerned sleep parameters (duration, quality) that may impact upon health and health related quality of life and life satisfaction of adolescents is made.

Several studies of children and adolescents have pointed out the relations of sleep duration with: daytime sleepiness [1-3], body mass index (BMI) [2,4-7], type II diabetes and insulin resistance [8], sleep disorders [1], health characteristics [2], high blood pressure [9], pain [10-12], cognitive tests and academic success [3,13-16], subjective psychological wellbeing [17,18], socioeconomic status [2,5], habits such as high screen or TV viewing time [5,16,19,20], low or moderate physical activity [5,21], poor dietary intake and quality [20,22], and risk-taking behaviours [19,23-28]. Some studies considered not only the parameter sleep duration, but also sleep deprivation, considering sleep deprivation the difference between week-days sleep duration and week-ends sleep duration [16,18,19].

In a recent meta-analysis of children and adolescents aged from 9 to 18 years, including 23 countries, sleep duration varied with gender, age, and geographical region [29]. School-day sleep differed slightly between boys and girls – girls slept for 11 min/night more than boys, and 29 min more on non-school days. Sleep time declined with age – minus 14 min/day per year of age on school days, and 7 min on non-school days.

In Finland, using a very large sample of adolescents (n = 384,076) aged 14 to 20 years, it was found that late bedtimes, especially after 11:30 pm, increase the prevalence of depression, accidents, neck or shoulder pain, low back pain, stomach-ache, anxiety or nervousness, irritability or tantrums, headaches, tiredness or dizziness [30].Insomnia is also a risk for pain chronicity, while pain, poor sleep hygiene, and higher depressive symptoms are the main risks for insomnia persistence [31]. Fatigue is another important associated symptom, often associated

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with depression and insomnia or sleep problems [32-34]. Fatigue is significantly associated with feeling depressed, with poor breakfast habits, with not being well in school, with low physical activity and with no adult to talk to, interpersonal violence and delinquent actions [16,33] and a mutual interaction between depression and sleep also exists [18,19].

Well-being and health-related quality of life (HRQoL) in children and adolescents are quite recent concepts [18]. It is important to consider these concepts within an ecological perspective throughout multiple levels of analysis, namely self-perceptions and family perceptions [35]. Children’s perceptions of their HRQoL are influenced by several factors, such as gender, age, personal and family characteristics and resilience, as well as their socio-economic status (SES) [35-39].

Healthy sleep is fundamental to human health and quality of life [39,40], and sleep deprivation increases the risk for mood and behavioural problems, such as drug and alcohol use and vulnerability to accidents [16-20,23-26,41].

Links between eveningness and poor physical, social/interpersonal relationships and mental health have also been found [42]. Adolescents with poor sleeping patterns present lower scores on emotional, social, school, psychosocial functioning and poor global perception of quality of life, when compared with same age adolescents without poor sleeping patterns [16-20,43-45]. Those with delayed sleep phase disorders have higher trends for alcohol and caffeine consumption, and lower sports participation [46]. Sleeping for 6 hours or less per night is linked to symptoms of depression and lower self-esteem [47]. Sleep deprivation is associated with deficits in child and adolescent functioning, and global health [48,49]. Children and adolescents who sleep for less than 5 hours per night present with more feelings of stress, depression, and suicidal ideation [50,51].

Thus this study focus both on sleep duration and sleep quality analysing their impact on health related quality of life and life satisfaction during adolescence.

**Methods**

**Study design, participants and procedures**

This is a cross-sectional study based on data from the Health Behaviour in School-Aged Children (HBSC) Portuguese survey conducted in 2014 [52]. HBSC is a World Health Organization study conducted every 4 years in nationally representative school-based samples [53]. HBSC examines a number of health behaviours and lifestyles and their context in young people. The Portuguese HBSC in 2014 survey included a representative sample of 6026 adolescents. For the current study only students from grades 8 and 10 where included because grade 6 did not answer the sleep group of questions. The final sample size included thus 3631 adolescents (46.9% boys), aged 13-18 years (mean age =14.8 ± 1.2).

The survey consisted of a self-administered questionnaire that was completed in public schools. The schools were randomly selected from a national list, which had been geographically stratified by administrative and educational regional divisions. The administration of the surveys was conducted according to standard guidelines from the HBSC survey protocol [53,54], and was carried out by trained teachers during class time. School administrators, legal guardians, and adolescents gave a written consent. Adolescents’ participation was voluntary, anonymous, and there were no incentives for participation. Research was conducted in accordance with both the Ethical Committee of Oporto Medical School and the National Data Protection System.

**Measures**

Adolescents’ socio-demographic characteristics included gender, school grade, and age. Adolescents were asked how many hours, in average, they sleep, per night during a weekday. Based on responses, a new variable was computed according sleep time duration recommendations [55], and sleep duration was dichotomised into <8 hours/night and ≥8 hours/night. Adolescents were also asked how often their sleep was “good”. Response options were never/always never, sometimes, and almost always/always.

HRQL was assessed by KIDscreen-10 [56-58]. It contains 10 items regarding family life, peers, and school life and results from a longer version developed in the context of an international project, and it is currently used in the context of the HBSC survey [56-58]. The 10 items result in one global score, after having reverted two single items (feeling sad and feeling alone), that were formulated in the direction opposite to wellbeing. This one-dimensional measure represents a global score adequate for use in large (epidemiological) surveys, such as HBSC. To identify the opinions about Life Satisfaction, the Cantril Self-Anchoring Striving Scale [59] was used. Adolescents indicated where they stood on a 10-point ladder, with zero being the worst possible life and ten being the best possible life. Based on HRQL/Kidscreen10 and life satisfaction responses, adolescents were classified as having low or high HRQL and life satisfaction according to the median value. The perception of adolescents about their health was collected through the question, “You would say your health is...?” Answers were given, through selection, on a 4-point scale (poor, fair, good, and excellent) [60].

**Data analysis**

Descriptive statistics (means, standard deviation and percentages) were calculated for the entire sample, and according to gender. Ordinal variables were treated as continuous variables, thus, they were tested for normality. Student t-test and Chi square were used to assess the differences between gender, sleep duration, sleep quality, HRQL, as per KIDscreen-10 score and life satisfaction. The comparison between sleeping duration (<8 hours/night vs. ≥8 hours/night), and perceived sleep quality, according HRQL/KIDScreen10-10 (for each item and for total score) and life satisfaction, ANCOVA was performed; age and gender were used as covariates, and school classes as random effect. The relationship of HRQL/KIDScreen-10 and life satisfaction with sleep duration time in its continuous form, sleep 8 or more hours per night and having good night of sleep were analysed using binary logistic regression. The regression analyses were adjusted for age, gender and health perception. Statistical analyses were performed using IBM SPSS Statistics 22.0. The level of significance was set at 0.05.

**Results**

Table 1 shows the sample characteristics, sleep duration, quality of sleep, HRQL/KIDScreen-10 and life satisfaction results for the general sample and stratified by gender. The sleep duration was in average 7.8 ± 1.1 hours/night (7.9 ± 1.1 for boys vs. 7.7 ± 1.1 for girls, p<0.001). Most of adolescents reported to have always a good night of sleep (63.8%), and the difference between boys and girls was significant (69.7% for boys vs. 58.5% for girls, p<0.001). Gender differences were also observed in HRQL and life satisfaction: the total score of HRQL was 37.6 ± 6.5 (39.0 ± 6.4 for boys vs. 36.3 ± 6.4 for girls, p<0.001) and life satisfaction was 7.2 ± 1.9 (7.4 ± 1.8 for boys vs. 7.0 ± 1.9 for girls, p<0.001) (Table 1).
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Table 1. Characteristics for total sample and stratified by gender.

|                   | Total (n=3631) | Boys (n=1704) | Girls (n=1927) | p     |
|-------------------|----------------|---------------|----------------|-------|
|                   | M ± SD or n (%)| M ± SD or n (%)| M ± SD or n (%)|       |
| Age               | 14.8 ± 1.2     | 14.8 ± 1.2    | 14.8 ± 1.2     | 0.705 |
| School year       |                |               |                |       |
| 8th grade         | 2187 (60.2)    | 1072 (62.9)   | 1115 (57.9)    | 0.002 |
| 10th grade        | 1444 (39.8)    | 632 (37.1)    | 812 (42.1)     |       |
| Sleep duration (hr/night) | 7.8 ± 1.1 | 7.9 ± 1.1     | 7.7 ± 1.1      | <0.001|
| Good night of sleep |               |               |                |       |
| Never             | 146 (4.0)      | 66 (3.9)      | 80 (4.2)       | <0.001|
| Sometimes         | 11169 (32.2)   | 450 (26.4)    | 719 (719)      |       |
| Always            | 2316 (63.8)    | 1188 (69.7)   | 1128 (55.5)    |       |
| HRLQ              |                |               |                |       |
| Felt fit and well | 3.8 ± 1.1      | 4.1 ± 1.0     | 3.6 ± 1.1      | <0.001|
| Felt full of energy | 3.7 ± 1.1     | 3.9 ± 1.0     | 3.4 ± 1.0      | <0.001|
| Felt sad          | 2.5 ± 1.1      | 2.2 ± 1.0     | 2.8 ± 1.0      | <0.001|
| Felt lonely        | 2.0 ± 1.1      | 1.9 ± 1.0     | 2.2 ± 1.1      | <0.001|
| Had enough time for yourself | 3.6 ± 1.1 | 3.8 ± 1.1     | 3.5 ± 1.1      | <0.001|
| Being able to do things in free time | 3.6 ± 1.2 | 3.9 ± 1.2     | 3.4 ± 1.2      | <0.001|
| Parent(s) treated you fairly | 4.1 ± 1.1 | 4.1 ± 1.1     | 4.0 ± 1.1      | 0.024 |
| Have fun with your friends | 4.2 ± 0.9 | 4.2 ± 0.9     | 4.2 ± 0.9      | 0.585 |
| Got on well at school | 3.6 ± 0.9    | 3.6 ± 1.0     | 3.6 ± 0.9      | 0.001 |
| Been able to pay attention | 3.5 ± 1.0 | 3.6 ± 1.0     | 3.5 ± 0.9      | 0.001 |
| HRLQ/KIDScreen-10 score | 37.6 ± 6.5 | 39.0 ± 6.4    | 36.3 ± 6.4     | <0.001|
| Life satisfaction  | 7.2 ± 1.9      | 7.4 ± 1.8     | 7.0 ± 1.9      | <0.001|

Abbreviation: M, mean; SD, standard deviation; hr, hours; HRQL, health-related quality of life. Differences between genders were tested by Chi-square and Independent Sample T Test.

Table 2. Relationship between HRQL and life satisfaction with sleep duration and sleep quality.

| Sleep duration | Perception of Sleep quality (good night of sleep) |
|----------------|---------------------------------------------------|
|                | <8 hours/night    | ≥8 hours/night    | p     | Never | Sometimes | Always | p     |
| HRLQ           |                    |                    |       |       |           |        |       |
| Felt fit and well | 3.6 ± 1.2         | 4.0 ± 1.0          | <0.001| 2.9 ± 1.4 | 3.5 ± 1.1 | 4.1 ± 1.0 | <0.001|
| Felt full of energy | 3.4 ± 1.1         | 3.8 ± 1.0          | <0.001| 2.7 ± 1.3 | 3.3 ± 1.0 | 3.9 ± 1.0 | <0.001|
| Felt sad        | 2.7 ± 1.1         | 2.4 ± 1.0          | <0.001| 3.1 ± 1.3 | 2.9 ± 1.0 | 2.3 ± 1.0 | <0.001|
| Felt lonely      | 2.2 ± 1.1         | 1.9 ± 1.0          | <0.001| 2.6 ± 1.3 | 2.3 ± 1.1 | 1.8 ± 1.0 | <0.001|
| Had enough time for yourself | 3.4 ± 1.2 | 3.8 ± 1.1          | <0.001| 2.8 ± 1.2 | 3.3 ± 1.1 | 3.9 ± 1.1 | <0.001|
| Being able to do things in free time | 3.4 ± 1.3 | 3.8 ± 1.2          | <0.001| 2.8 ± 1.3 | 3.3 ± 1.2 | 3.8 ± 1.2 | <0.001|
| Parent(s) treated you fairly | 3.9 ± 1.1 | 4.2 ± 1.1          | 0.014 | 3.5 ± 1.3 | 3.8 ± 1.1 | 4.3 ± 1.1 | <0.001|
| Had fun with your friends | 4.1 ± 1.0 | 4.3 ± 0.9          | <0.001| 3.6 ± 1.3 | 4.0 ± 1.0 | 4.4 ± 0.9 | <0.001|
| Got on well at school | 3.4 ± 1.0         | 3.7 ± 0.9          | <0.001| 3.0 ± 1.1 | 3.4 ± 0.9 | 3.7 ± 0.9 | <0.001|
| Been able to pay attention | 3.3 ± 1.0         | 3.7 ± 0.9          | <0.001| 2.8 ± 1.1 | 3.3 ± 0.9 | 3.7 ± 0.9 | <0.001|
| HRLQ score      | 35.3 ± 6.7        | 38.9 ± 6.1         | <0.001| 30.3 ± 7.4 | 34.7 ± 6.1 | 39.5 ± 5.8 | <0.001|
| Life satisfaction | 6.7 ± 2.0         | 7.4 ± 1.8          | <0.001| 5.9 ± 2.5 | 6.6 ± 2.0 | 7.5 ± 1.7 | <0.001|

Tested by ANCOVA. Analysis were adjusted for age, gender and health perception.

The relationship of sleep duration and perceived sleep quality with HRQL/KIDScreen-10 and life satisfaction are presented in table 2. Adolescents who spent ≥8 hours of nigh sleep had significantly better HRQL/KIDScreen-10 score (F (3, 3624) =220.120, p<0.001) and life satisfaction (F (3, 3624) =100.066, p<0.001). Both for the total and for all the single items of HRQL/ KIDScreen-10, adolescents who spend more time sleeping per night had higher values, and those who reported to have the perception of always having good night of sleep had better scores, except for feeling sad and lonely, whose score was reverted before summing; HRQL score (F (4, 3623) =322.723, p<0.001) and life satisfaction (F (4, 3623) =122.177, p<0.001) (Table 2).

Table 3 shows the results of the logistic regression models that analysed the relationship of sleep duration and perceived sleep quality with HRQL/KIDScreen-10 and life satisfaction. Sleep duration was positively related with having high HRQL/KIDScreen-10 (OR=1.35, 95% CI: 1.26-1.45, p<0.001) and high life satisfaction (OR=1.27, 95% CI: 1.19-1.35, p<0.001). Similarly, sleeping ≥8 hours per night increase the likelihood of having high HRQL/KIDScreen-10 (OR=1.97, 95% CI: 1.69-2.30, p<0.001) and high life satisfaction (OR=1.71, 95% CI: 1.47-1.89, p<0.001). As for the perception of sleep quality, to have always a good night of sleep was also associated with higher odds for high HRQL/KIDScreen-10 (OR=3.07, 95% CI: 2.63-3.59, p<0.001) and high life satisfaction (OR=1.91, 95% CI: 1.65-2.21, p<0.001). Similarly, when analysing the HRQL/KIDScreen-10 single items, eight out of them were positive and significantly related to adequate sleep duration and perceived quality; as expected only the negative oriented items (reporting feeling sad or lonely) were negative and significantly related with sleep time duration (sleeping ≥8 hours per night), and having the perception of always having a good night sleep (Table 3).

Discussion

Although most of adolescents reported to have always the perception of having had a good night of sleep, girls report poor perception of sleep quality and according to this study and also less quantity sleep, result not confirming previous studies that state that girls tend to sleep more [29], this fact must be due to participant age differences and because of a different estimation of sleep duration. As stated in several previous studies girls’ perception of HRQL/KIDScreen-10 is
poorer as well as their reported life satisfaction [36-38,52,57,58]. As for the analysis of sleep parameters, although in some previous studies the sleep dimension under analysis was sleep deprivation (as stated for the difference between sleep duration on week days and weekends) and the present study focuses sleep duration and sleep quality [16,18-20,26,27], the present results confirm the importance of sleeping eight hours or more in the perception of wellbeing and life satisfaction during adolescence, this study adds to previous studies that not only the duration and the perception of a good quality of sleep are equally important, but that the pattern of association of these two parameters with health outcomes is similar, either considering HRQL/KIDScreen-10 as a global score, either consider each of the 10 items individually. Although gender and age differences are often reported in the literature, in the present analysis even after adjusting for age, gender and health perception, both the number of sleeping hours and the perceived quality of sleep remained significant and positively correlated with HRQL/KIDScreen-10 score and life satisfaction, moreover this relation occurred significantly for all the single items of HRQL, positively whenever the item was positively oriented and negatively in the case of feeling sad and lonely.

Conclusion
The present results add to previous ones that both the duration and the perceived quality of sleep have impact upon the perception of quality of life and the perception of life satisfaction. These results are substantially important for sleep hygiene and for recommendations for adolescents, parents, health and education professionals and public policies. It is now widely recommended that adolescents must sleep at least 8 hours per night, what this study allow to recommend is that the perception of quality of that sleep is equally important for the perception of wellness and life satisfaction [1-3,17,18], and this leads to another set of recommendations for an adequate sleep hygiene, that include not exercising or practising sports in the evenings [5,21], avoiding conflicts at home in the evenings and not going to bed worried [61,62], not having caffeine and other energetic drinks in the evening [20], not abusing exercising or practising sports in the evenings [5,21], avoiding conflicts at home in the evenings and not going to bed worried [61,62], not having caffeine and other energetic drinks in the evening [20], not abusing

Table 3. Logistic regression model of HRQL/KIDScreen-10, life satisfaction with sleep duration and perception of good sleep quality.

| HRQL | Sleep time | ≥8 hr/night | Perception of always having a good night of sleep |
|------|------------|-------------|-----------------------------------------------|
| Felt fit and well | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 1.31 (1.22-1.41)** | 1.68 (1.44-1.97)** | 2.47 (2.11-2.89)** |
| Felt full of energy | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 1.25 (1.17-1.34)** | 1.67 (1.44-1.94)** | 2.22 (1.91-2.58)** |
| Felt sad | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 0.79 (0.72-0.86)** | 0.60 (0.50-0.73)** | 0.42 (0.35-0.51)** |
| Feel lonely | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 0.86 (0.78-0.95)* | 0.61 (0.49-0.77)** | 0.54 (0.43-0.68)** |
| Had enough time for yourself | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 1.24 (1.59-1.95)** | 1.60 (1.39-1.85)** | 2.37 (2.05-2.74)** |
| Being able to do things in free time | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 1.22 (1.15-1.30)** | 1.64 (1.42-1.90)** | 2.09 (1.81-2.42)** |
| Parent(s) treated you fairly | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 1.25 (1.17-1.35)** | 1.62 (1.38-1.90)** | 2.07 (1.77-2.43)** |
| Had fun with your friends | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 1.20 (1.11-1.30)** | 1.52 (1.28-1.80)** | 2.10 (1.77-2.49)** |
| Got on well at school | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 1.29 (1.21-1.38)** | 1.76 (1.52-2.03)** | 1.64 (1.42-1.89)** |
| Been able to pay attention | | | |
| Never to sometimes | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| Frequently and always | 1.30 (1.22-1.48)** | 1.76 (1.52-2.03)** | 1.97 (1.71-2.28)** |
| HRQL score | | | |
| Low | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| High | 1.35 (1.26-1.45)** | 1.97 (1.69-2.30)** | 3.07 (2.63-3.59)** |
| Life satisfaction | | | |
| Low | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |
| High | 1.27 (1.19-1.35)** | 1.71 (1.47-1.98)** | 1.91 (1.65-2.21)** |

Analyses were adjusted for age, gender and health perception.

* p<0.01, ** p<0.001

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