Are sleep duration and sleep quality associated with diet quality, physical activity, and body weight status? A population-based study of Canadian children

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ABSTRACT

OBJECTIVES: To describe sleep duration and sleep characteristics, and to examine the associations between sleep duration and characteristics and body weight status, diet quality, and physical activity levels among grade 5 children in Nova Scotia.

METHODS: A provincially representative sample of 5,560 grade 5 children and their parents in Nova Scotia was surveyed. Parents were asked to report their child's bedtime and wake-up time, and to indicate how often their child snored or felt sleepy during the day. Dietary intake and physical activity were self-reported by children using the Harvard Youth/Adolescent Food Frequency Questionnaire and the Physical Activity Questionnaire for Children respectively. Body weight status was determined using measured heights and weights. Linear and logistic random effects models with children nested within schools were used to test for associations.

RESULTS: Approximately half of the surveyed parents reported that their children were not getting adequate sleep at night. Longer sleep duration was statistically significantly associated with decreased risk for overweight and obesity independent of other sleep characteristics (OR = 0.82, 95% CI: 0.73, 0.91). Longer sleep duration was also associated with better diet quality and higher levels of physical activity.

CONCLUSIONS: These findings indicate a need for health promotion strategies to encourage adequate sleep and to promote healthy sleep environments among children. Given the links among sleep, body weight status and lifestyle behaviours, these messages should be included in public health interventions aimed at preventing obesity and promoting health among children.

KEY WORDS: Sleep; diet quality; physical activity; body weight; child

La traduction du résumé se trouve à la fin de l'article.

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The increasing prevalence of obesity among children is recognized as a public health concern. As the rise in obesity prevalence is paralleled by declining duration and quality of sleep,[1] short sleep duration and compromised sleep quality have been considered as contributing factors to the obesity epidemic.[2–4] Prospective and cross-sectional studies examining the relationship between sleep and body weight status have shown that children who slept less or who had poorer quality sleep were more likely to be overweight or obese compared to their peers.[2,3,5,6]

Potential mechanisms linking sleep and obesity may include decreased physical activity and consumption of a low-quality diet.[7,8] Participants in sleep deprivation studies who slept less were more likely to report higher levels of calorie intake and lower levels of physical activity.[9–11] Furthermore, there is some evidence indicating that sleep duration and quality may affect energy balance and metabolism through altered levels of regulating hormones such as leptin and ghrelin.[11]

Currently, the evidence linking sleep duration and quality to obesity and its related lifestyle factors is limited mostly to studies conducted among small and selected samples.[7–10] Furthermore, while the physiologic mechanisms linking sleep and energy balance are well described, large-scale population-based studies describing these associations are limited. While there were a few larger-scale studies that have reported on the relationships between sleep and obesity,[2,3,5,6] studies specific to the Canadian context remain scarce. Therefore, the purposes of this study are to describe sleep duration and other sleep characteristics, and to examine the associations among sleep duration, sleep characteristics, diet quality, physical activity levels, and body weight status among a provincially representative sample of grade 5 children in Nova Scotia.

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Conflict of Interest: None to declare.

METHODS

Study population

This analysis was conducted using data collected as part of the 2011 Children's Lifestyle And School performance Study (CLASS), a large cross-sectional provincial survey that studied health, nutrition, physical activity, and other lifestyle factors of grade 5 students (aged 10–11 years) in Nova Scotia. The vast majority of grade 5 students in Nova Scotia attend public schools, and all public schools were invited to participate in the survey. Of the 286 invited schools, 269 (94.1%) agreed to participate and 5,913 parents provided informed consent for their child to participate, resulting in an average response rate of 67.4%. Trained evaluation assistants visited the schools to administer the student surveys and to complete anthropometric measurements. Student surveys consisted of a questionnaire on physical and sedentary activities, mental health, and body image, and the Harvard Youth/Adolescent Food Frequency Questionnaire (YAQ) adapted for Canadian settings. Parents also completed a survey that included questions on the home environment and on socio-economic factors. All survey instruments used in this study are available on the CLASS project website.[12] The Human Research Ethics Boards at the University of Alberta and Dalhousie University approved all study procedures.

Measures of interest

Sleep Duration and Sleep Characteristics

The primary exposures of interest in this study were sleep duration and sleep characteristics, including snoring and daytime sleepiness. Sleep duration was calculated based on parent responses to a question adapted from Project EAT-III (Eating and Activity in Teens and Young Adults)[13] where they were asked to indicate the time their child usually goes to bed and the time their child usually wakes up for both a typical weekday and a typical weekend day. Sleep duration for a typical night was then calculated based on five weekdays and two weekend days. Bedtime was indicated through responses to the question asking about the time the child went to bed; these responses were then grouped into the categories of "before 9 pm", "9–10 pm", and "after 10 pm" for regression analyses. Parents were also asked to indicate how often their child snored and how often their child was sleepy during the daytime, with response options of "never", "rarely", "occasionally", "frequently" and "almost always". In order to allocate a sufficient number of observations in each category, responses to these questions were re-categorized by collapsing the groups of students who answered "occasionally", "frequently" and "almost always" into one response category ("frequently").

Diet Quality

Overall diet quality in this study was measured using the Diet Quality Index – International (DQI-I).[14] The DQI-I is a composite score (range: 0–100) derived to measure diet quality based on the aspects of variety, adequacy, moderation, and overall balance. The DQI-I was calculated based on child responses to the YAQ, a validated tool to assess dietary intake among children and youth,[15] and nutrient information from the 2007 Canadian Nutrient File.[16] Of the children who completed the YAQ, 138 (2%) children with average daily energy intake <500 kcal or >5000 kcal were excluded from analyses related to diet quality as these results were considered to be unreliable.[17]

Physical Activity

Level of physical activity was determined using the Physical Activity Questionnaire for Children (PAQ-C). The PAQ-C was included in the student survey and is a validated instrument to assess frequency and duration of physical activity in children over a 7-day period.[18] PAQ-C scores range from 0 to 5, with higher scores indicative of higher levels of physical activity.

Body Weight

Body mass index (BMI) was calculated using measured child height and weight. Height was measured to the nearest 0.1 cm after children had removed their shoes, and body weight was measured to the nearest 0.1 kg on calibrated digital scales. Body weight status (normal weight, overweight including obese, obese) was determined using age- and gender-specific cut-off points for children and youth established by the International Obesity Task Force.[19]

Other Covariates

Demographic information, such as parental education attainment (secondary or less, college, university and above) and household income (<$20,000, $20,001–$40,000, $40,001–$60,000, >$60,000), was obtained from responses to the parent survey. Region of residence (urban/rural) was determined using postal codes collected from parent surveys.

Data analysis

Data from a total of 5,560 children were used in analyses after excluding 353 (6%) children due to non-response to at least one of the questionnaires. All statistical analyses were weighted to represent provincial estimates of the grade 5 student population in public schools across Nova Scotia and for non-response bias. Linear and logistic random effects models with children clustered within schools were used to test for associations among diet quality, physical activity, weight status, and sleep duration and quality. These multivariable analyses were adjusted for the potential confounding effects of gender, household income, parental education, and place of residence. Analyses with diet quality as an outcome were also adjusted for energy intake. Further analyses where all exposures were included simultaneously in the model were conducted to determine whether each of the exposures of interest were independently associated with the outcomes. The table of descriptive statistics and the histogram of sleep duration were constructed with Stata version 12 (StataCorp, College Station, TX, USA). The regression analyses were conducted in R (version 3.0.2).

RESULTS

Characteristics of the surveyed children are shown in Table 1. Parents reported that their grade 5 child slept an average of 10.0 hours on a typical night (median 10 hours, range 7.8–12.1 hours), where half (50%) of the children slept less than the recommended 10 hours per night. Average sleep duration on a typical night was

Table 1. Characteristics of grade 5 children in Nova Scotia (n = 5560)*†

Characteristic	
Sex	
Male	48
Female	52
Household income	
<$20,000	6
$20,000–$40,000	14
$40,001–$60,000	14
>$60,000	47
Not reported	20
Parental education attainment	
Secondary or less	18
College	40
University or higher	38
Not reported	4
Region of residence	
Urban	64
Rural	36
Sleep duration, hours (mean ± SD)	10.0 ± 0.5
Bedtime, weekday	
Before 9 pm	57
9–10 pm	39
After 10 pm	4
Bedtime, weekend	
Before 9 pm	12
9–10 pm	47
After 10 pm	41
Snoring	
Never	31
Rarely	38
Frequently	31
Sleepy during daytime	
Never	27
Rarely	52
Frequently	22
DQI-I (mean ± SD)‡	63.0 ± 9.7
PAQ-C (mean ± SD)§	3.3 ± 0.7
Overweight‖	35
Obese	12

SD = standard deviation; DQI-I = Diet Quality Index – International; PAQ-C = Physical Activity Questionnaire for Children.
* Numbers are presented as% unless otherwise indicated.
† Results are weighted to represent provincial estimates of the grade 5 student population in Nova Scotia.
‡ Score range 0–100, higher score indicating better diet quality.
§ Score range 0–5, higher score indicating higher physical activity level.
‖ Including obese percent.

distributed normally throughout the study population (Figure 1). Most parents also reported that their children went to bed before 9 pm on weekdays (57%) and after 9 pm on weekends (88%). Among all surveyed children, 31% were reported to snore frequently and 22% to frequently feel sleepy during the day.

Sleep duration and associations with weight status, diet quality, and physical activity levels

Logistic random effects models were used to investigate relationships between sleep duration and weight status, with normal weight children as the reference group. After adjusting for potential confounding effects of the child's gender, parental education, household income, and place of residence, longer sleep duration was significantly associated with decreased odds of being overweight or obese (OR = 0.81, 95% CI: 0.75, 0.88; Table 2). Linear random effects models were used to investigate relationships among sleep duration, diet quality, and physical activity levels as measured through PAQ-C scores, adjusting for potential confounding effects of gender, parental education, household income, and region of residence. Longer sleep duration

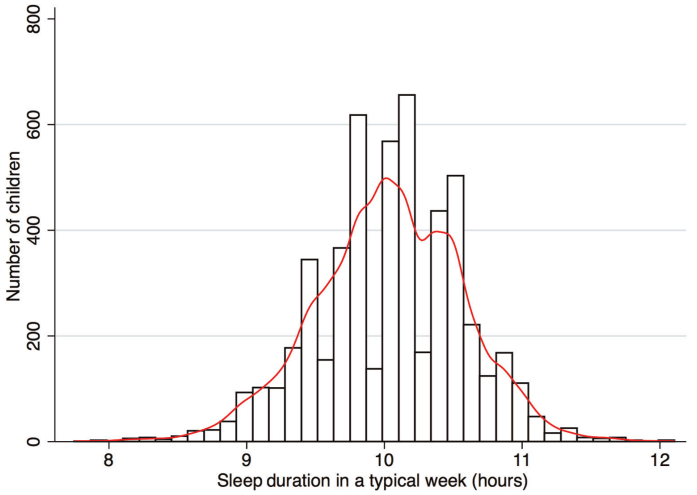

Figure 1. Distribution of nightly sleep duration of grade 5 children in Nova Scotia (n = 5560)
Notes: Bars indicate number of children. Red line indicates Kernel Density.

was associated with higher DQI-I scores (β = 0.60, 95% CI: 0.11, 1.09) and higher PAQ-C scores (β = 0.03, 95% CI: 0.01, 0.05) (Table 3). Furthermore, children who went to bed at a later hour on weekday nights were less physically active and had higher odds of being overweight or obese.

Other sleep characteristics and associations with weight status, diet quality, and physical activity levels

Logistic random effects models were used to investigate relationships between sleep characteristics such as snoring and daytime sleepiness, and weight status, with normal weight children as the reference group. Both snoring and daytime sleepiness were found to be associated with body weight status, and were reported to occur more frequently among children who were overweight or obese compared to normal weight children. Regression analysis revealed that children who were reported to snore or to be sleepy during daytime frequently had higher odds of being overweight or obese compared to children who never snored. Linear random effects models were used to investigate relationships between snoring and daytime sleepiness, and diet quality and physical activity levels. While there was no association observed between snoring and being physically active, children who were reported to frequently be sleepy during the daytime scored lower on the PAQ-C compared to children who were never sleepy (β = –0.11, 95% CI: –0.17, –0.06).

Independence of associations among sleep duration and other sleep characteristics and weight status, diet quality, and physical activity levels

Further analyses were conducted to determine whether each of the exposures of interest (sleep duration, bedtime, snoring, daytime sleepiness) were independently associated with weight status, diet quality, and physical activity levels. Logistic (for weight status) and linear random effects models (for diet quality and physical activity) where all exposures of interest were included simultaneously were used. After adjusting for all exposures, being sleepy during daytime was significantly

Table 2. Associations between sleep duration and indicators of sleep quality and body weight status among grade 5 children in Nova Scotia*

Sleep characteristic	Overweight						Obese					
	Univariable		Multivariable model 1†		Multivariable model 2‡		Univariable		Multivariable model 1†		Multivariable model 2‡	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Sleep duration (hours per day)	0.86	(0.8, 0.93)	0.81	(0.75, 0.88)	0.82	(0.73, 0.91)	0.75	(0.67, 0.85)	0.72	(0.64, 0.81)	0.80	(0.68, 0.95)
Bedtime on typical weekday												
Before 9 pm§	–	–	–	–	–	–	–	–	–	–	–	–
9–10 pm	**1.33**	**(1.17, 1.5)**	**1.35**	**(1.19, 1.52)**	1.11	(0.95, 1.29)	**1.48**	**(1.22, 1.8)**	**1.53**	**(1.26, 1.85)**	1.17	(0.92, 1.48)
After 10 pm	**1.62**	**(1.19, 2.22)**	**1.53**	**(1.12, 2.1)**	1.06	(0.74, 1.51)	**2.64**	**(1.75, 4.00)**	**2.50**	**(1.64, 3.80)**	1.51	(0.94, 2.45)
Bedtime on typical weekend												
Before 9 pm§	–	–	–	–	–	–	–	–	–	–	–	–
9–10 pm	1.2	(0.98, 1.47)	1.19	(0.97, 1.45)	1.04	(0.84, 1.29)	**1.43**	**(1.00, 2.03)**	1.39	(0.97, 1.98)	1.22	(0.84, 1.76)
After 10 pm	**1.6**	**(1.3, 1.96)**	**1.54**	**(1.26, 1.9)**	1.19	(0.94, 1.51)	**2.26**	**(1.59, 3.22)**	**2.13**	**(1.49, 3.03)**	1.53	(1.02, 2.29)
Snoring												
Never§	–	–	–	–	–	–	–	–	–	–	–	–
Rarely	**1.41**	**(1.21, 1.63)**	**1.37**	**(1.18, 1.59)**	**1.38**	**(1.18, 1.6)**	**1.54**	**(1.2, 1.98)**	**1.46**	**(1.14, 1.88)**	**1.42**	**(1.1, 1.83)**
Frequently	**2.27**	**(1.94, 2.64)**	**2.14**	**(1.83, 2.49)**	**2.07**	**(1.77, 2.43)**	**2.92**	**(2.29, 3.73)**	**2.68**	**(2.1, 3.42)**	**2.52**	**(1.96, 3.23)**
Sleepy during daytime												
Never§	–	–	–	–	–	–	–	–	–	–	–	–
Rarely	1.01	(0.88, 1.17)	1.02	(0.89, 1.18)	0.95	(0.82, 1.1)	1.11	(0.89, 1.4)	1.13	(0.90, 1.42)	1.02	(0.81, 1.29)
Frequently	**1.34**	**(1.13, 1.58)**	**1.31**	**(1.1, 1.55)**	1.11	(0.93, 1.32)	**1.51**	**(1.16, 1.96)**	**1.44**	**(1.11, 1.89)**	1.13	(0.86, 1.49)

* All analyses are weighted to represent provincial estimates and for non-response bias. Statistically significant results are highlighted in bold.
† Multivariable regression model adjusting for sex of child, household income, parental education attainment, and place of residence.
‡ Multivariable regression model adjusting for all exposure variables listed in the table, sex of child, household income, parental education attainment, and place of residence.
§ Reference category.

associated with lower PAQ-C scores, suggesting that this association was independent of other indicators of sleep quality or duration. Similarly, snoring and sleep duration were found to be significantly associated with increased odds of being overweight or obese independent of other exposure variables.

DISCUSSION

Results from this study indicated that almost half of the surveyed children in Nova Scotia were not getting adequate amounts of sleep per night. These estimates of sleep duration among children are not consistent with those reported in a previous study among children in the province of Quebec where mean sleep duration was observed to be longer at 10.8 hours per night.[2] Adequate sleep has been shown to be important for metabolic regulation, cognitive and psychological functioning, and school performance in children.[20,21] In recognition of the importance of sleep in children, the National Sleep Foundation currently recommends that children aged 5–12 years sleep an average of 10–11 hours per night for optimal physical and mental development and health.[22] The influence of sleep duration on health and weight status has been consistently demonstrated.[2–4,23] Furthermore, prospective studies have confirmed the causal pathway between sleep duration and obesity by showing that short sleep duration leads to increased risk for obesity at a later age.[5,6] This study further stressed the potential importance of adequate sleep to health by showing that sleep duration, independent of other measured indicators of sleep such as bedtime, snoring, and daytime sleepiness, influenced overweight risk. However, despite these recommendations and evidence for the importance of sleep, sleep durations among children and youth are progressively getting shorter,[1] indicating a need for health promotion messages encouraging adequate sleep among children.

Previous studies have indicated that children who went to bed late were more likely to lead a sedentary lifestyle with lower levels of physical activity and more screen time.[24] Similar findings were observed in the current study. However, the effects of bedtime on health outcomes are difficult to separate from that of sleep duration, given that a late bedtime is generally associated with shorter sleep duration. While studies conducted among Australian children found that bedtime had an effect on health behaviours independent of sleep duration,[24,25] the independent effect of bedtime was not observed in the current study. This suggests that bedtime and sleep duration may be more intricately linked among children in this study, thus an association between bedtime and health outcomes independent of sleep duration could not be observed.

Snoring and daytime sleepiness were more likely to be reported among overweight or obese children in this study. These findings are consistent with those of previous studies.[26,27] These associations are not surprising given that snoring and daytime sleepiness are both common symptoms of obstructive sleep apnea, a sleep disorder that is more prevalent among children who are overweight or obese.[26,27] The observed independent association between snoring and weight status in this study may be explained by the higher risk for sleep disorders among overweight or obese children, where snoring is indicative of the presence of a sleep disorder. Future analysis where there is a diagnosis of a sleep disorder is needed in order to increase understanding of this relationship, however this study has helped to further clarify the magnitude of compromised sleep among Canadian children.

In addition to weight status, this study also revealed associations between sleep and lifestyle factors, including diet quality and physical activity levels. These findings suggest that encouraging healthy sleep habits among children should be integrated into

Table 3. Associations among sleep duration and indicators of sleep quality and diet quality and physical activity among grade 5 children in Nova Scotia*

Sleep characteristic	Diet quality: Univariable β	(95% CI)	Diet quality: Multivariable model 1† β	(95% CI)	Diet quality: Multivariable model 2‡ β	(95% CI)	Physical activity: Univariable β	(95% CI)	Physical activity: Multivariable model 1† β	(95% CI)	Physical activity: Multivariable model 2‡ β	(95% CI)
Sleep duration (hours per day)	0.11	(−0.20, 0.42)	0.11	(−0.21, 0.43)	**0.60**	**(0.11, 1.09)**	0.02	(0, 0.04)	**0.03**	**(0.01, 0.05)**	0.02	(−0.01, 0.06)
Bedtime on typical weekday												
Before 9 pm§	–	–	–	–	–	–	–	–	–	–	–	–
9–10 pm	−0.02	(−0.58, 0.54)	−0.08	(−0.63, 0.48)	0.17	(−0.51, 0.85)	−0.02	(−0.05, 0.02)	−0.02	(−0.06, 0.02)	0	(−0.05, 0.05)
After 10 pm	−0.84	(−2.32, 0.63)	−0.74	(−2.21, 0.74)	−0.42	(−2.04, 1.20)	**−0.16**	**(−0.26, −0.06)**	**−0.17**	**(−0.27, −0.07)**	−0.13	(−0.24, −0.02)
Bedtime on typical weekend												
Before 9 pm§	–	–	–	–	–	–	–	–	–	–	–	–
9–10 pm	−0.11	(−0.99, 0.77)	−0.08	(−0.96, 0.8)	−0.05	(−0.96, 0.86)	0.03	(−0.03, 0.09)	0.03	(−0.03, 0.09)	0.04	(−0.02, 0.11)
After 10 pm	−0.17	(−1.07, 0.73)	−0.07	(−0.96, 0.83)	0.15	(−0.88, 1.18)	−0.02	(−0.08, 0.04)	−0.01	(−0.07, 0.05)	0.02	(−0.05, 0.09)
Snoring												
Never§	–	–	–	–	–	–	–	–	–	–	–	–
Rarely	−0.32	(−0.97, 0.32)	−0.21	(−0.85, 0.44)	−0.14	(−0.79, 0.51)	0.02	(−0.03, 0.06)	0.02	(−0.02, 0.06)	0.02	(−0.02, 0.07)
Frequently	−0.38	(−1.06, 0.30)	−0.12	(−0.8, 0.56)	−0.04	(−0.74, 0.65)	−0.01	(−0.06, 0.04)	−0.01	(−0.05, 0.04)	0.01	(−0.04, 0.06)
Sleepy during daytime												
Never§	–	–	–	–	–	–	–	–	–	–	–	–
Rarely	−0.08	(−0.72, 0.56)	−0.12	(−0.76, 0.52)	−0.02	(−0.66, 0.63)	**−0.07**	**(−0.11, −0.02)**	**−0.06**	**(−0.11, −0.02)**	**−0.06**	**(−0.1, −0.02)**
Frequently	−0.20	(−0.97, 0.58)	−0.08	(−0.86, 0.69)	0.03	(−0.76, 0.82)	**−0.12**	**(−0.17, −0.06)**	**−0.11**	**(−0.17, −0.06)**	**−0.11**	**(−0.16, −0.05)**

* All analyses are weighted to represent provincial estimates and for non-response bias. Statistically significant results are highlighted in bold.
† Multivariable regression model adjusting for sex of child, household income, parental education attainment, and place of residence. Analyses with diet quality as an outcome are further adjusted for energy intake.
‡ Multivariable regression model adjusting for all exposure variables listed in the table, sex of child, household income, parental education attainment, and place of residence. Analyses with diet quality as an outcome are further adjusted for energy intake.
§ Reference category.

public health strategies to promote healthy lifestyles. Therefore, future studies to obtain further insight into the social and environmental determinants of healthy sleep are essential to inform these intervention efforts. For instance, factors including family characteristics such as rules for bedtime[28] and the presence of electronic devices in the sleep environment[29] have been shown to be associated with sleep duration and quality, and should be targeted in interventions promoting healthy sleep habits.

A strength of this study is the inclusion of analysis to establish the independent importance of each sleep indicator in an attempt to separate the effects of each of these highly linked indicators on health behaviours and weight status. Other strengths include the large sample of children surveyed that is representative of the grade 5 student population in Nova Scotia, and the response rate that can be considered high for school-based research. This study was limited by the use of self-reported information. While parental report of sleep duration is shown to be highly correlated with objective measures among pre-school children,[30] it has also been shown to overestimate sleep duration by up to 50 minutes among school-aged children.[31] Nevertheless, validated measures for dietary intake[15] and physical activity[18] were used to minimize potential bias. Future studies using objective measurements for sleep and physical activity are needed to strengthen the observed findings. Finally, temporality and causality cannot be inferred based on the cross-sectional design of this study. It is possible that the associations observed are due to reverse causality. For instance, overweight and obese children have more difficulty sleeping and thus are more likely to sleep less.

In conclusion, results from this study indicated that short sleep duration and compromised sleep, such as snoring and daytime sleepiness, are associated with increased risk for overweight and obesity, and are prevalent among Canadian children. Furthermore, sleep duration is also associated with less desirable health behaviours, including poorer diet quality and lower physical activity levels. These findings suggest the need for further research to better understand the factors influencing sleep duration in children to inform intervention strategies, so that these strategies can be tailored to address these factors. Furthermore, public health obesity prevention strategies should include messages promoting healthy sleep behaviour among children.

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RÉSUMÉ

OBJECTIFS : Décrire la durée et les caractéristiques du sommeil, et examiner les associations entre la durée et les caractéristiques du sommeil, d'une part, et le statut pondéral, la qualité du régime alimentaire et les niveaux d'activité physique, d'autre part, chez les élèves de 5e année en Nouvelle-Écosse.

MÉTHODE : Nous avons sondé un échantillon provincial représentatif de 5 560 élèves de 5e année et leurs parents en Nouvelle-Écosse. Nous avons demandé aux parents d'inscrire l'heure du coucher et du lever de leur enfant et d'indiquer combien souvent leur enfant ronflait ou se sentait fatigué durant la journée. L'apport alimentaire et l'activité physique ont été autodéclarés par les enfants à l'aide des questionnaires *Harvard Youth/Adolescent Food Frequency* et *Physical Activity Questionnaire for Children*, respectivement. Nous avons déterminé le statut pondéral à l'aide de la taille et du poids mesurés. Des modèles linéaires et logistiques à effets aléatoires, avec les données des enfants emboîtées dans celles des écoles, ont servi à tester les associations.

RÉSULTATS : Environ la moitié des parents sondés ont déclaré que leurs enfants ne dormaient pas suffisamment la nuit. Un sommeil plus long présentait une corrélation statistiquement significative avec un risque réduit de surpoids et d'obésité, indépendamment des autres caractéristiques du sommeil (RC = 0,82, IC de 95 % : 0,73, 0,91). Un sommeil plus long était également associé à un régime alimentaire de meilleure qualité et à des niveaux d'activité physique supérieurs.

CONCLUSIONS : Il faudrait des stratégies de promotion de la santé qui encouragent un sommeil suffisant et de sains environnements de sommeil chez les enfants. Étant donné les liens entre le sommeil, le statut pondéral et les comportements liés au mode de vie, de tels messages devraient être inclus dans les interventions de santé publique visant à prévenir l'obésité et à promouvoir la santé chez les enfants.

MOTS CLÉS : sommeil; qualité du régime alimentaire; activité physique; poids; enfant