Sleep Duration and Body Mass Index among Southern Brazilian Preschoolers

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Abstract

Prevention and treatment of overweight are particularly complex, reinforcing the importance of studies aimed at clarifying their range of causes and effects. Thus, the objective of this study was to evaluate the relationship between night sleep duration and anthropometric measurements. A cross-sectional analysis was performed from data from 348 children aged 3 and 4 years in São Leopoldo/RS. Night sleep duration was reported by their mothers and body mass index, waist circumference and skinfold thickness were measured according to standard protocol. The analyses were adjusted for energy intake and hours of television watching. Overweight children had, on average, 0.39 hours less sleep than those with normal weight (9.77 ± 1.44 versus 10.17 ± 1.34; 95% CI 0.03 to 0, 76). We observed an inverse association between night sleep duration and z score values of body mass index for age (B = -0.12 95% CI -0.22−-0.02). Waist circumference and skinfold thickness showed an inverse relationship with sleep duration, but without any statistic differences. Among preschool children in southern Brazil, smaller night sleep duration was associated with higher body mass index

Introduction

The overall prevalence of overweight among preschool children increased from 4.2% in 1990 to 6.7% in 2010, and the change was greater in countries in developing countries[1]. This data may have implications even more relevant if we consider that childhood weight standards are maintained into adulthood, and are predictors of development cardiovascular diseases[2].

The prevention and treatment of overweight are particularly complex because of their multifactorial nature, reinforcing the importance of studies aimed at clarifying this range of cause and effects[3]. The epidemic of obesity is accompanied, in contemporary society, with a trend towards reduction of the sleep duration[4], and evidence from studies conducted in developed countries indicate sleep deprivation as a risk factor for excessive weight gain[5,6].

Considering that the etiology and pathogenesis of diseases differ according to ethnicity and lack of studies with this scope with Brazilian children, this study aimed to: (a) Assess the relationship between sleep duration and body mass index (BMI), waist circumference and skinfold thickness and (b) compare sleep duration for the presence of overweight among children aged 3-4 years, of low socioeconomic status, from the city of São Leopoldo, Rio Grande do Sul.

Keywords

Sleep; Body Mass Index; Waist Circumference; Skinfold Thickness; Child, Preschool.

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Methods

This paper uses data from a larger study whose design consisted of a randomized trial that tested the effectiveness of dietary counseling on breastfeeding and feeding practices in the first year of life. Between October 2001 and June 2002, 500 mother-infant pairs were recruited from the state-run maternity ward of Hospital Centenário, in the city of São Leopoldo/RS. Inclusion criteria were birth at ≥ 2500 g and term birth (≥ 37 weeks). The project was approved by the Ethics Committee of the Universidade Federal do Rio Grande do Sul and the mothers signed an informed consent.

The calculation of sample size was based on the primary objective of the original project; for this study, however, it was calculated that a sample of 346 children would be adequate to detect a correlation coefficient of 0.15 between the sleep duration and anthropometric variables, considering an 80% power and 5% significance.

When the children were aged 12 months, the mothers answered a questionnaire on socioeconomic and household characteristics. At 3-4 years of age, sleep duration, food intake and anthropometric measures data were collected.

The mothers were asked to report the number of hours that the children had slept the night before the interview, considering the time they were asleep until the time they woke up the next morning.

Dietary data were obtained with the aim of evaluating the energy consumption of children. Two 24-hour recall questionnaires were conducted with mothers on nonconsecutive days and the estimated average energy intake of the two days was held in the NutWin Program version 1.5.

With the objective of evaluating a marker of a sedentary lifestyle, mothers were asked to report the number of hours that children had watched television during the 24 hours preceding the interview.

Measurements of weight, height, waist circumference and triceps and subscapular skinfolds were measured in a standardized way. Z scores of BMI-for-age were estimated based on references from the World Health Organization and values > +1 were considered overweight.

The association between sleep duration and independent variables was assessed using simple linear regression. Multivariable models were performed for adjusting confounding variables — energy consumption, hours of television, maternal education and randomization group in the larger study — and the end result was presented in regression coefficients (*B*), confidence intervals of 95% (95 % CI) and coefficient of determination (R^2). The sleep duration of children with and without excess weight was compared using the Student *t* test. For comparisons, we considered an alpha of 0.05.

Results

Among the 500 children recruited at birth, 354 were evaluated at 3-4 years of age. Six children had not completed questionnaires for the outcomes of this study and were excluded from the analyses, resulting in 348 children. The characteristics of the samples are given in Table 1.

Children with overweight had, on average, 0.39 hours less sleep than those with normal weight (9.77 ± 1.44 versus 10.17 ± 1.34; 95% CI 0.03 to 0.76). We observed a significant inverse association between sleep duration and z score values of BMI-for-age and adjustment for confounders did not change the results (Table 2). Each hour less sleep represented an increase of 0.12 z-scores for BMI-for-age. Repeating the analysis with absolute values of BMI, every hour less sleep represented an increase of 0.17 kg/m² (95% CI -0.32 — - 0.02).

Table 1 - Characteristics of children and families (n = 348)

Variables	
Male, n (%)	196 (56.3)
Excess weight, n (%)	70 (20.3)
Night sleep duration, mean (SD)	10.1 (1.3)
Maternal age at birth <20 years, n (%)	55 (15.9)
Mothers who lived with a partner, n (%)	283 (81.3)
Maternal education <8 years, n (%)	204 (58.6)
Monthly family income (dollars), mean ± SD	634.3 (423.8)

Waist circumference and skinfold thickness showed an inverse relationship with sleep duration, but the statistics did not reach the critical value that allows ruling out the null hypothesis (Table 2).

Discussion

The results presented in preschool children in southern Brazil add consistency to the evidence of the inverse relationship between night sleep duration and BMI, and adjustment for confounding variables suggest that this association occurs not only by the influence of sleep on food intake and physical activity patterns but by independent metabolic influences.

The coefficient of determination shows that the proportion of the variability in BMI explained by the variability of sleep is small; this result, however, was expected, considering the numerous factors that influence nutritional status. This population group has a low socioeconomic status, which may explain the small effect found, since the adverse

Table 2 - Relationship between night sleep duration and anthropometric variables (n = 348)

	BMI-for-age (z score)	Waist circumference (cm)	Skinfold thickness (mm)*
Bivariate			
B (95% CI)	-0.10 (-0.18−-0.01)†	-0.25 (-0.53−0.02)	-0.15 (-0.34−0.02)
R^2	0.015	0.009	0.008
Multivariate‡			
B (95% CI)	-0.11 (-0.20−-0.02)†	-0.27 (-0.55−0.01)	-0.18 (-0.37−0.009)
R^2	0.019	0.016	0.011
Multivariate 2§			
B (95% CI)	-0.12 (-0.22−-0.02)†	-0.28 (-0.60−0.03)	-0.12(-0.35−0.07)
R^2	0.040	0.020	0.020

** Sum of the subscapular and triceps skinfolds;*
† P < 0.05;
‡ Adjusted for energy consumption;
§ Adjusted for energy consumption. hours of television. maternal education and randomization group in the larger study.

environmental and health conditions negatively influence the health indicators[7]. Though modest, the magnitude of association may have important implications in the context of public health, considering that the identification of risk factors is important to support actions that, taken together, help preventing overweight.

The cross-sectional design used has limitations for establishing a causal relationship, but the biological plausibility of the association allows raising assumptions to explain the possible influence of sleep on weight standards. Poor sleep duration may mediate changes in different mechanisms related to weight control, including decreased glucose tolerance and insulin sensitivity, increased sympathetic-parasympathetic balance, nocturnal cortisol levels and changes in neuropeptides such as ghrelin and leptin and growth hormone secretion[8]. In adults, strong effects of sleep duration were observed on markers of immune and anti-inflammatory function, which are also associated with metabolic dysfunctions[9]. Steptoe et al[10] point out, however, that poor sleep may be a marker of improper lifestyle and quality of life, which are more subjective non-measured characteristics in our data collection instruments; thus sleep would be one of the components involved in the range of factors associated with obesity and not just a causal factor.

There is evidence of progressive decrease in sleep duration in recent years[4], which further reinforces the importance of the results presented in this study. Despite the paucity of data on the sleep duration of Brazilian children, it seems that this issue is already causing concerns in our environment, especially with regard to children living in poor environmental conditions such as those evaluated in this study.

The same statistical significance was not observed in the association between sleep duration and skinfold thickness and waist circumference, and it is possible that the lower accuracy in the collection and greater variability in the results of these measures have influenced the test values. It is expected that future studies — which include other measures of body adiposity and other age groups — may clarify unanswered questions in this study.

The interpretation of the findings of this study is subject to limitations. Firstly, the evaluation of one single night is not able to faithfully reflect the child's sleep pattern, although its use is common in many studies. Secondly, the validity of mothers' reports regarding sleep duration is still unknown. Moreover, the measurement of confounders is also subject to errors of estimation of the energy consumption of 24-hour recall and reduced robustness of hours of television as a measure of inactivity.

Conclusions

Corroborating previous findings from other regions in the world, this study showed that sleep duration was negatively associated with BMI among preschool children in southern Brazil. It reinforces the importance of investigating children's sleep duration by health professionals, which should implement educational measures to guide parents regarding healthy habits.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any post-graduation program.

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