Review
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Sleep during, overweight and obesity in adolescence: a systematic review.

Duração do sono, sobrepeso e obesidade na adolescência: uma revisão sistemática.

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Abstract

Introduction: In adolescence, intense social and school demands, hormonal changes that modify the circadian rhythms and the overuse of electronic equipments causes an inadequate sleep duration to adolescents. Studies have linked short sleep duration with the increase odds to have overweight and obesity. **Objective**: To identify articles that analyzed relationship between inadequate sleep time and overweight and obesity in adolescents. **Method**: It was done a research on Bireme (Lilacs and MEDLINE), PubMed, Scielo and Ibecs for two independents researchers using Portuguese and English keywords: "sleep", "sleep duration", "adolescence", "obesity" and "overweigh". It was considerated as inclusion criteria: sample with 10-19-year adolescents, original articles between 2002 and 2013 in Portuguese and English. Therefore, it was excluded review articles, thesis, dissertations and monographs. **Results:** The initial Electronic search resulted in 663 articles and, after process of article select with read of titles, resumes and the complete form, it was selected 15 articles. **Conclusion**: Inadequate levels of sleep duration are associated with increase of overweight and obesity in adolescents.

Keywords: Adolescents. Sleep. Overweight. Obesity.

Resumo

INTRODUÇÃO: Na adolescência, as intensas demandas sociais e de atividade escolares, as mudanças hormonais que alteram o ritmo circadiano, além do uso excessivo de equipamentos eletrônicos fazem com que os adolescentes tenham uma duração inadequada do sono. Estudos tem associado uma curta duração de noites de sono ao aumento das chances de ter sobrepeso e obesidade. **OBJETIVO**: Identificar estudos que analisaram a relação entre tempo de sono inadequado e sobrepeso e obesidade em adolescentes. **MÉTODO:** Foi realizada uma pesquisa nas bases de dados Bireme (Lilacs e MEDLINE), PubMed, Scielo e Ibecs, por dois pesquisadores independentes, utilizando os seguintes descritores nas línguas portuguesa e inglesa: "sono", "duração do sono", "adolescência", "obesidade" e "sobrepeso". Considerou-se como critérios de inclusão: amostra com adolescentes de 10 a 19 anos, publicações originais entre 2002 e 2013 nos idiomas Português e Inglês. Assim, foram excluídos artigos de revisão, teses, dissertações e monografias. **RESULTADOS:** A busca eletrônica inicial resultou em 663 manuscritos, no qual, após o processo de seleção dos artigos que envolveu a leitura de títulos, resumos e textos completos, selecionamos 15 estudos que preencheram os critérios de inclusão. **CONCLUSÕES:** Níveis inadequados na duração do sono estão associados com o incremento do sobrepeso e obesidade em adolescentes.

Palavras-chave: Adolescentes. Sono. Sobrepeso. Obesidade.

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INTRODUCTION

Overweight and obesity have been considered relevant public health issues and has been gaining prominence on the world stage, both developed in those of low and middle income countries.[1] Thus, it is estimated that 40.6% of Brazilian adults are overweight, and this condition has increased progressively earlier ages.[2]

In this sense, the increasing prevalence of overweight and obesity among adolescents has tripled in the last four decades,[3] has aroused interest among researchers and health professionals. This concern is due to the positive association between overweight and obesity with metabolic, cardiovascular, pulmonary, orthopedic and psychological,[4,5] beyond the complications linked to this epidemic economic and social repercussions.[6,7,8]

In this perspective, realizing adolescence as a period in which a variety of psychosocial conflicts, resulting from intense physical, psychological and social changes,[9] occurs, one can understand the fact sleepless nights and sleep with short term needs are common in this population.[10-13] Thus, it is estimated that over 30% of children and adolescents in the world have sleep disorders that, somehow, will affect the time spent in bed.[14,15,16]

This way, studies[17,18] shows that most teenagers sleeping around seven hours per night, about an hour less than their estimated sleep need. This reduction of sleep adolescents would be linked to increased social demands, the insertion in the world of work, to school activities, the hormonal changes that alter the circadian rhythm, and the overuse of electronic equipment.[19]

In this scenario, studies suggest that inadequate sleep duration is associated with an increased odds of being overweight and obesity.[20,21,22] In this case, the underlying mechanisms of this association, although not fully understood, would be a reduction in spending energy, increased chances of eating, changes in appetite regulatory hormones, increased sympathetic nerve activity, which spilled over in decreased resting metabolic rate, weight gain and obesity.[20, 23]

Thus, given the scenario presented on adolescence, time spent on the bed and excess body fat, the aim of this study was to analyze the relationship between sleep duration and obesity in overweight adolescents, through a systematic literature review.

METHODS

This study employed a methodology based on systematic review, which added information from a set of previous studies[24] Thus, the search of scientific articles were performed by two independent researchers, in electronic databases: BIREME (MEDLINE and Lilacs), PubMed, SciELO and IBECS. Were used the descriptors "Sleep", "sleep duration", "teen", "obesity" and "overweight" in Portuguese and English languages for searche the. In addition, we resorted to the logical operators "AND" and "OR" to combine descriptors and terms used to search publications.

After the search procedure, was identified initially, a total of 1083 articles and subsequently selected articles that met the inclusion criteria: a) sample of adolescents aged 10-19 years,[25] b) publications between the years 2002 and 2013 in Portuguese and English; c) original research articles with humans. To this end, we chose not to include review articles, theses, dissertations and monographs.

RESULTS

After the first analysis, we found 1,083 publications, then 663 (MEDLINE=176, LILACS=10, PUBMED=186, SCIELO=235 and IBECS=56) were eligible for the second phase of this review, which consisted of the reading of summaries. Later evaluation of the abstracts, studies that met the inclusion criteria were read in full. At the end, 15 articles met all the selection criteria, as in figure 1.

In table 1 are presented chronologically general information about the 15 included studies. Of these, five used longitudinal design,[6, 29, 35, 37, 38] and the others had type sectional study[18, 26, 27, 28, 30, 31, 32, 33, 34, 36] with sample from 133 to 73.836 subjects, composed of adolescents aged between 10-19 years.[25]

This way, only three articles[29, 33, 37] stated in their results, no significant association between a few hours of sleep, with increased adiposity, the Body Mass Index (BMI) and obesity in adolescents, the others claimed that sleep duration with short of requirements (≤ 7 hours) is significantly associated with increased odds of being overweight and obesity.

According to table 1, the articles analyzed were conducted in several countries, however, there was a higher prevalence for the United States, gathering 60% of

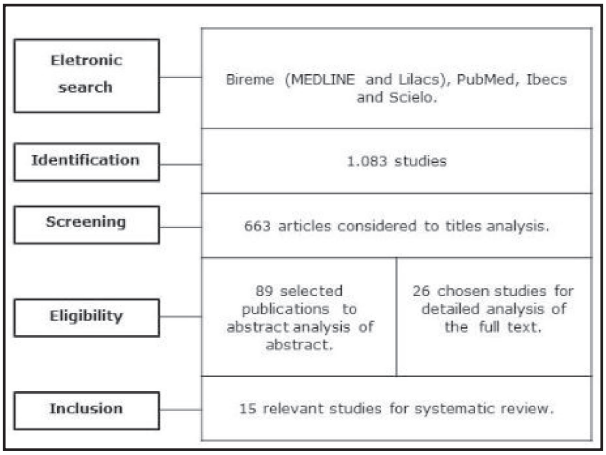

Figure 1. Identification and Studies selection.

Table 1. Characteristics of articles selected by electronic databases.

Author/year	Journal	Sample - Age	Objectives	Type of study	Conclusion
Gupta et al., 2002	American journal of human biology	383 (11-16)	To investigate whether there is a link between short sleep duration and obesity in a sample of adolescent males and females.	Cross-sectional	Decrease an hour during sleep was associated with less time doing physical activity, in addition to presenting an odds ratio of 0.20 Implying 80% increase in the odds of obesity.
Seicean, et al., 2007	Sleep breath	529 (14-18)	To define the prevalence of short sleep duration and quantify any association between sleep duration and overweight.	Cross-sectional	Short sleep duration was more frequent among obese than among normal individuals and students who slept> 5 hours per night had a probability of overweight by 8.5 Times, showing a cause-effect relationship.
Wells, et al., 2008	International journal of obesity	4.452 (10-12)	To examine the association between sleep duration, television viewing and obesity and blood pressure among adolescents.	Cross-sectional	Reduction of one hour of sleep had an odds ratio of 0.86 With obesity, favoring increases in body fat, obesity and blood pressure, regardless of physical activity level.
Bawazeer, et al., 2009	Obesity	5.877 (10-19)	To investigate the association between sleep duration and obesity in saudi students.	Cross-sectional	Sleep duration <7h increases the risk of obesity in males and females, with odds ratios of 1.25 And 1.38, Respectively. Poor quality was also significantly associated with obesity in saudi adolescents.
Calamaro, et al., 2010	Journal of sleep research	13.568 (12-18)	To assess the association between duration of less than six hours sleep and obesity in adolescents.	Longitudinal	One short sleep stage i obesity was not significantly associated with obesity in stage ii obesity (p <0.218). Although there is no association between sleep duration and obesity in adolescence, this aspect can play an important role in adult age.
Weiss, et al., 2010	Sleep	240 (16-19)	To investigate the relationship between sleep duration and energy consumption by adolescents.	Cross-sectional	Short sleep duration was associated with 2 times more likely to consume snacks, totaling more than 475 kcal daily, increasing the risk of obesity in view of small changes in the eating patterns that cumulatively alter energy balance.
Park, 2011	Western journal of nursing research	73.836 (12-18)	To explore the association between sleep duration, overweight and obesity in a representative sample of south koreans adolescents.	Cross-sectional	Short sleep was strongly associated with increased risk of overweight and obesity (or = 0.94, P <0.0001). Thus, intervention strategies must be developed and implemented to stem the rising prevalence of obesity in adolescents.
Lytle; pasch; farbakhsh, 2011	Obesity (silver spring)	723 (10-16)	To describe the relationship between sleep and body weight in a population of adolescents.	Cross-sectional	The inverse relationship between sleep duration and bmi proved evident in boys (or = 1.38) And girls (or = 1.19). Thus, especially for elementary school students ii, inadequate sleep is a risk factor for early adolescent obesity.
Sung, et al., 2011	Sleep	133 (10-17)	To determine whether a short duration of sleep is related to metabolic risk and severe obesity.	Cross-sectional	Despite inadequate sleep to be able to affect other areas of operation, there was no strong association with bmi (or = 1.03) Or metabolic responses.
Drescher, et al., 2011	Journal of clinical sleep medicine	319 (10-17)	To investigate the association between sleep duration and obesity incidence and risk factors among pre-adolescents and adolescents.	Cross-sectional	The total sleep time (tst) reported by parents was inversely associated with bmi (r = -0.160, P = 0.004). The tst was also inversely related to use of electronic and caffeine.
Seegers, et al., 2011	American journal of epidemiology	1.916 (10-13)	To evaluate the association between time spent in bed and bmi.	Longitudinal and prospective	Short sleep duration was associated with an increased odds ratio for overweight (or = 1.55) And obesity (or = 3.26) When compared with adolescents who slept longer. Thus, the reduction of an hour of sleep per night to 10 years of age represents an increased odds ratio for overweight (or = 1.51) And obesity (or=2.07) At 13 years of age.
Garaulet, et al., 2011	Internacional journal of obesity	3.311 (12-18)	A) to describe the duration of sleep in adolescents from nine european countries, (b) to evaluate the association between short sleep duration with excess adiposity and (c) to analyze weather physical activity,sedentary behavior and/or poor dietary habits are related overweight and obesity.	Cross-sectional	Few hours of sleep (<8 hours) showed significantly (p <0.05) Associated with higher bmi, body fat percentage, waist circumference and hip when compared with adequate sleep (> 8 hours).
Araújo; severo; ramos, 2012	Pediatrics	1.171 (13-17)	To study the association between sleep duration and adiposity from 13 to 17 years old.	Cross-sectional and longitudinal	In a cross-sectional analysis, sleep duration was inversely associated with bmi only in boys of 13 years old. Longitudinally, there was an association between the variables in both sexes at 13 years of age and only in boys at age 17.
Lytle, et al., 2012	Health education & behavior	723 (10-16)	To examine the longitudinal relationship between change in sleep duration over time and change in bmi and body fat percentage in adolescents.	Longitudinal	The findings of this study do not confirm the hypothesis that a decline in sleep duration during adolescence may increase the risk of obesity. However, the only longitudinal relationship that proved to be close to significance (p = 0.068) Was female.
Mitchell, et al., 2013	Pediatrics	1.429 (14-18)	To determine whether sleep duration is associated with changes in bmi distribution.	Longitudinal	Increase in sleep duration of 7.5 Hours to 10 hours per day, especially those having a concentration of fat in the upper body, can help reduce the risk of obesity in adolescent 4%.

the studies[18, 26, 29, 30, 32, 33, 34, 37, 38] the rest were distributed between South America[27], Asia[28, 31], North America[35], and Europe[6, 36].

DISCUSSION

Given the scenario presented in the review and the results, there is the involvement of adolescents with inadequate habits and insufficient sleep according to the minimum recommendations (8 hours).[17] Such behaviors are due to the increase in social, school and work, hormonal changes and demands increased utilization of technologies by adolescents,[19] and can lead to serious damage to health and quality of life as well as the emergence and worsening of diseases, obesity being the focus of the present study.

In this sense, studies[18, 39] claim that 45% of teenagers sleep about an hour less than their estimated sleep need.[17] Furthermore, we identified that a duration of less than 7 hours sleep is associated with increases in body fat[28,36], increased participation in sedentary leisure activities such as watching TV, using the computer and playing video games[27, 29, 31, 34, 36], decrease body movement[26, 36, 37], as well as eat foods high in fat and carbohydrate[30], favoring negative changes in BMI classification method used in all studies to determine whether subjects had levels of overweight and/or obesity.

According to Patel and Hu[23], increments of hunger due to changes in appetite regulating hormones (ghrelin and leptin), increased opportunities to eat, fatigue and changes related to body temperature, are potential mechanisms involved in this association between short durations of the sleep and increases in body weight and obesity. Thus, the first two conditions were associated with increased caloric intake and the last two with low energy expenditure. In this perspective, Knutson[20] reaffirms that inadequate sleep reduces energy expenditure, increases the chances of eating and alter levels of appetite-regulating hormones. Thus, the increased caloric intake is not offset by an increase in physical exercise, such mechanisms will cause weight gain and eventually obesity.

In this sense, most of the analyzed articles (6, 18, 29, 31, 32, 34, 35, 36, 37, 38) considered physical activity as a factor related to the association between sleep duration and overweight and/or obesity. This way, studies of Boscolo *et al*[41] and Bernard *et al*[42] reaffirmed the link between physical activity and quality of sleep, to explain that students from lower social classes, who were more physically active, had better quality of hours of sleep instead of teenagers from private schools that adopt more sedentary behaviors due to improved socioeconomic conditions.

In this context, the study of Petribú *et al*[43] observed that the proportion of overweight and obesity was higher in those who had a negative perception of sleep quality and showed insufficient levels of physical activity. Nevertheless, studies of Calamaro *et al* [29], Lytle *et al* [37] and Sung *et al* [33] found no significant value for the association between sleep duration and overweight and obesity.

Moreover, among the articles analyzed, only the studies of Sung *et al*[33] and Wells *et al*[27] analyzed the blood pressure of the subjects and identified association between too little sleep increases with inotropes, particularly systolic blood pressure, increasing the risk of developing cardiovascular disease[4,5].

Regarding the methods used to verify the quantity and quality of sleep, all the studies used validated questionnaires and adapted, however, only those studies Descher *et al*[34] and Weiss *et al*[30] used polysomnography, a method classified as a gold standard to assess sleep, and it was seen that the two evaluation techniques were associated in a few hours of sleep with obesity.

It was identified as a possible limitation of this review, that most of the studies analyzed used as a technique for body evaluation method of BMI may not indicate correctly the changes in body composition of adolescents, since this population is under development maturational. Therefore, it is necessary to carry out more studies, longitudinal character, using more specific and reliable methods for analysis of sleep and body composition to establish a consensus on the issue.

CONCLUSION

Given the scenario presented in the systematic review and the results, there is the involvement of adolescents with inadequate sleep habits and insufficient for their physical and cognitive recovery. Such behaviors are due to increased social demands of school and work, hormonal changes and the increased use of technology by teenagers and can cause serious damage to health and quality of life as well as the development and aggravation of diseases, being obesity focus of the present study.

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