Rev Bras Cineantropom Desempenho Hum review article

https://doi.org/10.1590/1980-0037.2021v23e82644

Adequate sleep duration among children and adolescents: a review of the Brazil's Report Card

Duração do sono adequada entre crianças e adolescentes: revisão para o Report Card Brazil

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Abstract – This study aimed to summarize existing research examining the prevalence of adequate sleep duration or meeting sleep recommendations among Brazilian children and adolescents. A systematic review was conducted on eight databases. The criteria for inclusion were original research, samples including Brazilian children and adolescents (age 0–18), studies that reported variables regarding sleep duration using both objective or subjective measures, school- or population-based surveys with random sampling, and cross-sectional or cohort studies. Of the 54 articles included, only 27 used data from different studies. Most of the studies were conducted in the southern region (n = 17) with only two studies having a nationally representative sample. Two studies included children below age five, and the age group most investigated was adolescents (>10 years old). A majority of the studies used a self-reported questionnaire and showed variability in the cutoff point applied for adequate sleep duration with the most reported being ≥8 hours. The proportion of adolescents who met recommendations or had adequate sleep duration ranged from 15% to 89%. Among children, the prevalence ranged from 17% to 95%. The least variability was observed among toddlers, ranging from 93% to 95%. No consistent gender differences were observed among the gender-stratified groups of children and adolescents across the studies. It can be observed that, because of the wide range of results and the lack of data with national representativeness, the prevalence of sufficient sleep among young people aged below 18 remains undefined in Brazil.

Keywords: Adolescent; Children; Preschool; Epidemiology; Sleep.

Resumo – *Objetivou-se resumir os estudos existentes que examinaram a prevalência de duração adequada do sono ou atendimento às recomendações de sono entre crianças e adolescentes brasileiros. Uma revisão sistemática foi realizada em oito bases de dados. Os critérios de inclusão foram pesquisas originais, amostras incluindo crianças e adolescentes brasileiros (de 0 a 18 anos), estudos que relataram variáveis relacionadas à duração do sono usando medidas objetivas ou subjetivas, pesquisas baseadas na escola ou na população com amostragem aleatória e transversal ou estudos de coorte. Dos 54 artigos incluídos, apenas 27 utilizaram dados de estudos diferentes. A maioria dos estudos foi realizada na região sul (n = 17), com apenas dois estudos tendo uma amostra representativa nacionalmente. Dois estudos incluíram crianças menores de cinco anos, e a faixa etária mais investigada foi de adolescentes (> 10 anos). A maioria dos estudos utilizou um questionário autorreferido e mostrou variabilidade no ponto de corte aplicado para a duração adequada do sono com a maioria relatada sendo ≥8 horas. A proporção de adolescentes que cumpriram as recomendações ou tiveram uma duração de sono adequada variou de 15% a 89%. Entre as crianças, a prevalência variou de 17% a 95%. A menor variabilidade foi observada entre as crianças, variando de 93% a 95%. Nenhuma diferença de gênero consistente foi observada entre os grupos. Observa-se que, pela ampla variabilidade de resultados e pela carência de dados com representatividade nacional, a prevalência de sono suficiente em jovens com menos de 18 anos permanece indefinida no Brasil.*

Palavras-chave: *Adolescentes; Crianças; Pré-escolares; Epidemiologia; Sono.*

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Received: December 23, 2020
Accepted: July 05, 2021

How to cite this article
Malheiros LEA, Knebel MTG, Lopes MVV, Mello GT, Barbosa Filho VC, Silva KS. Adequate sleep duration among children and adolescents: a review of the Brazil's Report Card. Rev Bras Cineantropom Desempenho Hum 2021, 23:e82644. DOI: https://doi.org/10.1590/1980-0037.2021v23e82644

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INTRODUCTION

Sleep is an essential component of human health and plays an important role in several physiological processes, such as hormone secretion and energy balance[1,2], regulating mood, attention, and behaviors[3]. Healthy and adequate sleep is associated with reduced body mass, better diet, and improved mental health (e.g., better regulatory emotion), which is essential to promote the learning process among children and adolescents[4,5]. Conversely, sleep deprivation is a risk factor for health conditions, such as obesity and depression[6].

In recent decades, there has been a significant reduction in the sleep duration of children and adolescents, making the monitoring of sleep behavior indispensable in this target population[7]. Therefore, age-based sleep guidelines have been created to prevent and reduce the burden of sleep deprivation (e.g., National Sleep Foundation—NSF from the USA[8]—and the Canadian 24-hour Movement Guidelines[9]). These guidelines provide similar recommendations for children and adolescents according to age groups as follows: school-aged children (5–13) and adolescents (14–17) are recommended to sleep 9–11 hours and 8–10 hours per night, respectively. Moreover, the guidelines are shown to be specific for infants aged less than a year old (NSF recommends 12–15 hours while the Canadian guidelines recommend 12–16 hours), toddlers aged 1–2 (11–14 hours), and preschoolers aged 3–4 (10–13 hours).

Studies from various countries have monitored the prevalence of sufficient sleep among young people with substantial distinctions between nations. In Canada, around 60% of children and 70% of adolescents sleep the number of hours recommended for their age group. In the USA, this prevalence dropped to 40% for children and 30% for adolescents. However, in Brazil, there are no national sleep guidelines, and studies investigating sleep deprivation in Brazilian children and adolescents have local representativeness and are based on no standardized recommendations or even on adults' cutoff points for adequate sleep duration. Accordingly, the present review seeks to summarize representative and standardized evidence related to sleep duration among Brazilian children and adolescents in order to accurately assess the current national scenario. Moreover, this is the first entry of sleep parameters to the Report Card Brazil, allowing it to cover the complete spectrum of 24-hour movement behaviors (i.e., physical activity, sedentary behavior, and sleep). Therefore, this review aims to summarize studies that analyzed the prevalence of adequate sleep duration or meeting the existing recommendations in Brazilian children and adolescents up to 18 years of age.

METHOD

Measured outcome

This systematic review included sleep duration as the outcome and involved articles that have quantified sleep duration as continuous (e.g., hours or minutes per night) or categorical (e.g., prevalence of adequate sleep) measures independent of the cutoff points and recommendations considered in the study.

Study search strategies

A systematic search was conducted in August 2020 in the following electronic databases: Medline (PubMed), Scopus, Web of Science (Web of Knowledge), EMBASE, PsycINFO, CINAHL, SciELO, and LILACS (*Literatura Latino-Americana em Ciências da Saúde*). The search strategy included four groups of descriptors: concept (sleep), context (country or nationality), population (young people < 18 years), and sleep duration evaluation methods (see Supplementary File 4). The Boolean operator "AND" was used for combinations among descriptor groups, and "OR" was used for intragroup combinations. The truncation symbols (\$, *, or "") specific to each database were also used to increase the range of searches for descriptor variations. Searches were conducted with descriptors in English and Portuguese (in databases that are available: LILACS and SciELO). The search of the electronic databases was supplemented by a personal library and a screening of the reference list of included articles in order to identify potentially relevant titles.

Identification of eligible studies

Selection criteria

The eligibility criteria in this review were (I) original research articles published in peer-reviewed journals, (II) samples with Brazilian children and adolescents aged 0–18 years old (or a mean age within these ranges or separate data for individuals in this age range), (III) articles that reported variables regarding sleep duration (e.g., hours per night, minutes per night, prevalence of adequate sleep duration [despite the cut-point used]) using objective (i.e., polysomnography or actigraphy) or subjective (i.e., self-, proxy-, or parent/guardian-report) measures, (IV) population- or school-based surveys with random sampling, and (V) cross-sectional or cohort studies.

Selection process

The initial analysis was performed based on the reading of the manuscript's titles, and, when there was doubt regarding the inclusion of the study, a reading of the abstract was carried out. After this analysis, the articles were screened based on full-text reading and subsequently analyzed according to the established selection criteria. All the processes were conducted by two independent peers (peer 1: LM and MK; peer 2: GM and ML). The peers screened an equal number of references (50%), and disagreements between reviewers were resolved by consensus.

Data extraction and synthesis

The included articles were equally divided and extracted by the two mentioned peers. The prevalence of adequate sleep duration was extracted, and the cutoff point adopted in each article was preserved. In cases in which the authors did not define an adequate sleep category (e.g., <6 h/d, 6–8 h/d, and >8h/d), the one that characterized the age-based sleep guidelines[9] was

extracted. In addition, articles from the same study were identified to avoid duplication of information.

Information extracted comprised i) basic descriptive information about the article (e.g. author, title); ii) sample size; iii) age range; iv) sleep measurement instrument or questionnaire, classified as "defined" when a valid and established questionnaire was nominated (e.g., Pittsburgh Sleep Quality Index), "undefined" when no information regarding the sleep duration measurement was provided, or "undefined-reproductible" when the questionnaire was not nominated but authors fully described the questions used for assessing sleep duration; v) sleep duration guidelines and/or sleep duration categories/cutoff points adopted; and vi) the results (by gender and age when provided) of the prevalence of adequate sleep (according to the authors) or the duration of sleep presented continuously.

The overall prevalence by gender and age (when reported by the authors) of adequate sleep duration and/or meeting sleep duration recommendations was extracted. The results of the studies were presented in alphabetical and chronological order by first author name and year of publication, respectively. The results were organized to present methodological aspects (Supplementary File 1) and the prevalence of sleep (Supplementary File 2) of the included studies. In the case of articles reporting findings from the same study or sample (e.g., 10 articles reported ISCOLE findings), the article with the largest sample size for sleep data was selected for study description.

RESULTS

The searches found 5,307 articles, 54 of which were identified and included in the review (no article was included from the screening of the reference list). Figure 1 presents a summary of the screening process. The articles were published between 2005 and 2019, but most were published after 2015 (n = 42). While 54 articles were identified, some used the same study sample: 10 articles used data from ISCOLE[10–19], 3 from ERICA[20-22], 7 from the "Brazilian Guide for Evaluating Physical Fitness Related to Health and Life Habits"[23-29], 2 from BRACAH[30,31], 2 from COMPAC[32,33], 2 from "1993 Pelotas Birth Cohort"[34,35], and 4 from "2004 Pelotas Birth Cohort[36–39]." Three studies were conducted with the same sample of adolescents from the city of Maravilha in Santa Catarina[24,40–42], and another three were conducted with the same sample of adolescents from the city of Teutônia in Rio Grande do Sul[43–45]. The other articles did not report their study name or were identified as having unique samples (n = 18). Overall, 27 different studies were identified among the 54 reports. Detailed information on all studies is available in the supplementary file (Supplementary File 1).

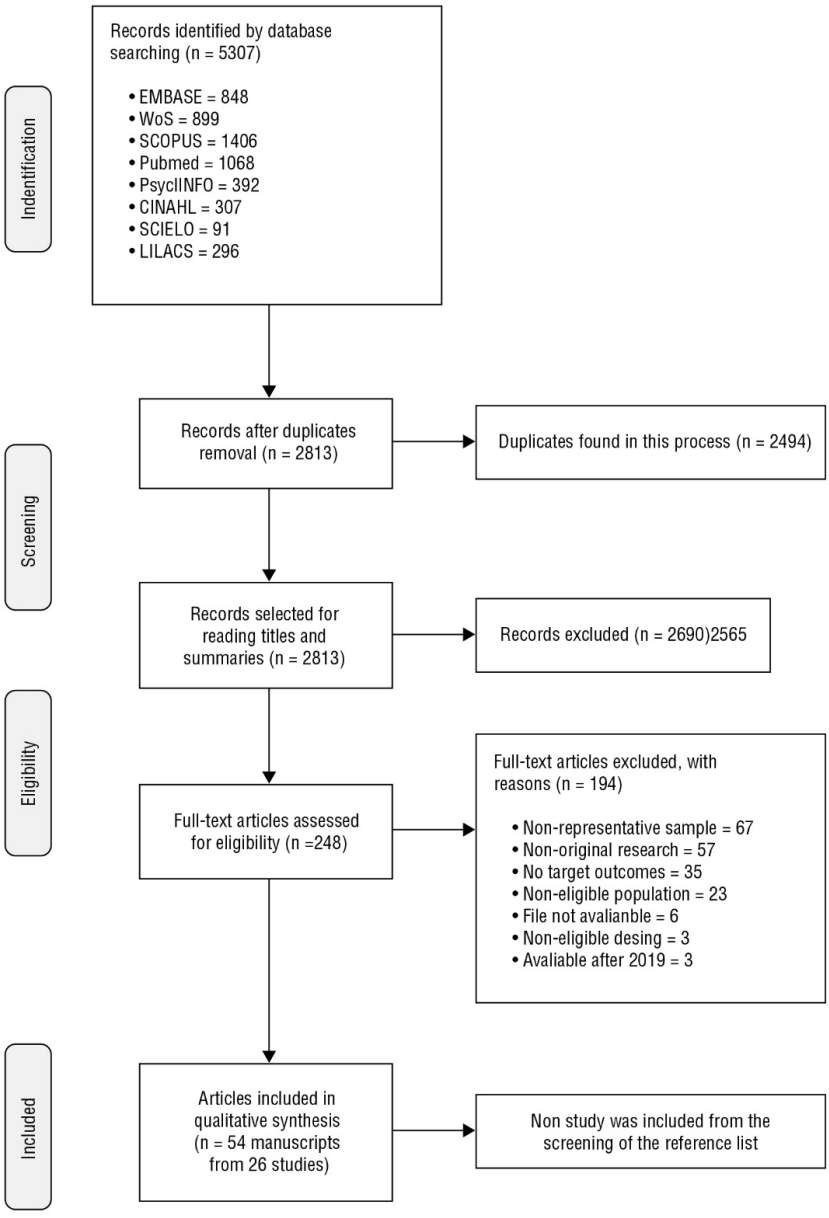

Figure 1. Flowchart of the studies through the phases of the systematic review.

The majority of studies were conducted in southern Brazil (n = 17)[28,30,31,33,35,39,43,46–55] followed by the southeast (n = 3)[15,56,57] and northeast (n = 5)[58–62]. No studies were available from cities in the mid-west or northern regions of Brazil. Two studies were from a national sample, contemplating all five Brazilian macro-regions[20,63]. Studies conducted with adolescents (>10 years old) were the most frequent (n = 16)[21,29,31,32,35,40,44,47,49,50,53,55,58,60–62] followed by those with children aged 5–10 (n = 6) [15,46,51,52,56,59] and infants and/or toddlers (n = 2) (<5 years old)[36,54]. Three studies analyzed more than one age group[48,57,63].

Regarding instruments for measuring sleep duration, one study used accelerometers (ActiGraph GT3X+)[15], and all the others used self-reported or parent-reported questionnaires[36,48,52,54,63]. Only five studies were classified as "Defined" and used the

following questionnaires: Brief Infant Sleep Questionnaire (BISQ)[62], The Sleep Disturbance Scale for Children (SDSC)[56,63], Pittsburgh Sleep Quality Index (PSQI)[63], and Back Pain and Body Posture Evaluation Instrument (BackPE)[44]. The other studies that used questionnaires did not report the name of the instrument used and were classified as "Undefined-Reproductible" (n = 12) or "Undefined" (n = 13).

The prevalence of compliance with sleep recommendations/adequate sleep duration was available in 22 studies (30 articles) (Supplementary File 2). Although some studies utilized the same study/sample, different cutoffs were adopted across them. Eight articles applied sleep duration cutoffs proposed by health organizations to describe sleep compliance (24-hour Canadian guideline, National Sleep Foundation) [16,20,25,27,31,32,34,53]. Other studies classified sleep duration as adequate or inadequate based on varying cutoff values with ≥8 hours per day as the most frequent criteria (n = 13).

The prevalence of meeting the recommended sleep duration ranged from 13.1% to 96.5%. The least variability was observed among toddlers, ranging from 93% to 95%. In children, the prevalence varied from 17% to 95%, and in adolescents, it ranged from 15% to 89% (Figure 2). Studies with data from all the five major Brazilian regions reported a high prevalence of sufficient sleep among children (95.1%)[63] and adolescents (82.2%[20] and 89.2%[63]). However, studies conducted specifically in the northwest showed lower compliance with the recommendations identified among adolescents. The results of the south and southeast regions varied considerably; however, data available from the southeast included only children (Figure 2).

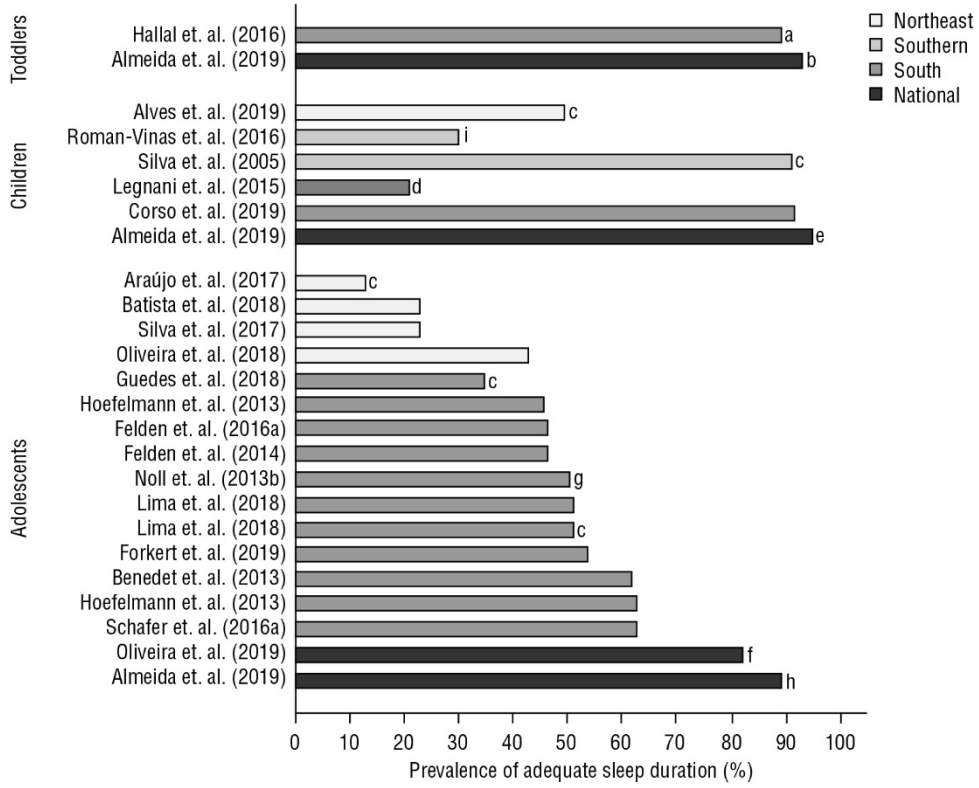

Figure 2. Prevalence of meeting recommendations or having adequate sleep according to age group and Brazilian macro-regions. Note: Letters refer to cutoff points applied: a (≥10h/d); b (≥9h/d); c (>8h/d); d (>10h/d); e (≥7h/d); f (>7h/d); g (8-9h/d); h (≥6h/d); i (9–11h/d); studies with no letter applied the ≥8h/d cutoff point.

Figure 3 shows the prevalence of meeting the recommendations according to sex, separately for each age group. No consistent sex difference was observed among the sex-stratified groups of children and adolescents across the studies. There were no studies stratified by sex in the pre-infant and toddler age groups.

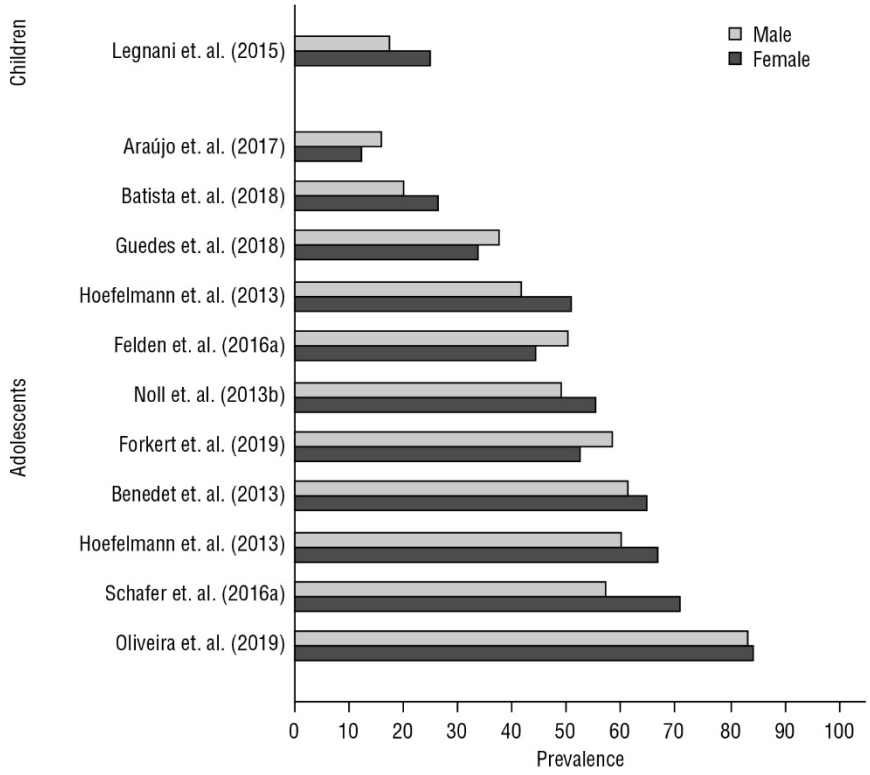

Figure 3. Prevalence of meeting recommendations or having adequate sleep according to age group by sex.

Studies showing only continuous sleep duration measurements are presented in Supplementary File 3. Briefly, five studies did not report the prevalence of adequate sleep duration; instead, they reported the mean sleep duration per night. One study was conducted with toddlers (12 months old)[54], three with children (7–13 years old)[46,48,57], and one with adolescents (14–19 years old)[47]. The average sleep duration of toddlers was 9.5 hours per night (no standard deviation was reported). For children, the mean sleep duration ranged from 9.9 to 10.2 hours per night while, in adolescents, the sleep duration was of 7.9 ± 1.8 hours on school days and 9.2 ± 1.8 on non-school days.

DISCUSSION

This systematic review aimed to verify the sleep duration among children and adolescents in Brazil. Accordingly, 54 articles, which accounted for 27 different studies, were included. The findings showed a higher predominance of studies in the southern region of Brazil, few studies with children less than six years of age, and higher methodological variability of the instruments used to examine sleep duration. In the present review, there was a wide range of the proportion of children and adolescents (from 13.1% to 96.5%) who had adequate sleep duration or who met any institutional recommendations.

Part of this variability may be explained by the use of different cutoff points for classifying sleep duration and the use of questionnaires with different recall periods with most of them classified as undefined-reproductible or undefined. Meanwhile, only ISCOLE, which is a multicenter study, assessed sleep duration using an accelerometer. This reflects the financial burden that Brazilian universities and researchers face when acquiring research-grade accelerometers, making it impractical to use them in largescale epidemiological studies.

This review highlights that there is no consensus in terms of the sleep time cutoff point among Brazilian studies, which inhibits comparability of the results, and provides overestimated proportions of adequate sleep duration in children and adolescents. Less than half of the reviewed studies stated the recommendation guidelines adopted, and, among these, the NSF guidelines[8] were the most frequent, although often confusing. For instance, most of the studies adopted ≥8 hours as sufficient sleep for adolescents younger than 13 years old while the NSF recommends 9–11 hours of sleep[8] and the American Academy of Sleep Medicine recommends 9–12 hours[64]. Similarly, adopting ≥10 hours represents a misclassification for toddlers aged 1–2 years old, who should have 11–14 hours of sleep[8,64]. This can be attributed to the stratification of participants in age groups according to the distribution of data or an arbitrary decision instead of grouping them by age ranges compatible with the current sleep recommendations. Applying different cutoff points leads to a systematic overestimation of the proportion of adequate sleep among children and adolescents, masking those who may be experiencing attention or learning problems[4,5] and facing an increased risk of obesity, diabetes, and depression[6]. This methodological concern may be overcome by reaching a consensus for sufficient sleep duration based on any previous institutional guidelines (e.g., WHO, NSF, Canadian/Australian Guidelines) and endorsing it in Brazilian pediatric research.

This review underscores the lack of sleep duration data representative of the country. Only one study reported the prevalence of sufficient sleep duration in Brazilian adolescents[20], but there is no -nationally representative evidence for toddlers and children. Meanwhile, the National School-Based Health Survey (PeNSE)[65], which monitors health-related factors among schoolchildren in Brazil every three years and is supported by the government, does not measure sleep duration. Given this gap, including pediatric sleep surveillance in the agenda for future epidemiological nationwide surveys is paramount.

Despite this review demonstrating a wide variability in the prevalence of adequate sleep or meeting a guidelines recommendation between studies, the pattern was not observed among studies with toddlers. From two studies with toddler data, approximately 92% of participants achieved adequate sleep or met the recommendations. These results are slightly larger than those of other countries such as Canada[66] and Australia[67], where values were around 83% and 88%, respectively. For the other age groups, variability was more evident. When considering studies with children, one study demonstrated that more than 90% of children met a sleep recommendation[63], and another showed less than 30%[52]. A study conducted with children aged 9–11 across 12 countries observed a prevalence of 42% for meeting the Canadian Guidelines among children from these countries, with countries such as Australia and the UK showing the highest prevalence (76%) while China had the lowest (15%)[16]. Adolescents were the most investigated population among the included studies,

which probably explains the highly heterogeneous results in this age group. A study by Araujo et al. (2017) showed that only 15% of adolescents met the recommendations of sleep hours while studies by Almeida and Nunes (2019) showed that approximately 90% of them adhered to this recommendation. Some countries show a low prevalence of adequate sleep, such as the USA, where the prevalence of sufficient sleep is around 32%[68], or China[69], showing only 8% of adolescents meeting the Canadian guidelines. However, in Canada, the results are opposite to the prevalence of sufficient sleep ranging from 66% to 74%[70], and similar results were found in the UK[71].

The prevalence of adequate sleep duration in children varied similarly within the Brazilian regions. Although Brazil is marked with social and health inequalities[72], the observed within-region differences were based on studies that applied distinct cutoff thresholds for adequate sleep duration, which may partially explain the differences. In this study, a lower prevalence of adequate sleep duration was found among adolescents from the northeast than among those from the southeast and southern regions. Brazil is the size of a continent, and these findings may be explained not only by individual and contextual factors but also by environmental parameters. According to evidence from South America[73], latitude is observed to strongly affect sleep patterns, leading to longer sleep duration with increasing latitude. Latitude affects the variation of daylight hours and locations near the Equator, such as Northeast Brazil, have approximately 12 hours of daylight all over the year, and the sun rises earlier in the morning.

This is the first study to compile evidence of adequate sleep duration among Brazilian children and adolescents. Another strength is the summary of findings per country region, which highlights the differences within the population given Brazil's size. However, this study has certain limitations that need to be acknowledged. The screening and extraction processes were conducted by two independent peers, and no calibration was performed between them to confirm that the interpretations were the same for all screened parameters. Despite this, the inclusion criteria were established among the group of reviewers, and all members were in accordance with the established criteria, and the criteria were reinforced at all stages of the process through periodic meetings. Owing to the nature of this study, publication bias may arise, and conclusions were limited to the available evidence. Therefore, the findings should be interpreted with caution because of the possibility of result bias (e.g., higher prevalence rates in recent studies than in older studies).

CONCLUSIONS

From this review, we can observe that, owing to the wide-ranging results and the lack of data with national representativeness, the prevalence of sufficient sleep among young people aged below 18 years of age is undefined in Brazil. These data also emphasize that researchers need to recognize that adult cutoffs do not apply to the pediatric population. It is necessary to standardize what is enough sleep for the infant-juvenile population based on cutoff points already published and established by various health organizations or even by creating a guideline for the Brazilian population recognizing the sociocultural aspects of the country.

COMPLIANCE WITH ETHICAL STANDARDS

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. This study was funded by the authors.

Ethical approval

This research is in accordance with the standards set by the Declaration of Helsinki

Conflict of interest statement

The authors have no conflicts of interest to declare.

Author Contributions

Participated in the methodological design, searching and evaluation of studies, writing the text, and approval of the final version of the manuscript: LEAM; Participated in the study search and selection, data extraction and synthesis, and writing the text of the manuscript: MTGK, MVVL, GTM; Participated in the methodological design, evaluation of studies, writing of the text, and approval of the final version of the manuscript: VCBF, KSS.

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SUPPLEMENTARY MATERIAL

Supplementary material accompanies this paper.

Supplementary File 1: Free access in https://osf.io/eu5kd/

Supplementary File 2: Free access in https://osf.io/eu5kd/

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