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# Association between sleep disorders and headache in adolescents: systematic review

# Associação entre distúrbios do sono e cefaleia em adolescentes: revisão sistemática

# Asociación entre trastornos del sueño y cefalea en adolescentes: revisión sistemática

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## Abstract

Objective: The aim of this study is to analyze the association between sleep disorders and headache in adolescents. Materials and Methods: A systematic literature review was carried out, analyzing the publications of articles indexed in the National Library of Medicine (Medline /Pubmed), Scientific Electronic Library Online (Scielo), Cochrane Library and Scopus.The inclusion criteria were as follows: articles in English, with available abstracts; articles that answered the guiding question; and covered the age group of 10 to 19 years old. Advanced search used the descriptors ‘’ Adolescents’’, ‘’ Sleep disorder’’,’’Headache’’, ‘’Quality of life’’, ‘’Poor sleep quality’’ and their synonyms recognized by the Mesch and Desc vocabulary. Results: of the 3.386 articles found, 2.318 articles were selected for having their titles and abstracts read. Among these articles, 41 were selected for reading in full,

resulting in the selection of 10 studies to be included in this review. Conclusions: It is concluded that sleep disorders are associated with headache in adolescents, this association being a complex and bidirectional phenomenon that does not allow to clearly distinguish which condition appears first.

**Keywords:** Sleep disorders; Headache; Teenager; Quality of life; Poor sleep quality.

**Resumo**

Objetivos: O objetivo deste estudo é analisar a associação entre os distúrbios do sono e a cefaleia em adolescentes e o impacto destas condições na qualidade de vida dos adolescentes. Métodos: Realizou-se uma revisão sistemática da literatura, analisando as publicações de artigos indexados na National Library of Medicine (Medline/Pubmed), Scientific Electronic Library Online (Scielo), Cochrane Library e Scopus. Os critérios de inclusão foram: artigos no idioma inglês com os resumos disponíveis; que respondiam à pergunta norteadora; e abrangessem a faixa etária de 10 a 19 anos. Na pesquisa avançada utilizou-se os descritores ‘’Adolescents’’, ‘’Sleep disorder’’,’’Headache’’, ‘’Quality of life’’, ‘’Poor sleep quality’’ e seus sinônimos reconhecidos pelo vocabulário Mesch e Desc. Resultados: dos 3.386 artigos encontrados, 2.318 artigos foram selecionados para leitura dos títulos e resumos, destes, 41 foram selecionados para leitura na íntegra, resultando na seleção de 10 estudos para compor esta revisão. Conclusão: Conclui-se que os distúrbios do sono estão associados à cefaleia em adolescentes, sendo esta associação um fenômeno complexo e bidirecional que não permite distinguir claramente qual condição aparece primeiramente, porém sabe-se que estas variáveis causam impacto negativo na qualidade de vida, sendo assim, estudos sobre o tema auxiliam na criação de ações de promoção à saúde que visem reduzir estes impactos.

**Palavras-chave:** Distúrbios do sono; Cefaleia; Adolescente; Qualidade de vida; Má qualidade do sono.

**Resumen**

Objetivos: El objetivo de este estudio es analizar la asociación entre los trastornos del sueño y la cefalea en adolescentes y el impacto de estas condiciones en la calidad de vida de los adolescentes. Métodos: Realizó una revisión bibliográfica sistemática, analizando las publicaciones de los artículos en la Biblioteca Nacional de Medicina (Medline / Pubmed), Scientific Electronic Library Online (Scielo), Cochrane Library y Scopus. Los criterios de inclusión fueron: artículos en inglés con los resúmenes disponibles; quién respondió la pregunta guía; y cubrió el grupo de edad de 10 a 19 años. En la búsqueda avanzada, los

descriptores " Adolescentes ", " Trastorno del sueño ", " Dolor de cabeza ", " Calidad de vida ", " Mala calidad del sueño " y sus sinónimos reconocidos por Mesch y Desc. Resultados: de los 3.386 artículos encontrados, se seleccionaron 2.318 artículos para lectura de títulos y resúmenes, de estos, 41 fueron seleccionados para lectura íntegra, resultando en la selección de 10 estudios para componer esta revisión. Conclusión: Se concluye que los trastornos del sueño se asocian con cefalea en adolescentes, siendo esta asociación un fenómeno complejo y bidireccional que no permite distinguir claramente qué condición aparece primero, pero se sabe que estas variables provocan un impacto negativo en la calidad de vida. por lo tanto, los estudios sobre el tema ayudan a generar acciones de promoción de la salud que tienen como objetivo reducir estos impactos.

**Palabras clave:** Trastornos del sueño; Dolor de cabeza; Adolescente; Calidad de vida; Mala calidad del sueño.

## 1. Introduction

Chronic pain is a public health problem that generates both personal and social losses (Abu-Arefeh et al., 2010). Chronic headache is disabling and capable of negatively impacting the quality of life of individuals, interfering with daily activities, school performance and generating high costs to the health system (Heyer et al., 2014; Silva et al, 2015; Souza et al., 2015; Pimentel et. al., 2020).

Headache is one of the most common complaints during adolescence[3]. In their epidemiological studies carried out in several countries, Abu-Arafeh et al. (2010) and Wober-Bingol (2013) respectively found headache prevalence levels of 58.4% and 54.4% in this age group. According to the International Classification of Headache (2014), the painful condition can be categorized as a primary headache; secondary headache; and painful cranial neuropathies, as well as other facial pain and other forms of headache. Primary headaches are the most common form of headache found in the pediatric population[3], being divided into: migraine or migraine; tension-type headache; trigeminal-autonomic headaches; and other primary headaches.

In primary headaches, sleep disorders are a common comorbidity. However, the number of studies addressing this relationship is still smal (Heyer et al., 2014). According to Torres-Ferrus et al. (2018), adolescents who experience episodes of primary headache have shorter sleep duration and other changes, such as insomnia and excessive daytime sleepiness.

Sleep deprivation is considered a trigger for headache, especially primary migraine-type headache (Kenezevic-Pogancev et al., 2014) and is associated with a lower sense of well-being, impaired daytime body functioning, as well as reduced school performance and attendance, directly interfering with learning (Kenezevic-Pogancev et al., 2014; Turco et al., 2011).

Despite this, it is known that the binomial primary headache and sleep disorders is complex, making it difficult to perceive which condition presents itself first. The presence of altered sleep patterns may trigger headaches, whereas headache is seen as a factor that generates changes in sleep (Heyer et al., 2014).

Accordingly, this study aims to investigate the association between sleep disorders and headache. Therefore, an integrative literature review was carried out as a research strategy, since this search provides the identification of existing evidence in the literature related to the topic in question. The present study can assist in planning actions aimed at adolescent health.

## 2. Methodology

This review followed the guidelines of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and was conducted through the analysis of articles on the theme “Sleep disorders and headache in adolescents’’. The present study included articles available in the following databases: National Library of Medicine (Medline / Pubmed), Scientific Electronic Library Online (Scielo), Cochrane Library and Scopus.

The PICO question guiding the research was the following: ‘’ Is poor sleep quality/sleep disorders associated with headache in adolescents?’’, With P: adolescents; I: presence of sleep disorder; C: absence of sleep disorder; O: headache.

To refine the choice of articles, the following inclusion criteria were established: articles in English; abstracts available in the cited databases; articles that answered the guiding question; and studies covering the age group between 10 and 19 years old, as recommended by the World Health Organization (WHO). The descriptors used in the advanced search were ‘’ Adolescents’’, ‘’Sleep disorder’’, ‘’Headache’’, ‘’Quality of life’’, ‘’Poor sleep quality’’ and their synonyms recognized by the Mesch and Desc vocabulary.

During the selection, studies duplicated in the databases, as well as those classified as literature review articles, clinical trials and case report and those that were not in an article format were excluded, such as editorials, guidelines, letters, conference summary, theses and dissertations.

A peer review was performed, that is, the articles were analyzed by two researchers individually (M.A.C.S. and S.S.S) for further analysis together, following the inclusion and exclusion criteria. In case of any divergence, a third reviewer was consulted (M.V.H.) until a consensus was reached, in order to bring greater reliability to the selection of the synthesis studies.

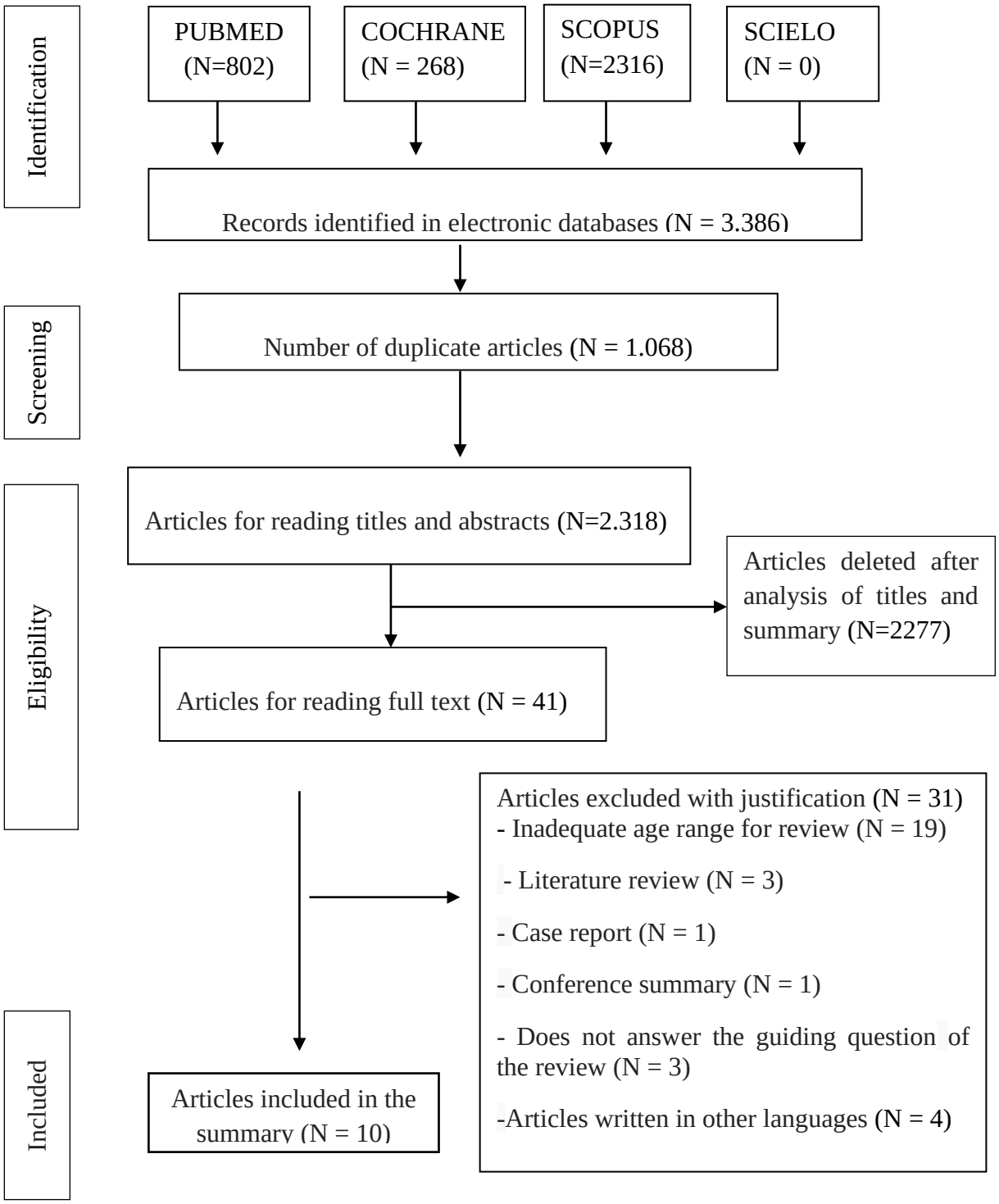
Thus, the first stage consisted of reading the titles and abstracts of the articles. Those which had titles and abstracts that did not include the researched subject were excluded. The studies that met the inclusion criteria were selected to have their full text read, resulting in the selection of articles included in this synthesis.

## 3. Results and Discussion

The search strategies used in this review were adapted according to the access specificities of each database. By crossing the descriptors in the databases, 3.386 articles were found. Of these, 802 were found in PUBMED, 268 in Cochrane, 2.316 in Scopus and 0 in Scielo. The next phase included the exclusion of 1.068 duplicate studies between the bases, with 2.318 remaining to have their titles and abstracts screened.

In this step, 2.277 studies were excluded, as they did not present titles and abstracts that addressed the researched topic, totaling 41 articles for reading the full text. After reading in full, 10 studies remained and were included in the synthesis (Figure 1).

**Figure 1.** Flow of study selection, according to the Prisma scale.




Source: Authors.

In the next stage, a data analysis and synthesis were carried out. The selected articles were organized in Table 1 according to the author, year of publication, country of origin, study design, sample, age group (years old) and results of the study.

As for the year of publication, 20% of the studies were carried out in 2016 and 20% were carried out in 2014. The years of 2019, 2018, 2015, 2012, 2008 and 2007 represented each 10% of the sample. Regarding the geographic distribution, 60% of the surveys were located in America, while 40% were in Europe. Regarding the study design, 8 were transversal and 2 were longitudinal.

**Table 1.** Studies distributed according to author / year of publication, country, study design, sample, age group.

| Author/Year | Country | Study design | Sample | Age group (years) | Results |
|---|---|---|---|---|---|
| Lateef et al (2019) | USA | Transversal | 10.123 | 13 - 18 | Headache was associated with DS (p = 0.001). Among the types of headache, adolescents with migraine had the shortest duration of sleep (p = 0.015). |
| Torres-Ferrus et al (2018) | Spain | Transversal | 1697 | 12–18 | Headache was associated with shorter sleep duration (p <0.01), and with insomnia, daytime sleepiness and restless sleep (p <0.001) |
| Kemper et al (2016) | USA | Transversal | 29 | 12 - 18 | There was no association between sleep disorders and headache (p=0.13). |
| Ming et al (2016) | USA | Transversal | 750 | 14 - 18 | Adolescents with headache had shorter sleep duration at the weekends, when compared to adolescentes without any forms of headache (p=0.0008). |
| Pecor et al (2015) | USA | Transversal | 976 | 10 - 18 | Adolescents with headache had significantly higher daytime sleepiness than those without headache (p<0.001). |

| | | | | | |
|---|---|---|---|---|---|
| Heyer et al (2014) | USA | Longitudinal | 52 | 10 - 18 | There was na association between sleep disorders and headache (p<0.01). |
| Knezevic-Pogancev et al (2014) | Serbia | Longitudinal | 20.917 | 10-18 | Insomnia was the trigger for the onset of pain in adolescents with a history of migraine and in those with other types of headache (p <0.001). |
| Moschiano et al (2012) | Italy | Transversal | 800 | 10 - 18 | Adolescents with headache reported more problems sleeping (p<0.001). |
| Gupta et al (2008) | India | Transversal | 1862 | 12 - 19 | Individuals with headache showed significant differences regarding total sleep time, sleep latency, night-time awakenings and sleep quality when compared to adolescents without headache (p <0.001). |
| Gilman et al (2007) | USA | Transversal | 69 | 13 - 17 | Higher sleep latency was associated with greater intensity (p <0.04) and headache duration (p < 0.05). |

Source: Authors.

The present study aimed to verify the association between sleep disorders and headache in adolescents. Both sleep disorders and headache are conditions that damage the quality of life of adolescents, as they prevent them from performing their daily tasks, also interfering in their performance (Heyer et al., 2014; Silva et al., 2015).

It is observed that most of the studies included in this synthesis took place in North America, more precisely in the United States (Gilman et al., 2007; Heyer et al., 2014;; Pecor et al., 2015; Kemper et al., 2016; Ming et al., 2016; Lateef et al., 2019). None of the studies were conducted in Brazil.

It was found that 80% of the studies have a cross-sectional design (Gilman et al., 2007; Grupta et al., 2008; Pecor et al., 2015; Kemper et al., 2016; Ming et al., 2016; Ming et al., 2016; Torres-Ferrus et al., 2018), thus, only demonstrating the association between the

variables and preventing the cause and effect verification, only allowing to raise certain hypotheses. Therefore, the conclusions drawn from these studies should be cautiously considered.

Adolescence is a period marked by several biological, social and psychological changes (Lima et al., 2014) Therefore, conducting longitudinal studies would be useful to identify critical factors which are characteristic of this age group, as well as their relationship with sleep disorders and headache, considering the impact on quality of life.

The study by Knezevic-Pogancev et al. (2014), with a longitudinal design, showed that the age group directly influences the development of headaches, with insomnia being a trigger reported both in adolescents suffering from migraine (90.6%) and in those who had other types of primary headache (94.5%).

The opposite was found in the study by Heyer et al. (2014), who demonstrated headache intensity ($p<0.009$) and its onset time ($p<0.001$) as predictive factors for sleep impairment. This divergence is present in the literature, since headache and sleep disorders interact in a bidirectional manner [2], through a common pathophysiological substrate (Sousa & Rosato, 2011).

In 50% of the studies included in the review, headache was seen as a predictive factor for the shorter duration of total sleep time (Gilman et al., 2007; Gruota et al., 2008; Ming et al., 2016; Torres-Ferrus et al., 2018; Lateef et al., 2019). According to Geib (2007), sleep is influenced by several modulators, including headache, categorized as na organic modulator, which leads to the installation of inappropriate sleep habits linked to nighttime awakenings and latency time, resulting in shorter total sleep duration.

A shorter total sleep duration leads to excessive daytime sleepiness (EDS). According to Pecor et al. (2015), adolescents who suffer from headaches have greater daytime sleepiness when compared to healthy adolescents. It is suggested that the presence of headache leads to longer latency and more night-time awakenings, resulting in a reduction in the total amount of sleep. According to Bittencourt et al. (2005), sleep deprivation is among the causes of EDS.

The study by Gilman et al. (2007) corroborates this observation. Their results show that there is an association between more severe headache and greater sleep latency.

In the study by Moschiano et al. (2012), individuals who reported more frequent and painful episodes of headache presented sleep disturbances. Although the study did not report which sleep disorders were found, it is clear that there is na association between the variables. According to Nunes [21] (2002), insomnia, a type of sleep disorder, is related to several chronic

diseases. Since primary headache is a chronic condition that modulates sleep habits, it can be suggested that this is a factor associated with insomnia.

In the present review, only one study found no association between any variables (Kemper et al., 2016). This result can be explained by the sample used in the research, since only 29 adolescents were included, not being a representative sample of the population. However, the depression variable was significantly associated with headache. Adolescents who had depression often developed headaches, as demonstrated by the HIT-6 headache test ($p = 0.0006$).

Taking into account that melancholic depression, also called typical depression, is associated with an altered sleep pattern in which the individual tends to present insomnia (Dalgalarrondo, 2019), this comorbidity can be a confusing factor in the present study. This is due to the failure to distinguish which condition generated insomnia, being either a result of headache or depressive disorder.

## 4. Final Considerations

It is concluded that there is an association between sleep disorders and headache in the studied population. Among the types of headache, the most common type found in adolescents are primary headaches, with migraine and tension-type headache frequently associated with insomnia, night-time awakenings and longer sleep latency.

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