SciMedCentral

Annals of Pediatrics & Child Health

Review Article

Review of Childhood Sleep Disorders

Sthefany Mais, Luiza Manfroi Lattmann, Matheus Niehues Militão, Arthur Nathan Luiz Ferreira Matos, Fernando Werner Kasemodel and Lygia Maria Coimbra de Manuel Petrini*

School of Health Sciences, Universidade Positivo, Brazil

***Corresponding author**

Petrini LM, School of Health Sciences, Positivo University, Curitiba, PR, BRA. Zip Code: 80740-050, Tel: 55 41 98854 5072; Email: lygia.petrini@gmail.com

Submitted: 07 June 2021

Accepted: 14 July 2021

Published: 16 July 2021

ISSN: 2373-9312

Keywords

- Sleep
- Sleep-wake disorders
- Sleep hygiene
- Child health

Abstract

Introduction: Sleep disorders in childhood are common complaints in pediatric consultations, so it is important to understand these disorders. Patients can be classified as those who cannot sleep, those who will not sleep, those with daytime sleepiness and those who have increased movements during sleep. The most frequent disorders are insomnia, parasomnias, nocturnal enuresis, noisy sleep and daytime tiredness.

Methodology: A non-systematic review was carried out focusing on the physiological aspects of sleep, the identification and management of the most prevalent sleep disorders in childhood. The research was made using classic articles and books from the literature of the last 20 years. The query in the online databases (PubMed, Google Scholar, Scielo and Medline) was made using terms as "sleep development", "childhood sleep", "sleep disorders" and "sleep hygiene". This article discusses the normal sleep pattern, the definition of sleep disorders, etiologies, epidemiology, clinical characteristics and therapeutic management.

Final considerations: It is necessary to understand that normal sleep patterns vary with age, along with the characteristics of sleep. For this, it is essential to carry out a structured anamnesis, with the purpose not only of diagnosis but also as a basis for the most appropriate therapeutic methods for each situation.

ABBREVIATIONS

ISDS: Infant Sudden Death Syndrome; OSAS: Obstructive Sleep Apnea Syndrome; NB: Newborn; REM: Rapid-Eye-Movements; NREM: Non-Rapid-Eye-Movements; CNS: Central Nervous System; VLPO: Ventrolateral Preoptic; MNPO: Median Preoptic; GABA: Gamma-Aminobutyric Acid; SIDS: Sudden Infant Death Syndrome; DSM-V: Diagnostic And Statistical Manual of Mental Disorders.

INTRODUCTION

Sleep-related disorders are frequent complaints in pediatric medical consultations, with variation in incidence depending on the age group [1-3]. In a study of 472 children, Stein et al describe an incidence of 10.8%, whereas the review by Carter et al exposes that more than 50% of children experience some type of sleep disorder throughout their lives [1,4]. Despite this, it is also known that there is a considerable portion of patients who have sleep disorders symptoms but do not actively say it during the consultation, reinforcing the importance of knowledge on this subject by the professional to enable a complete anamnesis [1].

Patients with sleep disorders can be classified as those who cannot sleep, those who will not sleep, those with excessive daytime sleepiness and those with increased movements during sleep [5]. As pediatric exclusivity disorders there is the infant sudden death syndrome (ISDS) and colic, the other sleep-related disorders can occur in any age group, including adults and elderly [2]. The most frequent disorders described in the literature are, in addition to those already mentioned, are insomnia, parasomnias - including sleepwalking, confusional awakening and night terror -, nocturnal enuresis, noisy sleep - including primary snoring and obstructive sleep apnea syndrome (OSAS) -, and daytime tiredness [1,2,4,5]. It is important to mention that there are still other disorders, but with a lower incidence in the population.

The sleep pattern considered normal in the child varies widely according to age [6]. In the newborn (NB), population we have sleep unrelated to the circadian cycle, but with hunger and/or discomfort, this will change in the first months of life. The NB sleeps for 3 to 4 hours with a wake-up period of around one hour, starting in the REM (*rapid-eye-movements*), phase and staying in this phase most of the time [7]. As the baby grows, the total hours of sleep decrease and become exclusively nocturnal, the night-time awakenings becomes less and less frequent and the sleep becomes predominantly NREM (*non-rapid-eye-movements*) [6,7]. Interesting fact found by the meta-analysis by Galland et al., is the ethnic difference in the sleep pattern, the total sleep time disagreement between Asian and non-Asian children became clear, with the shortest time in the first group [8].

In a systematic review, Dutil et al., demonstrated a

beneficial relationship between good sleep in childhood and the consolidation of memory after learning new tasks, in addition to the contribution to the neural plasticity of the developing brain, because sleep is also associated with the amount of myelin in white matter [9]. These findings further reinforce the need of having a good knowledge of the subject by health professionals, both of the normal sleep pattern and the altered one, to achieve improvement in quality of life from adequate management of this child, from diagnosis to treatment.

In general, it is possible to obtain success in the clinical management of these children with outpatient care and with no need of forwarding to specialists [10]. The treatment of sleep disorders is based mainly on behavioral changes and expansion of safety measures, especially in cases that there are nocturnal movement [7,10,11]. Medication or surgical treatment may be needed depending on the cause of the disorder, but this assessment is usually postponed to a second moment [11,12].

NORMAL SLEEP PATTERN

A good understanding of the normal development of sleep and its stages is of paramount importance for the health professional who is dealing with this complaint. It is from a change in normal that we identify or suspect a disorder, in the pediatrics population this becomes more complex because the regular pattern changes according to the age group.

Sleep regulation

Sleep regulation occurs in two ways, by the circadian system, and by sleep-wake homeostasis [13,14]. The first is controlled by the circadian clock with 24-hour biological rhythms, synchronized with exogenous stimulations [14]. Light represents the most important external factor, it stimulates the photoreceptors in the retina and subsequently inhibits the release of melatonin - a sleep-promoting hormone - by the pineal gland. The regulation of the sleep-wake cycle is time-dependent, the greater the number of hours during wakefulness, the greater the concentration of sleep-promoting substances in the central nervous system (CNS) later [14]. During sleep, these substances dissipate, in an attempt to maintain the sleep-wake cycle [13,14].

Sleep can be divided into REM and NREM, which alternate in cycles during the night, giving rise to the so-called ultradian cycle [14,15]. It is believed that NREM consists of the restorative and restful sleep phase, in which brain activities are reduced [14-16]. It can also be subdivided into phases, the first a transition from wakefulness to sleep (N1), the second the beginning of true sleep (N2), and the third deep sleep (N3) [14]. It is considered that REM sleep is responsible for the consolidation of memories and the development of the CNS [14,15]. In this phase there is an unsynchronized cortical activity, variable heart rate, active suppression of peripheral muscle tone, and a lack of thermoregulation [14,15].

The neurons responsible for promoting sleep are found in the ventrolateral preoptic (VLPO), and median preoptic (MNPO), areas of the brain. In the first region, neurons are mainly activated during sleep and have neurotransmitters that inhibit excitation -GABA (gamma-aminobutyric acid) and galanin [14,16]. During the waking state, the VLPO region is inhibited by the monoaminergic system and both norepinephrine and serotonin inhibit VLPO neurons [14]. Monoaminergic excitatory signals during the waking phase are responsible for muscle tone, during the REM phase they are inhibited, so atony is expected in this phase [14].

The waking state is mediated by a system of neurons that ascends from the brainstem and hypothalamus to the cerebral cortex. Associated with this, there is an excitatory neuropeptide, orexin/hypocretin, which is produced in the lateral hypothalamus, responsible for increasing the excitation of the ascending system [14,16,17]. Furthermore, the orexin antagonist receptors are responsible for increasing the amount of REM and NREM sleep, in addition to reducing sleep latency [17].

Standards by age

Sleep patterns change over the first 5 years of life. Neonates enter the sleep cycle through active sleep, which is similar to REM sleep, and because there is no inhibition of muscle tone it is expected that they appear restless [14]. During the first 3 to 6 months of age, an inversion occurs for deeper peaceful sleep (NREM sleep), after 6 months the time of NREM and REM sleep begin to be resemble to adults [15]. The duration of REM sleep declines from birth until the first year of age, this is an important step for neuronal differentiation and development of neural pathways [14].

As previously said, the duration of the REM and NREM sleep cycle changes as age increases [14,18]. Full-term NB sleep 16 to 18 hours a day, occurring from 18 to 20 cycles in a single day and each cycle lasting 50 to 60 minutes [18]. In the first months of life, the child may appear to have a turbulent sleep, due to the active phase of sleep correspond to more than 50% of the total hours of slept.[18] In this phase there are eye movements, suction, spasms and vocalizations, but again, this is considered appropriate for this age [18]. From the 2nd month of age it is possible to differentiate REM sleep from the NREM, between the 5th and the 6th month begins the subdivision of N1 and N2 (light sleep), N3 (deep sleep), and REM sleep, during this age should start uninterrupted sleep at night [10,19].

The American Academy of Pediatrics, the Sleep Research Society and the American Association of Sleep Technologists determine the sleep patterns to be followed, which is detailed in **Table 1** [20]. Children between 4th to 12th months of life need 12 to 16 hours of sleep per day, including daytime naps. Between the 1st and 2nd years, this amount of hours decreases to 11 to 14. In the 3rd to 5th years, the child should sleep 10 to 13 hours. Between 6th to 12th years, this period should be 9 to 12 hours per day. Adolescents from 13th to 18th years have the lowest need for sleep, being 8 to 10 hours sufficient. Sleeping an appropriate amount of hours for your age is associated with better intellectual, behavioral development, better mental health and quality of life.

DAYTIME SLEEPINESS

It is known that excessive tiredness during the day can generate behavioral, emotional and cognitive complications in children, with worsening functional development to perform tasks and in the ability to retain memory [21,22]. Despite this,

Table 1: Recommendations of necessary sleep hours divided by age group.

Age	Recommendation
4 months - 12 months	12 to 16 hours
1 years - 2 years	11 to 14 hours
3 years - 5 years	10 to 13 hours
6 years - 12 years	9 to 12 hours
13 years - 18 years	8 to 10 hours

there are few studies on sleep disorders that evaluate this variable, mainly in preschool children [23]. In the study by Simola et al., it was argued that all sleep problems should be considered as possible causes of daytime tiredness, regardless of the child's age group.

Narcolepsy

Among the disorders with a clear relationship with daytime sleepiness, narcolepsy is characterized as a clinical syndrome that, in addition to tiredness, has manifestations of REM sleep during the day [24]. This disorder has sudden drowsiness, cataplexy -sudden muscular atonement but with presence of consciousness-, sleep paralysis and hallucinations at the moment of transition between wakefulness and sleep [2]. The transmission is multifactorial, meaning it depends on genetic and environmental factors [24].

Symptomatic treatment is done with stimulants in a continuous and chronic way, and it is the professional's duty to advise the parents that it is not curative [2]. The objective is to allow the patient to be able to carry out all personal and academic activities normally. The association of psychological monitoring shows great benefits in the management of these patients [2,24].

Stimulating medications and their commonly used doses are: dexamphetamine (2.5 to 40 mg / day), methamphetamine (2 to 25 mg / day), methylphenidate (5 to 60 mg / day), mazindol (100 to 400 mg / day) and semolina (37.5 to 112.5 mg / day). Adjuvant medications can be associated with stimulants, such as protriptyline (2.5 to 10 mg / day) or viloxazine (50 to 200 mg / day). As an auxiliary treatment, tricyclic antidepressants have been shown to be beneficial, namely protriptyline (2.5 to 20 mg / day), clomipramine (25 to 100 mg / day or 3 mg / kg with a maximum of 100 mg), fluoxetine (20 to 60 mg / day) and viloxazine (50 to 200 mg / day). For cataplexy symptoms, sodium oxybate (60 mg / kg / night with a maximum of 3 g) is used [24].

EXCLUSIVE PEDIATRIC DISORDERS

Sudden infant death syndrome (SIDS)

SIDS was first described in 1969 and is defined as the sudden and unexpected death of an apparently healthy child under the age of 1 year old, whose cause of death remains unknown, despite investigations (clinical history, necropsy and review of the death site) [2,25-27]. This syndrome is considered the most prevalent cause of death in children from one month old to one year of age, with an incidence in 1000 births ranging from 0.09 to 0.55, respectively from the Netherlands and the United States in 2004 [25,27].

The etiology is unknown, but the deaths seem to be related to the abnormality of cardiac and respiratory control in the brain stem [25]. Risk factors are well reported in the literature, among them are some sleeping habits such as prone position or side, the lack of use of a pacifier, overheating, excessive wrapping of the child, bed-sharing, sleeping on soft surfaces, in addition to lack of breastfeeding, maternal age under 20, mental illness in either parent, pre or post-natal exposure to tobacco smoke, prematurity and intrauterine growth restriction [2,25-27]. The prone position is the most important isolated factor, but the factors influence significantly more when associated [26]. Recommendations to avoid SIDS are based on educating caregivers in order to avoid the previously mentioned risk factors [2,25-27].

Colic

Although not a sleep disorder itself, colic in infants seems to delay the establishment of circadian rhythm and therefore negatively influence the sleep-wake cycle [28]. Colic was first defined by Wessel (1954), as crying or agitation for more than three hours a day, occurring for at least three days a week; it was later updated by the Rome IV criteria (2016) as "recurrent and prolonged periods of infantile crying, agitation or irritability reported by caregivers that occur without an obvious cause and cannot be avoided or resolved" [29].

In a longitudinal study with 40 children, it was found that children with colic have greater difficulty falling asleep, are more easily awake and seem to have less deep sleep.[30] In addition, these children tend to have irregular and short naps throughout the day, and may even stop this habit.[31]

INSOMNIA

Insomnia is a term used in various ways in both the medical and the popular context and can be defined, briefly, as a difficulty related to sleep referred by an individual. Therefore, there is a high burden of subjectivity in this disease, but to be considered a disorder there must be negative repercussions arising from this condition [32]. It is interesting to note that even in the pediatric context, in which the difficulty related to sleep is often not self-reported, there is still a non-objectivity related to the parents' perception.

a. The prevalence of insomnia is about 20 to 30% within sleep disorders in childhood, being considered one of the most common disorders in this group [33]. This probably results from its multifactorial etiology and the subjective definition of the disease. The sleeping difficulty can occur both concerning the onset of sleep, maintenance of sleep, or non-restorative sleep [6,32]. Therefore, before addressing therapy it is relevant to address the main causes, in the next topics some will be discussed and **Table 2** presents a list with all*Medical conditions*: usually lead to insomnia acutely, and the disorder persists as long as the illness lasts. Among the conditions, the most prevalent in the pediatric population stand out, such as respiratory diseases, injuries, ear infections and the onset of dentition.[2]

b. *Fear and anxiety*: in infants it is possible to experience separation anxiety after 10 months; after the mother is

Table 2: Main etiologies of insomnia divided by age group.

Age	Causes
Infants	Sleep disturbance association disorders; Gastroesophageal reflux or other chronic or acute diseases; Excessive food or fluid intake at night.
2 to 3 years	Excessive food or fluid intake at night; Allergy to cow's milk; Chronic or acute diseases.
Preschooler or schooler	Lack of setting limits; Fear, nightmares; Restless legs syndrome; Obstructive sleep apnea-hypopnea syndrome; Other chronic or acute diseases.
Adolescence	Phase delay; Individual variability (afternoon versus morning); Anxiety; Family or school pressure; Emotional disorders (anorexia, schizophrenia, mania); Restless legs syndrome; Obstructive sleep apnea-hypopnea syndrome; Other chronic or acute diseases.

* Modified table by Nunes and Cavalcante [6].

distant, the child may present different degrees of stress, contributing to difficulty in initiating sleep. In children aged 2 to 3 years, the situation of fear is common, which can result from frightening events, parental fights, films, or stories. In adolescents, anxiety and depression can be frequent causes [2,34].

c. *Association disorders*: in these cases, there are certain conditions associated with the initiation and maintenance of sleep in the child, when present, it is easy for the child to fall asleep, when absent they present with long and frequent nighttime awakenings. The association can be positive, meaning that the child creates a condition for himself, such as the presence of a toy or an object, or it can be negative, requiring the presence of another person, a lullaby, a bottle, or sleeping while moving something (e.g. a body part) [35].

d. *Food during the night*: there is an inversion of the sleep-wake cycle when eating at night, conditioning hunger at that time and consequently providing a greater number of awakenings. Therefore, the infant after the 6th month no longer needs to be fed at night, with the exception of premature newborns [2].

Lack of limits: refusals at bedtime or delay in working hours, usually associated with parents' lack of ability to set certain limits. The lack of these establishments begins when the child has sufficient motor skills to leave the crib and the parents abdicate control of the child's nighttime activity [2,36].

Insomnia management

The treatment for insomnia can be carried out in several stages and with different approaches, the first step would be to diagnose the main cause. The second step consists of treating or removing the reason for the problem. The third stage concerns sleep hygiene. The fourth and fifth phases are related to a behavioral and medication approach, respectively [6].

To establish the cause, it is necessary to collect a history directed to the sleep problem, establish which pre-sleep rituals and associations, in addition to considering the report of the child's usual sleep pattern to verify if there is a disorder. Then proceed to the clinical description of the problem, onset, repercussions, correlations, and information regarding the sleep environment. The remainder of the anamnesis is intended to rule out issues related to organic problems and, in cases of chronic or acute diseases, to treat the cause.[6] As for sleep hygiene, a topic addressed in this review, it aims to maintain adequate conditions for healthy sleep and effectiveness.

The behavioral approach seems to be quite effective after two years of age when it is possible to establish a reward system with the child. It is based on a diagnosis not only of the patient but also of the family, to understand how the disorder occurs and can be applied only to children who do not have acute or chronic diseases. The drug approach, on the other hand, is more restricted, and indicated for specific cases, after establishing the cause and as an adjunct to behavioral techniques [6,36,37].

There are two main groups of effective measurements demonstrated for the pediatric age: chloral hydrate and antihistamines. Chloral hydrate can be administered orally or rectally (25 to 50 mg/kg), it should not be prescribed regularly as it can lead to arrhythmias and respiratory depression. The most frequent antihistamines in studies are: diphenhydramine (0.5 mg / kg), trimeprazine (30 to 60 mg / kg) and niaprazine (1.5 mg / kg). Some other drugs, such as melatonin, tricyclic antidepressants (imipramine), and benzodiazepine agents (clonazepam), appear to be effective for some situations [6,37,39].

PARASSONIES

a) Parasomnias are physical phenomena or undesirable experiences that can occur at the beginning, during, or when awakening from sleep and they are classified according to the phase in which they occur. In the NREM sleep period called excitation parasomnias, in REM sleep called behavioral disorders [2,40]. In the present review, we focused on the parasomnias associated with partial awakening during the NREM sleep period, which are sleepwalking, confusional awakening, and night terror*Sleepwalking:* is characterized by night walking and stereotypes. It can be calm or restless and, although not dangerous in itself, the child can be involved in undesirable situations such as climbing stairs, windows, or falling from heights. It is commonly associated with a positive family history, has little or no autonomic sign, is more prevalent in the pre-adolescent school age group and the patient has amnesia [2,40].

b) *Confusional awakening:* agitation, crying, shouting and confusion, which gradually worsen until they end spontaneously. During the crisis it is not possible to wake the child and the episodes last an average of 5 to 15

minutes. It is more prevalent in infants, preschoolers, and schoolchildren, and there is also amnesia [2,40].

c) *Night terror:* parasomnia with greater autonomic activity such as sweating, tachycardia, and mydriasis. It starts abruptly and due to great agitation and fear, it can cause serious damage to the child. The episodes are also associated with amnesia, have a short duration and are more prevalent in older children and adolescents [2,40].

Management of parasomnias

The management of parasomnias includes the explanation of the mechanisms to the parents and the affirmation of the benignity and the frequent self-limitation. Patients should not be restricted in their motor skills, but the safety of the environment must be strengthened, such as closing windows and clearing the room, encouraging regular schedules and avoiding sleep deprivation. Benzodiazepine medications (clonazepam 0.25 mg), can be prescribed before bedtime in cases where the episodes are very violent. From complimentary exams, polysomnography is indicated in the suspicion of some triggering factor and the electroencephalogram (EEG), for the differential diagnosis of complex partial seizures [2,40].

NOCTURNAL ENURESIS

Enuresis is the disorder of repeated elimination of urine in inappropriate places, which encompasses three subtypes: exclusively daytime, mixed, and exclusively nighttime, the latter being the most prevalent sleep disorder in the pediatric population ranging from 5 to 10% of individuals of 5 years old, from 3 to 5% among those aged 10 and around 1% among those aged 15 or more [2,41]. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), for diagnosis of nocturnal enuresis there must be the following factors: elimination repeated urination in bed or clothes, voluntary or involuntary; frequency of at least twice a week for at least three consecutive months or due to the presence of clinically significant suffering or impaired social functioning; minimum chronological age of 5 years or equivalent level of development; and behavior not attributable to the physiological effects of a substance or other medical condition [41].

The etiopathogenesis of this condition is multifactorial and complex [42]. There is a report of its relationship with the inability to awaken secondary to the sensation of the full bladder due to CNS immaturity, with nocturnal polyuria due to low levels of vasopressin hormone and with the low functional capacity of the bladder about age [2,42]. Furthermore, there is evidence of the genetic and hereditary component of the disease, with the child up to eleven times more likely to have nocturnal enuresis when compared to the general population, if both parents have been affected by this pathology in childhood [41,42].

Enuresis management

a. Among the treatment pillars of nocturnal enuresis are behavioral intervention, alarm, and pharmacotherap*Behavioral intervention*: having a calendar with the night's report (dry or wet), reward for dry nights, emptying the bladder frequently during the day and before going to bed, waking up at a fixed time to urinate (before the night enuresis often occurs), limit fluid intake at night and avoid caffeine.[2,43] They are more effective in a cooperative child, so parent support and encouragement are essential, as well as the exclusion of all attitudes that reflect guilt or punishment of the child [43].

b. *Alarm*: a sensor that fires at the beginning of urination, causing the child to wake up, and, after waking up, you must end urination in the bathroom. An alarm per night is considered sufficient and it should be used until 14 consecutive dry nights [42,43].

c. *Pharmacotherapy*: In the failure of non-pharmacological treatment, the administration of desmopressin (0.2 to 0.4 mg), can be considered, this synthetic analog of the antidiuretic hormone reduces nocturnal diuresis and nocturnal enuresis [42-44]. It should be administered one hour before bed combined with fluid restriction for the next 8 hours to avoid "water intoxication", the main side effect of the drug. The discontinuation of this medication should be gradual, avoiding its recurrence, which, in some studies, is in the range of 65% [43]. Imipramine (1.7 mg/kg), a tricyclic antidepressant, can be used when the child does not respond to others therapies, but there are several adverse effects and it has a high recurrence rate, which can reach 96% [2,43].

NOISE SLEEP

Primary snoring

Snoring is characterized by a vibrating sound, produced in the upper airways during sleep and generally coincides with the inspiratory phase of the respiratory cycle. According to the International Classification of Sleep Disorders, primary snoring, considered benign, does not present with apnea, hypoxemia, and/or hypercapnia [2,45]. The incidence is between 7 to 9% of children aged 1 to 10 years, being commun the presence of hypertrophic tonsils and adenoids, and uncommon the association with sleep disorders or signs of daytime sleepiness [45,46]. Other factors should also be investigated, such as the use of narcotics, sedatives, genetic syndromes, craniofacial malformations (macroglossia and micrognathia), hypothyroidism, and obesity [2]. There is no consensus on the impact of primary snoring on children, and further studies are needed.

Obstructive sleep apnea syndrome (OSAS)

Breathing disorder with prolonged and frequent episodes of total or partial upper airway obstruction, which occurs during sleep, leading to interference with ventilation and normal sleep patterns [2,47]. The main etiology in childhood is the enlargement of the tonsils and adenoids, but this condition can also be associated with obesity, insufficiency of the pharynx muscles, excess of soft tissue in the upper airways, or bone abnormalities [4]. Its prevalence is between 0.7 and 3%, with a peak in preschool children [46]. It is a disease that mostly affects males, overweight children, African descent and child with a history of atopy and/or prematurity [46,47].

Night symptoms include habitual snoring (≥ 4 times/week), breathing difficulty during sleep, restlessness, and apnea observed by family members. In addition, some daytime symptoms can be observed, such as breathing with an open mouth, daytime sleepiness, reduced weight gain, behavioral changes, learning changes, and, in more severe cases, cor pulmonale and death [47]. For a detailed anamnesis, it is recommended to include a questionnaire on snoring, including intensity, frequency, body position and association with respiratory effort, these factors demonstrated a sensitivity of about 78% [4].

On physical examination, the findings may include enlarged tonsils, micrognathia, and pectus excavatum. The results of the patient's history and physical examination alone are poorly correlated with the objective findings of OSAS, and therefore, it should be noted that they are not sufficient to discriminate the primary snoring of OSAS in children [4,47]. Therefore, children suspected of OSAS should be referred to polysomnography, which is the gold standard exam for diagnosis [4,47].

The treatment of OSAS varies according to the cause and its severity [4,46,47]. Behavioral changes, such as sleep hygiene and obesity treatment, have an important role in the therapeutic approach. In patients who have identified adenoid and/or tonsil hypertrophy, primary treatment is surgical. The multidisciplinary team is necessary to treat the chronic effects of oral breathing, therefore, the participation of speech therapists and/or orthodontists is essential to reestablish normal breathing patterns and craniofacial growth [4,46,47].

SLEEP HYGIENE

Sleep hygiene can be sufficient intervention for the treatment of many children with sleep disorders [48]. For best results, this practice should be daily, starting during the day, preparing for the night [7]. The first step to be taken to make this therapy successful is to educate the child's guardians, and three basic areas must be covered: normal sleep patterns, the importance of consistency, and sleep environment [7,14,48]. In addition, it is interesting that the patient has a sleep diary, containing accurate information not only about sleeping and waking times but with the description of sleeping place, rituals for starting sleep, nighttime behavior, sleep habits of the rest of the family, frequency of exposure to televisions during the day, all for about two weeks [48]. This diary allows the professional to obtain a more adequate assessment of the sleep pattern and understand which interventions should be made in the daily life of this family.

A consistent routine depends on regular times, both for sleeping and for waking up - including on weekends. In addition, the so-called "positive routines", which consist of calm activities, that the child likes, can be done just before putting the child to sleep, also valuing the consistency of the times in which they are applied. They trigger the creation of pleasant memories for the child to correlate with bedtime [48,49]. For younger children, the routine should start 20 to 30 minutes before going to bed, for older 30 to 60 minutes, and the end of the routine should take place in the bed/crib [7,14,48,49].

There are also some general precautions to be taken during the child's day and also for bedtime itself. During the day it is important to avoid the consumption of products with caffeine in their composition, encourage naps and decrease the time of televisions [7,48]. As for the appropriate environment to trigger sleep, it must be calm, with low light and room temperature - be careful with overheating due to excessive use of clothing or covers. In addition, the bed must not be associated with other activities unrelated to sleep, so the use of televisions in it should be avoided [7,14,48].

a. To promote better treatment efficiency, other methods can be associated with sleep hygiene, especially in refractory cas*Extinction*: determine a sleep period, put the child to sleep, and do not intervene if negative reactions occur during the period (e.g. waking up and crying). There are great difficulties in implementing this tactic due to the lack of consistency and anxiety generated by caregivers [7,48,49].

b. *Gradual extinction*: the process of partially ignoring the child's demands, trying to calm him down for maximum periods of 15 seconds to 1 minute. This technique tries to encourage the child to develop their capacity to reassure themselves, without parental interference [7,49].

c. *Scheduled wake-up*: wake the child 15 to 30 minutes before the usual time for spontaneous awakening, and then put the child back to sleep, the frequency of scheduled awakenings should be similar to spontaneous ones. Over time the tendency is to reduce spontaneous awakenings, because with this method the child does not have a complete awakening as would occur in spontaneous awakening, therefore it is easier to go back to sleep [7,48,49].

d. *Remodeling of sleep*: avoiding naps in the 4 hours before nighttime sleep, in an attempt not to disturb sleepiness [49].

FINAL CONSIDERATIONS

The normal sleep pattern varies according to the age group and the disorders that alter it are prevalent in the pediatric population. About the therapeutic resource, sleep hygiene must always be associated, postponing the medication only for specific refractory cases. A good anamnesis in childcare consultations is usually sufficient for the diagnosis, follow-up, and orientation of the disorders.

CONFLICT OF INTEREST

There was no targeted funding. All authors have contributed to the conception and design of the study, revising the article critically and given the final approval of this version to be submitted.

ACKNOWLEDGEMENTS

Matos ANLF, Kasemodel FW, Lattmann LM, Militão MN and Mais S participated in data extraction, its computation and first version of the manuscript. Petrini LM guided the entire process. All authors participated in the revisions of the manuscript, read and approved the final version of this article.

REFERENCES

1. Stein MA, Mendelsohn J, Obermeyer WH, Amromin J, Benca R. Sleep and behavior problems in school-aged children. Pediatrics. 2001;107: E60.
2. Nunes ML. Sleep disorders. J Pediatr (Rio J). 2002; 78: S63-72.
3. Olson LM, Inkelas M, Halfon N, Schuster MA, O'Connor KG, Mistry R. Overview of the content of health supervision for young children: reports from parents and pediatricians. Pediatrics. 2004; 113: 1907-1916.
4. Carter KA, Hathaway NE, Lettieri CF. Common sleep disorders in children. Am Fam Physician. 2014; 89: 368-377.
5. Ramar K, Olson EJ. Management of common sleep disorders. Am Fam Physician. 2013; 88: 231-238.
6. Nunes ML, Cavalcante V. Clinical evaluation and treatment of insomnia in childhood. J Pediatr (Rio J). 2005; 81: 277-286.
7. Halal CSE, Nunes ML. Sleep Organisation and Hygiene in Childhood and Adolescence. Resid Pediatr. 2018; 8: 45-48.
8. Galland BC, Taylor BJ, Elder DE, Herbison P. Normal sleep patterns in infants and children: a systematic review of observational studies. Sleep Med Rev. 2012; 16: 213-222.
9. Dutil C, Walsh JJ, Featherstone RB, Gunnell KE, Tremblay MS, Gruber R, Weiss SK, Cote KA, Sampson M, Chaput JP. Influence of sleep on developing brain functions and structures in children and adolescents: A systematic review. Sleep Med Rev. 2018; 42: 184-201.
10. Carter JC, Wrede JE. Overview of Sleep and Sleep Disorders in Infancy and Childhood. Pediatr Ann. 2017; 46: e133-e138.
11. Stores G, Wiggs L. Sleep disturbance in children and adolescents with disorders of development: its significance and management. Cambridge University Press: Clinics in Developmental Medicina No. 155; 2001. 167.
12. Cummings C; Canadian Paediatric Society, Community Paediatrics Committee. Melatonin for the management of sleep disorders in children and adolescents. Paediatr Child Health. 2012; 17: 331-336.
13. Mindell JA, Owens JA, Carskadon MA. Developmental features of sleep. Child and adolescent psychiatric clinics of North America. 1999; 8: 695-725.
14. Bathory E, Tomopoulos S. Sleep Regulation, Physiology and Development, Sleep Duration and Patterns, and Sleep Hygiene in Infants, Toddlers, and Preschool-Age Children. Curr Probl Pediatr Adolesc Health Care. 2017; 47: 29-42.
15. Jiang F. Sleep and Early Brain Development. Annals of Nutrition and Metabolism. 2019; 75: 44-53.
16. Saper CB, Scammell TE, Lu J. Hypothalamic regulation of sleep and circadian rhythms. 2005; 437: 1257-1263.
17. España RA, Scammell TE. Sleep Neurobiology from a Clinical Perspective. Sleep. 2011; 34: 845-858.
18. Rana M, Allende CR, Latorre TM, Astorga KR, Torres AR. Sueño en los niños: fisiología y actualización de los últimos conocimientos [Sleep in children: physiology and update of a literature review]. Medicina (B Aires). 2019; 79: 25-28.
19. Pennestri MH, Laganière C, Bouvette-Turcot AA, Pokhvisneva I, Steiner M, Meaney MJ, Gaudreau H, Mavan Research Team. Uninterrupted Infant Sleep, Development, and Maternal Mood. Pediatrics. 2018; 142: e20174330.
20. Paruthi S, Brooks LJ, D'Ambrosio C, Hall WA, Kotagal S, Lloyd RM, et al. Recommended Amount of Sleep for Pediatric Populations: A Consensus Statement of the American Academy of Sleep Medicine. J Clin Sleep Med. 2016; 12: 785-786.
21. Gottlieb DJ, Chase C, Vezina RM, Heeren TC, Corwin MJ, Auerbach SH, et al. Sleep-disordered breathing symptoms are associated with poorer cognitive function in 5-year-old children. J Pediatr. 2004; 145: 458-464.
22. Hiscock H, Canterford L, Ukoumunne OC, Wake M. Adverse associations of sleep problems in Australian preschoolers: national population study. Pediatrics. 2007; 119: 86-93.
23. Simola P, Niskakangas M, Liukkonen K, Virkkula P, Pitkäranta A, Kirjavainen T, Aronen ET. Sleep problems and daytime tiredness in Finnish preschool-aged children-a community survey. Child Care Health Dev. 2010; 36: 805-811.
24. Guilleminault C, Pelayo R. Narcolepsy in children: a practical guide to its diagnosis, treatment and follow-up. Paediatr Drugs. 2000; 2: 1-9.
25. Adams SM, Good MW, Defranco GM. Sudden infant death syndrome. Am Fam Physician. 2009; 79: 870-874.
26. Goldberg N, Rodriguez-Prado Y, Tillery R, Chua C. Sudden Infant Death Syndrome: A Review. Pediatr Ann. 2018; 47: e118-e123.
27. Hauck FR, Tanabe KO. Sids. BMJ Clin Evid. 2009; 2009: 0315.
28. White BP, Gunnar MR, Larson MC, Donzella B, Barr RG. Behavioral and physiological responsivity, sleep, and patterns of daily cortisol production in infants with and without colic. Child Dev. 2000; 71: 862-877.
29. Sung V. Infantile colic. Aust Prescr. 2018; 41: 105-110.
30. Keefe MR, Kotzer AM, Froese-Fretz A, Curtin M. A longitudinal comparison of irritable and nonirritable infants. Nurs Res. 1996; 45: 4-9.
31. Weissbluth M. Chapter 10 - Sleep and Colic. Principles and Practice of Pediatric Sleep Medicine: W.B. Saunders. 2005; 113-125.
32. Roth T. Insomnia: definition, prevalence, etiology, and consequences. J Clin Sleep Med. 2007; 3: S7-10.
33. Owens J. Classification and epidemiology of childhood sleep disorders. Prim Care. 2008; 35: 533-546.
34. Johnson EO, Chilcoat HD, Breslau N. Trouble sleeping and anxiety/depression in childhood. Psychiatry Res. 2000; 94: 93-102.
35. Pin Arboledas G, Soto Insuga V, Jurado Luque MJ, Fernandez Gomariz C, Hidalgo Vicario I, Lluch Rosello A, et al. Insomnio en niños y adolescentes. Documento de consenso [Insomnia in children and adolescents. A consensus document]. An Pediatr (Barc). 2017; 86: 165.
36. Brown KM, Malow BA. Pediatric Insomnia. Chest. 2016; 149: 1332-1339.
37. Pelayo R, Chen W, Monzon S, Guilleminault C. Pediatric sleep pharmacology: you want to give my kid sleeping pills? Pediatr Clin North Am. 2004; 51: 117-134.
38. Idiazábal Alecha MA, Estivill Sancho E. Tratamiento del insomnio en niños: aspectos farmacológicos [Treatment of insomnia in children: pharmacological aspects]. An Pediatr (Barc). 2003; 59: 239-245.
39. Esposito S, Laino D, D'Alonzo R, Mencarelli A, Di Genova L, Fattorusso A, Argentiero A, Mencaroni E. Pediatric sleep disturbances and treatment with melatonin. J Transl Med. 2019; 17: 77.
40. Maski K, Owens JA. Insomnia, parasomnias, and narcolepsy in children: clinical features, diagnosis, and management. Lancet Neurol. 2016; 15: 1170-1181.
41. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Porto Alegre, Brasil: Artmed Editora Ltda.

2014; 355-357.

42. Haid B, Tekgül S. Primary and Secondary Enuresis: Pathophysiology, Diagnosis, and Treatment. Eur Urol Focus. 2017; 3: 198-206.

43. Walker RA. Nocturnal Enuresis. Prim Care. 2019; 46: 243-248.

44. Nevéus T, Fonseca E, Franco I, Kawauchi A, Kovacevic L, Nieuwhof-Leppink A, et al. Management and treatment of nocturnal enuresis-an updated standardization document from the International Children's Continence Society. J Pediatr Urol. 2020; 16: 10-19.

45. Ferreira AM, Clemente V, Gozal D, Gomes A, Pissarra C, César H, et al. Snoring in Portuguese primary school children. Pediatrics. 2000; 106: E64.

46. Balbani AP, Weber SA, Montovani JC. Update in obstructive sleep apnea syndrome in children. Braz J Otorhinolaryngol. 2005; 71: 74-80.

47. Fagondes SC, Moreira GA. Apneia obstrutiva do sono em crianças [Obstructive sleep apnea in children]. J Bras Pneumol. 2010; 36: 57-61.

48. Meltzer LJ, Mindell JA. Nonpharmacologic treatments for pediatric sleeplessness. Pediatr Clin North Am. 2004; 51: 135-151.

Cite this article

Mais S, Lattmann LM, Militão MN, Ferreira Matos ANL, Kasemodel FW, et al. Review of Childhood Sleep Disorders. Ann Pediatr Child Health 2021; 9(6): 1244.