

Review

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Management of sleep problems in people with autism: an updated review

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Abstract

Sleep problems are more common in people with autism spectrum disorder (ASD) as compared to the general population, and may contribute to worsening social functioning, emotional symptoms, and lower quality of life. To support healthcare professionals and researchers in the field, we provide an updated overview of sleep problems in the context of autism across the lifespan and their evidence-based management, as derived from evidence-synthesis studies and the most recent randomized controlled trials. Most studies to date have been conducted in children and adolescents with autism. Several studies suggest that behavioral interventions aiming at improving sleep hygiene and environment may be beneficial, especially when actively involving parents. Furthermore, there is an increasing body of literature showing that melatonin is an effective pharmacological option for improving sleep quality in children and adolescents with autism, in line with reports showing a reduced endogenous synthesis of



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this hormone. Unfortunately, studies in adults are more limited, and thus, the evidence base around non-pharmacological and pharmacological interventions remains mixed. Finally, there is a growing interest towards the use of complementary interventions or food supplements, but further studies are needed to test their effectiveness. In sum, most studies to date support the use of behavioral interventions and melatonin, especially in children and adolescents with autism. However, findings need to be validated in large-scale, rigorous and blinded trials and extended to the adult population. Non-pharmacological interventions remain the first treatment option and should adopt an individualized approach, considering individual characteristics and needs, including comorbidities, family dynamics, and sleep environment.

Keywords: Autism, sleep, management, intervention, review

INTRODUCTION

Sleep difficulties are very commonly reported by people with ASD (from hereon, autism). To support healthcare professionals and researchers in the field, we here provide an updated overview of sleep problems in the context of autism across the lifespan and their evidence-based management. Building on data presented in previous reviews^[1,2], we present a narrative review of the evidence from more recently conducted systematic reviews, meta-analyses, and randomized controlled trials. These were identified via a systematic screening of records published in PubMed between January 2019 and September 2023 (i.e., after the search for^[1,2] was conducted). The search strategy was: (autism OR asperger OR autism*) AND (sleep).

AUTISM AND SLEEP PROBLEMS

Autism is a neurodevelopmental condition affecting about 1 in 170 people worldwide^[3]. Differences in social communication and interaction, and restricted/repetitive patterns of interest, behavior, or activities, are the main clinical characteristics^[4]. Sensory processing alterations (including but not limited to vision or auditory problems, and hypo- or hyper-sensitivity to sensory stimuli) are often reported by people with autism (see^[5] for an overview). It has been proposed that these difficulties, possibly originating from alterations in brain functioning and neurochemical imbalances, may also contribute to sleep problems. Sleep problems (i.e., mainly related to sleep quality) are reported by 50%-80% of children and about half of adults with autism (see^[6] for a review), and formally diagnosed as disorders in 10%-20% of them^[1,7]. Thus, the prevalence of sleep problems is much higher than that in neurotypical controls (25% of which report these problems), especially when autism arises in the context of a genetic syndrome, such as Fragile X syndrome^[8-12].

Sleep difficulties include but are not limited to insomnia, frequent night wakings, late sleep-onset latency, and - more generally - poor-quality sleep^[13]. Differences between neurotypicals and people with autism on sleep quality, sleep macrostructure, and architecture have indeed been reported^[14-17], together with positive associations between sleep problems, autistic symptoms, and behavioral problems^[18]. For instance, sleep problems in autism are likely to increase the likelihood of daytime sleepiness and negatively impact attentional processes^[19], which may affect work and academic performance. They can also indirectly impact the quality of sleep of parents/caregivers or partners. For example, children's sleep problems have been associated with worse social functioning, increased anxiety and mood dysregulation^[20,21], as well as poorer parent mental health and higher parental stress^[22]. In sum, sleep problems may significantly affect the quality of life and daily functioning of individuals with autism^[20,23]. Thus, accurate identification of these problems and their cause in people with autism is important to guide treatment and limit their impact on the individual and their families.

Sleep problems may arise from known organic causes (e.g., bruxism^[24]; breathing problems or involuntary excessive movements^[1]; or gastrointestinal problems^[25]) or specific behavioral patterns (e.g., use of caffeine or excessive use of digital devices close to bedtime). There is also evidence that environmental factors - such as the sleep environment or external stressors (e.g., the COVID-19 pandemic)^[26,27] - are likely to worsen sleep problems, including in people with autism. Thus, it is important to adopt a holistic approach during the assessment. However, in many cases, the exact etiology of the sleep problems may be unknown, which complicates their management.

As part of the assessment of sleep problems, clinicians may use self-reported measures (e.g., sleep diaries, or questionnaires), clinical interviews, and objective measures (e.g., polysomnography or actigraphy) to ascertain the nature of the difficulties and determine whether they meet diagnostic criteria for a sleep disorder. Several classifications have been developed to diagnose sleep disorders, such as the International Classification of Sleep Disorders (ICSD^[28]) or the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR^[4]). It may be difficult for people with autism to undergo assessments such as polysomnography; however, it has been recently demonstrated that the concordance of subjective and objective measures of sleep is high in both neurotypicals and in people with a neurodevelopmental condition (including autism). This suggests that - although with cautiousness - self-reported measures of sleep may be sufficient to diagnose a sleep disorder in people with autism and guide appropriate management and treatment strategies^[29].

Sleep problems are managed via pharmacological, non-pharmacological, or combined interventions, as reviewed in the following sections. Clinical guidelines recommend that, especially in children and young people with autism, non-pharmacological interventions are tested first before considering pharmacological options^[30-32].

NON-PHARMACOLOGICAL INTERVENTIONS

Children and adolescents

Non-pharmacological management of sleep problems in children and adolescents with autism often includes parental psychoeducation, promotion of sleep hygiene, behavioral strategies (e.g., bedtime fading, extinction, and positive reinforcement of adapted behaviors)^[33], and sensory-based interventions^[6].

Behavioral interventions aiming at managing and/or reducing sleep problems in this population have been designed and piloted in a few small-scale studies. For example, these have shown that parental psychoeducation, behavior management, and sleep consultations may positively contribute to increasing total sleep time and sleep efficiency, and reducing sleep-onset latency, with important positive consequences on morning waking and less frequent sleeping with parents^[34-36]. Carnett *et al.*, for example, found that 17 out of 19 studies included in their systematic review reported beneficial effects of behavioral interventions on several sleep quality outcomes, and moderate effect sizes across studies, which is in line with what was reported by Cuomo *et al.*, i.e., low-to-medium effect sizes for behavioral interventions^[34,35]. Although the existing studies are generally low-quality and heterogeneous in terms of methodology used, or outcome measures investigated^[34-36], it has been demonstrated that involving parents in behavioral therapy leads to positive outcomes for children and adolescents with autism, and it is well valued by both parents and children^[37].

Behavioral sleep interventions are usually well accepted and considered effective by children and adolescents with autism and/or their parents^[38], although treatment adherence and outcomes may be negatively affected by concomitant or contextual factors (e.g., co-occurring health problems, family

circumstances). For example, a recent randomized controlled trial compared a 20-week Parent-Child Sandplay Therapy (PCST) combined with Applied Behavior Analysis (ABA) therapy versus ABA-only in 52 preschoolers with autism, and showed that the combined intervention was superior in improving parent-reported sleep quality and parental stress^[39], with a large effect (estimated $d = 0.99$). As PCST combines family and sand-play therapy and uses a psychotherapeutic approach to promote communication of feelings between the child and their parent/caregiver, the authors concluded that it may improve sleep quality by helping preschoolers to express their feelings and thoughts in a safe environment and thus feel calmer and emotionally more stable. Another recent randomized controlled trial including 245 primary school-aged children with autism (5-13 years of age) tested a very brief (two sessions) individualized behavioral intervention, including parental psychoeducation and discussions with the child about sleep problems and potential management strategies^[40]. They reported that the behavioral intervention was more effective in reducing sleep problems at 3-month follow-up as compared to treatment as usual (with moderate to large effects). Taken together, these findings suggest that non-pharmacological interventions involving both children and adolescents, as well as their parents, are effective in improving sleep, especially when based on individualized management strategies targeting the specific factors negatively impacting sleep. However, these findings need to be validated in large-scale rigorous and blinded trials involving both parents and children/adolescents with autism.

Alternative non-pharmacological therapies have also been suggested to improve sleep quality, but with only some preliminary evidence. As mentioned, individuals with autism may have specific sensory needs and sensitivities, which have been linked to suboptimal sensory integration and processing. A series of sensory-based studies, summarized by Lane *et al.* in a scoping review, showed that weighted blankets may positively affect sleep in children and young people with autism, since they make the children feel a sense of calmness by providing deep touch pressure^[6]. Similarly, the authors reported preliminary evidence of the effectiveness of a sensory-enhanced swim program for children with autism. Furthermore, preliminary evidence of beneficial effects on sleep has been found for massage therapy^[6,35], yoga^[41], physical activity^[42], aquatic exercise^[43], and virtual mindfulness-based interventions^[44]. Physical activity is important to promote health and well-being and has been associated with better sleep quality. However, only a few studies have specifically addressed activity in youths with autism and, although differences with neurotypical controls appear to be subtle^[45], a decrease in activity level has been noticed with age^[46]. In line with this, interventions aiming at enhancing physical activity have been shown to have beneficial effects on sleep quality in children and young people with autism.

In relation to supplements, it has recently been reported that cobalamin (vitamin B12^[47]) may be beneficial. A recent small-scale randomized double-blind placebo-controlled trial tested the effects of omega fatty acid supplementation in 31 preterm toddlers (18-38 months) exhibiting autistic symptomatology^[48]. Results showed that omega fatty acids reduced anxious and depressive behaviors and improved social interactions, but did not have any effect on sleep (the effect size was small and statistically non-significant). Similarly, a meta-analysis of randomized controlled trials conducted to test the effects of polyunsaturated fatty acids (PUFAs) on several outcomes in children and adolescents with autism found uncertain evidence of PUFAs worsening the quality of sleep^[49]. However, the authors recommended that more studies shall be conducted, considering the very low quality of the studies included.

Adults

Only a very limited number of studies have been conducted to investigate the effectiveness of non-pharmacological interventions for sleep problems in adults with autism. It is, in fact, more difficult to involve this population in behavioral and/or psychoeducational training, and the evidence base around these interventions remains mixed. Some studies have investigated whether psychotherapeutic or

psychological interventions aiming at reducing stress and anxiety have positive effects on sleep in adults with autism. Pahnke *et al.* conducted a randomized controlled trial to test the effectiveness of a 14-week acceptance and commitment therapy intervention on several outcomes associated with quality of life in 39 adults with autism^[50]. They reported an improvement in participants' ability to manage stressful situations, but no positive effects on sleep quality (medium effect, statistically non-significant). A systematic review of meta-analyses by Vancampfort *et al.* suggested that physical activity may be helpful in improving sleep quality in adults with a series of psychiatric diagnoses (including autism), as also preliminarily reported in children and adolescents^[51]. In sum, evidence on the use of psychological interventions is very limited in the adult population with autism, and pharmacological interventions are often more commonly used in clinical practice, although this may vary from country to country (e.g., due to differences in availability of over-the-counter medicines^[52]).

PHARMACOLOGICAL INTERVENTIONS

Children and adolescents

The most used pharmacological treatment for sleep problems in children and young people with autism is melatonin, which may help counteract a decreased endogenous synthesis^[33]. This is administered one to two hours before bedtime and is usually well tolerated. Both immediate- and prolonged-release melatonin formulations have been reported to be effective in increasing sleep duration and reducing sleep-onset latency in children and adolescents with autism^[47,53]. As an indirect effect, it has also been shown to reduce the likelihood of children having to sleep with their parents^[35]. These findings are supported by two recently conducted meta-analytic studies, one including four studies for a total of 238 children and adolescents with autism^[54] and one including 15 studies with more than 1000 children and adolescents with autism^[55]. In line with previous studies, these meta-analyses confirmed a significant positive effect of melatonin in reducing sleep-onset latency and the number of awakenings, and in improving total sleep time and overall sleep efficiency, even at low doses (with medium-to-large effect sizes)^[56].

Besides melatonin, clonidine was also reported to be “moderately effective” for increasing sleep duration and reducing sleep-onset latency and night wakings, while risperidone has been proven “strongly effective” in increasing sleep duration^[35]. There is also preliminary evidence that cannabidiol (CBD) may be helpful for treating sleep disorders in children with autism. This has been linked to its positive effects on inhibitory GABA neurotransmission, which has been widely reported to be altered in autism^[57]. Furthermore, case reports have suggested that the antidepressant trazodone may decrease sleep latency and improve sleep in children with autism, although this should be confirmed in randomized controlled trials^[8]. Lastly, there is no evidence of positive effects of L-carnosine supplementation^[58] or atomoxetine^[59,60] in improving sleep problems in children and adolescents with autism. In sum, most studies have investigated melatonin, mostly reporting positive effects, while other compounds have received limited attention.

Adults

As mentioned above, only a few randomized controlled trials have been conducted in adults with autism (e.g., see^[32]), thus the evidence is very limited. In clinical practice, prolonged-release melatonin has been used to improve insomnia and other sleep problems in adults with autism^[30,32]. Nevertheless, as recommended by Palagini *et al.*, rigorous and large-scale randomized controlled trials should be conducted to corroborate these findings and help identify those that may benefit the most^[32]. As reported for children, CBD has preliminarily proven helpful for managing sleep problems in adults with autism^[57]. Finally, studies testing other medications have reported secondary beneficial effects on sleep. For example, a randomized controlled trial^[61] showed that agomelatine (an atypical antidepressant) was effective in increasing total sleep time (medium effect size) and *optimizing* sleep-wake phases (small effect size) in adults with autism and intellectual disability, with only mild and transient adverse effects. These findings may encourage future studies to also consider sleep changes among outcomes in trials of medications in autism, even if not primarily targeting sleep disturbances.

Table 1. Overview of evidence of the effectiveness of pharmacological and non-pharmacological management strategies for sleep problems in autism

Intervention	Evidence
<i>Non-pharmacological</i>	
Behavioral interventions (e.g., parental psychoeducation, behavior management, and sleep consultations)	Effective in increasing total sleep time and sleep efficiency, reducing sleep-onset latency, reducing morning wakings in children and young people with autism, especially when they involve both children and their parents, and when based on individualized management strategies targeting the specific factors negatively impacting on sleep ^[29-35]
Massage and physical activity	Beneficial effects of massage therapy ^[30] , yoga ^[36] , physical activity ^[37] , aquatic exercise ^[38] in children and young people with autism; and physical exercise in adults ^[44]
Psychological interventions	Preliminary evidence of beneficial effects of mindfulness-based interventions ^[39] and cognitive behavioral therapy ^[29-31] in children and young people with autism. In adults, no evidence of the effectiveness of acceptance and commitment therapy intervention ^[43]
Supplements and vitamins	Beneficial effects of cobalamin ^[40] , but not omega fatty acid ^[41] or polyunsaturated fatty acids ^[42] , in children and young people with autism
<i>Pharmacological</i>	
Agomelatine	Effective for increasing total sleep time and optimizing sleep-wake phases in adults with autism and intellectual disability ^[54]
Atomoxetine	No evidence of positive effects in children and young people with autism ^[52,53]
Cannabidiol	Effective for improving sleep quality in both children/young people and adults with autism, considering its positive effects on inhibitory GABA neurotransmission ^[50]
Clonidine	Effective for increasing sleep duration and reducing sleep-onset latency and night wakings in children and young people with autism ^[30]
L-carnosine supplementation	No evidence of positive effects in children and young people with autism ^[51]
Melatonin	Both immediate- and prolonged-release formulations are effective in increasing sleep duration and reducing sleep-onset latency in children and adolescents with autism ^[40,46-48] and in adults ^[25,27]
Risperidone	Effective for increasing sleep duration in children and young people with autism ^[30]

CONCLUSION & CLINICAL GUIDANCE

We presented an updated and comprehensive overview of sleep problems in autism, and their management (see [Table 1](#) for an overview). It should be acknowledged, though, that narrative reviews - such as this one - are less rigorous than a systematic review, which was beyond the scope of the present article. Nevertheless, based on the evidence to date and existing clinical guidelines, the use of behavioral interventions and melatonin is recommended, especially in children and adolescents with autism. However, it is important to note that, due to the heterogeneity of phenotypical presentations in people with autism, interventions found to be beneficial at the group level may not prove effective at an individual level. A thorough assessment and individualized management plan with regular follow-ups is therefore recommended. Future large-scale rigorous and blinded trials should focus on validating these findings (giving priority to adults, for which only a few studies exist). It would also be important to advance our understanding of the long-term effectiveness of pharmacological and non-pharmacological interventions for sleep problems and disorders in autism, and the exact impact of co-occurring conditions (e.g., ADHD^[62]) on sleep problems; for example, it could be that similar interventions lead to different outcomes in those with less or more complex clinical profiles^[40]. Lastly, more research is needed to fully understand the acceptability and tolerability of melatonin for individuals with autism. To conclude, our review recommends the use of non-pharmacological interventions as the first treatment option for sleep problems in autism, and highlights the important role of clinicians in evaluating individual characteristics (e.g., co-occurring symptoms), family dynamics, and the sleep environment when addressing sleep problems in autism.

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Not applicable.

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