Athens Journal of Sports - Volume 13, Issue 2, June 2026 – Pages 81-100

The Association between Sleep Hygiene and Sport Participation in Girls: A Rapid Review of the Literature

By Jayda Hylton-Pelaia[*], *Lauren Shields*[±], *Caroline Barakat*[•] *& Efrosini Papaconstantinou*[○]

Introduction: *Sport participation and healthy sleep hygiene behaviours are important for girls' growth and development. Given the importance of both, this rapid review synthesized existing evidence on the association between sleep hygiene and sport participation in girls aged 6 to 12 years.* ***Methods:*** *We conducted a rapid review registered on the Open Science Framework (OSF) and reported our findings following PRISMA guidelines. MEDLINE, PsycINFO, and SportDiscus were searched from inception to March 8, 2025, and updated in February 2026. We included cross-sectional, cohort, and case-control studies. Two reviewers screened citations. Risk of bias was appraised using CASP checklists. Findings were synthesized.* ***Results:*** *The search retrieved 1401 articles, with an additional 118 records identified through an updated search (n=1519). Three studies met inclusion criteria, were critically appraised, and synthesized. Findings were mixed. Higher sleep efficiency was associated with participation in school-based sport, whereas shorter sleep duration, greater daytime tiredness, and sleep-related impairments were associated with involvement in specialized or competitive sport contexts.* ***Conclusion:*** *This review highlights limited evidence on the association between sleep hygiene and sport participation in girls aged 6-12 years. Further research is needed to clarify this relationship, and targeted interventions need to be developed.*

Keywords: *sleep; sport participation; girls; middle childhood*

Introduction

Regular physical activity, including sport participation, defined as the purposeful participation in a sports-related activity (Deelen et al., 2018), is crucial during childhood and adolescence. Engaging in sports not only enables children and adolescents to meet physical activity recommendations, but it also influences other aspects of one's life, including social connections and overall quality of living (Mohammed, Barakat, & Stanyon, 2020). Furthermore, it promotes a healthier lifestyle for children, helps to lower the prevalence of non-communicable diseases (such as cancer, osteoporosis, coronary heart disease, or cardiovascular disease), and enhances psychological well-being (Chen et al., 2021; Griffith et al, 2021).

In addition to sport participation, maintaining good sleep hygiene is essential for sleep quality in adolescents, as it influences various aspects of their lives, including academic performance, emotional well-being, and overall enjoyment of physical activities (Blackwell et al., 2020). Sleep hygiene is defined as

[*]PhD Candidate, Faculty of Health Sciences, Ontario Tech University, Canada.
[±]Medical Laboratory Science Student, The Michener Institute of Education, Canada.
[•]Professor, Faculty of Health Sciences, Ontario Tech University, Canada.
[○]Associate Professor, Faculty of Health Sciences, Ontario Tech University, Canada.

https://doi.org/10.30958/ajspo.13-2-1 doi=10.30958/ajspo.13-2-1

environmental and behavioural practices that promote healthy sleep. For example, having the same sleep and wake time and avoiding caffeine and alcohol too close to bedtime, while environmental factors include the sleep environment, such as comfortable temperature, dark light, and a reduction in noise levels (De Pasquale et al., 2024). It is important to note that insufficient sleep has been associated with several negative health outcomes, such as poorer general health, irregular moods, and an increased risk of illness (Biggins et al., 2019; Pagerols et al., 2023). Insufficient sleep increases the risk of conditions such as obesity, poor cardiovascular health, anxiety, depression, and cognitive impairments, such as memory and recognition (Ordway et al., 2022).

Further, children who are sedentary are more likely to have unhealthy dietary habits, a higher likelihood of consuming fast food, and fewer sleeping hours compared to children who are physically active (Kosti et al., 2023). Despite this, studies have shown that children and adolescents who participate in sports struggle to obtain sufficient sleep, and the quality of their sleep is often less than ideal (Biggins et al., 2019; Roberts et al., 2019).

Middle childhood (age 6-12) is a particularly important developmental stage for examining sleep and sport participation because behavioural routines, health habits, and participation patterns are established during this period (Griffith et al., 2021). Additionally, girls' sport participation frequently declines during adolescence, making early identification of factors associated with positive sport participation experiences important (Mohammed, Barakat, & Stanyon, 2020; Westerbeek & Eime, 2021).

While there are known benefits for both sleep hygiene practices for healthy sleep and sport participation, middle childhood-aged girls (ages 6-12 years old) face challenges in achieving optimal levels of both. There is a concerning trend regarding girls' sport participation, as during adolescence, participation for girls drops by 22% (Mohammed, Barakat, & Stanyon, 2020). In terms of sleep hygiene, school-aged children between 6 to 12 years old face sleep problems at an alarming rate, with 37% experiencing issues such as bedtime resistance, which leads to sleep onset delay, sleep anxieties, and ultimately daytime sleepiness from sleep insufficiency (Ophoff et al., 2018). Given the importance of both healthy sleep hygiene for good sleep quality and sport participation behaviours for the health and well-being of middle childhood-aged girls, it is crucial to understand if these two factors interact. The benefits of sleep hygiene and sport participation have been well-researched separately; however, the gap in the investigation of the relationship between sleep hygiene and sport participation in young girls is apparent. Research examining the association between sport participation and sleep has predominantly focused on adolescents or adult athletes, often within performance-oriented contexts (e.g., recovery and competition demands), whereas studies involving children more commonly investigate general physical activity and sleep rather than organized sport specifically, and frequently rely on mixed-gender samples (Kredlow et al., 2015; Chandrasekaran et al., 2020; Fonseca et al., 2021).

To our knowledge, no previously published systematic reviews have investigated the association between sleep hygiene practices and sport participation among middle childhood girls. Given the importance of sleep health and the declining prevalence of sport participation in girls, investigating this association among

young girls between the ages of 6 and 12 years is important. Therefore, the objective of this study was to evaluate and synthesize the existing evidence on the association between sleep hygiene practices and sport participation among girls aged 6-12 years.

Methods

Study Design

We conducted a rapid review of the literature. A rapid review was chosen due to its ability to accelerate the synthesis of existing literature without sacrificing the quality of findings (Ganann et al., 2010). A rapid review is a type of knowledge synthesis in which components of the systematic review process are simplified or omitted to produce information in a short period of time (Lagisz et al., 2022). We followed the methodology recommended by the World Health Organization (Tricco et al., 2017). The review was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. A full protocol for the systematic review was registered with Open Science Framework (OSF) and placed under embargo (OSF; registration ID: 5wae2).

Eligibility Criteria

Eligible studies met the following predefined criteria: 1) investigated middle childhood (between 6 and 12 years of age) girls; 2) study of the association of sleep hygiene and sports participation; 3) published in English or translatable; and 4) cross-sectional, case-control, or cohort studies published in peer-reviewed journals.

We excluded guidelines, letters, editorials, unpublished manuscripts, dissertations, and government reports, pilot studies, case reports, case series, qualitative studies, systematic reviews focused on clinical populations, cadaveric or animal studies and studies not reporting on methodology.

Population: Middle Childhood Girls

The target population was middle childhood girls between the ages of 6 and 12 years, consistent with developmental classifications that define middle childhood as the period spanning approximately 6 to 12 years, characterized by continued cognitive, social, and physical development before adolescence (Mah & Ford-Jones, 2012). For studies that included other age groups (e.g., 12 to 14 years), we included those that provided stratified results for our eligible age group. Studies with mixed-gender populations were included only if data for girls within the specified age range were reported separately.

Exposure: Sleep Hygiene

Sleep hygiene was defined as modifiable behaviours or environmental conditions that influence sleep. This included sleep duration, quality, timing, efficiency, and bedtime routines. However, the available literature in this age group primarily measures sleep using observable sleep characteristics rather than direct assessments of sleep hygiene behaviours. Therefore, for this review, sleep hygiene exposure was operationalized using sleep-related outcomes and sleep characteristics that are commonly used as indicators of sleep health and are influenced by underlying sleep hygiene practices. Although these sleep outcomes are not synonymous with sleep hygiene, they reflect the potential to influence behavioural and environmental sleep practices and are frequently used in pediatric sleep research as proxy indicators of sleep health (Irish et al., 2015). Findings should therefore be interpreted cautiously, recognizing that direct behavioural sleep hygiene was not measured in the included studies. Studies were included if they used subjective measures (e.g., questionnaires, self/parent reports) or objective tools (e.g., actigraphy, wearable devices) to assess any aspect of sleep hygiene or related factors.

Outcome: Sport Participation

Sport participation was defined as engagement in organized or recreational sports outside of mandatory physical education classes (Deelen et al., 2018). This included competitive sports, recreational leagues, individual sports with structured training, and non-competitive multi-sport camps. Studies measuring general physical activity without reference to sport participation were excluded.

Search Strategy

A search strategy was developed in consultation with a health sciences librarian. Searches were initially conducted in three electronic databases from inception to March 8, 2025: MEDLINE (via OVID), PsycINFO (via ProQuest), and SportDiscus (via EBSCO). These databases were selected to ensure comprehensive coverage of medical, psychological, and sport-specific literature relevant to the review topic. The search strategy included keywords and subject headings related to sleep hygiene, sport participation, and girls age 6-12 years. Before manuscript submission, an updated search was conducted in February 2026 to identify any newly published studies and ensure the review reflected the most current available evidence. The updated search used the same databases, search strategy, and eligibility criteria as the original search. The full search strategy is presented in Appendix A.

Data Collection and Analysis

Study Selection

Pairs of trained, independent reviewers screened articles in two phases to determine eligibility. In phase I, paired reviewers (L.S. and J.H) screened titles and abstracts to determine "possibly relevant" and "irrelevant" citations independently based on the predetermined eligibility criteria. In phase II, paired reviewers (L.S. and J.H.) reviewed possibly relevant citations from phase I using the full text article to determine whether the source was relevant, documenting the reasons for exclusion. Any disagreements during screening were resolved by discussion between the paired reviewers to reach consensus. If consensus could not be reached, a third reviewer was consulted.

Methodological Quality and Risk of Bias Appraisal

Risk of bias was assessed by a single reviewer (L.H) using checklists developed by the Critical Appraisal Skills Programme (CASP) to inform judgment on the internal validity of each included study. The use of a single reviewer for appraisal was consistent with rapid review methodology, incorporating a streamlined process to accelerate evidence synthesis while maintaining methodological rigor (Ganann et al., 2010). Before formal appraisal, the reviewer pilot-tested the CASP tools to ensure familiarity and consistent application of criteria. Any uncertainties regarding appraisal decisions were discussed with a second reviewer (J.H) until consensus was reached. Studies were rated as having low, moderate, or high risk of bias based on factors such as study design, sampling strategy, measurement reliability, and control of confounding variables. In accordance with the review protocol, only studies that were categorized as low or moderate risk of bias were to be included in the final synthesis.

Data Extraction

A researcher (L.H) extracted data from the included studies and entered the relevant information into a prepared evidence table. A second reviewer reviewed the table for accuracy and completeness (J.H.). The data extraction table was used to report components of each study including study design, population characteristics, measures of sleep hygiene and sport participation, and key findings regarding their association.

Evidence Synthesis

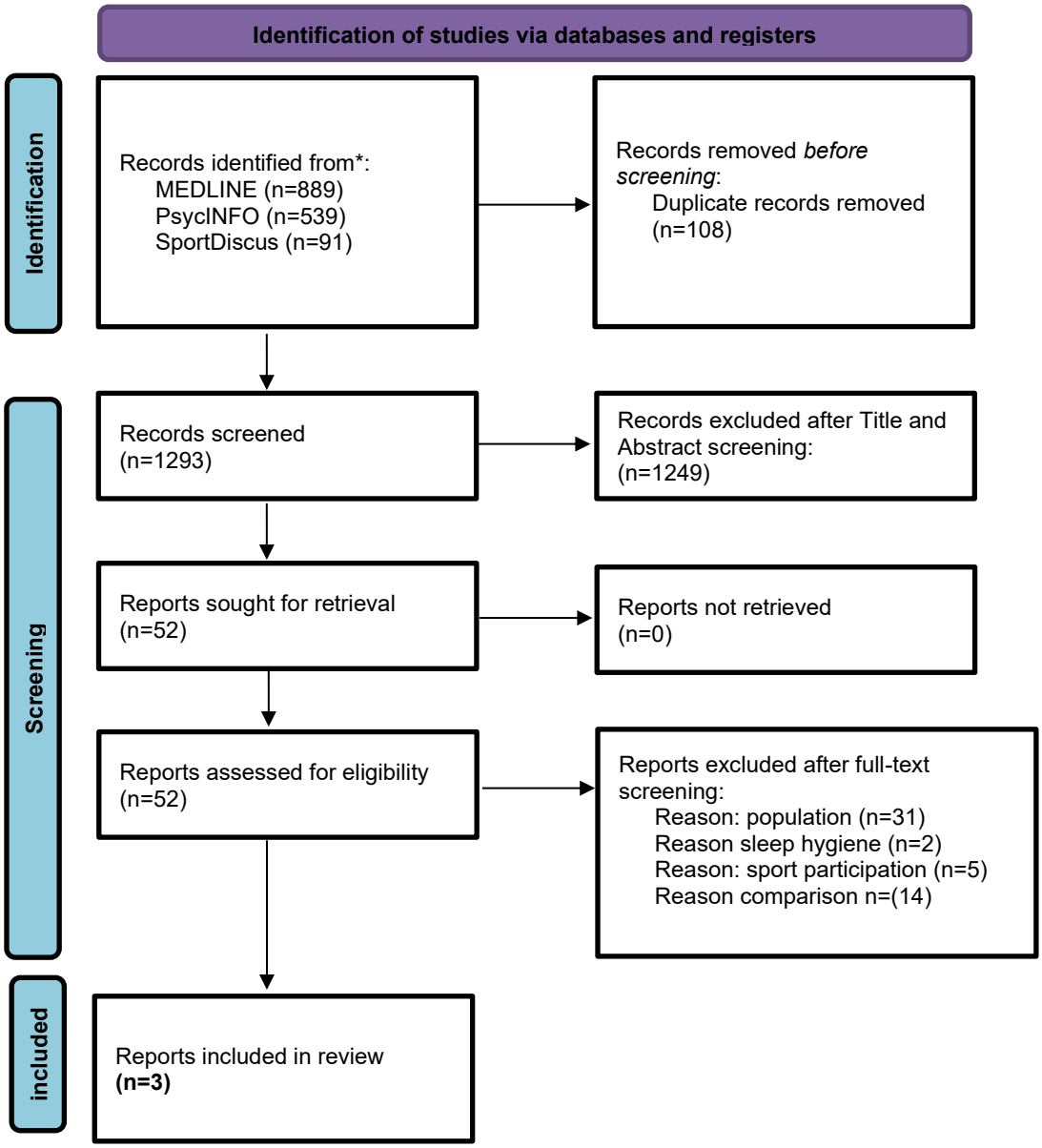
Synthesis Without Meta-Analysis (SWiM) was used for a structured, transparent narrative synthesis of included studies (Campbell et al., 2020), providing an overview of the association between sleep hygiene and sport participation among middle childhood girls.

Results

Study Selection

The search retrieved 1401 records. After removing duplicates, 1293 titles and abstracts were screened for eligibility. Of these, 44 full-text articles were reviewed, and three met the eligibility criteria and proceeded to the risk of bias appraisal. An updated search conducted in February 2026 identified 118 additional records published since the initial search. Eight articles were reviewed in full text; however, none met the eligibility criteria. Therefore, the final synthesis remained unchanged and included three studies. The screening and selection process is summarized in Figure 1 (PRISMA flow diagram). The most common reasons for full-text exclusion were ineligible population (n=31) and lack of comparison or analysis between sleep hygiene and sport participation (n=14).

Figure 1. *PRISMA Flow Diagram*



Quality Assessment

The methodological quality of the three included studies was evaluated using the CASP Cohort and CASP Cross-sectional checklists. A detailed appraisal of each study is presented in Appendix B. Of the three studies, one was rated as low risk of bias, and two were rated as moderate risk of bias. No studies were categorized as high risk of bias to warrant exclusion from the review.

Study Characteristics

Three studies met the inclusion criteria: two cohort studies (Watson et al., 2021; Falstrom et al., 2022) and one cross-sectional study (Larrinaga-Undabarrena et al., 2023), published between 2021 and 2023. Detailed study characteristics are presented in Table 1. The studies were conducted in the United States, Sweden, and Spain. Sample sizes ranged from 233 middle school athletes to 1082 school-children, with all studies including girls within or overlapping with the target age range of 6 to12 years. Where studies included broader age ranges, only results relevant to the review focus were considered.

The measurement of sleep-related characteristics varied with Falstrom et al. (2022) and Watson et al. (2021) using self- or parent-reported methods (daily/ weekly sleep duration, sleep difficulties, tiredness), while Larrinaga-Undabarrena et al. (2023 employed objective accelerometry capturing measures of sleep duration, sleep efficiency, and wake after sleep onset. None of the included studies directly assessed behavioural sleep hygiene practices.

Sport participation measurement was operationalized through club membership, weekly training hours, or organized activity participation across studies (e.g., competitive football, school-based sport participation, weekly sport specialization).

Table 1. *Summary of Study Characteristics from included Studies*

Author, Year	Study Design	Aim	Location	Population	Sleep Hygiene	Sport Participation	Main Findings relevant to Review
Falstrom, 2022	Cohort (1 year)	To describe lifestyle factors, including sleep, in adolescent female football players and changes over 1 year	Sweden	419 girls, 12-17 (97 aged 12)	Self-reported sleep problems (difficulty falling asleep, waking up at night and trouble returning to sleep, daytime tiredness), and duration (sleeping hours per night) also recorded. Sleep measured using a five-point scale (1=never, 5=every day) Impaired sleep defined as: frequent problems falling asleep or staying asleep several times per week, and rated tiredness in daily activities several times per week or every day.	Weekly club football participation, years in club. Mean years playing football: 7 (SD 2.2). Average football training: 5 hours per week; 1.5 matches per week.	Sleep insufficiency and tiredness common among competitive girl athletes; tiredness increased over 1 year. Sleep issues were common, with 16% sleeping less than 8 hours per night, 8% experiencing impaired sleep with daytime consequences, and 22% feeling tired during daily activities. Sleep problems and insufficient sleep increased at 1-year follow-up. The proportion of players feeling tired during the day increased over 1 year (20% to 27%).
Larrinaga-Undabarrena, 2023	Cross-sectional observational study	To compare physical activity and sleep in schoolchildren by	Basque Country, Spain	1082 children (49.9% girls), 6-17 (subset: 6-12)	Objective (accelerometer) Variables recorded: sleep	Physical/sport activity participation (yes/no)	Girls (6–12) who participated in sport had higher sleep efficiency

		sport participation status			efficiency, total sleep time, WASO (wake after sleep onset) Sleep diaries complemented accelerometer data for context.	Participants categorized as PSA (physical sport activity) practitioners or non-practitioners.	and less sedentary time than non-participants. PSA practitioners showed significantly better sleep efficiency and lower sedentary time compared to non-practitioners. No significant difference in total sleep time or WASO between PSA and non-PSA groups. Children aged 6-12 showed higher sleep parameters and less sedentary behavior compared to adolescents irrespective of sex. Girls participated similarly in PSA and showed similar trends in sleep efficiency improvements when engaged in physical sports.

Watson, 2021	Prospective cohort conducted over an academic year (39 weeks)	To evaluate effects of sport specialization, sleep, and physical activity on illness in middle school athletes	Wisconsin, USA	233 athletes 10-14 (39% girls)	Weekly electronic parent-reported surveys on the child's average sleep duration during the prior week. Sleep Variables: Weekly average sleep duration (hours).	Weekly hours of organized physical activity reported by parents; sport specialization level categorized as low, moderate, or high using established criteria. Weekly organized and unorganized physical activity hours recorded.	Specialized athletes tended to have slightly lower average sleep duration. More sleep and PA independently predicted lower illness risk; specialization had no effect.

Summary of Evidence

Three studies met the eligibility criteria and provided preliminary evidence relevant to the association between sleep-related indicators and sport participation among girls in middle childhood between the ages of 6 and 12 years.

In the cross-sectional accelerometer-based study by Larrinaga-Undabarrena et al. (2023) found that girls who participated in school-based sport exhibited a higher mean sleep efficiency of 87.16% (SD = 5.84) compared to 86.12% (SD = 6.81) among non-participants, representing a mean difference of 1.04 percentage points (p = 0.022). No significant differences were observed for total sleep time or wake after sleep onset.

In the prospective cohort study, Watson et al. (2021) found that girls who were more specialized in sport reported slightly shorter average sleep duration compared to those with lower levels of specialization (high specialization: 8.48 hours [95% CI, 8.3-8.6 hours]; moderate specialization: 8.71 hours [95% CI, 8.6-8.9 hours]; low specialization: 8.63 hours [95% CI, 8.5-8.8 hours]).;). Pairwise comparisons indicated a statistically significant difference in sleep duration between low- and high-specialization groups (p = 0.045), while other group comparisons were not statistically significant.

Falstrom et al. (2022) reported indicators of compromised sleep among girls who participated in competitive football, including insufficient sleep, daytime tiredness, and sleep-related impairment. At one year follow-up, the proportion of girls reporting daytime tiredness several times per week or daily increased from 20% to 27%.

Overall, findings across the included studies were mixed with some studies reporting associations between sleep-related indicators and sport participation among middle childhood girls.

Discussion

This rapid review aimed to explore the association between sleep hygiene and sport participation among middle childhood girls. Three studies met the eligibility criteria and were included following quality appraisal, each investigating this association using different designs, measurement approaches, and varied operationalizations of sleep hygiene (e.g., sleep duration, sleep efficiency), as well as different sport contexts. Importantly, the findings synthesized in this review primarily reflect associations between sport participation and sleep characteristics rather than direct measures of behavioural sleep hygiene. The findings were mixed. In the accelerometer-based study, girls with higher sleep efficiency were more likely to participate in school-based sport compared to girls with lower sleep efficiency. In contrast, cohort studies involving specialized or competitive athletes indicated that girls reporting shorter sleep duration, greater daytime tiredness, or sleep-related impairments were engaged in higher levels of organized or specialized sport participation. Considerable heterogeneity existed across study designs, sport contexts, and sleep measures, limiting direct comparison. The small number of eligible studies, combined with

variability in methodology and sleep measurement, highlights the need for additional high-quality research to better understand the association between sleep hygiene indicators and sport participation among girls in middle childhood.

A notable challenge in interpreting the evidence across the included studies is that none of the studies directly assessed sleep hygiene as a multidimensional construct. Validated measures of sleep hygiene (e.g., the Sleep Hygiene Index) conceptualize it as a behavioural construct distinct from sleep outcomes such as duration or efficiency (Mastin et al., 2006). Instead, the included studies measured selected components of sleep (e.g., sleep duration, sleep efficiency, sleep difficulties, or daytime tiredness) that are related to but not synonymous with sleep hygiene. As a result, interpretations about sleep hygiene must be drawn from the specific sleep indicators used in each study.

Across the included studies, sleep was measured using three different approaches: objective accelerometry (Larrinaga-Undabarrena et al., 2023), parent-reported sleep duration (Watson et al., 2021), and self-reported sleep difficulties and tiredness (Faltstrom et al., 2022). Although each of these indicators reflects aspects of girls' sleep, none of the studies directly assessed sleep hygiene (e.g., the Sleep Hygiene Index or CSHQ bedtime routine items). As such, this review synthesizes evidence based on sleep characteristics that may be influenced by underlying sleep hygiene behaviours rather than on direct measures of sleep hygiene itself. Therefore, findings should be interpreted as reflecting associations between sleep characteristics and sport participation, recognizing that the sleep measures assessed may reflect the influence of underlying sleep hygiene behaviours rather than direct measurement of those behaviours.

Larrinaga-Undabarrena et al. (2023) used objective measurement using accelerometry which is considered best practice in sleep research, particularly for children (Miller et al., 2024). This provided reliable estimates of sleep efficiency, total sleep time, and wake after sleep onset. Although these metrics are not direct measures of sleep hygiene, they are influenced by sleep-hygiene behaviours such as consistent bedtime routines, limited evening stimulation, and appropriate sleep timing (Irish et al., 2015). Thus, girls with higher sleep efficiency were more likely to participate in school-based sport, suggesting that better sleep efficiency may reflect underlying behavioural routines consistent with healthy sleep hygiene practices. Although statistically significant, the magnitude of difference in sleep efficiency was modest.

In contrast, Watson et al. (2021) relied on parent-reported which is more vulnerable to recall bias. The parent-reported sleep duration, collected weekly, captures one dimension of sleep patterns but does not provide insight into behaviours that promote sleep quality (e.g., bedtime routines, screen use, caffeine, or sleep environment). Sleep duration can be influenced by both sleep hygiene (such as consistent bedtimes) and structural constraints (such as training schedules), making interpretation more complex (De Pasquale et al., 2024; Milewski et al., 2014). Lower sleep duration among specialized athletes may partly reflect behavioral disruptions inconsistent with good sleep hygiene, such as late practices or competing demands between school and sport.

Similarly, Faltstrom et al. (2022) used self-reported sleep difficulties, tiredness, and sleep-related impairment, which represent perceived sleep problems and daytime functioning rather than sleep hygiene behaviours. These indicators reflect the consequences of poor sleep hygiene rather than the behaviours themselves. These indicators are subjective and can be influenced by stress, mood, or training load. Frequent tiredness or sleep impairment may signal inconsistent routines, high stress, insufficient recovery time, or environmental disruptions, which are factors that are common with high-intensity sport participation.

With each study capturing different sleep hygiene-related indicators, the sport contexts in which girls participated (school-based, specialized, or competitive) also varied, further shaping the observed associations.

Larrinaga-Undabarrena et al. (2023) found that girls who participated in school-based sport demonstrated higher sleep efficiency than non-participating peers. This aligns with previous research showing that regular physical activity like structured sport participation is associated with improved sleep quality and sleep efficiency among children and adolescents (Brand et al., 2014; Lang et al., 2016). A systematic review on sleep and health-related physical fitness in children and adolescents (Fonseca et al., 2021) concluded that longer sleep and better sleep quality were associated with higher levels of physical fitness among children and adolescents, which indirectly supports the tie between being active (often via sport) and sleep.

In contrast, shorter sleep duration and greater sleep-related difficulties were observed among girls engaged in specialized or competitive sport contexts (Watson et al., 2021; Faltstrom et al., 2022). Girls engaged in higher-intensity or specialized sport tended to report shorter sleep duration, greater sleep difficulties, or daytime tiredness. Competitive and specialized sport often requires evening practices, greater training volume, performance expectations, and additional psychosocial demands, all of which may disrupt routines and interfere with sleep hygiene (Meisel et al., 2022). School-based programs tend to support healthy sleep hygiene because they are typically low-barrier, embedded within the school day, and free of additional costs or late-evening commitments (Dobbins et al., 2021). The structure of these environments, such as, consistent schedules, predictable routines, supervised activity, and moderate physical exertion, supports healthy sleep regulation and may help reinforce sleep-hygiene practices, potentially explaining the observed improvements in sleep efficiency. Unlike school-based programs, competitive and specialized sports typically occur outside of school hours and may place less emphasis on balancing academic schedules, making it more challenging for girls to maintain healthy sleep-wake patterns.

Further, Faltstrom et al. (2022) reported that, at one-year follow-up, a greater proportion of girls experienced daytime tiredness "every day" or "several times per week," suggesting that cumulative training loads and competitive pressures may erode sleep quality over time. High-performance environments often involve elevated expectations, intensified schedules, and occasional travel or competition-related disruptions, all of which can make consistent sleep routines difficult to sustain. Based on the studies included in this review, it can be inferred that girls involved in school-based sport may be more likely to maintain healthier sleep

practices compared to those participating in more specialized or competitive sport settings.

The absence of additional eligible studies in the updated search further underscores the limited and underdeveloped evidence base examining sleep hygiene indicators in relation to sport participation among middle childhood girls.

Strengths

This rapid review has several strengths. First, the review protocol was prospectively registered and reported in accordance with PRISMA guidelines, enhancing transparency and methodological rigor. Second, study selection was conducted by independent reviewers, reducing the risk of selection bias. Third, risk of bias appraisal was systematically performed using validated CASP checklists, with transparent reporting of study quality.

Additionally, this review focused specifically on middle childhood girls between the ages of 6 and 12 years a population that is often underrepresented in sport and sleep research. By distinguishing between behavioural sleep hygiene practices and measurable sleep characteristics, this review provides important conceptual clarity and highlights a critical gap in the existing literature. The inclusion of both subjective and objective sleep measures further strengthens the comprehensiveness of the synthesis.

Limitations

This rapid review has several limitations. Firstly, the included studies varied widely in design, sport context, and sleep measurement methods (objective, parent-report, self-report), which may have contributed to the mixed findings. Secondly, the sport contexts differed substantially. School-based sport, specialized sport, and competitive sport environments carry distinct demands, schedules, and expectations, which likely contributed to the mixed findings. Additionally, none of the included studies directly assessed behavioural sleep hygiene using validated sleep hygiene instruments. Consequently, this review synthesized evidence based on sleep characteristics and sleep-related outcomes that may reflect, but do not directly measure, sleep hygiene practices. Despite these limitations, the studies provide preliminary insight into how sleep hygiene and sport participation are associated among middle childhood girls.

Implications

The findings of this rapid review have important implications for research, practice, and parental decision-making. First, the variability in sleep indicators across studies highlights the need for more consistent and comprehensive measurement of sleep hygiene in youth girls sport research. Future studies should incorporate

validated, multidimensional sleep hygiene tools alongside objective sleep measures whenever possible to better capture the range of behaviours that influence girls' sleep. Examining these relationships during middle childhood may be particularly important for supporting long-term sport participation and healthy behavioural development among girls before adolescence.

Insights from this review will directly inform the development of a parental educational toolkit designed to support parents in making informed decisions about their daughters' sport involvement and sleep hygiene practices. For parents and caregivers, these findings highlight the importance of monitoring sleep patterns alongside sport involvement, particularly when children participate in specialized or high-volume training environments. Parents may benefit from education regarding consistent bedtime routines, adequate sleep duration, recovery needs, and balancing sleep health with sport schedules. Supporting healthy sleep behaviours may represent one strategy for promoting positive sport participation experiences and sustained involvement among girls. The toolkit will aim to provide practical, evidence-informed guidance to help parents support healthy sleep routines while fostering positive and sustainable sport participation experiences.

References

Biggins, M., Purtill, H., Fowler, P., Bender, A., Sullivan, K. O., Samuels, C., & Cahalan, R. (2019). Sleep in elite multi-sport athletes: Implications for athlete health and wellbeing. *Physical Therapy in Sport*, 39, 136–142. https://doi.org/10.1016/j.ptsp.2019.07.006

Blackwell, C. K., Hartstein, L. E., Elliott, A. J., Forrest, C. B., Ganiban, J., Hunt, K. J., Camargo, C. A., & LeBourgeois, M. K. (2020). Better sleep, better life? How sleep quality influences children's life satisfaction. *Quality of Life Research, 29(9)*, 2465–2474. https://doi.org/10.1007/s11136-020-02491-9

Brand, S., Gerber, M., Kalak, N., Kirov, R., Lemola, S., Clough, P. J., ... & Holsboer-Trachsler, E. (2014). Adolescents with greater mental toughness show higher sleep efficiency, more deep sleep and fewer awakenings after sleep onset. *Journal of Adolescent Health*, 54(1), 109-113.

Bruce, E. S., Lunt, L., & McDonagh, J. E. (2017). Sleep in adolescents and young adults. *Clinical Medicine (London, England), 17(5)*, 424–428. https://doi.org/10.7861/clinmedicine.17-5-424

Campbell, M., McKenzie, J. E., Sowden, A., Katikireddi, S. V., Brennan, S. E., Ellis, S., Hartmann-Boyce, J., Ryan, R., Shepperd, S., Thomas, J., Welch, V., & Thomson, H. (2020). Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline. *BMJ,* l6890. https://doi.org/10.1136/bmj.l6890

Chen, C., Weyland, S., Fritsch, J., Woll, A., Niessner, C., Burchartz, A., Schmidt, S. C. E., & Jekauc, D. (2021). A Short Version of the Physical Activity Enjoyment Scale: Development and Psychometric Properties. *International Journal of Environmental Research and Public Health*, *18*(21), 11035-. https://doi.org/10.3390/ijerph182111035

Chandrasekaran, B., Fernandes, S., & Davis, F. (2020). Science of sleep and sports performance a scoping review. *Science & Sports*, 35(1), 3-11.

Deelen, I., Ettema, D., & Kamphuis, C. B. M. (2018). Sports participation in sport clubs, gyms or public spaces: How users of different sports settings differ in their motivations, goals, and sports frequency. *PloS One*, *13*(10), e0205198–e0205198. https://doi.org/10.1371/journal.pone.0205198

De Pasquale, C., El Kazzi, M., Sutherland, K., Shriane, A. E., Vincent, G. E., Cistulli, P. A., & Bin, Y. S. (2024). Sleep hygiene – What do we mean? A bibliographic review. *Sleep Medicine Reviews*, *75*, Article 101930. https://doi.org/10.1016/j.smrv.2024.101930

Dobbins, M., Neil-Sztramko, S. E., & Caldwell, H. (2021). School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. *Cochrane Database of Systematic Reviews*, 2021(9), CD007651. https://doi.org/10.1002/14651858.CD007651.pub3

Fältström, A., Skillgate, E., Weiss, N., Källberg, H., Lyberg, V., Waldén, M., Hägglund, M., Asker, M., & Tranaeus, U. (2022). Lifestyle characteristics in adolescent female football players: data from the Karolinska football Injury Cohort. *BMC Sports Science, Medicine & Rehabilitation*, *14*(1), 212–212. https://doi.org/10.1186/s13102-022-00603-1

Fonseca, A. P. L. M., de Azevedo, C. V. M., & Santos, R. M. R. (2021). Sleep and health-related physical fitness in children and adolescents: a systematic review. *Sleep Science*, 14(04), 357-365.

Ganann, R., Ciliska, D., & Thomas, H. (2010). Expediting systematic reviews: methods and implications of rapid reviews. Implementation science: IS, 5, 56. https://doi.org/10.1186/1748-5908-5-56

Griffith, J. M., Clark, H. M., Haraden, D. A., Young, J. F., & Hankin, B. L. (2021). Affective Development from Middle Childhood to Late Adolescence: Trajectories of Mean-Level Change in Negative and Positive Affect. *Journal of Youth and Adolescence*, 50(8), 1550–1563. https://doi.org/10.1007/s10964-021-01425-z

Irish, L. A., Kline, C. E., Gunn, H. E., Buysse, D. J., & Hall, M. H. (2015). The role of sleep hygiene in promoting public health: A review of empirical evidence. *Sleep Medicine Reviews*, 22, 23–36. https://doi.org/10.1016/j.smrv.2014.10.001

Kredlow, M. A., Capozzoli, M. C., Hearon, B. A., Calkins, A. W., & Otto, M. W. (2015). The effects of physical activity on sleep: a meta-analytic review. *Journal of behavioral medicine,* 38(3), 427-449.

Kosti, R. I., Tsiampalis, T., Kouvari, M., Gketsios, I., Kanellopoulou, A., Notara, V., ... & Panagiotakos, D. B. (2023). Clustering of activity-related behaviors in relation to self-reported causes of stress among pre-adolescents: results from a national epidemiological study. *Life, 13*(3), 622.

Lang, C., Kalak, N., Brand, S., Holsboer-Trachsler, E., Puehse, U., & Gerber, M. (2016). The relationship between physical activity and sleep from mid adolescence to early adulthood. A systematic review of methodological approaches and meta-analysis. *Sleep medicine reviews*, 28, 32-45.

Larrinaga-Undabarrena, A., Río, X., Sáez, I., Angulo-Garay, G., Aguirre-Betolaza, A. M., Albisua, N., Martínez de Lahidalga Aguirre, G., Sánchez Isla, J. R., García, N., Urbano, M., Guerra-Balic, M., Fernández, J. R., & Coca, A. (2023). Physical Activity Levels and Sleep in Schoolchildren (6-17) with and without School Sport. *International Journal of Environmental Research and Public Health*, *20*(2), 1263-. https://doi.org/10.3390/ijerph20021263

Lagisz, M., Vasilakopoulou, K., Bridge, C., Santamouris, M., & Nakagawa, S. (2022). Rapid systematic reviews for synthesizing research on built environment. *Environmental Development*, 43, 100730.

Mah, V. K., & Ford-Jones, E. L. (2012). Spotlight on middle childhood: Rejuvenating the 'forgotten years'. *Paediatrics & child health*, 17(2), 81-83.

Mastin, D. F., Bryson, J., & Corwyn, R. (2006). Assessment of sleep hygiene using the Sleep Hygiene Index. *Journal of behavioral medicine*, 29(3), 223-227.

Meisel, P. L., DiFiori, J. P., Côté, J., Nguyen, J. T., Brenner, J. S., Malina, R. M., Ryan, E., & Güllich, A. (2022). Age of Early Specialization, Competitive Volume, Injury, and Sleep

Habits in Youth Sport: A Preliminary Study of US Youth Basketball. *Sports Health*, 14(1), 30–44. https://doi.org/10.1177/19417381211056301.

Milewski, M. D., Skaggs, D. L., Bishop, G. A., Pace, J. L., Ibrahim, D. A., Wren, T. A., & Barzdukas, A. (2014). Chronic lack of sleep is associated with increased sports injuries in adolescent athletes. *Journal of pediatric orthopedics*, 34(2), 129–133. https://doi.org/10.1097/BPO.0000000000000151

Miller, L., Dockrill, M., Corkum, P. V., Kirk, S. F. L., & Stone, M. (2024). Associations of objectively measured physical activity and sleep in preschoolers aged 3 to 6 years. *Frontiers in Sleep*, 3. https://doi.org/10.3389/frsle.2024.1329774.

Mohammed S., Barakat, C., & Stanyon, W. (2020). "Examining Constraints to Sport Participation among Immigrant Adolescent Girls who reside in the Greater Toronto Area", *Arch Health Sci*; 4(1): 1-13.

O'Donnell, S., & Driller, M. W. (2017). Sleep-hygiene education improves sleep indices in elite female athletes. *International Journal of Exercise Scienc*e, 10(4), 522–530. https://doi.org/10.70252/DNOL2901

Ophoff, D., Slaats, M. A., Boudewyns, A., Glazemakers, I., Van Hoorenbeeck, K., & Verhulst, S. L. (2018). Sleep disorders during childhood: a practical review. *European Journal of Pediatrics*, *177*(5), 641–648. https://doi.org/10.1007/s00431-018-3116-z

Ordway, M. R., Logan, S., & Sutton, E. H. (2022). Sleep deficiency in young children. *Clinics in chest medicine*, 43(2), 229-237.

Pagerols, M., Bosch, R., Prat, R., Pagespetit, È., Cilveti, R., Chaparro, N., Esteve, A., & Casas, M. (2023). The Sleep Disturbance Scale for Children: psychometric properties and prevalence of sleep disorders in Spanish children aged 6–16 years. *Journal of Sleep Research*, *32(4)*, e13871-n/a. https://doi.org/10.1111/jsr.13871.

Roberts, S. S. H., Teo, W.-P., & Warmington, S. A. (2019). Effects of training and competition on the sleep of elite athletes: a systematic review and meta-analysis. *British Journal of Sports Medicine*, *53*(8), 513–522. https://doi.org/10.1136/bjsports-2018-099322

Tricco, A. C., Langlois, E., Straus, S. E., & Organization, W. H. (2017). *Rapid reviews to strengthen health policy and systems: a practical guide.* World Health Organization.

Vitale, K. C., Owens, R., Hopkins, S. R., & Malhotra, A. (2019). Sleep Hygiene for Optimizing Recovery in Athletes: Review and Recommendations. *International journal of sports medicine*, 40(8), 535–543. https://doi.org/10.1055/a-0905-3103

Watson, A., Post, E., Biese, K., Kliethermes, S., Brooks, M. A., & Bell, D. (2021). Decreased Physical Activity and Sleep, Not Sport Specialization, Predict Illness in Middle School Athletes. *Sports Health*, 13(1), 25–30. https://doi.org/10.1177/1941738120927599

Westerbeek, H., & Eime, R. (2021). The Physical Activity and Sport Participation Framework-A Policy Model Toward Being Physically Active Across the Lifespan. *Frontiers in sports and active living, 3*, 608593. https://doi.org/10.3389/fspor.2021.608593.

Whiting, S., Buoncristiano, M., Gelius, P., Abu-Omar, K., Pattison, M., Hyska, J., Duleva, V., Musić Milanović, S., Zamrazilová, H., Hejgaard, T., Rasmussen, M., Nurk, E., Shengelia, L., Kelleher, C. C., Heinen, M. M., Spinelli, A., Nardone, P., Abildina, A., Abdrakhmanova, S., Breda, J. (2021). Physical Activity, Screen Time, and Sleep Duration of Children Aged 6–9 Years in 25 Countries: An Analysis within the WHO European Childhood Obesity Surveillance Initiative (COSI) 2015–2017. *Obesity Facts*, 14(1), 32–44. https://doi.org/10.1159/000511263

Yman, J., Helgadóttir, B., Kjellenberg, K., & Nyberg, G. (2023). Associations between organised sports participation, general health, stress, screen-time and sleep duration in adolescents. *Acta Paediatrica*, *112*(3), 452–459. https://doi.org/10.1111/apa.16556

Appendix A. *S*earch Strategy used for the Rapid Review

Category	Terms
Middle childhood (ages 6-12) girls	"girl*" OR "female*" AND "p?ediatric*" OR "child*" OR "preadolescen*" OR "pre-adolescen*" OR "prepubescen*" OR "pre-pubescen*" OR "pubescen*" OR "school aged" OR "elementary school*" OR "middle childhood" OR "middle school*" OR "youth*" OR "young adult*" OR "school age*" OR "schoolchild*" OR "juvenile*"
Sleep Hygiene	"sleep.mp." OR "asleep" OR "oversleep*" OR "nap*" OR "doz*" OR "snooz*" OR "drows*" OR "slumber*" OR "slumbrous" OR "bed" OR "bedtime*" OR "bed time*" OR "restful" OR "wake" OR "waking" OR "wakefulness" OR "wide awake" OR "tired*"
Sports participation	sport* or athlet* or acrobat* or alpine* or archer* or badminton* or baseball* or basketball* or baseball* or biath* or bmx* or bobsle* or boccia* or boxing* or boxer* or bowling* or bowler* or broomball* or canoe* or cheerlead* or cricket* or crossfit* or cross-fit* or curling* or (cross adj1 country*) or cross-country or cycling* or cyclist* or diving* or diver* or equest* or fencing* or fencer* or (field adj1 hockey*) or (figure adj skat*) or football* or futsal* or golf* or goalball* or gymnast* or handball* or hockey* or judo* or karate* or kayak* or kickbox* or kick-box* or lacross* or (lawn adj1 bowl*) or luge* or (martial* adj2 art*) or muay thai or (mountain* adj1 bik*) or netball* or pentath* or racquet* or ringette* or (rock adj1 climb*) or rockclimb* or rower* or rowing* or rugby* or runner* or running* or sailing* or sailor* or soccer* or (ski adj1 jump*) or (ski adj1 mountain*) or skiing* or skier* or skateboard* or skating* or skater* or sledding* or snowboard* or softball* or speedskat* or speed-skat* or (speed* adj1 skat*) or squash* or swim* or surfing* or surfer* or taekwondo* or tennis* or (track adj field) or trampolin* or triath* or volleyball* or wakeboard* or (water adj1 polo*) or wrestling* or wrestler* or weightlight* or (weight adj lift*) or jiu jitsu* or jiu-jitsu* or jogging* or jogger* or kendo* or kung fu* or kung-fu* or mountaineer* or qigong* or (tai adj1 ji) or (tai adj1 chi*) or taiji* or taichi*) adj3 (participat* or involve* or join* or engage* or play)).mp

Appendix B. Risk of Bias (CASP) Tables

Table C1. *Risk of Bias Assessment of included Cohort Studies using the CASP Cohort Study Checklist*

Author, Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Overall
Watson et al., 2021	Yes	Some concern	Some concern	Some concern	Some concern	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Moderate
Falstrom, 2022	Yes	Yes	Some concern	Some concern	No	No	Yes	Yes	Yes	Some concern	Yes	Yes	Moderate

Q1. Did the study address a clearly focused issue?
Q2. Was the cohort recruited in an acceptable way?
Q3. Was the exposure accurately measured to minimize bias?
Q4. Was the outcome accurately measured to minimize bias?
Q5. Have the authors identified all important confounding factors?
Q6. Was the follow up of subject complete/long enough?
Q7. What are the results of the study?
Q8. How precise are the results?
Q9. Do you believe the results?
Q10. Can the results be applied to the local population?
Q11. Do the results of this study fit with other available evidence?
Q12. What are the implications of this study for practice?

Table C2. *Risk of Bias Assessment of included Cross-sectional Studies using the CASP Cross-Sectional Study Checklist*

Author, Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Overall
Larrinaga-Undabarrena, 2023	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low

Q1. Did the study address a clearly focused issue?
Q2. Did the authors use an appropriate method to answer their question?
Q3. Were the subjects recruited in an acceptable way?
Q4. Were the measures accurately measured to reduce bias?
Q5. Were the data collected in a way that addressed the research issue?
Q6. Did the study have enough participants to minimize the play of chance?
Q7. How are the results presented and what is the main results?
Q8. Was the data analysis sufficiently rigorous?
Q9. Is there a clear statement of findings?
Q10. Can the results be applied to the local population?
Q11. How valuable is the research?