

Impact of Sleep Characteristics on Temperament and Dental Caries Experience Among

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ABSTRACT

Background: Early childhood caries (ECC) is one of the most prevalent chronic diseases in young children and is influenced by biological, behavioural, and psychosocial factors. Sleep disturbances may affect health behaviours, immune function, and daily routines, while temperament traits such as emotionality, activity, and sociability may influence children's oral hygiene practices, dietary habits, and cooperation during dental care. Examining sleep patterns and temperament together may provide new insights into risk factors associated with dental caries.

Materials and Methods: A cross-sectional study was conducted among 30 children aged 3–8 years. Sleep patterns were assessed using parent maintained 7-day sleep records and structured parental interviews based on a questionnaire, while temperament was evaluated using the Emotionality, Activity, and Sociability (EAS) Temperament Scale. Dental caries experience was recorded using the WHO caries index. Parents completed a structured questionnaire to obtain sociodemographic information, dietary habits, oral hygiene practices, and sleep-related details. Data were analysed using descriptive statistics and multivariable regression analysis to determine the associations between sleep characteristics, temperament, and dental caries experience.

Results: Sleep pattern showed a positive association with caries, indicating a tendency toward higher caries experience with poorer sleep patterns. In contrast, sleep duration demonstrated no meaningful linear association with temperament.

Conclusion: Child's daily habits is important in preventive pediatric dentistry. The present study found that irregular sleep patterns and certain temperamental traits are associated with increased dental caries experience, emphasizing the importance of incorporating behavioural and lifestyle factors into early childhood oral health promotion and caries prevention strategies.

Keywords: Sleep, Temperament, Dental Caries, Children.

INTRODUCTION

Sleep is a crucial physiological process in early childhood, supporting normal growth, immune function, emotional stability, and behavioural performance. Adequate sleep plays a vital role in neurodevelopment and immune regulation, while disturbances in sleep have been associated with adverse physical and behavioural outcomes in children. During the preschool and early school years, many children experience sleep problems

such as reduced sleep duration, frequent nocturnal awakenings, and irregular sleep schedules¹. Recent evidence suggests that inadequate sleep in children may negatively influence overall health behaviours, thereby increasing susceptibility to unfavourable oral health outcomes, including dental caries^{2,5}

Dental caries is one of the most prevalent chronic diseases affecting children worldwide, particularly

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during the mixed dentition stage^{3,7}. The etiology of dental caries is multifactorial, involving the interaction of cariogenic microorganisms, dietary habits, host susceptibility, and oral hygiene practices⁴. Behavioural factors play a pivotal role in both the initiation and progression of caries, as young children largely depend on caregivers for regulation of dietary intake and maintenance of oral hygiene routines⁴. Several mechanisms have been proposed to explain the association between sleep patterns and dental caries. Children with insufficient or poor-quality sleep often exhibit irregular daily routines, increased frequency of snacking, and a preference for sugar-rich foods⁸. Furthermore, inadequate sleep has been associated with impaired immune response, increased inflammatory markers, and possible alterations in salivary flow and composition, which may enhance vulnerability to cariogenic bacteria and promote caries development^{1, 5}.

Temperament refers to biologically based individual differences in emotional reactivity, activity level, and self-regulation that are evident early in life⁶. Children with high emotionality may respond to routine oral hygiene practices with resistance or distress, while highly active children may struggle to adhere to structured daily schedules, including consistent toothbrushing routines⁶. These temperament traits can influence caregiver child interactions, dietary supervision, and compliance with oral health practices, thereby affecting caries experience^{6, 9}. Poor sleep has been shown to exacerbate emotional dysregulation and behavioural difficulties, while temperament characteristics may influence sleep onset, sleep duration, and sleep quality^{3, 10}. The combined presence of sleep disturbances and challenging temperament traits may therefore create a behavioural environment that increases the risk of dental caries in young children.

Children aged 3–8 years constitute a clinically significant group, as this developmental period encompasses the transition from primary to mixed dentition and the gradual acquisition of independence in daily health behaviours. During this stage, sleep habits and temperament become more stable and reliably measurable, allowing for meaningful clinical and behavioural assessment^{1,6}. Despite growing recognition of the influence of sleep on behaviour and general health, there remains a

paucity of studies examining the combined relationship between sleep patterns, duration, temperament, and dental caries in this age group, highlighting the need for integrated research in paediatric oral health^{5,9}.

Clinical Significance

Identification of sleep pattern disturbances may assist pediatric dentists in recognizing children at risk for unfavorable temperamental traits and increased caries susceptibility. Incorporating sleep assessment into routine pediatric dental evaluations may support early preventive interventions and individualized behavior management strategies.

MATERIALS AND METHODS

The present cross-sectional study was conducted after obtaining approval from the Institutional Ethics Committee and written informed consent from the parents/guardians of the participants. A total of 30 healthy children aged 3–8 years, comprising 17 males (56.7%) and 13 females (43.3%), who reported to the Department of Pediatric and Preventive Dentistry, were randomly selected for the study.

Inclusion and exclusion criteria Inclusion criteria

Children aged 3-8 years who showed willingness for participation

Assessment of Sleep Patterns

Exclusion criteria

Children with history of any systemic disorder, on constant medication

Child having a congenital oral disease, having a history of radiotherapy.

Sleep patterns were assessed using parent-maintained 24-hour sleep records over seven consecutive days, supplemented by structured parental interviews conducted by a single trained investigator. The questionnaire, adapted from Patel et al. (2025), assessed preschool sleep practices, bedtime routines, screen exposure, oral hygiene behaviours, and snacking habits associated with early childhood caries. Information regarding total sleep duration (weekdays and weekends), nap status, sleep schedule regularity, sleep-related

behaviours, pre-bedtime electronic media use, household structure, primary caregiver, maternal employment, number of siblings, and birth order was also recorded.

Sleep duration was categorised according to the National Sleep Foundation age-specific recommendations as adequate or insufficient: 10–13 hours for children aged 3–5 years and 9–11 hours for children aged 6–13 years¹¹.

Assessment of Temperament

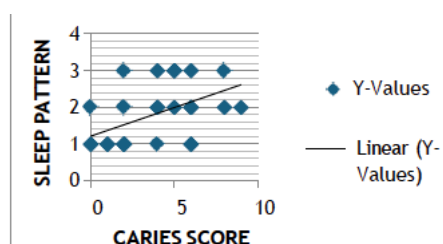
Temperament was assessed using the Emotionality, Activity, and Sociability (EAS) Temperament Questionnaire. Parents completed the 20-item questionnaire by rating their child's behaviour on a 5-point Likert scale across the four temperament domains: emotionality, activity, sociability, and shyness. Scores were calculated for each domain, and the domain with the highest score was considered the child's dominant temperament for statistical analysis.

Caries Assessment

Caries experience was recorded using the WHO deft/DMFT index by a calibrated examiner.

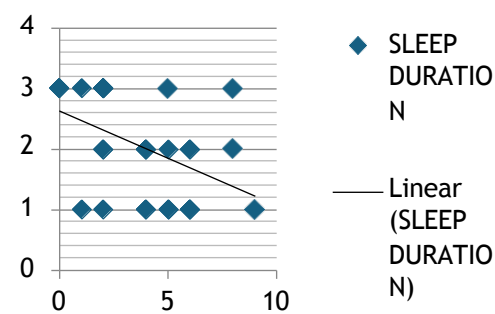
RESULTS

A total of 30 children aged 3–8 years participated in the study, comprising 17 males (56.7%) and 13 females (43.3%). The mean age of the participants was 5.67 ± 1.81 years, with males having a mean age of 5.12 ± 1.83 years and females 6.38 ± 1.56 years.

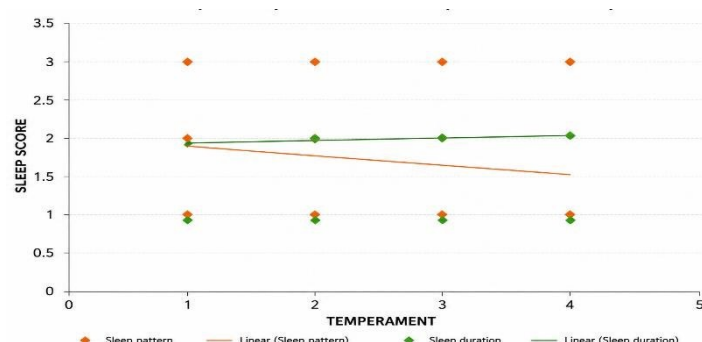


Graph 1: Scatter plot showing the correlation between caries scores and sleep pattern among children (sleep pattern 1- morning, 2-interval, 3-evening)

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Graph 2 Scatter plot showing the correlation between caries scores and sleep duration among children (Sleep duration 1- <9, 2- 9-11, 3- >11)



Graph 3: Scatter plot showing the association between dominant temperament and sleep pattern, duration among children.

The association between sleep characteristics and dental caries, assessed using caries scores, is summarized in graph 1 and 2. Statistically significant correlations were observed between caries scores and sleep duration ($r = -0.455$, $p = 0.011$), sleep pattern ($r = 0.478$, $p = 0.008$), and adherence to a scheduled sleep routine ($r = 0.469$, $p = 0.009$). Graphical analysis of caries scores across sleep patterns (morning, interval, evening) demonstrated a tendency for children with more structured or morning-oriented sleep patterns to exhibit lower caries scores. Similarly, children with longer sleep durations (>11 hours) had lower caries scores compared to those with shorter sleep (<9 hours), suggesting that both adequate and regular sleep may have a protective effect against early childhood caries.

Among the 30 children, emotionality was the most common dominant temperament (30.0%), followed by shyness (26.7%), activity (23.3%), and sociability (20.0%). Dominant temperament categories were distributed across all sleep-duration groups without

any apparent clustering, and no significant association was observed between dominant temperament and sleep characteristics.

DISCUSSION

Sleep has emerged as an important behavioural factor influencing general health in early childhood however, its role in oral health outcomes has received comparatively limited attention. In the present study, sleep duration, sleep pattern, and adherence to a scheduled sleep routine were significantly associated with dental caries experience among children aged 3–8 years. In contrast, temperament traits did not show a statistically significant association with sleep duration or sleep pattern among the participants.

The association between sleep characteristics and dental caries observed in the present study is in agreement with previous reports. Ogawa et al. reported that insufficient sleep duration was significantly associated with higher caries prevalence even after adjustment for dietary habits and oral hygiene practices¹. Similarly, a systematic review by Sardana et al. demonstrated that shorter sleep duration and irregular bedtime routines were consistently associated with increased odds of early childhood caries across diverse populations¹³. In contrast, Tada and Miura observed that irregular sleep habits were not independently associated with dental caries once lifestyle and oral hygiene behaviours were controlled², and Zhou et al., in a systematic review of risk indicators for early childhood caries, did not identify sleep-related variables as consistent independent predictors⁹.

Several biological and behavioural mechanisms may explain the relationship between sleep and caries experience. Sleep deprivation and circadian rhythm disruption have been associated with altered immune responses and reduced nocturnal salivary flow, potentially increasing vulnerability to cariogenic challenges¹⁴. Irregular sleep schedules may also interfere with bedtime routines, resulting in delayed or missed toothbrushing and increased nocturnal feeding, thereby prolonging exposure of teeth to fermentable carbohydrates¹⁵. Shantinath et al. highlighted that sleep-related problems in children are frequently accompanied by unfavourable oral health behaviours, which may

mediate the association between sleep disturbances and caries development¹⁶.

Temperament did not demonstrate a statistically significant association with sleep duration or sleep pattern in the present study. This finding aligns with literature suggesting that, beyond infancy, sleep quantity is largely shaped by environmental and caregiver-regulated factors rather than intrinsic temperament traits. Hayes reported that sleep wake behaviour and temperament, although developmentally related, largely function as independent constructs during early childhood¹⁷. Gregory and Sadeh similarly noted that temperament is more closely associated with sleep quality and night awakenings than with total sleep duration, which is primarily influenced by external regulation¹⁸. Supporting this observation, De Jongh et al. reported no significant association between temperament traits and dental behavior or anxiety in children⁶. In contrast, Mindell and Owens suggested that certain temperament characteristics, such as higher activity levels or emotionality, may contribute to bedtime resistance and variations in sleep duration¹⁹, while Tikotzky reported that children with more difficult temperaments may exhibit greater irregularity in sleep schedules²⁰.

Although minor numerical variations were observed, with sociable and active temperament traits appearing slightly more frequently among children sleeping for 9–11 hours, these differences were not statistically significant and did not demonstrate a consistent trend. Such variations may reflect the influence of structured daily routines rather than a direct effect of temperament on sleep duration. Touchette et al. reported that regular daily schedules are associated with more stable sleep patterns in early childhood, although these associations are context-dependent²¹.

The present study has certain limitations. As, a cause-and-effect relationship between sleep patterns, temperament, and dental caries could not be established. Sleep-related information and temperament were assessed using parent-reported questionnaires, which may have been influenced by recall or reporting bias. In addition, classifying children based on their dominant temperament may not have fully reflected the individual variations in temperament. Further longitudinal studies with larger sample sizes and objective measures of sleep

are recommended to better understand the relationship between sleep, temperament, and dental caries in children.

CONCLUSION

Sleep duration and sleep patterns were associated with dental caries experience in children, with irregular sleep habits being associated with comparatively higher caries scores. No significant association was observed between dominant temperament and sleep characteristics. These findings indicate that healthy sleep habits may be considered one of the behavioural factors influencing oral health and should be encouraged as part of preventive pediatric dental care.

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