J Compr Ped. 2025 November; 16(4): e160414 https://doi.org/10.5812/jcp-160414

Published Online: 2025 July 27 **Research Article**

Exploring the Association of Melatonin Levels with Sleep Patterns and Emotional Status of Children Experiencing Online Learning

Nenden Nursyamsi Agustina [1, 2, *], Aaliyah Putri Sabrina [3], Lantip Rujito [4], Joko Mulyanto [5]

[1] Department of Child Health, Faculty of Medicine, Jenderal Soedirman University, Purwokerto, Indonesia
[2] Department of Child Health, Prof. Dr. Margono Soekarjo Hospital, Puwokerto, Indonesia
[3] College of Medicine, Faculty of Medicine, Universitas Jenderal Soedirman, Purwokerto, Indonesia
[4] Department of Molecular Biology, Faculty of Medicine, Universitas Jenderal Soedirman, Purwokerto, Indonesia
[5] Department of Public Health and Community Medicine, Faculty of Medicine, Jenderal Soedirman University, Purwokerto, Indonesia

[*] ***Corresponding Author:*** Department of Child Health, Faculty of Medicine, Universitas Jenderal Soedirman/ Prof. Dr. Margono Soekarjo Hospital, Purwokerto, Indonesia. Email: dr.nursyamsi@gmail.com

Received: 10 February, 2025; **Revised:** 23 June, 2025; **Accepted:** 6 July, 2025

Abstract

Background: Sleep plays an important role in brain function, impacting critical periods of brain development and maturation. Sleep disturbances in children must be addressed, as they increase the risk of emotional disturbances. Sleep quality has been associated with melatonin levels. However, evidence of the association between sleep quality, emotional disturbance, and melatonin levels in children is still lacking.

Objectives: The present study aimed to assess the association between sleep and emotional disturbances with melatonin levels in children experiencing online learning.

Methods: This analytical cross-sectional study involved 82 elementary school students aged 6 - 12 years in Banyumas Regency, West Java, Indonesia, from August to September 2022. Subjects with major depressive disorder and attention deficit hyperactivity disorder (ADHD) were excluded to minimize potential bias. Salivary melatonin levels were measured using enzyme-linked immunosorbent assay (ELISA). Sleep disturbance was assessed using the Sleep Disturbance Scale for Children (SDSC), and emotional disturbance was measured by the Strengths and Difficulties Questionnaire (SDQ). The Mann-Whitney test with $\alpha < 0.05$ was applied to test the difference in melatonin levels among various groups of children with sleep and emotional disturbances.

Results: Of the 82 subjects, 7 children (8.5%) experienced sleep and emotional disturbances. The melatonin levels varied widely, with a median of 301.9 pg/mL. No significant difference was found in melatonin levels between children with sleep disturbance compared to those without sleep disturbance ($P = 0.67$), as well as for children with emotional disturbance compared to those without emotional disturbance ($P = 0.79$).

Conclusions: Sleep and emotional disturbances were not associated with variations in melatonin levels in children experiencing online learning.

Keywords: Sleep Disturbance, Emotional Disturbance, Online Learning, Salivary Melatonin Level

1. Background

Sleep in children plays a crucial role during critical developmental periods, such as growth, cognitive development, emotion regulation, and body recovery. Addressing sleep disturbances in children is essential. Studies in the United States and Germany have shown that the prevalence of sleep disturbances in children ranges from 15 - 44% (1). Children aged 6 - 12 years typically require 9 - 12 hours of sleep, while in Asia, the average sleep duration for children is about 8 hours (2). A study in Indonesia found that 153 out of 493 children experienced sleep disturbances, including difficulties in

How to Cite: Nursyamsi Agustina N, Putri Sabrina A, Rujito L, Mulyanto J. Exploring the Association of Melatonin Levels with Sleep Patterns and Emotional Status of Children Experiencing Online Learning. J Compr Ped. 2025; 16 (4): e160414. https://doi.org/10.5812/jcp-160414.

initiating, maintaining, and terminating sleep, as well as short sleep duration (3).

Sleep disturbances in children are associated with emotional dysregulation, such as irritability, impaired attention, and reduced engagement (4, 5). Additionally, children with sleep disturbances are more likely to exhibit aggressive behavior, memory problems, and low attention (6). A study found that children with sleep disturbances have an increased risk of experiencing emotional disturbances and depression (7).

The COVID-19 pandemic has had a significant impact, particularly due to social restriction policies implemented to curb the virus's transmission. One major change affecting children's development is the studying-at-home policy, which limits social interaction among children. This leads to social isolation, affecting children's sleep needs, duration, and quality. Sleep disturbances cause problems in daily life, such as sleepiness, headaches, and disturbances in emotional conditions and behaviors. This condition has been associated with the excessive use of gadgets during online learning. The amount of screen time significantly increased during the lockdown compared to pre-lockdown period (8). The excessive use of gadgets during online learning increases children's exposure to blue light radiation, potentially affecting melatonin production and causing sleep disturbances (8).

2. Objectives

Studies assessing the association between sleep and emotional disturbances are still lacking, particularly in Indonesia. The present study aimed to explore the association between sleep disturbances and emotional disturbances with melatonin levels in children experiencing online learning.

3. Methods

This was an analytical cross-sectional study involving 82 children aged 6 - 12 years. The sample size was calculated using a sample size formula (9). Subjects were recruited consecutively from elementary school students in Banyumas Regency, Indonesia. The inclusion criteria were children aged 6 - 12 years who had experienced online learning for at least 3 months. Subjects with major depressive disorder and attention deficit hyperactivity disorder (ADHD) were excluded from the study. Data was collected from August 2022 to September 2022. Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Medicine, Universitas Jenderal Soedirman (Ref. 002/KEPK/PE/IX/2022). All legal guardians of the subjects provided consent for participation in the study.

Melatonin levels were measured from saliva. Approximately 3 ml of saliva was collected from each subject at 9 pm. All samples were collected on the same day, and melatonin levels were measured using the enzyme-linked immunosorbent assay (ELISA) method. Sleep disturbance was assessed using the Indonesian version of the Sleep Disturbance Scale for Children (SDSC), which has been tested for validity and reliability (10, 11). The SDSC has relatively high validity and reliability compared to similar questionnaires. It consists of 26 items with a five-point Likert scale for each item. Sleep disturbance was defined as a total SDSC score > 39, while a total score ≤ 39 indicated the absence of sleep disturbance (12).

The Indonesian version of the Strengths and Difficulties Questionnaire (SDQ), with tested validity and reliability, was used to measure the mental and emotional development of children (13, 14). The questionnaire assessed five domains: Emotional symptoms, behavioral problems, hyperactivity, relationship problems, and prosocial behavior. It consists of 25 items, with scores for each item ranging from 0 to 2, and a maximum total score of 50. Emotional disturbance was categorized as normal if the total score was < 14, borderline if the total score ranged between 14 - 16, and abnormal if the total score was > 16 (13).

The Indonesian version of the Parenting Style and Dimension Questionnaire-Short Version (PSDQ), with tested validity and reliability, was used to analyze the parenting style of the children participating in this study (15, 16). The questionnaire consists of 32 items with a Likert scale ranging from 1 to 5, evaluating three types of parenting styles: Authoritarian, permissive, and democratic (17).

The basic characteristics of the study subjects were described in two ways. Categorical variables were described using percentages, while means and standard deviations were used for numerical variables. Characteristics described include age, gender, nutritional status, screen time, parenting style, parents' occupation, and educational level. The Mann-Whitney

Table 1. Characteristics of Subjects

Characteristics	No. (%)	Mean ± SD
Children characteristics		
Age (y)		10.07 ± 1.57
6 - 7	10 (12.2)	
8 - 9	10 (12.2)	
10	21 (25.6)	
11	30 (36.6)	
12	11 (13.4)	
Gender		
Female	41 (50.0)	
Male	41 (50.0)	
Nutritional status		
Normal	66 (80.5)	
Underweight	9 (11.0)	
Overweight/obese	7 (3.7)	
Screen time (h)		92.99 ± 48.002
< 2	45 (54.9)	
> 2	37 (45.1)	
Parents characteristics		
Father's employment		
Employed	82 (100.0)	
Unemployed	0 (0.0)	
Father's education		
High school or lower	44 (53.6)	
Higher education	38 (46.4)	
Mother's employment		
Unemployed/housewife	63 (76.8)	
Employed	19 (23.2)	
Mother's education		
High school or lower	47 (57.3)	
Higher education	35 (42.7)	
Parenting style		
Democratic	76 (92.7)	
Permissive	6 (7.3)	
Authoritarian	0 (0)	
Independent variable		
Sleep disturbance		
Yes	58 (70.7)	
No	24 (29.3)	
Emotional disturbance		
Normal	60 (73.2)	
Borderline	13 (15.9)	
Abnormal	9 (11.0)	
Sleep and emotional disturbance		
Yes	7 (8.5)	
No	75 (91.5)	

and Kruskal-Wallis tests were used to test the association between sleep disturbance and emotional disturbance with melatonin levels. These non-parametric tests were selected because the data did not meet the assumptions of parametric tests, and data transformation failed to normalize the data distribution. For hypothesis testing, the significance level was set at 5%, and a P-value < 0.05 was considered statistically significant.

4. Results

The characteristics of the subjects are displayed in Table 1. A total of 82 children were included in the analysis. Most of the subjects were 11 years old (36.6%) and had good nutritional status (80.5%). The gender distribution was equal between male and female subjects. Most of the subjects had a screen time of less than 2 hours per day (54.9%), with an average screen time of 92.99 minutes.

Regarding the characteristics of the parents, all fathers were employed, and most had a high school education or lower (53.6%). For the mothers, most were

housewives (76.8%) and had a high school education or lower (53.6%). The democratic style was the most frequently practiced parenting style by the parents (92.7%). Most of the subjects had sleep disturbances (70.7%) and no emotional disturbances (73.2%). Only 8.5% of the subjects had both sleep and emotional disturbances.

Table 2 shows that the mean melatonin level in all subjects is 301.92 pg/dL. Subjects without any disturbances had a relatively higher melatonin level (317.59 pg/dL) compared to those with sleep disturbances. Subjects with sleep disturbances had the lowest melatonin level (277.06 pg/dL), while subjects with emotional disturbances (322.46 pg/dL) and those with both disturbances (304.87 pg/dL) had relatively high melatonin levels compared to those with sleep disturbances.

Table 2. Level of Melatonin Based on Category of Subjects

Categories	Mean ± SD (pg/dL)
All subjects	301.92 ± 229.01
Subjects without any disturbances	317.59 ± 261.74
Subjects with sleep disturbance	277.06 ± 206.27
Subjects with emotional disturbance	322.46 ± 260.44
Subjects with both disturbances	304.87 ± 252.79

Table 3 shows that melatonin levels did not significantly associate with emotional disturbance (P = 0.79). The borderline group had a lower melatonin level (278.48 pg/dL) than the normal group (303.91 pg/dL), but the abnormal group showed a higher melatonin level (322.46 pg/dL) compared to both the normal and borderline groups.

Table 3. Association Between Social and Emotional Disturbance with the Melatonin Level

Disturbance and Category	No.	Mean ± SD Melatonin Level (pg/dL)	P-Value [a]
Social and emotional			0.79 [b]
Normal	60	303.91 ± 238.03	
Borderline	13	278.48 ± 228.48	
Abnormal	9	322.46 ± 260.27	

[a] Kruskal-Wallis test.

[b] A P-value of less than 0.05 is considered statistically significant.

Table 4 shows that subjects with sleep disturbances had lower melatonin levels (277.06 pg/dL) compared to those without sleep disturbances (361.98 pg/dL). However, the difference in melatonin levels between these groups is insignificant, as indicated by a P-value of 0.67. A similar result was found for subjects with both disturbances. Although subjects with both disturbances showed a higher melatonin level (304.87 pg/dL) compared to those without both disturbances (301.64 pg/dL), the difference was not significant (P = 0.79).

Table 4. Association Between Sleep Disturbance and Both Emotional and Sleep Disturbance with the Melatonin Level

Disturbance and Category	No.	Mean ± SD Melatonin Level (pg/dL)	P-Value [a]
Sleep			0.48
Yes	58	287.80 ± 206.27	
No	24	319.96 ± 257.04	
Both emotional and sleep			0.79 [b]
Yes	7	304.87 ± 252.79	
No	75	301.64 ± 228.53	

[a] Mann-Whitney test.

[b] A P-value of less than 0.05 is considered statistically significant.

5. Discussion

The present study explored melatonin levels in children experiencing online learning and found no significant association between sleep disturbance and melatonin levels. For children with emotional disturbances, more variations were found in melatonin levels, yet no significant association was observed between emotional disturbance and melatonin levels. When both disturbances were considered, the association remained insignificant. This finding aligns with a study by Claustrat et al., which suggests that the weak association may be due to the slower secretion of melatonin in individuals with sleep disturbances, which does not necessarily result in lower melatonin levels (18). This hypothesis is supported by Pandi-Perumal et al., who found that children with sleep disturbances, particularly delayed sleep-phase syndrome, experienced a late release of melatonin but maintained normal overall levels (19).

Additionally, previous studies suggest that children with sleep disturbances and relatively normal melatonin levels may experience sleep disturbances with acute onset (20). Amalina et al. argued that low melatonin levels are likely caused by chronic sleep

disorders due to increased glucocorticoid hormones, leading to elevated cortisol and adrenaline levels, which may affect learning, memory, and anxiety, and suppress melatonin receptors (21).

Sleep hygiene also plays a role in sleep initiation and maintenance. Fadzil found that good sleep hygiene, such as reducing physical activity before sleep and limiting light and sound exposure, positively impacts sleep (22). Exposure to blue light from gadgets for more than two hours at night can suppress melatonin secretion, explaining the relatively low melatonin levels in some children without sleep disturbances (23). Lee et al. confirmed that lamp brightness and color temperature can suppress melatonin, contributing to the high variability in melatonin levels observed in this study (24).

Parenting style may also influence sleep and emotional disturbances in children. A positive parent-child relationship increases compliance with sleep schedules and reduces sleep problems. Abidin et al. found that children with poor relationships with authoritarian parents are more likely to experience depression and mental problems due to unmet psychological needs (25). However, most children in this study experienced democratic parenting, even those with sleep and emotional disturbances. Hosokawa and Katsura found that parents' education, occupation, and income directly influence children's emotional and mental states, with children from low-income families more likely to develop emotional problems due to harmful parent-child interactions (26). In this study, all children had working fathers, while most mothers were housewives. While this may lead to more time spent with children, dual-income families often have better outcomes for children (27).

The nutritional status of children with sleep and emotional disorders was normal. Anusha and Hegde found that sleep disorders can occur in children of all nutritional statuses, although the incidence of sleep and emotional disturbances slightly increases in children with obesity (28). Gombert et al. found no differences in salivary melatonin concentrations before sleep between children with normal body weight and those with obesity, although significant differences were observed after one hour of sleep (29).

This study is the first in Indonesia to explore the association between melatonin levels and sleep and emotional disturbances in children experiencing online learning. However, the results should be interpreted cautiously, highlighting the need for further studies assessing multiple factors that may mediate the association between melatonin levels and sleep and emotional disturbances in children.

5.1. Conclusions

The present study found no significant association between melatonin levels and sleep disturbance, emotional disturbance, or both disturbances in children. The main argument for this finding relates to the variation in melatonin release timing, leading to variations in melatonin levels during certain periods. Other factors, such as socioeconomic status, screen time, and parenting style, may also mediate the association. Further studies with larger sample sizes and multiple factors in the analysis are needed to better understand the relationship between melatonin levels and sleep and emotional disturbances in children. Practically, melatonin level tests combined with other screening methods may be considered for children with sleep and emotional disturbances.

Acknowledgements

The present study was funded by an internal research grant from Universitas Jenderal Soedirman.

Footnotes

Authors' Contribution: N. N. A.: Study concept and design, methodology, acquisition of data, data analysis and interpretation, and drafting the manuscript; A. P. S.: Acquisition of data, administrative, statistical analysis, and drafting the manuscript; L. R.: Supervision, reviewing, data curation, and editing; J. M.: Statistical analysis, reviewing, and editing.

Conflict of Interests Statement: The authors declare no conflict of interests.

Data Availability: The dataset presented in the study is available on request from the corresponding author during submission or after its publication. The data are not publicly available due to privacy.

Ethical Approval: The present study received ethics approval from the Health Research Ethics Committee, Faculty of Medicine, Universitas Jenderal Soedirman (Ref. 002/KEPK/PE/IX/2022).

Funding/Support: The present study was funded by an internal research grant from Universitas Jenderal Soedirman.

Informed Consent: All legal guardians of the subjects provided consent for their participation in the study.

References

1. Lewien C, Genuneit J, Meigen C, Kiess W, Poulain T. Sleep-related difficulties in healthy children and adolescents. *BMC Pediatrics*. 2021;**21**(1):82. https://doi.org/10.1186/s12887-021-02529-y.
2. Takeshima M, Ohta H, Hosoya T, Okada M, Iida Y, Moriwaki A, et al. Association between sleep habits/disorders and emotional/behavioral problems among Japanese children. *Scientific Rep*. 2021;**11**(1). https://doi.org/10.1038/s41598-021-91050-4.
3. Retnosari GY, Irwanto I, Herawati L. Prevalence and characteristics of sleep problems of Indonesian children in 0 – 36 months old. *Indonesian J Med Health*. 2021;**12**(1):28-33. https://doi.org/10.20885/JKKI.Vol12.Iss1.art6.
4. Nagata JM, Abdel Magid HS, Pettee Gabriel K. Screen Time for Children and Adolescents During the Coronavirus Disease 2019 Pandemic. *Obesity (Silver Spring)*. 2020;**28**(9):1582-3. [PubMed ID: 32463530]. [PubMed Central ID: PMC7283714]. https://doi.org/10.1002/oby.22917.
5. Widiantini EJL, Sugiharto S, Andiana O. Pengaruh Olahraga Selama Puasa Terhadap Hormon Melatonin Pada Tikus Putih Jantan Jenis Wistar. *J Sport Sci*. 2019;**9**(1). https://doi.org/10.17977/um057v9i1p84-94.
6. Halstead EJ, Joyce A, Sullivan E, Tywyn C, Davies K, Jones A, et al. Sleep Disturbances and Patterns in Children With Neurodevelopmental Conditions. *Frontiers in Pediatrics*. 2021;**9**. https://doi.org/10.3389/fped.2021.637770.
7. Jansen PW, Saridjan NS, Hofman A, Jaddoe VW, Verhulst FC, Tiemeier H. Does disturbed sleeping precede symptoms of anxiety or depression in toddlers? The generation R study. *Psychosom Med*. 2011;**73**(3):242-9. [PubMed ID: 21257976]. https://doi.org/10.1097/PSY.0b013e31820a4abb.
8. Humirah LA, Hidayati BN, Pratiwi EA, Romadonika F, Wasliah I. [Hubungan Penggunaan Gadget dan Kejadian Insomnia pada Remaja Saat Pandemi Covid-19]. *J Nursing*. 2021;**13**(2):381-6. ID.
9. Sastroasmoro S, Ismael S. *Dasar-dasar metodologi penelitian klinis*. 4th ed. Jakarta, Indonesia; 2011. p. 1-16.
10. Bruni O, Ottaviano S, Guidetti V, Romoli M, Innocenzi M, Cortesi F, et al. The Sleep Disturbance Scale for Children (SDSC). Construction and validation of an instrument to evaluate sleep disturbances in childhood and adolescence. *J Sleep Res*. 1996;**5**(4):251-61. [PubMed ID: 9065877]. https://doi.org/10.1111/j.1365-2869.1996.00251.x.
11. Natalita C, Sekartini R, Poesponegoro H. Skala gangguan tidur untuk anak (SDSC) sebagai instrumen skrining gangguan tidur pada anak sekolah lanjutan tingkat pertama. *Sari Pediatri*. 2016;**12**(6):365-72.
12. Wearick-Silva LE, Richter SA, Viola TW, Nunes ML. Sleep quality among parents and their children during COVID-19 pandemic. *J Pediatr (Rio J)*. 2022;**98**(3):248-55. [PubMed ID: 34480854]. [PubMed Central ID: PMC8432904]. https://doi.org/10.1016/j.jped.2021.07.002.
13. Goodman R. The Strengths and Difficulties Questionnaire: a research note. *J Child Psychol Psychiatry*. 1997;**38**(5):581-6. [PubMed ID: 9255702]. https://doi.org/10.1111/j.1469-7610.1997.tb01545.x.
14. Oktaviana M, Wimbarti S. Validasi klinik strenghts and difficulties questionnaire (SDQ) sebagai instrumen skrining gangguan tingkah laku. *J Psychol*. 2014;**41**(1):101-14.
15. Robinson CC, Mandleco B, Olsen SF, Hart CH. Authoritative, authoritarian, and permissive parenting practices: Development of a new measure. *Psychological reports*. 1995;**77**(3):819-30.
16. Rachmayani D, Zabrina N. Measurement of Parenting Types Based on Adolescent Perspective: Modification and Content Validity Analysis of the Parenting Styles and Dimensions Questionnaire (PSDQ). *Psikostudia : Jurnal Psikologi*. 2023;**12**(4). https://doi.org/10.30872/psikostudia.v12i4.10475.
17. Oliveira TD, Costa DS, Albuquerque MR, Malloy-Diniz LF, Miranda DM, de Paula JJ. Cross-cultural adaptation, validity, and reliability of the Parenting Styles and Dimensions Questionnaire - Short Version (PSDQ) for use in Brazil. *Braz J Psychiatry*. 2018;**40**(4):410-9. [PubMed ID: 29898189]. [PubMed Central ID: PMC6899386]. https://doi.org/10.1590/1516-4446-2017-2314.
18. Claustrat B, Brun J, Chazot G. The basic physiology and pathophysiology of melatonin. *Sleep Med Rev*. 2005;**9**(1):11-24. [PubMed ID: 15649735]. https://doi.org/10.1016/j.smrv.2004.08.001.
19. Pandi-Perumal SR, Srinivasan V, Spence DW, Cardinali DP. Role of the melatonin system in the control of sleep: therapeutic implications. *CNS Drugs*. 2007;**21**(12):995-1018. [PubMed ID: 18020480]. https://doi.org/10.2165/00023210-200721120-00004.
20. Palagini L, Manni R, Aguglia E, Amore M, Brugnoli R, Bioulac S, et al. International Expert Opinions and Recommendations on the Use of Melatonin in the Treatment of Insomnia and Circadian Sleep Disturbances in Adult Neuropsychiatric Disorders. *Front Psychiatry*. 2021;**12**:688890. [PubMed ID: 34177671]. [PubMed Central ID: PMC8222620]. https://doi.org/10.3389/fpsyt.2021.688890.
21. Amalina S, Sitaresmi MN, Gamayanti IL. Hubungan penggunaan media elektronik dan gangguan tidur. *Sari Pediatri*. 2016;**17**(4):273-8.
22. Fadzil A. Factors Affecting the Quality of Sleep in Children. *Children (Basel)*. 2021;**8**(2). [PubMed ID: 33572155]. [PubMed Central ID: PMC7915148]. https://doi.org/10.3390/children8020122.
23. Wahl S, Engelhardt M, Schaupp P, Lappe C, Ivanov IV. The inner clock-Blue light sets the human rhythm. *J Biophotonics*. 2019;**12**(12). e201900102. [PubMed ID: 31433569]. [PubMed Central ID: PMC7065627]. https://doi.org/10.1002/jbio.201900102.
24. Lee SI, Matsumori K, Nishimura K, Nishimura Y, Ikeda Y, Eto T, et al. Melatonin suppression and sleepiness in children exposed to blue-enriched white LED lighting at night. *Physiol Rep*. 2018;**6**(24). e13942. [PubMed ID: 30556352]. [PubMed Central ID: PMC6295443]. https://doi.org/10.14814/phy2.13942.
25. Abidin FA, Yudiana W, Fadilah SH. Parenting Style and Emotional Well-Being Among Adolescents: The Role of Basic Psychological Needs Satisfaction and Frustration. *Front Psychol*. 2022;**13**:901646. [PubMed ID: 35783695]. [PubMed Central ID: PMC9242003]. https://doi.org/10.3389/fpsyg.2022.901646.

26. Hosokawa R, Katsura T. A longitudinal study of socioeconomic status, family processes, and child adjustment from preschool until early elementary school: the role of social competence. *Child Adolesc Psychiatry Ment Health*. 2017;**11**:62. [PubMed ID: 29270216]. [PubMed Central ID: PMC5738164]. https://doi.org/10.1186/s13034-017-0206-z.

27. Cooper K, Stewart K. Does household income affect children's outcomes? A systematic review of the evidence. *Child Indicators Research*. 2021;**14**(3):981-1005. https://doi.org/10.1007/s12187-020-09782-0.

28. Anusha Y, Hegde AM. Correlation of nutritional status to sleep problems in school going children: A preliminary study. *Indian J Sleep Med*. 2018;**13**(1):1-4. https://doi.org/10.5005/jp-journals-10069-0015.

29. Gombert M, Martin-Carbonell V, Pin-Arboledas G, Carrasco-Luna J, Carrasco-García Á, Codoñer-Franch P. Melatonin Levels in Children with Obesity Are Associated with Metabolic Risk and Inflammatory Parameters. *Nutrients*. 2021;**13**(10). [PubMed ID: 34684629]. [PubMed Central ID: PMC8541212]. https://doi.org/10.3390/nu13103629.