



Assessment of Sleep Patterns and Their Correlation with Height in Children Aged 8–11 Years: Insights from the Sleep Disturbance Scale for Children (SDSC)

Ahmad Mahfur¹, Laksmitha Saktiono Safitri², Hawin Nurdiana³,
Annisa Nurul Arofah⁴

¹Rumah Sakit Umum Daerah Jombang, Jl. KH. Wahid Hasyim No.52, Kepanjen,
Kec. Jombang, Kabupaten Jombang, Jawa Timur 61416

^{2,3,4}Universitas Muhammadiyah Malang, Jl. Bendungan Sutami No.188,
Sumbersari, Kec. Lowokwaru, Kota Malang, Jawa Timur 65145

Corresponding Author : Ahmad Mahfur

Email : ahmadmahfur@umm.ac.id

Receive : May 21th2024. Revised : July 4th2024. Published: July 12th2024

DOI: <https://doi.org/10.22219/sm.Vol20.SMUMM1.38539>

ABSTRACT

Sleep plays a crucial role in human growth, particularly during slow-wave sleep when the growth hormone functions optimally. Sleep disturbances are prevalent in 20–30% of children. Over the past century, there has been a notable decline in children's sleep duration, with the most significant reductions observed in school-aged children. This study investigates the relationship between sleep patterns and the height of boys aged 8–11 years at Muhammadiyah 4 Elementary School in Malang. A cross-sectional design was employed, involving 98 boys who met the inclusion criteria. Data on height and weight were collected from school records, while sleep pattern information was obtained through parent-completed questionnaires. Statistical analysis was conducted using Fisher's exact test with a significance level of $p \leq 0.05$. The results revealed no significant association between sleep patterns and children's height ($p = 0.649$). Most participants were 8 years old, with poor sleep patterns observed. However, based on maternal and paternal height, the majority were categorized as having an appropriate height. This study concludes that there is no significant relationship between sleep patterns and the height of boys aged 8–11 years at Muhammadiyah 4 Elementary School in Malang.

Keywords: Sleep patterns, Child growth, Height development, Sleep duration

Copyright © 2024, Ahmad Mahfur et al.
This is an open-access article under the CC-BY-SA license.

INTRODUCTION

Sleep has the meaning of a life phenomenon that takes place in a circadian cycle that affects the endocrine cycle and behavior patterns directly or indirectly (Jacobus, 2016). Sleep patterns are models, shapes, or patterns of sleep in a relatively sedentary period and include sleep and wake-up schedules, sleep rhythms, sleep frequencies in a day, maintaining sleep conditions, and sleep satisfaction (Suwarna, 2016). Short sleep duration is associated with a variety of negative effects on

physical, social, emotional, and cognitive outcomes, including poor concentration (Matricciani et al., 2013, Li et al., 2022; Sigmundová et al., 2023), so sleep is very important for children's health.

Sleep problems in children are one of the problems that parents pay attention to, occurring in about 20-30% of children (Mindell et al., 2015). The study, which included 690,747 children from 20 countries, proved that a child's sleep has decreased per year over the past century, with the greatest rate of change occurring in school-age children (Matricciani et al., 2013). The study, which included 690,747 children from 20 countries, proved that a child's sleep has decreased per year over the past century, with the greatest rate of change occurring in school-age children (Riya, 2019). Low sleep duration is related to short height in children. The Santos & Nunes study (2019) stated that the duration of sleep at night and sleep during the day had a relationship with height growth. This explains the importance of sleep for children and its effect on children's height. In addition, based on research, difficulty initiating or maintaining sleep occurs in about 10%-20% of children aged 8-9 years (Tanjung & Sekartini, 2016).

Sexual hormones also influence changes in a child's height. Boys under 12 years old have not felt any changes in their bodies because sexual dimorphism caused by sexual hormones is very evident in the variables of height, fat thickness, and shoulder width from the age of 12 (Artaria, 2010). Measurement of children's sleep patterns can be done using *the Sleep Disturbance Scale for Children* (SDSC), which is a multidimensional sleep questionnaire (Tharakan & Varadraj, 2019). SDSC can investigate the incidence of sleep disturbances during the previous 6 months (Romeo, et al., 2013).

Muhammadiyah 4 Elementary School (SD) Malang City is one of the elementary schools that implements a *full-day* system and tahajud prayer program with the supervision of each parent. This results in much time spent at school and home studying independently and implementing the Tahajud prayer program, which has the potential to provide a different variety of sleep than other elementary schools. From this explanation, the author wants to analyze the influence of sleep patterns based on SDSC on the height of children aged 8-11 years, which will be carried out at SD Muhammadiyah 4 Malang City.

METHODS

This study included an analytical observational study with a *cross-sectional research design to analyze the influence of sleep patterns on the height of children aged 8-11. An SDSC questionnaire was used to assess sleep patterns.*

RESULTS AND DISCUSSION

Cross-sectional research on 98 children, using a *purposive sampling* technique, at SD Muhammadiyah 4 Malang City from February to March 2020. The data in this study is primary data collected through filling out questionnaires and secondary data obtained from the school. Statistics are used using Fisher's test because it does not qualify for *Chi-Square*.

a. Age Distribution of Respondents

In the results of the analysis that has been explained in the previous chapter, it is stated that the age of the children who participated in this study was 8-11 years old, of which the majority were 8 years old, which was 33.7%. This is related to the nutritional status of children who are included in one of the inclusion criteria in this study; after the calculation of nutritional status, it was found that most of the boys aged 8-11 years at SD Muhammadiyah 4 Malang City who have good nutritional status are children who are 8 years old.

b. Distribution of Sleep Patterns for Children Aged 8-11 Years

In this study, the result of a child experiencing poor sleep patterns was obtained as a result, which was 57.1%. This is in line with a study that included 690,747 children from 20 countries, proving that a child's sleep has been declining per year over the past century, with the highest rate of sleep disorders occurring in school-age children (Matricciani et al., 2013).

Based on the analysis, it was found that most of the children who had poor sleep patterns were 8 years old. Changes in sleep-wake rhythm variations begin to occur at the age of 8-9 years, with abnormal sleep-wake patterns and poor circadian rhythm sleep leading to low sleep quality (Kjeldsen et al., 2013). This is by research conducted by Ophoff et al. (2018), stating that more than 50% of children will experience sleep disorders with a fairly high prevalence of sleep disorders by the age of 8 years. However, most of the respondents in this study are 8-year-old children, so the results show that most variations in good sleep patterns or bad sleep patterns can occur at that age.

It was found that a child with poor sleep patterns experienced sleep-wake transition disorder, which was as much as 30.4%. Sleep-wake transition disorder is part of parasomnia sleep disorder (Shakankiry, 2011). Prevalensi parasomnia dengan gangguan transisi tidur-bangun tertinggi terjadi pada usia 3-13 tahun (Carter, Hathaway, & Lettieri, 2014). The appearance of disorder episodes can occur due to lack of sleep, stress, and environmental disturbances (Montplaisir et al., 2017). In this study, the cause of the sleep-wake transition disorder experienced by the respondents has not been identified. However, the respondents in this study have a school program that is awakened at night for tahajud prayers around 01.00 am until dawn, which has the potential to increase sleep disturbances and needs further research (Delahunt et al., 2022; Li et al., 2022; Martínez-Gómez et al., 2023; Sigmundová et al., 2023).

1. Distribution of Height Distribution

Children aged 8-11 years

Based on the results of the analysis, the child has a height in the appropriate category, which is 94.9% of the respondents in this study. Most of the children who are included in the appropriate height are 8-year-olds, or as much as 36% (Bakour et al., 2020; Deng et al., 2021; Zhang et al., 2021). Based on the research of Mansur et al. (2015), children's height, according to their present, has a significant relationship with the supportive environment, genetics, and sociocultural factors. In addition, the maximum potential of a child's genetic arisan can only be realized if he is cared for in a balanced and correct way, and the child can live healthily, filled with love and care (Barilla Center for Food & Nutrition, 2016). So, the achievement of children's height according to the *mid-parental height target* can be influenced by several factors that support the optimization of children's height growth (LeMay-Russell et al., 2021; Milanović et al., 2021; Parker et al., 2022).

In this study, it was found that most of the respondents who were included in the low-height category were 8-year-old children, namely nine children (3.1%) out of 25 children in this category. Height research conducted by Aterlo et al. (2015) in children aged 10 years explained that a low child height occurs in children with low nutrition, energy intake, and macronutrients (i.e., protein, carbohydrates, and fats) must be adequate so that growth runs optimally (Agustina et al., 2022; Al-Rashed et al., 2021; Kahn et al., 2021; Miller et al., 2021). However, in children with *centile height* in the target, *mid-parental height is not always interpreted as a child experiencing abnormal growth; this must be based on the existence of other accompanying conditions*, so further investigation must be carried out (Garza, 2012).

1. The Effect of Sleep Patterns on the Height of Children Aged 8-11 Years

In this study, there was no significant effect between sleep pattern and height of children aged 8-11 years at SD Muhammadiyah 4 Malang City ($p\text{-value} = 0.649, p > 0.05$). The results in this study are from the study conducted by Gulliford (2011) in the assessment of sleep patterns of children aged 5-11 years over seven days, which showed negative results on the relationship between children's height and total sleep duration. There was no evidence of a relationship between long sleep duration and increased height, which may have occurred due to other unexplained factors (Cartanya-Hueso et al., 2021; Danial et al., 2023; Lin et al., 2021). Meanwhile, a sleep study was conducted on 305 children, with height measurements at 12, 18, and 24 months after birth and then interval measurements until the age of 10 years (Reyna-Vargas et al., 2022; Schultz et al., 2020; Zhao et al., 2022). It was found that a variety of sleep changes every year, but it does not affect the growth of children's height. The sleep assessment in the study was carried out subjectively through information provided to parents, so the honesty of parents in conveying information was greatly influenced (Berry et al., 2021; Magee et al., 2022; Oliveira et al., 2020; Yu et al., 2021). In addition, it is recommended in future studies to re-examine biological factors that can cause bias toward height growth, such as heredity, sex, and nutrition (Jenn et al., 2014).

Another study conducted on children in Iran showed that sleep habits did not affect height. The results of this study are different from those of previous studies; this may be due to the existence of several factors that affect growth in children, especially the large amount of nutrient intake, which plays a role in growth but was not studied in this study (Moradnia et al., 2016). This study found no relationship between sleep patterns

and children's height but that it was influenced by several other factors. Other factors that affect height, such as physical activity and health conditions, were not studied in this study and should be re-evaluated.

CONCLUSION

Based on the findings of this study, it can be concluded that there is no significant relationship between sleep patterns and the height of children aged 8–11 years at SD Muhammadiyah 4 Malang City. The majority of the children in this study were aged 8 years, accounting for 33.7% of the sample. Alarmingly, 57.1% of the children exhibited poor sleep patterns, with 30.4% experiencing sleep-wake transition disorders, indicating a potential area of concern for sleep quality in this age group. Despite these findings, 94.9% of the children's height, assessed based on mid-parental height, fell within the appropriate category, suggesting that other factors might play a more dominant role in influencing growth patterns in this population. These results emphasize the importance of investigating multifactorial determinants of child growth while addressing sleep quality as a significant aspect of overall health and development.

REFERENCES

- Agustina, R., Novelia, S., & Kundaryanti, R. (2022). *The Effect of Baby Massage on The Sleep Duration of Infants Aged 6-12 Months*. nhs-journal.com. <http://nhs-journal.com/index.php/nhs/article/view/147>
- Al-Rashed, F., Sindhu, S., Madhoun, A. Al, & ... (2021). Short sleep duration and its association with obesity and other metabolic risk factors in Kuwaiti urban adults. ... *and Science of Sleep*. <https://doi.org/10.2147/NSS.S311415>
- Bakour, C., Schwartz, S. W., Wang, W., Sappenfield, W. M., & ... (2020). Sleep duration patterns from adolescence to young adulthood and the risk of asthma. *Annals of ...* <https://www.sciencedirect.com/science/article/pii/S104727972030257X>
- Berry, K. M., Berger, A. T., Laska, M. N., Erickson, D. J., Lenk, K. M., & ... (2021). Weekend night vs. school night sleep patterns, weight status, and weight-related behaviors among adolescents. *Sleep Health*. <https://www.sciencedirect.com/science/article/pii/S2352721821001662>
- Cartanyà-Hueso, À., Lidón-Moyano, C., & ... (2021). Association of screen time and sleep duration among Spanish 1-14 years old children. *Paediatric and ...* <https://doi.org/10.1111/ppe.12695>
- Danial, B., Faresjö, T., Fredriksson, M., & ... (2023). Childhood sleep and obesity risk: A prospective cohort study of 10 000 Swedish children. *Pediatric ...* <https://doi.org/10.1111/ijpo.12983>
- Delahunt, A., Conway, M. C., McDonnell, C., & ... (2022). Sleep duration and eating behaviours are associated with body composition in 5-year-old children: findings from the ROLO longitudinal birth cohort study. *British Journal of ...* <https://www.cambridge.org/core/journals/british->

[journal-of-nutrition/article/sleep-duration-and-eating-behaviours-are-associated-with-body-composition-in-5-year-old-children-findings-from-the-rolongitudinal-birth-cohort-study/48312F70614CA3740F41AA68C559AB8E](https://doi.org/10.1016/j.jnpe.2023.100000)

- Deng, X., He, M., He, D., Zhu, Y., Zhang, Z., & Niu, W. (2021). Sleep duration and obesity in children and adolescents: evidence from an updated and dose–response meta-analysis. *Sleep Medicine*. <https://www.sciencedirect.com/science/article/pii/S1389945720305773>
- Kahn, M., Schnabel, O., Gradisar, M., Rozen, G. S., & ... (2021). Sleep, screen time and behaviour problems in preschool children: an actigraphy study. *European Child & ...* <https://doi.org/10.1007/s00787-020-01654-w>
- LeMay-Russell, S., Schvey, N. A., Kelly, N. R., Parker, M. N., & ... (2021). Longitudinal associations between facets of sleep and adiposity in youth. <https://doi.org/10.1002/oby.23281>
- Li, X., Haneuse, S., Rueschman, M., Kaplan, E. R., Yu, X., & ... (2022). Longitudinal association of actigraphy-assessed sleep with physical growth in the first 6 months of life. *Sleep*. <https://academic.oup.com/sleep/article-abstract/45/1/zsab243/6401902>
- Lin, J., Sun, W., Song, Y., Dong, S., Lin, Q., & ... (2021). Cohort profile: the shanghai sleep birth cohort study. *Paediatric and ...* <https://doi.org/10.1111/ppe.12738>
- Magee, L., Goldsmith, L. P., Chaudhry, U. A. R., & ... (2022). Nonpharmacological interventions to lengthen sleep duration in healthy children: a systematic review and meta-analysis. *JAMA* <https://jamanetwork.com/journals/jamapediatrics/article-abstract/2795862>
- Martínez-Gómez, J., Fernández-Alvira, J. M., & ... (2023). Sleep duration and its association with adiposity markers in adolescence: a cross-sectional and longitudinal study. *European Journal of ...* <https://academic.oup.com/eurjpc/article-abstract/30/12/1236/7151260>
- Milanović, S. M., Buoncristiano, M., Križan, H., & ... (2021). Socioeconomic disparities in physical activity, sedentary behavior and sleep patterns among 6-to 9-year-old children from 24 countries in the WHO European region. *Obesity* <https://doi.org/10.1111/obr.13209>
- Miller, M. A., Bates, S., Ji, C., & Cappuccio, F. P. (2021). Systematic review and meta-analyses of the relationship between short sleep and incidence of obesity and effectiveness of sleep interventions on weight gain in *Obesity Reviews*. <https://doi.org/10.1111/obr.13113>
- Oliveira, M. T. de, Lobo, A. S., Kupek, E., Assis, M. A. A. de, & ... (2020). Association between sleep period time and dietary patterns in Brazilian schoolchildren aged 7–13 years. *Sleep Medicine*. <https://www.sciencedirect.com/science/article/pii/S1389945720303178>
- Parker, M. N., LeMay-Russell, S., Schvey, N. A., & ... (2022). Associations of sleep with food cravings and loss-of-control eating in youth: An ecological momentary assessment study. *Pediatric* <https://doi.org/10.1111/ijpo.12851>
- Reyna-Vargas, M. E., Parmar, A., Lefebvre, D. L., & ... (2022). Longitudinal associations between sleep habits, screen time and overweight, obesity in preschool children. ... *and Science of Sleep*. <https://doi.org/10.2147/NSS.S363211>

- Schultz, L. F., Kroll, C., Constantino, B., & ... (2020). Association of maternal depression and anxiety symptoms with sleep duration in children at preschool age. *Maternal and Child ...* <https://doi.org/10.1007/s10995-019-02843-z>
- Sigmundová, D., Dygrýn, J., Vorlíček, M., Banátová, K., & ... (2023). FAMILY Physical Activity, Sedentary behaviour and Sleep (FAMIPASS) study: protocol for a cross-sectional study. *BMJ Open*. <https://bmjopen.bmj.com/content/13/8/e073244.abstract>
- Yu, J., Jin, H., Wen, L., Zhang, W., Saffery, R., & ... (2021). Insufficient sleep during infancy is correlated with excessive weight gain in childhood: a longitudinal twin cohort study. ... *of Clinical Sleep ...* <https://doi.org/10.5664/jcsm.9350>
- Zhang, Z., Adamo, K. B., Ogden, N., Goldfield, G. S., Okely, A. D., & ... (2021). Associations between sleep duration, adiposity indicators, and cognitive development in young children. *Sleep Medicine*. <https://www.sciencedirect.com/science/article/pii/S1389945721002082>
- Zhao, T., Xuan, K., Liu, H., Chen, X., Qu, G., Wu, Y., & ... (2022). Sleep disturbances and correlates among a sample of preschool children in rural China. *Sleep and Biological ...* <https://doi.org/10.1007/s41105-021-00348-3>