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# The Relationship between Sleep Behavior and Obesity in Children Age 3-5 Years Old in Pati Regency

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## ABSTRAK

**Pendahuluan:** Obesitas merupakan kondisi klinis yang diakibatkan adanya penumpukan lipid tubuh yang melebihi normal. Di Indonesia berdasarkan hasil riskesdas tahun 2018 persentase anak yang mengalami obesitas sebesar 8%. Di Kabupaten Pati persentase anak usia 3-5 tahun yang mengalami obesitas sebesar 9,76 %. Obesitas pada anak usia 3-5 tahun memiliki dampak negatif jangka panjang terhadap kesehatan fisik dan mental anak yang dapat mengganggu tumbuh kembang anak. Faktor yang mepengaruhi obesitas anak salah satunya adalah perilaku tidur. Penelitian ini bertujuan untuk mengetahui hubungan antara perilaku tidur dengan obesitas pada anak usia 3-5 tahun di Kabupaten Pati.
**Metode:** Penelitian ini merupakan penelitian observasional analitik dengan pendekatan *cross-sectional*. Subjek dari penelitian ini adalah anak usia 3-5 tahun di wilayah Kabupaten Pati. Pengambilan sampel dilakukan dengan teknik *purposive sampling* yang berjumlah 83 anak. Data primer yang didapat kemudian dianalisis dengan uji *Chi-square*, *Fisher's Exact Test*, dan regresi logistik berganda.
**Hasil:** Hasil uji *Fisher's Exact Test* untuk perilaku tidur didapatkan hasil *p-value* = 0,04 < 0,05. Dari hasil analisis multivariat menggunakan uji regresi logistik berganda, terdapat adanya hubungan yang signifikan antara perilaku tidur (*p-value* = 0,003 < 0,05) dengan obesitas pada anak usia 3-5 tahun di Kabupaten Pati.
**Kesimpulan:** Perilaku tidur memiliki pengaruh yang signifikan terhadap obesitas pada anak usia 3-5 tahun di Kabupaten Pati.

***Kata Kunci: perilaku tidur, gangguan tidur, obesitas anak***

## ABSTRACT

***Background:*** *Obesity is a clinical condition caused by excessive body's lipid accumulation. In Indonesia's basic health research (Riskesdas) in 2018, prevalence of obesity in children reach 8 %. In Pati regency, the prevalenceobesity in children aged 3-5 years old reach 9,76%. Obesity in children aged 3-5 years old has long-term negative effects to children's physical and mental health and can cause defects in children's growth and development. This research is intended to understand correlation between sleeping habit and obesity in children aged three to five years old in Pati regency.*
***Method:*** *this research is an analytic observational research using cross-sectional approach. Subjects of the research are children aged 3-5 years old in Pati regency. Data sampling is done through purposive sampling technique with subjects of 83 children. The data is then analyzed with Chi-square, Fisher's Exact Test, and double logistic regression.*
***Result:*** *The result of Fisher's Exact Test for sleeping habit has p-value = 0,04 < 0,05. From the multivariate analysis using double logistic regression, the result shows significant correlation between sleeping habit (p-value = 0,003 < 0,05) and obesity in children aged 3-5 years old in Pati regency.*
***Conclusion :*** *Sleeping habit has significant correlation with obesity in children aged 3-5 years old in Pati regency.*

***Keywords: sleeping habit, sleeping disorder, obesity in children***

## INTRODUCTION

In 2020, the World Health Organization (WHO) stated that the number of children under 5 years old with obesity had reached more than 38 million. Currently, the incidence of obesity has increased in Asia as well as in Indonesia [1]. In Indonesia, based on data from the Baseline Health Research (Riskesdas) in 2018, the percentage of toddlers with obesity is 8%. This data shows a 3.8% decrease from 11.8% in 2013. In Pati Regency, the percentage of toddlers with obesity is 9.76%. Nonetheless, obesity is a very serious health problem as it becomes a risk factor for the emergence of non-communicable diseases among patients [2].

Obesity is a clinical condition characterized by an accumulation of lipids that surpasses the normal level. It has long-term adverse effects on children's physical and mental health, including developmental disorders in gross and fine motor skills, cognitive function, and psychosocial condition [3]. Childhood obesity is also a precursor to obesity and metabolic syndrome in adulthood [4].

Children aged 3-5 years are entering preschool age, a critical period marked by rapid growth in motor skills, socio-emotional skills, and intellectual abilities. Nutritional issues during this time can lead to growth limitations [5]. According to Guyton and Hall (2016) in their book "Guyton and Hall Textbook of Medical Physiology," the etiology of obesity is very complex. Although genetics play a significant role in energy intake and metabolism, non-genetic factors such as lifestyle and environment also contribute to obesity. One such non-genetic factor is sleep behavior. Sleep is an essential component influencing both mental and physical health. It plays a crucial role in children's growth by regulating the diurnal hormone cycle and maintaining energy homeostasis.

Several studies have reported a significant correlation between poor sleep behavior, characterized by reduced sleep duration, and the incidence of obesity in children. Reduced sleep duration is believed to affect neurohormonal regulation, leading to increased ghrelin and decreased leptin levels, thereby causing energy imbalance and promoting adiposity and obesity in children [6].

Therefore, this study aims to explore the relationship between sleep behavior and the incidence of obesity in children aged 3-5 years in Pati Regency.

## METHODS

### Research Design and Methodology

This study utilized a descriptive analytic design with a cross-sectional approach, aimed at understanding the relationship between sleep behavior and obesity in children aged 3-5 years in Pati Regency. The cross-sectional design allows for the observation and analysis of data at a single point in time, providing a snapshot of the current status of the participants with respect to the study variables.

### Sampling Technique and Study Population

The sampling technique employed in this study was purposive sampling, a non-probability sampling method where participants are selected based on specific characteristics or criteria. The inclusion criteria for this study were children aged 3-5 years currently residing in Pati Regency, whose parents or guardians were willing to consent to their participation in the research. The exclusion criteria included children whose parents or guardians did not complete the questionnaire entirely, thereby providing incomplete data.

The total sample size consisted of 83 children. The study population was drawn from several Integrated Health Centers (Posyandu) across different villages in Pati Regency. Specifically, the participants were selected from Bumimulyo, Raci, and Kedalon villages, which are part of the Batangan Public Health Center (Puskesmas) working area; Tambahmulyo village, which is part of the Jakenan Puskesmas working area; and Srikaton village, which is part of the Jaken Puskesmas working area. This population is considered representative of the larger community of preschool-aged children in Pati Regency.

**Research Instruments and Variables**

To assess children's sleep behavior, the study utilized "A Brief Screening Questionnaire for Infant Sleep Problems," a validated tool designed to identify sleep-related issues in young children. The children's nutritional status was evaluated following the guidelines for Body Mass Index (BMI)-for-Age as defined by the World Health Organization (WHO) in 2005.

The study's dependent variable was obesity in children, which was measured on an ordinal scale and categorized according to the nutritional status assessment results. The independent variable was sleep behavior, determined by the ABISQ questionnaire, and categorized as either "having a sleep behavior disorder" or "not having a sleep behavior disorder" on a nominal scale.

In addition to the primary variables, the study also considered several potential confounding factors, including the mother's occupation and education level. The mother's occupation was classified on a nominal scale as "employed" or "not employed," while her education level was categorized on an ordinal scale into four levels: elementary, secondary, high school, and university/academy. These confounding factors were included in the analysis to control for their potential influence on the relationship between sleep behavior and obesity in children.

**Data Collection and Measurement Tools**

Data on the children's weight were collected using a digital scale, while their height was measured using a microtoise (a stadiometer). The researchers ensured that all measurements were conducted under standardized conditions to maintain accuracy and reliability.

**Data Analysis**

Data analysis involved both univariate and multivariate statistical techniques. Initially, the data were analyzed using the Chi-square test to examine the association between sleep behavior and obesity. However, when the expected cell counts were less than five in 25% of cases, the Fisher’s Exact Test was used as an alternative. To further explore the relationship and adjust for potential confounders, a logistic regression analysis was conducted. This method allowed the researchers to determine the strength and direction of the association between sleep behavior and obesity while accounting for other variables such as maternal occupation and education level.

**Ethical Considerations**

The study was conducted between April and May 2021. All participants’ mothers were fully informed about the study's objectives, procedures, and potential risks before their children’s involvement. They provided informed consent by signing the consent forms. Ethical approval was obtained from the Medical Research Ethics Board of Dr. Moewardi Hospital, Surakarta, with the approval number 403/III/HREC/2021. This ensured that the study adhered to the ethical standards for research involving human subjects, including respect for participant autonomy, confidentiality, and the right to withdraw from the study at any time.

## RESULTS

### Univariate Analysis

Table 1. Distribution of research sample

| Sample Distribution | Frequency | Percentage (%) |
|---|---|---|
| Sex | | |
| Male | 52 | 62,7 |
| Female | 31 | 37,3 |
| Obesity | | |
| Yes | 20 | 24,1 |
| No | 63 | 75,9 |
| Sleep Behavior | | |
| Having sleep behavior disorder | 17 | 20,5 |
| Not having sleep behavior disorder | 66 | 79,5 |
| Mother's Occupation | | |
| Working | 31 | 37,3 |
| Not Working | 52 | 62,7 |
| Mother's Education Level | | |
| Elementary | 7 | 8,4 |
| Secondary | 28 | 33,7 |
| High School | 28 | 33,7 |
| University/Academy | 20 | 24,1 |

Table 1. showed the distribution of the research subjects, it is showed that there are 52 male subjects (62,7%) and 31 female subjects (37,3%). There are 20 obese subjects (24,1%) and 63 non-obese subjects (75,9%). The sleeping behavior is categorized into having sleep behavior disorder that has 17 subjects (20,5%) and not having sleep behavior that has 66 subjects (79,5%). The number of the research subjects that have a working mother are 31 subjects (37,3%) and that has non-working mother are 52 subjects (62,7%). And then the subjects that has mother with the latest education in elementary school are 7 subjects (8,4%), in secondary school are 28 subjects (33,7%), in high school are 28 subjects (33,7%), and in university/academy are 20 subjects (24,1%).

### Bivariate Analysis

Table 2. Bivariate Analysis results on the relationship between sleep behavior and obesity in children age 3-5 years old

| | | Obesity | | Total | *p* |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Sleep Behaviour | Having Disorder | 9 | 8 | 17 | 0,004 |
| | Not Having Disorder | 11 | 55 | 66 | |
| Total | | 20 | 63 | 83 | |

According to the results of the Chi-square test, it was found that the expected score <5 is 25% from the total of the cell. Therefore, the requirement for Chi-square test is not fulfilled, thus Fisher's Exact Test can be used as an alternative test.

Table 2. showed the significance test using Fisher's Exact Test with p-value = 0,04, therefore it can be concluded that there is a relationship between sleep behavior and obesity in children age 3-5 years old.

Table 3. Bivariate Analysis results on the relationship between mother's occupation and obesity in children age 3-5 years old

| | | Obesity | | Total | *p* |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Mother's Occupation | Working | 8 | 23 | 31 | 0,779 |
| | Not Working | 12 | 40 | 52 | |
| Total | | 20 | 63 | 83 | |

Table 3. showed that the result of the Chi-square test is p-value = 0,779 (p > 0,05), therefore it can be concluded that there isn't any relationship between mother's occupation and obesity in children age 3-5 years old in Pati Regency.

Table 4. Bivariate analysis results on the relationship between mother's education level and obesity in children age 3-5 years old

| | | Obesity | | Total | *p* |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Mother's Education Level | Elementary | 3 | 4 | 7 | 0,204 |
| | Secondary | 6 | 22 | 28 | |
| | High School | 7 | 21 | 28 | |
| | University | 4 | 16 | 20 | |
| Total | | 20 | 63 | 83 | |

Table 4. showed that the result of Chi-square test is p-value = 0,204 (p > 0,05). Therefore it can be concluded that there isn't any relationship between mother's last education level with obesity in children age 3-5 years old in Pati Regency.

**Multivariate Analysis**

Table 5. Variables that have relationship with obesity in children age 3-5 years old

| No | Variable | Exp (B) | 95% CI | | *p* |
|---|---|---|---|---|---|
| | | | Upper | Lower | |
| 1 | Sleep Behavior | 5,649 | 18,050 | 1,768 | 0,003 |
| 2 | Mother's Education Level | 0,985 | 1,699 | 0,571 | 0,957 |

Table 5. showed that the result of the multivariate logistic regression analysis is the independent variable has the most influence with obesity in children age 3-5 years old in Pati Regency, the result of the logistic regression test for the sleep behavior variable showed a p-value of 0,003 < 0,05, it means that there is a significant relationship between sleep behavior and obesity in children age 3-5 years old in Pati Regency (95% CI = 1,768 – 18,050). Meanwhile on the mother's education level, the logistic regression test for the variable showed a p-value of 0,957 > 0,05, which means there isn't any significance meaning between the mother's education level and obesity in children age 3-5 years old in Pati Regency (95% CI = 0,571 – 1,699).

## DISCUSSION

### Correlation Between Sleeping Habits and Obesity in Children Aged Three to Five Years Old in Pati Regency

The study found that out of 83 children aged 3-5 years, 20 (24.1%) were classified as obese, and 9 of these (52.9%) experienced sleep disorders. The results from Fisher's Exact Test (p-value = 0.04) and logistic regression (p-value = 0.003, 95% CI = 1.768 – 18.050) indicate a significant correlation between sleep habits and obesity in children in this age group in Pati Regency.

These findings align with the research conducted by Ingram et al. (2019), which also found a significant correlation between sleep habits and obesity in children, with a p-value from multivariate linear regression analysis of 0.006 [7]. Similarly, a meta-analysis by Firouzi et al. (2014) reported that the score for sleep disorders was significantly higher in children with obesity compared to those with normal nutritional status (54.9 ± 13.3 versus 49.3 ± 7.5; $p < 0.01$). This relationship was further supported by a non-parametric test with a p-value of 0.001, indicating a significant correlation between poor sleep habits and obesity in children [8].

Conversely, a study by Klingenberg et al. (2013) presented different results, showing no correlation between sleep habits and increased BMI or the incidence of obesity in children, with a parametric test p-value of 0.70 [9].

Sleep plays a critical role in maintaining physiological processes that optimize immunity, metabolism, hormone stability, emotional and mental health, cognitive function, and memory processes. Poor sleep habits, such as sleeping for less than ten hours per night, have been associated with a 1.5- to 2-fold increased risk of obesity compared to children with healthy sleep habits [10]. Poor sleep disrupts neurohormonal balance, increasing the incidence of obesity through changes in hormones like ghrelin and leptin, which regulate hunger and appetite. A study by Spiegel et al. (2004) found that shorter sleep durations increased leptin levels by 18% and ghrelin levels, leading to a preference for high-carbohydrate and high-calorie foods compared to a control group [11].

### Analysis of Confounding Factors: Mother's Occupation and Education Level

This study also explored potential confounding factors such as the mother's occupation and education level. The results indicated no significant correlation between a mother's occupation and childhood obesity in this population (p-value = 0.833), consistent with findings from Kurniasari and Nurhayati (2017) in Surabaya [12]. However, Lee and Kim (2013) reported different results, suggesting that the children of working mothers had a higher risk of obesity, with 17 children (20.4%) in their sample classified as obese. The study concluded that the longer a mother worked, the higher the risk of obesity in her children, potentially due to less control over dietary intake and reduced physical activity among the children [13].

Similarly, no significant correlation was found between the mother's education level and obesity in children in this study (Chi-square test p-value = 0.204; logistic regression p-value = 0.395). These findings are consistent with research by Suriani and Sari (2019) in Cirebon, which also found no significant correlation between maternal education level and childhood obesity (p-value = 0.225) [14]. The study by Humairoh (2021) in Samarinda further supports this conclusion, with a p-value of 0.912, indicating no significant relationship [15].

However, some studies have suggested a link between maternal education and child obesity. For example, Broccoli et al. (2020) found that higher maternal education levels were associated with reduced screen time and healthier diets in children, which could lower the risk of obesity [16]. Charter et al. (2011) also identified parental education as an environmental factor significantly correlated with child obesity (p-value = 0.03) [17]. Mothers with higher education levels are generally more likely to implement healthy eating habits and lifestyles in their children, while those with lower education levels may be less able to monitor diet and screen time effectively [18, 19].

This study also found that some children with normal BMI still experienced sleep disorders. This may be attributed to a lack of parental awareness regarding healthy sleep habits for young children. Additionally, not all children with low maternal education levels were obese, likely due to effective health promotion efforts by local healthcare professionals and social workers in the Batangan, Jakenan, and Jaken primary healthcare centers. These professionals continuously encourage mothers to monitor and evaluate their children's nutritional status and engage in preventive actions against childhood obesity.

This study has several methodological limitations: The cross-sectional design only provides a snapshot of the data at one point in time and cannot establish causality between variables. The data collection period was relatively short due to restrictions related to the COVID-19 pandemic, limiting the ability to gather comprehensive information. The study did not explore other potential underlying factors of obesity, such as genetic predispositions, endocrine disorders, physical activity levels, and dietary intake, which could act as confounding variables.

## CONCLUSION

This study demonstrates a significant correlation between sleep habits and obesity in children aged 3-5 years in Pati Regency. Children with poor sleep habits were found to be at a higher risk of obesity, as indicated by the significant p-values obtained from both Fisher’s Exact Test (p = 0.04) and logistic regression analysis (p = 0.003, 95% CI = 1.768 – 18.050). The findings align with previous studies suggesting that inadequate sleep duration or poor sleep quality contributes to obesity by disrupting neurohormonal regulation and promoting an imbalance in energy homeostasis.

Moreover, this study also examined the influence of confounding factors such as maternal occupation and education level on childhood obesity. The results indicated no significant correlation between these factors and obesity in children aged 3-5 years in Pati Regency. However, this does not rule out their potential impact, as other studies have suggested varying outcomes. These findings underscore the complexity of childhood obesity and the need for a multifaceted approach to its prevention and management.

To effectively address childhood obesity, it is essential to educate parents, particularly mothers, about the importance of healthy sleep habits and balanced nutrition for young children.

Further research is recommended to explore additional factors influencing childhood obesity, including genetic predispositions, physical activity, and diet.

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