



# Sleep and Playing Gadgets Duration as Obesity Risk Factors in Children

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**Abstract.** The prevalence of obesity in children aged 5 - 12 years in Indonesia is still high at around 9,2%, while in Central Java it is around 9,1%. Pati is one of the districts in Central Java with a prevalence of obesity above Central Java. In Pati, the incidence of obesity is 13,4% for elementary school children. Some of the factors that cause obesity include excessive consumption of instant food, short sleep duration, and lack of physical activity. This research aims to determine sleep and playing gadgets duration as risk factors for obesity. Observational research with a case-control study design is the type of research used. The total sample was 22 students (11 cases and 11 controls) aged 7-12 years, who met the inclusion criteria using the matching method based on gender and age. Statistical tests use the Chi-square test with a confidence level of 95%. The results of the analysis showed sleep duration as a risk factor for obesity ( $p = 0,03$ ;  $OR=7,11$ ; 95%  $CI: 1,09 - 46,44$ ). Children with short sleep duration ( $<10$  hours) have a 7.11 times risk of obesity compared to respondents who have long sleep duration ( $\geq 10$  hours). The duration of playing with gadgets is a risk factor for obesity ( $p = 0,01$ ;  $OR=12,0$ ; 95%  $CI=1,58 - 91,08$ ). Children with a high duration of playing gadgets ( $>2$  hours/day) have a 12,00 times risk of obesity compared to children with a duration of playing gadgets  $\leq 2$  hours/day. This research concludes that short sleep duration and high duration of playing with gadgets are risk factors for obesity in children at SD Negeri Tanjungsari.

**Keywords:** Children, Obesity, Playing Gadgets Duration, Sleep Duration.

## 1. Introduction

The prevalence of overweight and obesity in children aged 5 - 12 years according to BMI/U is 10,8% obese (overweight) and obesity is 9,2%. In general, the problem of overweight children aged 5 - 12 years in Central Java is still high, namely 11.1% are obese and 9.1% are obese. Pati is one of the districts in Central Java with a prevalence of obesity above the Central Java figure, namely 13,4% in children aged 5 - 12 years or school-age children [1].

An excessive increase in body fat is associated with obesity. Obesity is caused by the energy intake consumed being greater than the energy expended. Obesity has become a global

epidemic that must be addressed immediately. The prevalence of obesity in children continues to increase from year to year. Obesity can cause the risk of various diseases such as coronary heart disease, cerebrovascular disease, colorectal cancer, hypertension, and type II DM [2].

Several factors causing obesity in school-aged children include excessive food intake from various instant foods, lack of physical activity, and sleep duration. Less physical activity can be triggered due to frequent playing with gadgets. Playing with gadgets is one of the causes of obesity in children. Children who play gadgets for 1-3 hours a day tend to have an increased risk of obesity of up to 30%. This can result in children tending to be passive, lazy to move, lazy to play, and lazy to exercise. This kind of behavior is a factor in obesity in children [3].

Short sleep duration can also be a contributing factor to obesity. Children with a sleep duration of less than 10 hours are at risk of obesity 2,61 times greater than children with a sleep duration of  $\geq 10$  hours each day [4]. Based on data from the National Sleep Foundation (NSF), insufficient sleep duration will result in less physical activity which will result in increased calorie intake. Increasing calorie intake can enhance the risk of developing obesity. In previous research, it was concluded that children who were obese had shorter sleep duration [5]. The shorter the duration of a child's sleep, the higher the risk of obesity.

## **2. Methodology**

This research is an observational study using a case-control study design. The case-control approach is carried out by identifying case groups and control groups which are then studied retrospectively. The population in this study were all SD Negeri Tanjung Sari students aged 7 – 12 years. The sample was taken as many as 22 students, which was a case sample of 11 students and a control sample of 11 students who had been matched based on gender and age. Data collection methods use primary and secondary data. Primary data was obtained by interview using a questionnaire, sleep duration data using a sleep duration questionnaire, gadget playing duration data using a gadget usage duration questionnaire, and anthropometric data on body weight and height. Secondary data is in the form of a general description of the school profile of SD Negeri Tangjungsari, Jakenan District. Univariate analysis is used to describe the frequency of each variable. Bivariate analysis uses the Chi-square test to determine the p-value and OR of each variable.

### 3. Result and Discussion

**Table 1.** Characteristics of Respondents

Characteristics	Frequency	Percentage (%)
Age (years)		
7 – 9	12	54,5
10 – 12	10	45,5
Gender		
Man	16	72,7
Woman	6	27,3
Sleep Duration		
Short (< 10 hours/day)	11	50
Long ( $\geq$ 10 hours/day)	11	50
Gadget Playing Duration		
Normal ( $\leq$ 2 hours/day)	10	45,5
High (> 2 hours/day)	12	54,5

Based on Table 1, it shows that the majority of the respondents, 54,5%, were aged in the range of 7 – 9 years. The smallest respondent's age was 7 years and the largest respondent's age was 12 years. Elementary school-age children (children aged 6 to 12 years) are still growing so their nutritional needs are also increasing. The lowest body weight of respondents was 18,3 kg, while the highest was 54,2 kg, and the average body weight of respondents was 37,0 kg. The lowest height of the respondents was 110 cm, while the highest height was 146 cm, the average height of the respondents was 133,1 cm.

The distribution of respondents based on gender revealed that there were more male respondents than females, namely 16 children (72,7%). The national prevalence of obesity in 2018 according to gender characteristics was found to be 10,7% in boys and 7,7% in girls aged 5 - 12 years.<sup>1</sup> Previous research concluded that there was a relationship between gender and the incidence of obesity. The possibility of obesity in boys who are at risk of being overweight at the age of 8 - 12 years is caused by a rapid increase in pre-pubertal fat and will continue until adolescence [6].

The sleep duration of respondents in the short category was 11 children (50%) and in the long category was 11 children (50%). Respondents' short sleep duration was mostly due to being too busy watching television and playing with gadgets. There is no difference between respondents' sleep time on holidays and normal days because learning is done online. Sleep is an absolute basic need that must be fulfilled for everyone. The benefits of getting enough sleep will allow the body to function optimally. Each age's sleep needs are different. As you get older, sleep duration will decrease. This is because each individual is busy going to school or working during the day. Childhood is a time characterized by rapid

physiological and neurocognitive growth where every description of sleep patterns must be included [7]. Sleep duration plays a role in regulating the metabolism of the hormones leptin and ghrelin.

If the duration of sleep is less than required, it will result in a decrease in the hormone leptin, which can even result in a person being resistant to leptin and increasing the hormone ghrelin which can trigger excessive appetite. Respondents in this study with the habit of playing gadgets for a higher duration were 12 children (54,5%). The research results showed that all respondents used gadgets. The use of gadgets is not only used for learning activities but also to fill free time, looking for entertainment such as playing games and watching YouTube. Gadgets are communication tools with a wide range of functions and features. Gadgets are more practical to use than electronic devices, so they're easier to use. The American Academy of Pediatrics (AAP) recommends that children use gadgets or screen-based media for no more than 1 to 2 hours per day.

**Table 2.** Analysis of the Relationship between Sleep Duration and Gadget Playing Duration with Respondents' Obesity Incident.

Variable	Obesity Status				P value	OR	95% CI	
	Obesity		Not Obesity				Lower	Upper
	n	%	n	%				
<b>Sleep Duration</b>								
Short (< 10 hours/day)	8	72,7	3	27,3	0,03	7,11	1,09	46,44
Long (≥ 10 hours/day)	3	27,3	8	72,7				
<b>Gadget Playing Duration</b>								
High (> 2 hours/day)	9	81,8	3	27,3	0,01	12,00	1,58	91,08
Normal (≤ 2 hours/day)	2	18,2	8	72,7				

The number of respondents who have been overweight is found in Table 2. There were 8 children (72,7%) who had short sleep duration, while among respondents who were not obese, there were 8 children (72,7%) who had long sleep duration. 81,8% of respondents who were obese had a high duration of playing gadgets, while 72,7% of respondents who were not obese had a normal duration of playing gadgets. The results of statistical tests on sleep duration with obesity using chi-square showed that sleep duration was a risk factor for obesity ( $p < 0,05$ ) (OR=7,11; 95% CI: 1,09 – 46,44). This means that respondents with short sleep duration (<10 hours) have a 7,11 times risk of obesity compared to respondents who have long sleep duration (≥10 hours).

The results of this study are consistent with earlier research which indicated that there was a significant correlation between children's sleep duration and obesity. Children who sleep <10 hours/day are 1,7 times more likely to be obese (OR = 1,74; 95% CI: 1,06 – 2,84) compared to children who sleep > 10 hours/day. This is further strengthened by the results of research which states that there is a relationship between sleep duration and the incidence of obesity. Insufficient duration of sleep duration increases the occurrence of obesity in

children aged 3 – 8 years in South Rengasdengklok Village, Rengasdengklok District, Indonesia [8]. A short sleep pattern greatly influences eating patterns because it increases ghrelin and reduces leptin resistance.

Insufficient sleep duration might lead to positive energy balance, for example when the amount of energy that enters the body is higher compared to the energy expenditure because the child prefers to consume snacks with high energy and high fat, accompanied by the habit of today's children who prefer playing games online at home rather than doing physical activity outside the home. In addition, short sleep duration can cause fatigue during the day, thereby reducing physical activity. This situation can cause obesity [6].

Decreased sleep duration may increase hunger and change in thermoregulation. Increased hunger will cause an increase in the desire to eat thereby increasing energy intake. However, changes in thermoregulation and increased fatigue can reduce energy expenditure. The risk of obesity can be increased in both cases [9].

An increase in energy intake without being balanced with energy expenditure can cause obesity. Short sleep duration can result in a loss of 18% of the leptin hormone and an increase in the ghrelin hormone by 28% which can cause appetite to increase by 23 – 24%. Leptin may be a protein hormone created in fat tissue that capacities to control fat reserves and impact craving, whereas ghrelin could be a hormone that can impact sentiments of starvation and totality. If the hormone leptin diminishes and ghrelin increments, it can increment sentiments of hunger and can cause the digestion system to diminish and decrease the capacity to burn fat within the body [10].

The risk of obesity in children can be doubled by short sleep duration. The endocrine and molecular mechanisms that occur in children with short sleep duration are through sympathetic activation, increased catecholamines, and increased cortisol through activation of the hypothalamic -pituitary-adrenal axis, increased interleukins, and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) [11].

Short sleep duration will cause an increase in endocannabinoids. The endocannabinoid system (eCB) regulates food intake and hedonic hunger, which causes excessive food consumption, triggering a positive energy balance, and thereby causing weight gain. Short sleep duration is also related to a decrease in glucagon-like peptide-1 (GLP-1). These changes that occur in ghrelin, leptin, and GLP-1 can cause increased appetite and increased hunger in children who have a habit of short sleep duration [12].

The results of the chi-square statistical tests in this study show that the duration of playing with gadgets is a risk factor for obesity ( $p < 0,05$ ) (OR = 12,00; 95% CI: 1,58 – 91,08). This means that respondents with a high duration of playing gadgets ( $> 2$  hours/day) have a 12,00 times risk of obesity compared to respondents who have a normal duration of playing gadgets ( $\leq 2$  hours/day). The results of this study are the same as previous research which concluded that there was a relationship between the duration of gadget use and obesity with a p-value of 0.00 and stated that fast food consumption habits, long duration of gadget use, and family history of obesity were factors causing obesity in school children [13]. If the use

of gadgets for a long duration is not immediately addressed, it will harm children because it can increase the risk of children experiencing obesity, sleep disorders, and even mental illness [14].

The relationship between playing with gadgets and obesity is related to two factors, namely low physical activity and higher consumption of energy-dense food while playing with gadgets [15]. Advances in gadget technology such as televisions, computers, and cell phones can result in children being lazy about moving because they prefer to spend most of their time doing passive activities including video games, online games, the internet, and watching television for up to 2 hours or more a day which can put children at risk obesity. 16 Lack of physical activity will result in a reduction in muscle mass and enlarged fat mass in the body [17]. Some of the energy in the body should be used for physical activity. If physical activity is very low there will be a positive energy balance. Excess energy that comes in from the food consumed is stored in the form of fat reserves in the body [18][19]. On average, children at SD Negeri Tanjungsari use gadgets for more than 2 hours a day with activities using gadgets in the form of playing games, watching YouTube, social media, and online school.

#### **4. Conclusion**

Based on research results, it is known that short sleep duration and high duration of playing with gadgets are risk factors for obesity in school children at SD Negeri Tanjungsari, Jakenan Pati District, Indonesia.

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