

# THE RELATIONSHIP OF DIETARY PATTERNS, PHYSICAL ACTIVITY, AND SCREEN TIME WITH THE INCIDENCE OF OVERWEIGHT AMONG TODDLER AGED 24–59 MONTHS IN SUDIMARA PINANG HEALTH CENTER AREA, TANGERANG CITY

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## Abstract

**Background:** Overweight in toddlers may further develop into obesity. The Sudimara Pinang Community Health Center area has the highest number of overweight toddlers in Tangerang City. This study aims to examine the relationship between dietary patterns, physical activity, screen time, and the incidence of overweight among toddlers aged 24-59 months in Sudimara Pinang area. **Method :** This study employed a quantitative approach with a cross-sectional study design. A total of 93 toddlers were purposively selected from the five integrated health posts with the highest number of overweight toddlers. Nutritional status was assessed using anthropometric measurements. Dietary patterns were measured with a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), Physical activity with the Early Year Physical Activity Questionnaire (EY-PAQ), and screen time with the Seven in Seven Screen Exposure Questionnaire. **Result:** The findings revealed a significant association between dietary pattern (p-value = 0.016), and between physical activity and overweight incidence (p-value = 0.000). However, no significant relationship was found between screen time and overweight (p-value = 0.523). **Conclusion:** Dietary patterns and physical activity were significantly associated with overweight among toddlers, whereas screen time showed no significant relationship. These findings highlight the need for comprehensive intervention programs in the area, focusing on promoting healthy eating and physical activity.

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**Keywords :** Toddlers, Overweight, Dietary Pattern, Physical Activity, Screen Time.

## Introduction

Overweight in toddlers is defined as a weight-for-height value greater than +2 SD on the WHO Growth Chart. If not properly managed, this condition can progress to obesity, defined as greater than +3. Global data in 2022 reported that 35 million children under five years old were overweight, nearly half living in Asia.<sup>1</sup> According to NHANES 2017–2018 data, among children aged 2-19 years, 16.1% were overweight, 19.3% were obese, and 6.1% were severely obese. Specifically, among children aged 2–5 years, 13.4% were obese.<sup>2</sup> In Indonesia, the 2023 Health Survey reported that the prevalence of overweight toddlers increased from 3,5% in 2022 to 4,2% in 2023. Riskesdas data also indicated that the prevalence of overweight or obese toddlers was 13.6% based on weight-for-height. Regional variations are considerable, such as in 2022, Banten Province ranked among the top 10 provinces with the highest prevalence 3.9%, with Tangerang City showing highest proportion (6.1%). In 2023, the prevalence further increased to 4.9% in Banten Province and 6.9% in Tangerang City.<sup>3</sup> These numbers remain above the target set in the 2024 Maternal and Child Nutrition and Health Program Indicators (2.5%). Part of Indonesian population still believes that overweight toddlers are healthy and that this is not a problem requiring intervention. However, obesity in early childhood is a strong predictor of obesity in adulthood. This condition is concerning, as obesity contributes to various health problems, including metabolic disorders, hypertension, musculoskeletal and orthopedic issues, sleep apnea, and even increased risk of infectious diseases and mortality.<sup>4,5</sup> Obesity also affects psychosocial and developmental aspects, such as bullying, low self-esteem, and reduced academic achievement.<sup>6</sup> Toddlers with obesity are reported to have a 12-fold higher risk of delayed gross motor development

compared to those without obesity.<sup>7</sup> Obesity is influenced by multiple factors with dietary patterns being one of the most important. Several studies show that Indonesian children, adolescents, and adults have poor dietary pattern, characterized by excessive consumption of foods and beverages high in sugar, salt, and fat (SSF) with insufficient fruit and vegetable intake.<sup>8</sup> Toddlers consumed unhealthy food > 32 times/week tended to be obese 4.26 times higher than those who did not.<sup>9</sup> Childhood intake of sugar-sweetened beverages and unhealthy foods may raise the risk of overweight/obesity, while artificially sweetened drinks and 100% fruit juice show little to no effect (low-certainty evidence). Types of unhealthy foods is referring to foods high in added sugars, free sugars, artificial sweeteners, fats, ultra-processed foods and fast food.<sup>10</sup>

Diet plays a crucial role in children's growth and development, including brain cell development. Toddlers' diets should contain balanced macronutrients and micronutrients in appropriate portions to minimize both undernutrition and overnutrition.<sup>11</sup> A healthy diet should include energy sources, regulatory nutrients, and building nutrients, which are essential for growth, health maintenance, and brain development and productivity, to meet children's daily needs.<sup>5</sup> Recent expert opinions argue that plant-based diets supplemented with dietary fiber can play a meaningful role in supporting children's growth and development, by ensuring not only energy sufficiency but also optimal nutrient balance.<sup>12</sup> This suggests that dietary patterns in toddlers should not be judged solely on caloric intake, but also on the nutritional composition, especially the inclusion of fiber and appropriate macronutrient balance, to promote healthy growth trajectories and minimize the risk of overweight. Feeding pattern are significantly associated with the risk of obesity in children aged 2–5 years ( $p <$

0.05). The larger the portion size, frequency, and variety of food given to toddlers, the higher the risk obesity by 1.04 times.<sup>11</sup> In other studies parents feed toddlers three times a day with a simple and appropriate daily menu, consider still not meet optimal intake.<sup>13</sup>

In addition to diet, physical activity is another key determinant of obesity. Energy intake must be balanced with energy expenditure through regular physical activity. Physical activity helps increase energy expenditure, optimize metabolic rate and promotes fat burning.<sup>14</sup> Research shows that toddlers with very low physical activity levels have a 6.15 times greater risk of obesity compared to those with light to moderate physical activity.<sup>15</sup> Children engaging in less than one hour of moderate to vigorous physical activity per day are five times more likely to become obese compared to those engaging in at least one hour.<sup>16</sup>

Meanwhile, advances in technology have reduced children's physical activity levels, as screen time often replaces active play. Children frequently use gadgets for both educational and entertainment purposes. Children who spend more time on physical activity compare to children who spend screen time could achieve better physical and mental health.<sup>17</sup> Excessive screen time is associated with poor eating behavior and unhealthy dietary in toddlers aged three to five years.<sup>18</sup> WHO recommends no screen time for children under one year of age, while children aged 2–4 years should be limited to one hour per day, with less being better.<sup>17</sup> However, many children exceed these limits, placing them at risk of negative health outcomes.<sup>19</sup>

Dietary patterns, physical activity, and screen time are interrelated factors influencing overweight in toddlers. Understanding their relationship is important to develop effective preventive interventions.

## Method

This quantitative study employed a cross-sectional design to examine the relationship between toddlers' dietary patterns, physical activity, and screen time with overweight status among children aged 24–59 months in the Sudimara Pinang area. The inclusion criteria were mothers of toddlers aged 24–59 months who actively attended integrated health posts (Posyandu) and consented to participate, while the exclusion criteria were mothers of toddlers with visual impairments.

A total of 93 toddlers were selected using a purposive sampling technique from five Posyandu with the highest prevalence of overweight cases, namely Lili, Kenanga, Anyelir 2, Wijaya Kusuma 1, and Teratai. Data were collected through two main methods: anthropometric measurements to determine toddlers' body mass index (BMI) and questionnaires assessing dietary patterns, physical activity, and screen time.

Nutritional status was determined based on BMI/age, calculated as weight (kg) divided by height squared ( $m^2$ ). The BMI-for-age z score was then derived to evaluate each child's nutritional status relative to the WHO Child Growth Standards. Dietary patterns were assessed using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), which records the frequency of food consumption categorized by sugar, salt, and fat content over the previous month. Dietary patterns were classified as “poor” when average daily nutrient intake exceeded the sample mean and “good” when it was below the mean.

Physical activity data were obtained using the Early Years Physical Activity Questionnaire (EY-PAQ), which measures moderate-to-vigorous physical activity (MVPA) and sedentary time (ST) over the past month. Activity scores below 180 minutes were categorized as insufficient

physical activity, whereas scores above 180 minutes indicated sufficient activity. The reliability of the EY-PAQ, assessed using Cronbach's alpha, was 0.623, indicating acceptable reliability.<sup>20</sup>

Screen time data were collected using the Seven-in-Seven Screen Exposure Questionnaire, consisting of seven items regarding toddlers' screen exposure during the past month. A total score <7 indicated low screen time, while a score  $\geq 7$  indicated high screen time. The reliability coefficient (Cronbach's alpha) of this instrument was 0.49.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software. The Chi-Square test was used to examine the relationship between independent and dependent variables. A p-value less than 0.05 was considered statistically significant. This study received research approval from the relevant authorities and ethical clearance from the Ethics Committee of the Faculty of Dentistry, Airlangga University (No. 0021/HRECC.FODM/1/2025).

## **Results and Discussion**

### **Respondent Characteristic**

The characteristic data in this study include variables such as toddler gender, nutritional status, dietary pattern, physical activity, and screen time. These respondent characteristics serve as a crucial foundation for further analysis to identify factors associated with overweight in toddlers. Additional information regarding respondent characteristics is presented in Table 1.

From the table, the majority of respondents were female (54 children; 58.1%), while males accounted for 39 children (41.9%). In terms of nutritional status, most toddlers were classified as not overweight (81 children; 87.1%), with only 12 (12.9%) categorized as overweight. This imbalance may reflect the purposive sampling technique, which did not

target specific characteristics, resulting in a smaller proportion of overweight cases. Regarding dietary patterns, 53 respondents (57%) had a good dietary pattern, whereas 40 (43%) had a poor dietary pattern. Physical activity was generally adequate, with 71 children (76.3%) categorized as having sufficient activity and 22 (23.7%) as insufficient. For screen time, 69 children (74.2%) were exposed to high screen time, while 24 (25.8%) had low screen time. Notably, most toddlers exceeded one hour of daily screen exposure, whether through mobile phone use or television viewing.

**Table 1.** Frequency Distribution of Characteristics of Toddlers Aged 24–59 Months

Characteristics	Frequency	Percentage
<b>Gender</b>		
Male	39	41.9
Female	54	58.1
<b>Nutritional Status</b>		
Overweight	12	12.9
Risk of Overweight	7	7
Normal	69	74.2
Wasted	5	5.3
<b>Diet</b>		
Good	53	57
Poor	40	43
<b>Physical Activity</b>		
Sufficient	71	76.3
Insufficient	22	23.7
<b>Screen Time</b>		
High	69	74.2
Low	24	25

The analysis revealed that the majority of respondents were within the normal nutrition status. This finding may be attributed to the use of a non-probability sampling methods which might not have fully represented all population characteristics, thereby resulting in a greater

proportion of non-overweight toddlers being included. This finding suggests that most respondents maintained a normal nutritional status, indicating generally favourable lifestyles behaviour within the community. A balanced diet plays a vital role in supporting optimal physical growth, cognitive development, and both physical and mental activities in children, enabling them to optimize their potential physically, intellectually, and emotionally.<sup>22</sup> Although most children maintained good nutritional status, the occurrence of overweight findings also requires particular attention, as excess body weight in early childhood may contribute to multiple health, psychological, and social issues that consequently affect their development into healthy and productive individuals.<sup>23</sup>

The predominance of children with good nutritional status may also reflect generally favorable factors, including dietary pattern, physical activity, and screen time. A good dietary pattern, including appropriate food selection and meal frequency, plays an essential role in ensuring adequate nutrition requirements are met. Conversely, excessive nutrient intake and unhealthy food intake may increase the risk of various diseases.<sup>24</sup> Physical activity facilitates the balance between dietary energy intake and energy expenditure, supporting effective body weight management.<sup>25</sup> Physical activity levels are also influenced by screen time, as prolonged screen time may reduce physical activity and affect the balance between energy intake and energy expenditure. This sedentary behaviour contributes to an increased risk of obesity across all age groups, including children.<sup>26</sup> Therefore, these interrelated factors collectively influence children's overall nutritional status.

Table 2 shows that the proportion of overweight children was significantly higher in the poor dietary pattern group compared to those in the good dietary pattern group. The Chi-

square test indicates a significant association between dietary pattern and overweight among children ( $p=0.016$ ).

### Relationship between Dietary Pattern and Nutritional Status

**Table 2.** Relationship between Dietary Pattern of Toddlers and the Incidence of Overweight Toddlers

Dietary Pattern	Yes		No		P-Value
	N	%	N	%	
Good	3	5.7	50	94,3	0,016
Poor	9	22.5	31	77,5	

These results suggest that dietary patterns are an important determinant of overweight in this population. This finding is consistent with previous studies reporting that feeding patterns significantly influence the nutritional status of children aged 4–5 years.<sup>25</sup> Dietary patterns play a crucial role in determining nutritional status, encompassing both the quantity and quality of food consumed. Excessive nutrient intake may lead to overweight and obesity, consequently increasing the risk of various health problems.<sup>27</sup>

In addition to excessive food intake, which can increase the risk of obesity, intake of food high in sugar, salt, and fat also has a significant impact.<sup>28</sup> Excessive sugar intake promotes fat deposition in adipose tissue, and high salt intake increases appetite and contributes to fluid retention. Furthermore, excess fat intake also contributes to body fat accumulation, particularly in the abdominal area, thereby increasing the risk of central obesity.<sup>17</sup> This condition is exacerbated by the growing popularity of fast food among children. Fast food typically contains high levels of fat, calories, and salt, yet is low in dietary fiber, making its excessive consumption contribute to increasing the risk of obesity. Commonly consumed fast

food includes fried chicken, meatballs, nuggets, and sweet beverages<sup>29</sup>. In this study, many children were found to consume sweet foods and beverages as well as high-fat foods such as packaged drinks, ice cream, snacks, wafers, chocolate, crispy chicken, and various fried foods.

The mean calorie intake among children in this study was 1,185.07 kcal, which is below the Indonesian Recommended Dietary Allowance (RDA) for children aged 1-3 years (1,350 kcal) and for children aged 4-6 years (1,400 kcal). This indicates that the toddler's energy intake did not meet the recommendation. In addition to the dietary pattern, meal frequency is also important. Previous studies have found a significant association between meal frequency and nutritional status.<sup>30</sup> When meal frequency is appropriate, achieving good nutritional status becomes more feasible.<sup>31</sup> Timely feeding is essential for maintaining the nutritional balance of children. It is recommended to provide three main meals a day, with nutritious snacks, such as fruits.<sup>32</sup> For children aged 2-5 years, each meal should include staple foods, animal-based protein, plant-based protein, fats, vegetables, and fruits. The dietary intake for children aged 2-5 years should emphasize three important principles: ensuring adequate nutritional content, maintaining food hygiene, and ensuring adequate daily fluid intake of 5-7 glasses.<sup>33</sup> The fulfillment of carbohydrates, fats, proteins, vitamins, and minerals is essential not only for sustaining vital function but also promoting physical growth and cognitive development in children. Conversely, Fast food that is high in saturated fats, sugar, and salt should also be limited as they contribute to various health problems.<sup>34</sup> As reported by Prasadajudio et al. (2023), poor dietary quality, whether due to excessive intake of low-quality energy-dense foods or lack of dietary diversity, may increase the risk of both underweight and overweight conditions in children.<sup>35</sup> Therefore, the occurrence of overweight among children

in this study can be considered as a malnutrition, a serious nutritional problem, as undernutrition. This highlights the need for integrated nutritional interventions that not only address overweight but also ensure adequate nutrient intake to support optimal growth and development in early childhood.

Furthermore, the role of community-based health services such as Posyandu plays a vital role in promoting good dietary patterns and nutritional status among children. Findings from the National Survey showed that more than 98% of mothers understand the child weighing schedules, the concept of Posyandu, and the benefits of child monitoring at Posyandu; about 88.5% of mothers expressed strong trust in Posyandu's capacity to improve maternal and child health. Moreover, many mothers reported visiting Posyandu multiple times per year (e.g., **37.9%** visited 1–3 times, **25%** visited 4–6 times, and **29.3%** visited 10–12 times). Frequent engagement with Posyandu allows for regular growth monitoring and opportunities for nutritional counseling and behavior change. Therefore, enhancing Posyandu-based education and increasing service utilization could strengthen parental adherence to healthier dietary patterns and reduce the risk of overweight in toddlers.<sup>36</sup>

### **The Relationship Between Physical Activity and Nutritional Status**

Based on the data analysis, most toddlers were classified as having adequate physical activity (n = 71), while the remaining 22 toddlers were classified as having insufficient physical activity. More detailed information on the relationship between physical activity and overweight status among toddlers is presented in Table 3.

**Table 3.** Relationship Between Physical Activity of Toddlers and the Occurrence of Overweight Toddlers

Physical Activity	Yes		No		P-Value
	N	%	N	%	
Sufficient	4	5.6	67	94	0,000
Insufficient	8	36.6	14	63,7	

The finding also indicates an association between physical activity levels and the incidence of overweight. The majority of children with sufficient physical activity were not overweight (94%), while only 5.6% of them were overweight. In contrast, among children with insufficient physical activity, the proportion of overweight children was 36.3%, and 63.7% were not overweight. Statistical test indicates a significant relationship between the two variables ( $p=0.000$ ). Similarly, a study conducted on children aged 6–12 years found a relationship between physical activity and nutritional status.<sup>37</sup> Physical activity plays an important role in maintaining physical and emotional health, as well as helping to achieve and maintain an ideal body weight. By balancing calorie intake and expenditure, physical activity plays a key factor in weight management.<sup>25</sup>

Children aged 1–2 years are recommended to engage in at least 180 minutes of diverse physical activity each day while minimizing prolonged sitting. Children aged 3–4 years require 180 minutes of activity, including 60 minutes of moderate to vigorous activity while children aged 5–17 years need an average of 60 minutes of moderate to vigorous physical activity per day, with additional high-intensity aerobic exercise and muscle and bone strengthening at least 3 times per week. For less active children, alternative activities such as reading and

storytelling with their caregivers are suggested <sup>38</sup>. This study adopts these recommendations because the questionnaire used did not specify a clear cut-off for activity levels, which represents a limitation of this study. Low physical activity level combined with high energy intake contributes to an increased risk of obesity. However, sufficient to high levels of physical activity can help reduce the risk of obesity even with a high energy intake.<sup>39</sup> Insufficient physical activity at school, such as limited extracurricular programs, and children’s habits of spending time at home watching television or playing *games*, lead to a dominance of sedentary behaviour among children.<sup>40</sup>

#### The Relationship Between Screen Time and Nutritional Status

The results of the study indicate that most toddlers aged 2–5 years in the Sudimara Pinang Community Health Center area had good screen time habits, with 69 toddlers classified in the good category and 24 in the poor category, according to the Seven-in-Seven Screen Exposure Questionnaire. Further details of the analysis are presented in Table 4.

**Table 4.** Relationship Between Toddler Screen Time and Toddler Overweight Incidence

Screen Time	Yes		No		P-Value
	N	%	N	%	
High	8	11.6	61	88,4	0,523
Low	4	16.7	20	83.3	

Based on the table above, the proportion of overweight children was found to be higher in the low screen time group (16.7%) compared to the high screen time group (11.6%). However, neither the low nor the high screen time groups are overweight, at 88.4% and 83.3%, respectively. The statistical analysis indicates there is no significant association

between screen time and overweight among infants ( $p=0.053$ ). A similar finding was reported in a study conducted in Samarinda, which also found no significant relationship between BMI and screen time behavior ( $p=0.809$ ), showing that children with excessive screen time behavior still had normal BMI.<sup>41</sup> Another study suggested that the children who frequently eat while using gadgets tend to experience early satiety, slower eating (slowness in eating), or even lose interest in eating.<sup>17</sup> Children with high appetite levels and excessive screen time habits are at risk of weight gain, whereas those with naturally low appetite levels and frequent screen time are more likely to become lazy or forget to eat, leading to weight loss.<sup>41</sup> Contrastingly, other studies reported a significant relationship between screen time in children and higher nutritional status ( $p=0.017$ ), where children with high BMI/age were exposed to excessive screen time, i.e., more than four hours per day.<sup>42</sup> The recommended screen time for children aged two to five years is less than one hour.<sup>43</sup> The study also indicate that high screen time duration is associated with high nutritional status or BMI, as screen-based activities reduce time for physical activity since they are performed in passive positions such as sitting, standing, or lying down, thereby reducing energy expenditure.<sup>44</sup>

## Conclusion

The results of the study indicate that overweight in toddlers is significantly associated with physical activity and dietary pattern. Screen time may not have a direct effect but appears to interact with toddler eating habits. Because overweight is influenced by multiple interrelated factors, a balanced approach is required. Therefore, comprehensive approach including nutrition education, promote physical activity, and setting appropriate screen time

limits are needed to support healthy lifestyle among toddlers. This study can serve as a reference or foundation for developing strategies and policies to address overweight toddlers within the region. Future research is recommended to explore additional factors that may contribute to overweight in this age group.

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