Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga

JUXTA: Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga
2025 August, XVI (02)

ORIGINAL ARTICLE

The Frequency of Fast-Food Consumption and the Habit of Using Gadgets and Playing Games as Risk Factors for Childhood Obesity

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ABSTRACT

Introduction: Obesity is defined as the result of excessive fat accumulation caused by an energy imbalance, and it poses significant health risks. The contributing factors to be considered in this instance are the frequent consumption of fast food and reduced physical activity, which result from the increased use of gadgets and games. This study aimed to investigate the correlation between the aforementioned factors and the prevalence of obesity among elementary school children.

Methods: The heights and weights of 112 participants were measured to calculate their body mass index (BMI). The respondents were interviewed directly about their fast-food consumption habits over a one-week period and their daily use of gadgets and games. This study employed bivariate analysis to examine the relationships between variables in a sample, using the chi-square test with odds ratio determination, a 95% confidence interval, and a significance level of 0.05, as implemented in the International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS) version 29.

Results: The chi-square test showed p>0.05, indicating no significant relationship between fast-food consumption or gadget use and obesity in elementary school children.

Conclusion: There was no association between the frequency of fast-food consumption and the habit of playing gadgets and games as a risk factor for obesity in elementary school children.

Highlights:

1. There was no relationship between the frequency of fast-food consumption and the risk of obesity in elementary school children. This result was based on interviews with students of Rangkah VII Elementary School in Surabaya, conducted during their daily life activities and observations of their tendencies.
2. There was no relationship between the habit of playing gadgets and games as a risk factor for obesity in elementary school children. This result was based on interviews with students of Rangkah VII Elementary School in Surabaya, conducted during their daily life activities and observations of their tendencies.

ARTICLE INFO

Article history:
Received 29-11-2023
Received in revised form
01-07-2025
Accepted 23-07-2025
Available online 10-08-2025

Keywords:
Children,
Fast food,
Gadget,
Game,
Obesity.

Cite this as:
Zunnahri SQA, Sulistiawati S, Athiyyah AF, Fatmaningrum W, Adiwinoto RP. The Frequency of Fast-Food Consumption and the Habit of Using Gadgets and Playing Games as Risk Factors for Childhood Obesity. *JUXTA J Ilm Mhs Kedokt Univ Airlangga* 2025; 16: 135–141.

JUXTA: Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga
p-ISSN: 1907-3623; e-ISSN: 2684-9453
DOI: https://doi.org/10.20473/juxta.V16I22025.135-141

Introduction

Obesity is the accumulation of excess fat in the body due to an imbalance between energy intake and expenditure over an extended period, which can lead to potential health issues.[1] According to the World Health Organization (WHO), children aged 5-19 years old are considered overweight if their body mass index (BMI) is +1 standard deviation (SD) above the WHO growth reference and classified as obese if it is +2 SD.[1] Meanwhile, in 2000, the Centers for Disease Control and Prevention (CDC) defined childhood obesity as when BMI is ≥95th percentile on the CDC BMI-for-age curve.

Childhood obesity remains a prevalent global issue. The prevalence of overweight and obesity in children aged 5-19 years old has sharply increased from 4% in 1975 to 18% in 2016. In 2019, half of childhood obesity cases under 5 years old occurred in Asian countries. In Indonesia, obesity in children is on the rise, with a 3.6% prevalence among children under 5 years old and 21.8% among those aged 18 years old and above. In East Java, 22.4% of the population suffered from obesity in 2018.[2] In Surabaya, 21.8% of residents aged ≥15 years old were affected by obesity in 2019.[3]

Obesity generally leads to cardiovascular diseases such as stroke, liver diseases, diabetes, musculoskeletal disorders, and an increased risk of certain cancers. Children with obesity are at a higher risk of developing obesity, premature death, and various health issues in adulthood. Obese children may experience difficulty breathing, an elevated risk of bone fractures, hypertension, early signs of cardiovascular disease, insulin resistance, and psychological effects.[1]

According to the Ministry of Health of the Republic of Indonesia, one of the risk factors for childhood obesity is unhealthy eating habits, including the consumption of fast food, coupled with a decline in physical activity, such as frequent gaming, gadget use, and watching television (TV).[2] The increase in prosperity in Indonesia has led to lifestyle changes and altered eating habits. Eating habits, especially in urban areas, have shifted from traditional to a more Westernized diet, including fast food, resulting in an imbalanced nutritional intake and excess body fat, leading to obesity.[4]

Aside from poor eating habits, physical activity plays a crucial role in obesity. Insufficient physical activity allows stored energy to turn into fat, leading to weight gain in individuals with sedentary habits and high-calorie diets.[5] The time children spend on gaming, replacing time that should be allocated for physical activities, tends to lead to unhealthy snacking.[6] Various studies on the frequency of fast-food consumption have been conducted previously. A previous study in Europe categorized frequent consumption of fast food by children as ultra-processed food (UPF), stating that high consumption levels can lead to childhood obesity.[7] Another study in Brazil suggested that regularly consuming UPF can increase the risk of obesity.[8] Fast food containing high levels of fat, salt, and sugar can contribute to childhood obesity.[8]

Studies on gadget and gaming habits have also been extensively conducted. A study in Malaysia suggested that elementary school children tend to spend more time at home playing with gadgets and games than engaging in outdoor physical activities. Elementary school children with low physical activity levels have a threefold higher risk of obesity compared to those with regular physical activity. Other studies link obesity to low physical activity, prolonged sitting in school, insufficient participation in sports, excessive use of electronic devices (such as gadgets), and a lack of outdoor play.[9,10]

In Indonesia, numerous studies have explored the risk factors for childhood obesity, particularly regarding the frequency of fast-food consumption and gadget and gaming habits. In Surabaya, the last research on the risk factors of childhood obesity related to fast food was conducted in 2007, and no research has been performed on gadget and gaming habits. This study aimed to evaluate the frequency of fast-food consumption and the habit of using gadgets and playing games as risk factors for obesity in elementary school children, to prevent an increase in obesity among these children in Surabaya.

Methods

This was an analytical observational study employing a case-control approach, comparing case and control groups to determine the proportion of occurrences based on their exposure histories. The study sample consisted of all students at Rangkah VII Elementary School, Surabaya, totaling 112 children, including 56 obese children (cases) and 56 children with normal weight (controls). The inclusion criteria for the case group were children who were willing to participate as respondents, children attending school during the sample collection period, and children with obesity. The exclusion criteria included children with severe infectious diseases (coronavirus disease/COVID-19, Singapore flu, diphtheria, and typhoid fever), as well as children with conditions that could affect the research (disabilities or special needs).

The dependent variable in this study was obesity in elementary school children. The independent variables included the frequency of fast-food consumption, gaming, and gadget use. The frequency of fast-food consumption by children in a week is categorized as follows: 1) Often: ≥3 times per week, 2) Rarely: 1-2 times per week, and 3) Never: 0 times per week.[9] The frequency of children using gadgets and playing games is categorized based on daily duration as follows: 1) Often: more than 2 hours per day, 2) Rarely: 1-2 hours per day. For the dependent variable, weight and height were measured using a digital scale and a stature meter to calculate BMI.

The independent variables were assessed through interviews with all students of Rangkah VII Elementary School, Surabaya, documented on observation sheets. Data analysis involved univariate and bivariate analyses. Univariate analysis produced frequency distribution and percentages for each variable. Meanwhile, bivariate analysis explored the correlation between fast-food consumption, gaming habits, and obesity in elementary

school children using the Chi-square correlation test. Informed consent was obtained before the research, with consent forms provided to potential respondents. However, this informed consent was obtained from the teachers, who served as legal guardians at the school, as the respondents were underage and required the approval of a guardian.

Data Analysis

Bivariate analysis was used to determine the relationship between two or more variables in a sample. In this study, the statistical test used was the chi-square test, with the determination of odds ratio (OR) and a 95% confidence interval (CI), and a significance level of 0.05, using the International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS) version 29.[11] The chi-square test aims to examine the relationship between one dependent variable and one independent variable, both of which are measured on a nominal scale. The sample size used was limited to the number of samples collected at the time. Therefore, the data used was not continuous.

Results

Based on Table 1, the gender distribution of the respondents consisted of 48 boys (42.9%) and 64 girls (57.1%). In the case group (students with obesity), there were 34 boys (60.7%), which was higher than 22 girls (39.3%). In the control group (non-obese/normal students), there were 42 girls (75%), outnumbering 14 boys (25%). Regarding the ages of the respondents, the majority in both the case group (obese students) and the control group (normal students) were 9 years old, with a total of 72 children (64.3%). This study included 33 children (58.9%) in the case group and 39 children (69.6%) in the control group. Additionally, the number of third-grade students in both the case group (obese students) and the control group (normal students) was higher than that in other grades, with a total of 74 children (66.1%), divided into 33 children (58.9%) in the case group and 41 children (73.2%) in the control group. In this study, students from grade 2, 3, and 4 participated due to differences in entry times compared to grade 1, 5, 6, preventing the researcher from sampling other grades.

According to Table 1, the majority of children fell into the category of those who rarely consumed fast food. This was allowed by the group that frequently consumed fast food, and the least represented group was that of children who never consumed fast food.

Based on Table 2, it can be observed that the most frequently consumed types of fast food were fried chicken (by 85 children), snacks (by 70 children), and ice cream (by 69 children). Conversely, a minor proportion of children reported never consuming certain fast foods, including frozen food, snacks, and ice cream. This finding suggests a general tendency among children to frequently consume high-calorie fast foods, although the frequency of consumption varies according to the type of food consumed. According to Table 2, it can be seen that a greater proportion of children had a high daily gadget playing habit compared to those with a low or infrequent gadget playing habit. Furthermore, the data indicated that a greater proportion of children did not engage in frequent gaming activities on a daily basis. Additionally, the data suggested that a larger number of children were rarely involved in other physical activities, such as playing outside, and only engaged in physical exercise at school without additional activities.

Table 1. Frequency distribution based on gender, age, and classes

	Case n (%)	Control n (%)	Total Children (%)
Gender			
Boys	34 (60.7)	12 (25)	48 (42.9)
Girls	22 (39.3)	42 (75)	64 (57.1)
Total	**56 (100)**	**56 (100)**	**112 (100)**
Age (Years Old)			
8	0 (0)	2 (3.6)	2 (1.8)
9	33 (58.9)	39 (69.6)	72 (64.3)
10	16 (28.6)	10 (17.9)	26 (23.3)
11	7 (12.5)	5 (8.9)	12 (10.7)
Total	**56 (100)**	**56 (100)**	**112 (100)**
Elementary Grade			
2	0 (0)	2 (3.6)	2 (3.6)
3	33 (58.9)	41 (73.2)	74 (66.1)
4	23 (41.1)	13 (23.3)	36 (30.3)
Total	**56 (100)**	**56 (100)**	**112 (100)**

Source: Research data, processed

Based on Table 3, the percentage of students with infrequent fast-food consumption was higher than the categories of frequent or never, and the difference between the case and control groups was not significant. The chi-square test with corrections yielded a p-value of 0.298, which was greater than 0.05, indicating no relationship between fast-food consumption frequency and the risk of obesity in elementary school children.

Table 2. Frequency distribution based on fast-food consumption and the most frequently consumed fast food, and frequency distribution based on gadget and game playing habits, physical activity, and others

Frequency of Fast-Food Consumption				
	Frequent n	**Rare n**	**Never n**	**Total**
Total Children	13 (11.6%)	88 (78.6%)	11 (9.8%)	112 (100%)
French fries	43	68	1	112
Frozen food	64	48	0 (0)	112
Snack	70	42	0 (0)	112
Pizza	29	81	2	112
Chocolate/ candy	66	45	1	112
Fried chicken	85	27	0	112
Instant noodle	59	51	2	112
Soft drink	53	56	3	112
Hamburger	29	79	4	112
Ice cream	69	43	0	112
Frequency of Gadget Playing Habits				
	Frequent n	**Rare n**		**Total**
Gadget-playing habits	66 (58.9%)	46 (41.1%)		112 (100)
Game-playing habits	23 (20.5%)	89 (79.5%)		112 (100)
Physical activity and others	16 (14.3%)	96 (85.7%)		112 (100)

Source: Research data, processed

Based on Table 4, the p-value for the three most commonly consumed types of food by respondents was greater than 0.05, indicating no relationship with obesity in elementary school children. However, the test results for hamburgers showed p <0.05, indicating a statistically significant relationship with childhood obesity. However, hamburgers were a type of fast food that was rarely consumed by most children at Rangkah VII Elementary School, Surabaya.

Table 3. Relationship between fast-food consumption frequency and obesity in elementary school children

	Case (Obesity) n (%)	Control (Normal) n (%)	OR	95% CI	p-value
Frequency of Fast-Food Consumption					
Frequent	4 (7.1)	9 (16.1)	0.15	0.00 -0.68	0.298
Rare	47 (83.9)	41 (73.2)			
Never	5 (8.9)	6 (10.7)			
Total	**56 (100)**	**56 (100)**			

OR: odds ratio; 95% CI: 95% confidence interval
Source: Research data, processed

According to Table 5, the percentage of obese students with high gadget playing habits was 36 (64.3%), which was higher than normal students with high habits (53.6%). However, the chi-square test with corrections yielded a p-value of 0.337, which was greater than 0.05, suggesting no relationship between gadget playing habits and obesity risk in elementary school children.

Table 4. Relationship between types of foods examined and obesity in elementary school children

Food Type	BMI	Frequent	Rare	Never	p-value
French fries	Normal	23	33	0	0.53
	Obesity	20	35	1	
Frozen food	Normal	35	21	0	0.34
	Obesity	29	27	0	
Snack	Normal	36	20	0	0.845
	Obesity	34	22	0	
Pizza	Normal	18	36	2	0.096
	Obesity	11	45	0	
Chocolate	Normal	35	20	1	0.407
	Obesity	31	25	0	
Fried chicken	Normal	44	12	0	0.659
	Obesity	41	15	0	
Instant noodle	Normal	30	25	1	0.982
	Obesity	29	26	1	
Soft drink	Normal	26	28	2	0.839
	Obesity	27	28	1	
Hamburger	Normal	21	33	2	0.019
	Obesity	8	46	2	
Ice cream	Normal	39	17	0	0.12
	Obesity	30	26	0	

BMI: body mass index
Source: Research data, processed

Based on Table 5, the percentage of obese students with high gaming habits was 13 (23.2%), while the percentage of normal students with high gaming habits was 10 (17.9%). Despite a subtle difference, the chi-square test with corrections yielded a p-value of 0.64, which was greater than 0.05, indicating no relationship between gaming habits and obesity risk in elementary school children. In this case, the habit of using gadgets and playing games was distinguished because not all children used gadgets for gaming. For example, some children might spend their time watching TV or browsing social media on their phones instead of engaging in active play.

Table 5. Relationship between gadgets and game-playing habits for obesity in elementary school children

	Case (Obesity) n (%)	Control (Normal) n (%)	OR	95%CI	p-value
Gadget-Playing Habits					
Frequent	36 (64.3)	30 (53.6)	1.56	0.73-3.33	0.337
Rare	20 (35.7)	26 (46.4)			
Total	56 (100)	56 (100)			
Game-Playing Habits					
Frequent	13 (23.2)	10 (17.9)	1.39	0.55-3.5	0.64
Rare	43 (76.8)	46 (82.1)			
Total	**56 (100)**	**56 (100)**			

OR: odds ratio; 95% CI: 95% confidence interval
Source: Research data, processed

Discussion

Obesity is a condition caused by an imbalance between the energy intake and the energy required by the body to perform various biological functions, such as growth, development, and physical activity.[12] It can also lead to multiple health disorders in individuals, including cardiovascular diseases like stroke and liver disease, diabetes, musculoskeletal disorders, and certain cancers.[1,13,14] Children are at greater risk of obesity, as it may lead to obesity in adulthood, premature death, and diseases.[1] Obesity affects all age groups, and childhood obesity is a prevalent issue worldwide. The prevalence of obesity continues to rise globally, including in Asia and Indonesia. Surabaya, as one of the provincial capitals in East Java, Indonesia, has experienced an increase in childhood obesity cases. Lack of healthy food consumption is one of the risk factors for obesity in Indonesia.[15] Childhood obesity is influenced by various factors, including genetic predisposition, gender, dietary patterns, lifestyle, physical activity, and other environmental factors.

Frequency of Fast-Food Consumption

Based on bivariate analysis using the chi-square test to examine the relationship between the frequency of fast-food consumption as a risk factor for obesity in elementary school children, a p-value of 0.298>0.05 was obtained. This indicated no significant relationship between the frequency of fast-food consumption and the risk of obesity in elementary school children. This conclusion is supported by responses from respondents during interviews regarding the frequency of fast-food consumption per week. Most respondents reported infrequent fast-food consumption, and the chi-square analysis revealed no significant relationship between the frequency of fast-food consumption and the risk of obesity in children. Although most respondents rarely consumed fast food, some students ate instant noodles daily without interruption.

Additionally, almost all respondents were regularly provided with fried chicken by their parents. In this study, fast-food consumption was categorized into three groups: frequent, infrequent, and never.

Only a few students fell into the categories of 'never' or 'frequent', while the majority were categorized as infrequent consumers of fast food. However, during interviews, nearly all respondents mentioned frequently consuming fast food or convenience food. This is evident from the three categories of food most commonly consumed, namely fried chicken, snacks, and ice cream. The chi-square test conducted on these three types of frequently consumed fast food showed no significant relationship with the risk factors for obesity in elementary school children. Changes in lifestyle and dietary patterns are key factors contributing to the high prevalence of obesity. In major cities, dietary patterns have shifted from traditional to westernized diets, particularly in the form of fast food. This shift towards high-calorie, high-fat, high-carbohydrate, high-cholesterol, and high-sodium diets, which are low in fiber, such as those found in fast food, contributes to the imbalance in nutritional intake and becomes one of the risk factors for childhood obesity.[4]

Many factors contribute to why many respondents consumed fast food. One reason was that parents prefer things that are more practical and easier to pack for their children's school lunches.[16] Thus, without considering the child's nutritional intake, parents often choose fast food or convenience food for their children's meals. In addition to comfort, children who consume fast food too frequently every day may feel fuller, causing them to avoid eating staple foods or homemade meals. Instant noodles, sweet drinks, and snacks are types of fast food that are popular among children.[17] Many respondents participating in this study frequently consumed snacks and ice cream. It was because almost all children lived near small shops that provided ice cream and snacks. With the advancement of time, there are now many shops that consistently sell ice cream because the distribution of ice cream refrigeration machines has become easier. Consequently, this becomes a habit for children to buy ice cream and snacks at home.[18]

Fast food is the primary choice for busy parents and serves as the main food consumed when spending time together with the family in today's modern society. This is because fast food processing tends to be quick due to the use of machines, making it appear cleaner and more hygienic as it is processed in restaurants. Fast food is also easily accessible, with service available at all times, and the ordering process is easy to understand due to current technological advancements.[16] Moreover, the availability of school canteens offering fast food such as fried foods, nuggets, sausages, candies, and soft drinks leads children to purchase these snacks during school hours. With the onset of the COVID-19 pandemic, children's eating habits have undergone significant changes. Lockdown measures, which prohibited activities outside the home, led to a less regulated eating pattern for children. Children are more inclined to consume fast food or convenience food at home. The WHO suggested introducing local isolation measures and more health-focused epidemic measures. With restrictions on public activities, individuals are required to work from home (WFH) and engage in online learning. This shift to online education has led to changes in children's habits at home, including altered daily eating habits and a decline in physical activity.[19]

Respondents in this study reported frequently consuming fast food. However, when statistically analyzed, only a small number of respondents fell into the 'frequent' category of fast-food consumption because this study did not measure daily consumption of fast food. While categorized as frequent due to consuming fast food ≥3 times a week, this study did not inquire about the quantity consumed each time, affecting the categorization of respondents' fast-food consumption frequency. This aligns with previous studies, which also found no relationship between the frequency of fast-food consumption and the risk of obesity in children.[9,20] However, it differs from another study, which stated a connection between fast-food consumption patterns and obesity in children.[21] The variation in study results was due to the use of different parameters in each study.

Gadget Playing Habits

Based on bivariate analysis using the chi-square test to examine the relationship between gadget playing habits as a risk factor for obesity in elementary school children, a p-value of 0.337 was obtained, which was greater than 0.05. This implied no significant relationship between gadget playing habits and the risk of obesity in elementary school children.

Generally, children, in addition to playing with gadgets or games, also watch TV when these devices are not in use. Only a few students were allowed by their parents to use smartphones every day. For those restricted from using smartphones, watching TV often becomes a primary means of entertainment. With the development of gadget technology such as TV, computers, and smartphones, children may become inactive as most of their time is spent on passive activities like playing on smartphones, video games, online games, internet use, and watching TV every day for up to 3 hours, contributing to the risk of obesity.[22,23] The more extended use of gadgets is strongly associated with the COVID-2019 pandemic, where students are required to engage in online learning.[24] Although online learning is no longer in place, the habit of playing with gadgets and games persists in children. Moreover, parents may feel that they have already facilitated their children, paying less attention to their children's routines. Some parents also believe that having a TV or smartphone keeps their children happy at home, reducing concerns about their children playing outside.

In addition to the high prevalence of gadget and game playing habits, children also tend to have insufficient physical activity. Based on the interviews, as many as 96 respondents (85.7%) stated that they only engaged in sports at school and rarely played outdoors. Physical activity is the primary contributor to energy expenditure. Insufficient energy expenditure leads to an imbalance between energy intake and energy output, causing unused energy to be stored as fat and potentially resulting in

obesity.[25] Addressing and eliminating high gadget use habits in children begins with the home environment. Parents can limit their children's gadget usage and schedule beneficial activities to ensure that children are not solely focused on gadgets. Additionally, supporting their hobbies, such as swimming and playing football, can reduce gadget usage in children. This is similar to a study that also concluded there was no relationship between gadget and game playing habits and childhood obesity.[26] However, it differs from another study, which indicated a connection between gadget use and childhood obesity.[22]

Gaming Habits

Based on the chi-square test results examining the relationship between gaming habits as a risk factor for obesity in elementary school children, a p-value of 0.64 ($p>0.05$) was obtained, indicating no significant relationship between gaming habits and the risk of obesity in elementary school children. It was noted that 13 children with high gadget usage habits also had high gaming habits, with more than half being boys. Games or online gaming are activities that require an internet connection and have become a significant cultural phenomenon. Consumers of online games are not only adults but predominantly children and teenagers.[27] With technological advancements, children can play online games anywhere, using gaming consoles, computers, or even smartphones. With internet access via mobile data or Wi-Fi, children can play online games without any obstacles.

Children with high gaming habits tend to be more addicted to playing games compared to those with high gadget usage habits. This is because games can be highly addictive when one becomes accustomed to them. Addiction to games can be defined as excessive or obsessive game usage that disrupts various aspects of a person's daily life. Gaming addiction can have negative impacts on different life aspects for those who excessively play, including health, academic performance, psychological well-being, economic factors, and social interactions.[27] Heavy gaming of online games tends to make children stay in one place for extended periods, becoming too lazy to engage in daily physical activities. Consequently, most of the energy and nutrients from consumed food will accumulate excessively in the body, leading to obesity. Lack of physical activity will cause stored energy to accumulate as fat in the body, resulting in a tendency to become overweight (obese).[28] To address the high habit of playing games, parents can start by encouraging children to be physically active. By engaging in and encouraging children to participate in sports, parents can guide them toward sports they enjoy. Children and teenagers should limit the time spent playing online games each day, and it would be beneficial if they only engage in online gaming on weekends or holidays.[29]

Strengths and Limitations

The strengths of this study include its comprehensive data collection, which provides measurements of height and weight, as well as direct interviews, thereby enhancing the reliability of the findings. A sample of 112 respondents strengthens the generalizability of this study. The use of statistical analysis, particularly the chi-square test, adds validity to the study, which maintained clear objectives focused on exploring the relationship between fast food consumption, gadget/game usage, and obesity in elementary school students. A limitation of this study was that it could not generalize the habits of fast-food consumption, gadget use, and gaming among all elementary school students in Rangkah VII Elementary School, Surabaya. Time constraints confined sampling to grade 2, 3, and 4, while the study focused on two variables, fast food frequency and gadget/game habits, excluding other potential risk factors for obesity. Furthermore, the study did not assess the frequency of daily fast-food consumption.

Conclusion

There was no correlation between the frequency of fast-food consumption and the risk of obesity in elementary school children. This study revealed no association between the habit of playing gadgets and games and the risk of obesity in this age group.

Acknowledgments

The first author would like to thank all the supervisors and research participants who willingly participated in the data collection, which enabled the successful implementation of this study.

Conflict of Interest

The authors declared there is no conflict of interest.

Funding

This study did not receive any funding.

Ethical Clearance

This study received ethical clearance from the Ethics Committee for Health Research, Faculty of Medicine, Universitas Airlangga, Surabaya (No.34/EC/KEPK/FKUA/2023) on 09-02-2023.

Authors' Contributions

Designed the study and drafted the manuscript: SQAZ. Collected data and performed background literature review: SQAZ. Performed statistical analysis: SQAZ. Supervised result and discussion: SS, AFA, WF, RPA. All authors reviewed and approved the final version of the manuscript.

Data Availability

N/A.

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