

The Multilevel Influence of Individual, Parental, and School Factors on the Nutritional Status of Obese Children in Banda Aceh: A PLS-SEM Analysis

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ABSTRACT

Overweight and obesity in children are serious global problems that threaten their long-term health. These issues are major health problems in Indonesia, and the causes of these problems in school-aged children are unclear. Indonesia faces a rising health concern with childhood obesity, and the main causes in school-aged kids are not well-known. The goal of this research is to identify what impacts nutritional status, specifically in children with weight issues. This study employed the Disjoint Two-Stage Approach in PLS-SEM, guided by socio-ecological theory, and applied a purposive sampling method to select 87 overweight and obese children, along with their parents and school principals, as the study group. Parental factors exerted the strongest positive influence ($\beta=0.500$, $p<0.001$), followed by individual factors ($\beta=0.341$, $p<0.001$), while school factors were negative but insignificant ($\beta=-0.086$, $p=0.293$). Together, individual, parent, and school factors accounted for 43% of the variance in children's nutritional status. These findings highlight the importance of family- and child-focused nutrition interventions. Strengthening schools with clear policies and programs is also needed to promote healthy eating.

Keywords: Child Nutritional Status; Individual; Parent; School; PLS-SEM

INTRODUCTION

The clear cause-and-effect relationship is highlighted by a statement: Fast food consumption is on the rise due to busy modern lifestyles, leading people to choose convenient meal options. (Heryanda & Khoiriyah, 2024). The statement observes a growing trend in fast food consumption, implying a significant and ongoing increase. Advertisements and social media also play a major role through appealing promotions and tempting visuals (Fainurryzky Annisa, 2025; Li et al., 2020). Fast food is also more affordable than healthy options and has a savory taste that can be addictive. Fast food is popular not just because it's easy, but also because of social and cultural habits, like young people meeting up at fast-food places. The issue of people eating fast food is complicated, as it is linked to personal choices, surroundings, money, and social reasons (Bohara et al., 2021; Bui et al., 2021). Eating unhealthy fast food is a big worry for public health because of the harmful chemicals in it. The increasing consumption of fast food makes more children and adolescents overweight or obese. Obesity is a major cause of mortality worldwide, leading to about 2.8 million deaths annually from related health problems. These statistics demonstrate that obesity is a serious global health threat (Putri et al., 2025; Sri Mulyani et al., 2020).

Globally, fast food consumption is increasing in every country, especially in poorer and

developing nations. This habit has become common, particularly among schoolchildren and teenagers. The associated with fast food pertains to its excessive content of detrimental components—elevated caloric content, unhealthy fats, refined sugars, sodium, monosodium glutamate (MSG), and various preservatives. Moreover, it does not provide sufficient essential nutrients such as protein, fiber, or vitamins (Jasmine, 2022; Putri et al., 2025). Looking at the data for overweight children under five years old, globally, there was a slight increase from 5.5% to 5.6% between 2012 and 2022. However, the total number of overweight children remained constant at around 37 million. In Asia, only Southeast Asia showed an increase in cases, rising from 3.6 million children in 2012 to 4.1 million in 2022. In Indonesia in particular, the percentage of overweight children under five increased from 9.2% (2,217,700 children) in 2012 (categorized as "medium") to 10.6% (2,357,600 children) in 2022, placing it in the "high" category. In short, unhealthy fast-food consumption is a significant factor in the increasing problem of overweight children, particularly in Southeast Asia and Indonesia (Kemenkes RI, 2023; Nourmayansa Vidya Anggraini, 2022; UNICEF, 2023).

A deeper understanding of childhood obesity—including its link to fast food—requires us to look beyond a child's individual choices and examine broader frameworks like the Ecological Model of Child Obesity and the Social Determinants of Health. The ecological model shows that a child's eating habits are shaped by many things at once. These include their own tastes, their family's habits, their school and community, and government rules. Meanwhile, the Social Determinants of Health approach focuses on issues like whether healthy food is easy to get and how much a child sees fast food ads. These factors quietly influence what a child chooses to eat and their health risks. Therefore, obesity isn't just about eating fast food. Obesity is not just caused by a single factor; it results from the interplay of personal, social, financial, and environmental factors. Taking this multilevel view is the key to developing long-term and effective solutions (Irawan et al., 2025; Putri et al., 2025).

The 2023 Indonesian Health Survey revealed that 11.9% of children aged 5-12 across Indonesia were overweight and 7.8% were obese, with boys more affected than girls. Specifically in Aceh Province, 10.2% were overweight and 7% were obese. Shifting to a more local view, the 2024 nutritional status assessment of 31,237 elementary students in Banda Aceh City found 3% underweight, 0% severely underweight, 1% obese, and 3% overweight. Notably, Syiah Kuala District, a more rural area, has 16 elementary schools, while the urban Kuta Alam District has 21. The 2014 study revealed a link between a child's nutritional status and their school's location in which city center elementary schools showed better nutritional status, with 63% of students having normal nutritional status and only 10.9% being underweight (Acharya et al., 2021; Irawan et al., 2025).

The Increased consumption of fast food in Aceh and its link to obesity is a pressing concern. A study in Banda Aceh found an association between fast food consumption and obesity among elementary school children. The study revealed that 62.5% of obese children frequently consumed fast food, while most children with normal weight (68.7%) rarely did. Statistical analysis confirmed a significant association between fast food consumption and obesity in these students ($p = 0.024$). For teenage girls in Aceh Besar, nutritional knowledge, breakfast routines, fast food intake, and physical activity were identified as risk factors for obesity. The study found that the level of knowledge about healthy eating, breakfast habits, frequency of fastfood consumption, and engagement in physical activity all affected their risk of obesity. The results showed that 51.9% of these girls frequently consumed fast food, which was associated with obesity (Fajri et al., 2025; Wardani et al., 2024).

A small study of 10 obese children (out of 27 total) from Syiah Kuala District (specifically in the Jeulingke Health Center area) found some interesting things. A majority of these obese

children (70%) often ate fast food, consuming it more than four times a week. They enjoyed a wide variety of fast foods, including burgers and fries, and consumed them in big portions. When it came to knowledge about food, 4 children showed a basic understanding of nutrition, while 6 children demonstrated good knowledge about the effects of fast food, healthy food choices, and the nutritional content of fast food. However, they still liked fast food, with 7 children reporting that they enjoyed it because it tasted good, was fast and easy, made them happy, and they even preferred it over home cooking. Lastly, concerning physical activity, all the children had low activity levels throughout the week, mostly because they spent a lot of time (3-4 times a week to daily) playing video games and over an hour daily on gadgets/phones.

The primary novelty of this research is its comprehensive approach, a method that is entirely new to Banda Aceh. Specifically, it's the first study in the region to use a multilevel Structural Equation Modeling (SEM) analysis to combine factors from different levels—individual, family, and school environment—into a single model. By integrating the most influential variables from each level, the research aimed to examine whether this multilevel combination had a stronger, more significant impact on fast food consumption behavior. Thus, this study provides a more holistic and in-depth understanding that differs from previous research, which tends to focus on single factors.

Based on the preliminary study, if we don't control elementary school children's fast-food habits, they face a higher risk of future health problems like being overweight, malnutrition, chronic diseases, digestion issues, and tooth problems. Children might end up with obesity, diarrhea, tooth decay, or even serious diseases that don't spread. Our study aims to identify the most important risk factors for children's healthy eating, by looking at what happens with the child, in their family, and at their school. We hope this study helps in two ways: First, academically, it will add to our scientific understanding of what affects children's nutrition. It will also help us understand more completely how individual choices, home environment, and school/social settings play a role in fast food consumption. Second, practically, the results can be used to create new rules and nutrition education programs in schools, especially in Banda Aceh. Finding out which level (individual, family, or school) has the biggest impact will help policymakers, health workers, and schools design better ways to prevent and lower obesity rates in elementary school children.

METHOD

This study used a quantitative, cross-sectional design that applied Urie Bronfenbrenner's Socio-Ecological Model (SEM). This framework focuses on the influence of the Microsystem (family environment) and the Mesosystem (school environment) on the nutritional status of children. This study was conducted over one month, from July to August 2025, in the districts of Syiah Kuala and Kuta Alam, Banda Aceh City. The primary data used were the results of student health screenings at elementary schools, which were carried out from September to November 2024.

Population and Sample

The population and sample of this study were elementary school students with overweight and obese nutritional status. A total of 87 students aged 11–12 years were identified as overweight/obese based on their WHO body mass index-for-age Z scores. These students were selected using a purposive sampling technique, with the following criteria: students enrolled in grades 5–6, aged 11–12 years, and classified as overweight or obese according to WHO body mass index-for-age Z scores (inclusion). Students who had chronic illnesses, physical disabilities, or incomplete anthropometric data were excluded (exclusion). In addition, the research involved two other levels of respondents: 87 parents (Microsystem) and 9 teachers from 9 different schools (Mesosystem). In total, the research sample consisted of 183 respondents.

Variables and Research instruments

In this study, the nutritional status of school children was the main outcome measured. Weight and height were measured directly by trained enumerators using a calibrated digital weighing scale (to the nearest 0.1 kg) and a portable stadiometer (to the nearest 0.1 cm). The independent variables were categorized by level, starting with the Individual Level (students), which included frequency of fast-food consumption, nutritional knowledge, attitude toward fast food, and physical activity. At the Parental Level (Microsystem), the variables were parental knowledge, family eating patterns, and parental support for healthy eating.

Variables analyzed at the School Level (Mesosystem) were school policies on fast food and peer influence. Using a questionnaire created by the research team, primary data were collected by observation and interviews. The questionnaire's indicators all met the validity the validity and reliability standards, with values higher than 0.70. Reliability was measured using Cronbach's Alpha and Composite Reliability, which indicated good internal consistency for all constructs.

Data Analysis and Research Ethics

A Partial Least Squares - Structural Equation Modeling (PLS-SEM) approach was used to conduct the data analysis. The Multilevel PLS-SEM method with a disjoint Two-Stage Approach was used to analyze the hierarchical data structure. The software used was SmartPLS version 4.1.1.4. This analysis enabled researchers to see how variables from the student, parent, and school levels affected the dependent variable. This research followed the principles of research ethics and received approval from the Health Research Ethics Committee of Universitas Indonesia Maju with Number: 1657/Sket/Ka-Dept/RE/UIMA/V/2025. Before collecting data, researchers secured informed consent from all participants or their guardians to confirm voluntary participation.

RESULTS AND DISCUSSION

An analysis of 87 children revealed a concerning nutritional status, with their average BMI-for-age at +2 SD, indicating obesity. Most of the sample were boys (70%) with an average age of 11, pointing to a pre-adolescent obesity issue. At the family level, most parents of the children in the sample had a secondary education and a monthly income of Rp 3-4 million. While this socio-economic background suggests a middle-income level of financial stability, it may not directly correlate with a deep understanding of balanced nutrition or healthy lifestyle practices to prevent childhood obesity. The data also showed that unhealthy eating habits in parents significantly increased the risk of obesity in children ($\beta = -0.779$), underscoring the vital role of the family.

The characteristics of the school environment also varied. Of the nine schools surveyed, 78% of school canteens met health requirements. However, only 44% achieved an "optimal" rating for their School Health Program (*Usaha Kesehatan Sekolah/UKS*) activities. This low number suggests that health and nutrition promotion programs in schools may not be running at their full potential or are ineffective in preventing nutritional issues like obesity in children. At the individual level, the average BMI-for-age Z score for the 87 children in the sample was +3.0 SD (SD = 0.5), with an average age of 11.4 years (SD = 0.39). These results strongly indicate obesity. The significant proportion of boys (70%) in the sample also highlights the need for specialized interventions.

Tabel 1. Characteristics of Samples

	Mean	Standard Deviation
First Level (Individual, n = 87)		
BMI (Z score)	25,40	3,00
Age	11,4	0,39

	Mean	Standard Deviation
Male (proportion)	0,70	0,50
Second Level (Parent, n = 87)		
Education	2,33	0,75
Income	2,71	0,53
Occupation	2,31	0,53
Level 3 (School, n = 9)		
Canteens (Proportion)	0,78	0,50
School Health Program Optimal Grade (Proportion)	0,44	0,94

Financial and Social Status of Parents

For the parents' information, 87 individuals were also involved. Their financial and social details were reviewed, specifically their education, income, and occupations. The average education score was 2.33 (with a standard deviation of 0.75), indicating that most parents had completed a secondary education. Their average income score was 2.71 (standard deviation 0.53) and their job score was 2.31 (standard deviation 0.53). With diverse occupations ranging from business owners to private company employees and civil servants, these parents had an average income. This socio-economic status, while indicating a stable, middle-income level, may not directly correlate with a deep understanding of balanced nutrition or healthy lifestyle practices that could prevent childhood obesity (Leila Pebriani, 2022).

School Environment Characteristics

Data from nine surveyed schools revealed varied results. The proportion of school canteens that met health standards was quite high at 78% (standard deviation of 0.50), showing a good commitment to providing healthy food. However, a significant concern was the low proportion of schools that achieved an "optimal" grade for their School Health Program (*Usaha Kesehatan Sekolah/Madrasah* — UKS/M) development, at only 44% with a large standard deviation (0.94). This result indicates substantial variation and highlights the pressing need to improve these programs to make them more effective in promoting health and preventing nutritional problems among students.

Statistical Modeling and Findings

Figure 1 presents a statistical model (PLS-SEM) showing the relationships among different factors. This model helps us understand how hidden factors at three levels—individual, parental, and school—are connected to a child's nutritional status. The analysis, performed using a Disjoint Two-Stage Approach in SmartPLS version 4 (Heryanda & Khoiriyah, 2024), aimed to identify the key influences on a child's nutritional status. In this hierarchical structure, each level is represented by a blue circle that groups together measured variables.

The PLS-SEM analysis revealed that both individual and parental factors significantly and positively influence a child's nutritional status, with parental factors having the greatest impact. Individual factors had a moderate positive effect ($\beta = 0.341$ and 0.500), with the child's eating frequency having the strongest influence ($\beta = 0.819$). This result suggests that more frequent eating, especially of unhealthy foods, has a major effect on their nutritional status. The child's knowledge ($\beta = 0.642$) and activity level ($\beta = 0.471$) were also moderate positive contributors, while attitude ($\beta = 0.261$) had a lesser effect.

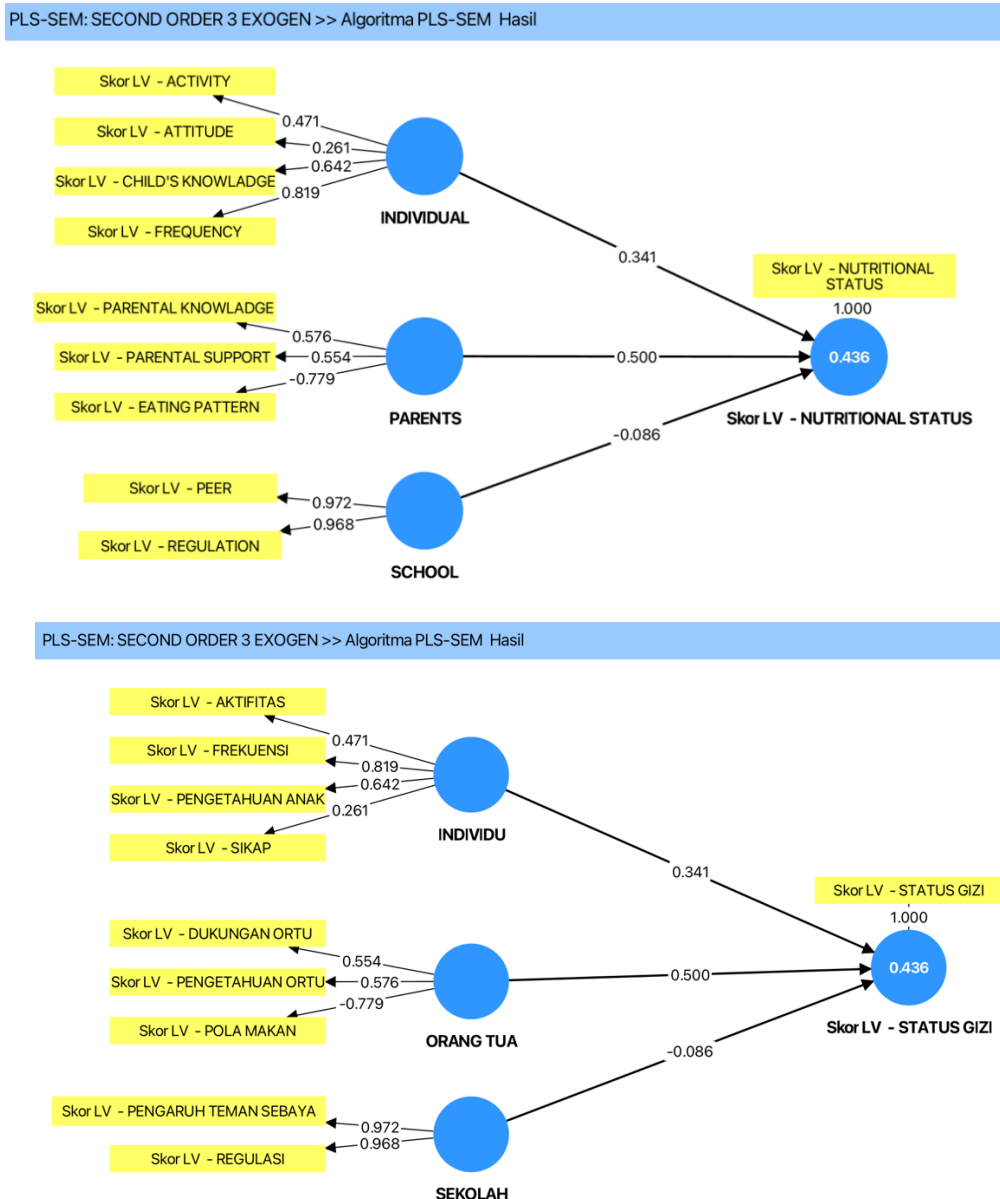


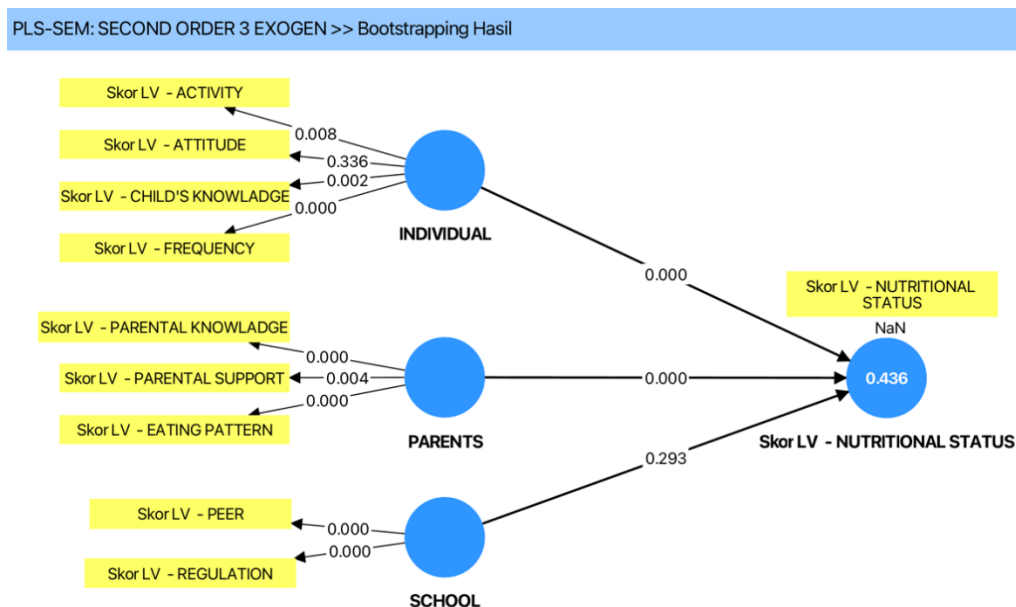
Figure 1. PLS-SEM Path Diagram for Child Nutritional Status

A child's nutritional status was more positively influenced by parental factors ($\beta=0.500$) than by individual attributes. Parental support ($\beta=0.554$) was the key driver of this notable positive impact. Interestingly, while parental knowledge had a high positive weight ($\beta=0.576$), parental eating patterns ($\beta=-0.779$) showed a very strong negative influence. This result suggests that unhealthy eating habits at home might be a hindering factor, even if parents are knowledgeable and provide support.

At the school level, a significant impact was observed from "Regulations" ($\beta=0.963$) and "Peers" ($\beta=0.987$), as evidenced by their very high loading factors. This result suggests that existing school rules may be ineffective or even harmful, and that peer influence might encourage unhealthy eating habits. The overall collective impact of the "School" level on "Nutritional Status"

is negative, though small, with a path coefficient of -0.086 . This result contrasts with the positive finding that 78% of school canteens meet health standards, indicating that while there are positive efforts, the overall school environment is not yet a positive influence on a child's nutritional status.

Figure 2 shows the outcomes of a bootstrapping analysis within the PLS-SEM model, conducted to pinpoint what affects children's nutritional well-being. This analysis is vital for determining if the connections (path coefficients) and individual influences (loading factors) are statistically meaningful. At the individual level, although the path coefficient from the "Individual" construct to "Nutritional Status" appears the supporting text explicitly states a p-value of <0.000 . A child's individual traits, including their activity levels, how often they consume junk food, and their personal outlook, are shown to reliably affect their nutritional status. A similar situation occurs at the parental level; the path coefficient from the "Parent" construct to "Nutritional Status" is also very small a p-value of <0.000 , it shows a very statistically significant influence. This result shows for sure that what parents do – how they support, what they know, and how they eat – all together really affects a child's nutrition.



PLS-SEM: SECOND ORDER 3 EXOGEN >> Bootstrapping Hasil

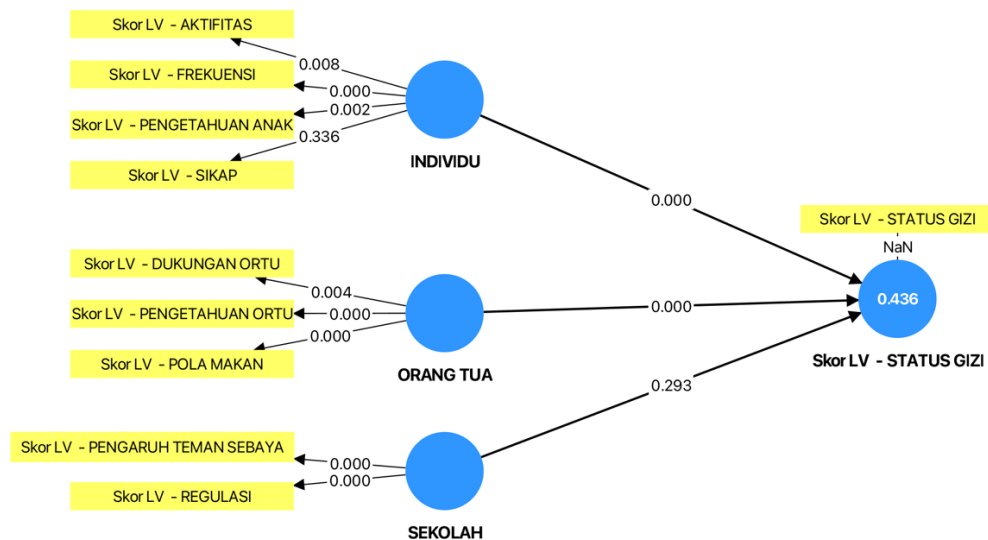


Figure 2. Path Diagram with Bootstrapped Results on Child Nutritional Status

The research showed that schools did not directly influence a child's nutritional status in a major way. The result can't be considered important because the p-value of 0.293 is too high. This result means that even though there are school factors like regulations or peer influence, their impact on children's nutrition might be more complex, indirect, or not well-measured in this study. Overall, this PLS-SEM analysis strongly confirmed that individual and parental factors significantly impacted children's nutritional status. This result shows we need to focus on changing kids' habits (like their knowledge of nutrition and exercise) and how parents raise them. Even though schools had different indicators, they didn't directly affect children's nutrition in a meaningful way ($p=0.293$). This result contrasts sharply with the very strong influence of individual and parental factors ($p=0.000$ for both).

The Effect of Individual Factors on Children's Nutritional Status

A child's personal factors have a significant influence on their nutritional status. This was shown by a PLS-SEM analysis, which found a beta value of 0.341. It was measured by looking at four main things. The four factors include a child's fast-food frequency and their nutrition knowledge. They also include physical activity and a child's attitude toward fast food. Fast food frequency has the biggest influence ($\beta = 0.819$). A child's risk of unhealthy nutrition and obesity goes up when they eat fast food more often (Chan et al., 2022). In some cases, this risk can be up to 4.2 times higher. A child's knowledge about nutrition also plays a significant role. It is a significant factor, with a beta value of 0.642. Children with good knowledge tend to have a normal nutritional status. Physical activity is also effective ($\beta = 0.471$). It helps lower the risk of being overweight. A child's attitude toward fast food has the smallest influence, but still contributes to unhealthy eating. These findings show the importance of nutrition education and school programs that include regular physical activity. These efforts can help children make healthier food choices. This improves their overall nutrition (Jakobsen et al., 2023; Poorolajal et al., 2020).

The Effect of Parental Factors on Children's Nutritional Status

The effect of parental factors on children's nutritional status occurs due to three main things: parental knowledge, parental support, and family eating patterns. They are parental

knowledge, parental support, and family eating patterns. Parental knowledge has a significant positive influence ($\beta = 0.576$), as parents with good nutrition knowledge tend to have children with a normal weight. Similarly, parental support contributes positively ($\beta = 0.554$); actions like preparing healthy lunches or limiting spending money increase a child's intake of nutritious food. Conversely, family eating patterns have a strong negative influence ($\beta = -0.779$). When parents have unhealthy eating habits at home, their children often copy them. This behavior leads to a higher risk of obesity (de Menezes et al., 2023). As a result, children are much more likely to become obese. Children are much more likely to become obese if their parents have unhealthy eating habits. This risk can be up to 3.2 times higher. Therefore, nutritional interventions shouldn't just target children. To be effective, nutrition programs must actively involve parents. The programs help parents to know more about nutrition and healthy eating practices and be more supportive, which leads to healthier eating at home (Prasetyo et al., 2023).

The Effect of School Factors on Children's Nutritional Status

The analysis results indicated that the school factor had a very limited influence on a child's nutritional status, with a beta coefficient of $\beta = -0.086$. Nevertheless, two key indicators—school regulations and peer influence—have a very high loading factor. The condition creates an interesting paradox: although the rules on paper, such as the presence of healthy canteens (78% of canteens meeting standards), are good, their overall impact on a child's nutrition remains minimal. One possible cause is a lack of effective implementation and supervision. These rules may be merely administrative and not applied consistently. On the other hand, the very strong influence of peers might be more dominant in shaping children's eating habits, overriding the formal school rules. The strong influence of peers is a factor that is difficult for schools to fully control. Therefore, the school's role needs to be strengthened not only through regulations but also through stricter enforcement, improved supervision, and the active involvement of teachers as role models. In addition, the curriculum and extracurricular activities should be enhanced to provide more effective and engaging nutrition education for students, which can counteract the negative influence of their social environment (Nilesh Rojekar, 2021).

Interpretation of the R-Square Value in Path Analysis

An analysis shows that the R-squared (R^2) value is 0.436. This result indicates that 43.6% of the variation in a child's nutritional status can be explained by the factors studied—namely, individual attributes, parental influence, and the school environment. According to common criteria in the social and behavioral sciences, such as those proposed by (Poorolajal et al., 2020), an R^2 value of around 0.43 is considered to have moderate explanatory power, confirming the model's validity and relevance. This finding was also consistent with similar research that found R^2 values around 0.40, which further strengthens the model's validity in explaining child nutrition from the perspective of their immediate environment (home and school). The model's moderate R^2 value points to a key limitation, namely that it is missing over half of the important variables that affect a child's nutrition.

A moderate R^2 value suggests our model is incomplete, as it fails to account for more than half of the key factors influencing a child's nutritional status. It meant that means important variables such as a family's financial situation, access to healthy food, and exposure to digital media were not included. From a practical standpoint, these results affirm the importance of nutritional interventions that not only target the child individually but also involve the family and strengthen the school's role as an effective support system

CONCLUSION

Based on the PLS-SEM analysis, many different factors affect a child's nutrition. Their overall health is a result of all these things working together. The most significant influence comes

from parents. A person's individual choices are the next biggest factor. Although school factors as a whole do not show a significant influence, the indicators within them, such as regulations and peer influence, have a big impact and can potentially affect a child's nutrition if implemented consistently. How parents act matters most, in which parents' understanding of nutrition and their support for healthy eating are beneficial. The most harmful thing for a child's diet is having a family that eats unhealthily. How frequently people eat fast food is the strongest predictor of their nutritional health. Eating fast food often is a major problem. It significantly increases the risk of a bad diet. The factors in our model can predict 43.6% of the differences in children's nutritional health. This finding shows that a lot of other factors we didn't study are also affecting a child's nutrition. Further investigation will examine family wealth, the ability to purchase nutritious food, and the impact of digital media. Therefore, nutritional interventions require a holistic, multi-level approach that not only targets children with education and physical activity but also actively involves parents in creating healthy eating habits at home and strengthens the school's role in enforcing rules and providing effective nutrition education.

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