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The Association Between Dietary Patterns and Nutritional Status of Primary School Children in Lowokwaru District, Malang City, Indonesia

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Abstract

Dietary patterns play a crucial role in determining the nutritional status of primary school children, particularly in developing countries undergoing rapid nutritional transitions. Indonesia continues to face a double burden of malnutrition, where undernutrition and overnutrition coexist among school-aged children. This study aims to examine the association between dietary patterns and the nutritional status of primary school children in Lowokwaru District, Malang City, Indonesia. A cross-sectional study was conducted involving 210 students aged 9–12 years selected using stratified random sampling from public primary schools. Dietary patterns were assessed using a semi-quantitative food frequency questionnaire, while nutritional status was determined based on BMI-for-age Z-scores following WHO standards. Data were analyzed using descriptive statistics and chi-square tests. The results showed a significant association between dietary patterns and nutritional status ($p < 0.05$). Children with balanced dietary patterns were more likely to have normal nutritional status, whereas unhealthy patterns characterized by high consumption of energy-dense, nutrient-poor foods were associated with overweight and obesity. These findings are consistent with previous studies conducted in various regions of Indonesia and other countries. In conclusion, dietary patterns significantly influence the nutritional status of primary school children. Nutrition education interventions targeting healthy eating habits are urgently needed to improve child health outcomes.

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Introduction

Dietary patterns during primary school age constitute a critical determinant of children's nutritional status, health trajectory, and human capital development. At this stage of life, children experience steady physical growth, cognitive maturation, and increased autonomy in food choices,

making them particularly vulnerable to unhealthy dietary exposures. Inadequate dietary patterns established during childhood tend to persist into adolescence and adulthood, increasing the risk of malnutrition, non-communicable diseases, and reduced academic performance. Numerous studies have demonstrated that both insufficient and excessive nutrient intake among school-aged children are closely associated with deviations in nutritional status, reflected in undernutrition, overweight, and obesity (Noviani et al., 2016; Syahla & Rasmita, 2024).

Globally, malnutrition among school-aged children has shifted from being predominantly characterized by undernutrition to a more complex phenomenon known as the double burden of malnutrition. This condition refers to the simultaneous presence of undernutrition and overnutrition within the same population, household, or even individual. Dietary transitions marked by increased consumption of ultra-processed foods, sugar-sweetened beverages, and energy-dense snacks, combined with declining intake of fruits, vegetables, and fiber-rich foods, have significantly altered children's nutritional profiles. International evidence indicates that unbalanced dietary patterns influenced by socioeconomic, behavioral, and environmental factors substantially affect children's nutritional outcomes (Villa et al., 2015).

Indonesia reflects this global trend, with school-aged children increasingly exposed to unhealthy food environments. National and regional studies consistently report that dietary patterns play a significant role in determining children's nutritional status. Research has shown that inadequate dietary diversity, excessive intake of sugar, salt, and fat, and irregular meal patterns are associated with both undernutrition and overnutrition among Indonesian children (Widodo et al., 2018; Istianah & Rolag, 2023). These patterns are further shaped by food availability, household economic conditions, parental education, and nutrition knowledge (Wirawan & Rahmawati, 2016).

Empirical evidence from various regions in Indonesia supports the strong association between dietary patterns and nutritional status among primary school children. Studies conducted in Gresik, Manyar, Nganjuk, Kendari, and Bantul have reported significant relationships between energy intake, macronutrient consumption, eating behaviors, and body mass index-for-age (Noviani et al., 2016; Nariswari et al., 2023; Sholikhah & Rahma, 2024; Effendy & Ruwiah, 2023). Children with balanced dietary patterns, characterized by adequate intake of energy, protein, fat, and carbohydrates, are more likely to maintain normal nutritional status. In contrast, unhealthy dietary patterns dominated by high-calorie snacks and low-nutrient foods are associated with overweight and obesity (Syahla & Rasmita, 2024).

Beyond dietary intake itself, nutrition-related knowledge and behaviors also contribute significantly to children's nutritional status. Several studies have emphasized the importance of nutrition education initiatives in shaping healthy dietary behaviors among school-aged children. Knowledge-based interventions, such as campaigns promoting balanced meals and healthy snacking, have demonstrated measurable associations with improved nutritional status (Masluhiya & Maemunah, 2024). However, the effectiveness of such interventions varies across regions, suggesting that local food environments and socio-cultural contexts play an important moderating role.

Malang City, particularly Lowokwaru District, represents an urban setting experiencing rapid demographic, economic, and lifestyle changes. The expansion of modern food outlets, increased availability of processed foods, and shifting family eating habits may substantially influence children's dietary patterns. Despite this, empirical research specifically examining the relationship between dietary patterns and nutritional status among primary school children in Lowokwaru District remains limited. Existing studies in East Java have largely focused on other districts, such as Gresik and Nganjuk, leaving a contextual gap in understanding the nutritional challenges faced by children in Malang City (Sholikhah & Rahma, 2024; Permatasari et al., 2023).

The absence of localized evidence presents a challenge for designing effective nutrition interventions and policies tailored to urban primary school populations. Without district-specific

data, nutrition programs risk being inadequately targeted or insufficiently responsive to local dietary behaviors and risk factors. Given the documented variability in dietary patterns and nutritional outcomes across regions, localized research is essential to inform evidence-based decision-making at the municipal and school levels.

Furthermore, previous studies have often examined dietary patterns in isolation or focused on specific components of diet, such as sugar, fat, or protein intake. While these approaches provide valuable insights, a more comprehensive assessment of overall dietary patterns offers a better understanding of children's habitual food consumption and its cumulative impact on nutritional status. Studies utilizing holistic dietary pattern approaches have demonstrated stronger associations with nutritional outcomes compared to single-nutrient analyses (Widodo et al., 2018; Pertiwi, 2014).

Considering these gaps, this study focuses on examining the association between dietary patterns and nutritional status among primary school children in Lowokwaru District, Malang City, Indonesia. By adopting a comprehensive dietary pattern approach and assessing nutritional status using standardized anthropometric indicators, this study seeks to generate robust empirical evidence relevant to urban school settings.

The findings of this study are expected to contribute to the existing body of literature by providing context-specific evidence from Malang City, thereby strengthening the understanding of dietary determinants of nutritional status among Indonesian school-aged children. In practical terms, the results may inform school-based nutrition education programs, parental guidance initiatives, and local health policies aimed at promoting balanced dietary patterns and preventing malnutrition.

In summary, dietary patterns represent a modifiable determinant of nutritional status among primary school children. Understanding how these patterns are associated with nutritional outcomes at the local level is essential for developing effective, targeted interventions. This study addresses an important research gap by investigating the association between dietary patterns and nutritional status in Lowokwaru District, Malang City, thereby supporting evidence-based strategies to improve child nutrition and health outcomes.

Materials and Methods

Study Design and Setting

This study employed a cross-sectional design to examine the association between dietary patterns and the nutritional status of primary school children. The cross-sectional approach was considered appropriate to assess exposure and outcome simultaneously within a defined population and timeframe. The study was conducted in Lowokwaru District, Malang City, Indonesia, an urban area characterized by diverse socioeconomic backgrounds and a rapidly changing food environment. Data collection was carried out from January to March 2025.

Study Population and Sampling

The study population consisted of all public primary school students aged 9–12 years enrolled in elementary schools in Lowokwaru District. This age range represents the later stage of primary school, during which children begin to develop greater autonomy in food choices while still being influenced by family and school environments.

A total of 210 students were selected using stratified random sampling to ensure proportional representation from different public primary schools in the study area. Schools served as strata, and respondents were randomly selected within each stratum. The sample size was considered adequate for categorical data analysis using the chi-square test.

Inclusion criteria were students aged 9–12 years who were present during data collection and whose parents or guardians provided written informed consent. Students with chronic illnesses or health conditions that could affect nutritional status were excluded from the study.

Study Variables

The independent variable in this study was dietary patterns, while the dependent variable was nutritional status. Dietary patterns were defined as habitual consumption of various food groups over a specified period. Nutritional status was assessed using the body mass index-for-age (BMI-for-age) indicator.

Data Collection Procedures

Dietary patterns were assessed using a semi-quantitative food frequency questionnaire (FFQ) adapted from previously validated instruments and relevant to the Indonesian primary school context (Widodo et al., 2018). The FFQ captured the frequency of consumption of major food groups, including staple foods, animal and plant protein sources, vegetables, fruits, and foods high in sugar, salt, and fat. Based on FFQ assessment, dietary patterns were categorized into balanced and unbalanced patterns.

Anthropometric measurements were conducted to determine nutritional status. Body weight was measured using a digital scale with 0.1 kg precision, and height was measured using a microtoise with 0.1 cm precision. All measurements were performed by trained enumerators following standardized procedures to minimize measurement error. Body mass index (BMI) was calculated and converted into BMI-for-age Z-scores using World Health Organization (WHO) growth standards. Nutritional status was then classified into under-nourished, normal, and overweight or obese categories.

Data Analysis

Collected data were checked for completeness and consistency before analysis. Descriptive statistical analysis was used to summarize respondents' characteristics, dietary patterns, and nutritional status. The results are presented as frequencies and percentages.

The association between dietary patterns and nutritional status was analyzed using the chi-square test, with a significance level set at $p < 0.05$. This test was selected because both variables were categorical and the objective was to identify statistically significant associations.

Ethical Considerations

The study was conducted in accordance with ethical principles for health research. Permission to conduct the study was obtained from the relevant school authorities. Written informed consent was secured from parents or guardians prior to data collection. Confidentiality of respondents' data was strictly maintained, and all information was used solely for research purposes.

Results and Discussion

Nutritional Status of Respondents

A total of 210 primary school children participated in this study. Nutritional status assessment based on the body mass index-for-age (BMI-for-age) indicator revealed that the majority of respondents had a normal nutritional status. However, a considerable proportion of children still experienced nutritional problems, including undernutrition and overnutrition.

Table 1. Distribution of Nutritional Status of Primary School Children in Lowokwaru District

Nutritional Status	Number (n)	Percentage (%)
Under-nourished	35	16.6
Normal	131	62.4
Overweight and obesity	44	21.0
Total	**210**	**100.0**

As shown in Table 1, 62.4% of children were classified as having normal nutritional status. Meanwhile, 21.0% were categorized as overweight or obese, and 16.6% were undernourished. These findings indicate the presence of a double burden of malnutrition among primary school children in an urban setting, where undernutrition and overnutrition coexist. Similar patterns have been reported in previous studies conducted in various regions of Indonesia (Noviani et al., 2016; Widodo et al., 2018).

Although most children achieved normal nutritional status, the relatively high proportion of overweight and obese children highlights an emerging public health concern. Nutritional problems during school age may adversely affect physical growth, metabolic health, and academic performance if not addressed appropriately.

Dietary Patterns of Primary School Children

Dietary patterns were assessed using a semi-quantitative food frequency questionnaire and subsequently classified into balanced dietary patterns and unbalanced dietary patterns. Children with balanced dietary patterns consumed staple foods, protein sources, vegetables, and fruits more regularly. In contrast, unbalanced dietary patterns were characterized by frequent consumption of energy-dense and nutrient-poor foods, such as sugary snacks, fried foods, fast food, and sugar-sweetened beverages, accompanied by low intake of fruits and vegetables.

Association Between Dietary Patterns and Nutritional Status

Bivariate analysis using the chi-square test demonstrated a statistically significant association between dietary patterns and nutritional status ($p < 0.05$). Children who adhered to balanced dietary patterns were predominantly found in the normal nutritional status category. Conversely, children with unbalanced dietary patterns were more frequently classified as overweight or obese.

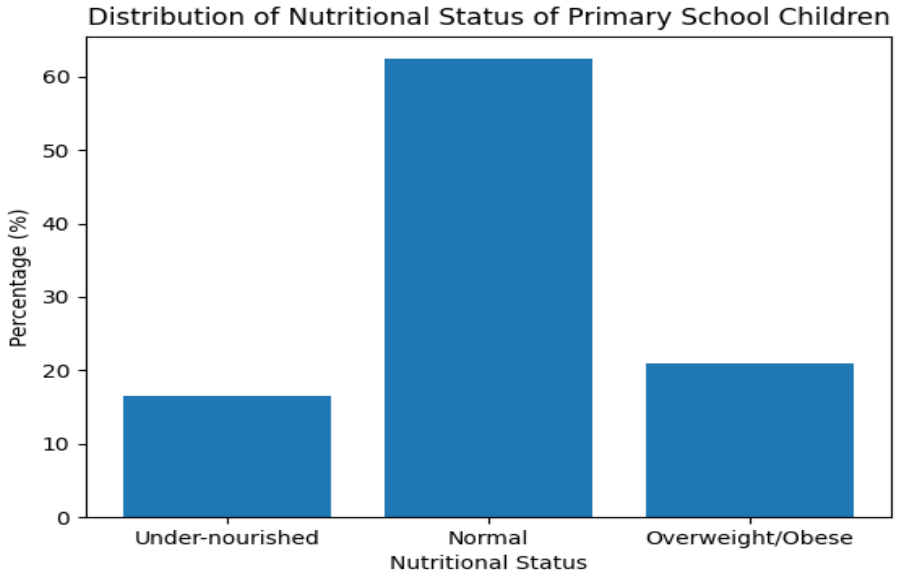
This finding is consistent with studies conducted in Manyar and Gresik Districts, which reported significant relationships between dietary consumption patterns, energy intake, and nutritional status among primary school children (Nariswari et al., 2023; Sholikhah & Rahma, 2024). Excessive intake of foods high in sugar, fat, and salt has been widely associated with increased risk of overweight and obesity in children (Syahla & Rasmita, 2024).

On the other hand, balanced dietary patterns contribute to better nutritional outcomes. Adequate intake of macronutrients and dietary diversity plays an essential role in maintaining normal nutritional status. This result supports previous findings by Permatasari et al. (2023) and Widodo et al. (2018), which emphasized the importance of balanced food consumption and dietary diversity for optimal child growth.

Distribution of Nutritional Status

To provide a clearer empirical illustration, the distribution of nutritional status is presented in the following bar chart.

Figure 1. Distribution of Nutritional Status of Primary School Children in Lowokwaru District



The figure illustrates that children with normal nutritional status constitute the largest proportion of the sample. Nevertheless, the proportion of overweight and obese children is higher than that of undernourished children. This pattern reflects a nutritional transition occurring in urban areas, where overnutrition increasingly emerges alongside persistent undernutrition.

Implications of the Findings

From a conceptual perspective, these results confirm that dietary patterns are a key determinant of nutritional status among primary school children. An unsupportive food environment at school and at home may encourage unhealthy eating behaviors, leading to nutritional imbalance. Therefore, school-based nutrition education programs, regulation of unhealthy snacks, and increased involvement of parents in promoting healthy eating practices are crucial strategies to improve children's nutritional status.

Conclusion

This study demonstrates a significant association between dietary patterns and the nutritional status of primary school children in Lowokwaru District, Malang City. Children who adhered to balanced dietary patterns were more likely to have normal nutritional status, whereas unbalanced dietary patterns were associated with an increased risk of both undernutrition and overnutrition. These findings indicate that dietary behavior plays a critical role in shaping nutritional outcomes during primary school age.

The results reflect the coexistence of undernutrition and overnutrition among school-aged children in an urban setting, highlighting the presence of a double burden of malnutrition. Although the majority of children exhibited normal nutritional status, the proportion of overweight and obese children remains a concern and underscores the need for early preventive efforts. Unhealthy food choices characterized by frequent consumption of energy-dense and nutrient-poor foods may contribute to this condition.

From a practical perspective, the findings emphasize the importance of promoting balanced dietary patterns through school-based nutrition education programs and parental involvement. Creating supportive food environments at both school and household levels is essential to encourage

healthier eating behaviors among children. Such interventions may help reduce nutritional disparities and improve overall child health.

In conclusion, dietary patterns constitute a modifiable determinant of nutritional status among primary school children. Strengthening nutrition education and fostering healthy eating practices are essential strategies to address nutritional problems and support optimal growth and development during school age.

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