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Implementation of Balanced Nutrition Guidelines and Their Association with Children's Nutritional Status in Private and Public Elementary Schools of Pekalongan Regency

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ABSTRACT

Introduction: Double malnutrition has become a major nutritional concern among elementary school children, potentially impairing growth, development, and academic performance. This study aims to analyze the implementation of balanced nutrition and nutritional status in school-age children.

Methods: A cross-sectional design was applied from November – December 2024 at SDIT Plus Mutiara Umat (private school) and SDN 1 Wiroditan (public school), Pekalongan Regency, Central Java, Indonesia. A total of 140 students (70 from each school) were selected through simple random sampling. Data collection included self-administered questionnaires, 24-hour food recall, Individual Dietary Diversity Score (IDDS), and anthropometric measurements. Statistical analyses were performed using the independent t-test for normally distributed data and the Mann–Whitney test for non-normal distributions.

Results: Most parents in private school have completed college education (71.6%) while in public school only completed high school education (48.6%). Most subjects in private school had lower pocket money than in public schoolObesity prevalence was higher in private schools (15.7%), while underweight was more frequent in public schools (8.6%). Most respondents exhibited moderate nutritional knowledge (private: 68.6%; public: 77.1%) and negative nutritional attitudes (private: 88.6%; public: 94.3%). Moderate dietary diversity was observed in both groups. Public school students showed significantly higher energy, fat, and carbohydrate intakes ($p < 0.05$). Significant differences were also found in pocket money, maternal education, nutritional status, and attitude ($p < 0.05$).

Conclusion: This study contributes provides information to the community regarding balanced nutrition and the nutritional status of school-aged children. The findings of this research can serve as a reference for schools in promoting the implementation of balanced nutrition and for government may be used as a source of literature in development of programs aimed at achieving normal nutritional status among children.

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INTRODUCTION

Elementary school children, aged 6–12 years, are in second critical growth phase, requiring adequate and balanced nutrition to support optimal development (1). However, nutritional problems among this age group remain high in Indonesia, particularly the double burden of malnutrition, which includes both underweight and overweight. In Indonesia, the prevalence of nutritional problems among children aged 5–12 years includes 3.5% classified as severely thin, 7.5% thin, 11.9% overweight, and 7.8% obese (2).

Nutritional problems can affect physical growth, cognitive development, immune function, and academic performance, ultimately affecting future human resource quality (3). Children have poor eating habits such as they prefer high intake of fat, sugar, and salt and low consumption of fiber raise the risk of non-communicable diseases such as obesity, hypertension, diabetes, and heart disease (4). Nutritional status is directly influenced by dietary intake and illness, and indirectly by food security, parenting, hygiene and healthcare (5).

Children at this age start to make their own food choices. Their preferences often based on appeal rather than nutritional value, and tend to consume unhealthy snacks available around schools (6). These snacks may lack hygiene and contribute to health issues (7). Additionally, children's low intake of fruits and vegetables far below the recommended 300–400g/day is a concern, with averages as low as 108.8g/day (8).

School environmental plays a crucial role in shaping balanced nutrition practices among elementary school children. Influencing factors are different in food availability and accessibility between public and private schools, which is largely determined by institutional policies, the presence of catering services, and the quality of supporting facilities. Study in Samarinda City, Indonesia, showed that in private schools often with full-day programs, offer catering and better hygiene facilities, while public schools have fewer restrictions and more limited infrastructure due to government funding (9).

Considering these issues, a comparative analysis of implementation of balanced nutrition and nutritional status between private and public school in Pekalongan Regency is needed. The two schools were selected purposively to enable a focused yet comparative analysis of balanced nutrition guidelines implementation across different institutional and socioeconomic contexts in Pekalongan Regency. The schools were chosen based on their similarity in school context and geographic proximity to control for environmental variation, thereby strengthening internal validity. This purposive selection allows examination of how management systems and resource availability may influence children's nutritional outcomes. While the limited number of schools may constrain external validity, the inclusion of both public and private institutions enhances representativeness across key educational categories. This study focuses on exploring the implementation of balanced nutrition and describes how balanced nutrition may influence children's nutritional status.

METHOD

Research Type

A cross-sectional comparative design was employed. Sampling was involving 140 children aged 6-12 years in Pekalongan Regency. Data were collected from November to December 2024 and analyzed statically.

Population and Sample/Informants

Subjects were selected using simple random sampling through the "RAND" function in Microsoft Excel. Each eligible student was assigned a unique ID, random numbers were generated, and samples were chosen based on sorted random values to ensure equal selection probability. The minimum required sample size was calculated using the Lemeshow *et al.* (1997) formula, resulting in 63 subjects for each group. Additional 10% was added to account for potential drop-outs, resulting total minimum sample was 69 subjects for each school. Inclusion criteria included being a student aged 6–12 years, enrolled in grade 4 or 5, in good health, able to read and write, willing to participate in this research.

Research Location

This research was conducted in SDIT Plus Mutiara Umat (private school) and SDN 1 Wiroditan (public school) in Pekalongan Regency, Central Java, Indonesia.

Instrumentation or Tools

Data collection instruments consisted of questionnaires for knowledge, attitudes, and demographic information, food recall 1x24 hour, individual dietary diversity scores (IDDS), and anthropometric measurements. Nutritional knowledge and attitude were assessed using questionnaire by Khomsan (2018), with a Cronbach's alpha coefficient 0.614. The reability score of questionnaires for nutrition knowledge variable would be considered sufficient if the Cronbach's Alpha score showed the range between 0.6 to 0.7 (10).

Data Collection Procedures

Data collection was conducted from November to December 2024 in two elementary schools in private and public schools in Pekalongan Regency. Subjects were given a informed consent and instruction on how to complete the questionnaire

Data Analysis

Univariate analysis was conducted to describe the frequency distribution, means, and standard deviations of key variables. Normality was tested using the Kolmogorov-Smirnov test. Bivariate analysis was used to identify differences between public and private school students. The independent t-test was used for normally distributed data, while the Mann-Whitney test was used for non-normally distributed variables. Statistical significance was determined at $\alpha = 0.05$, following standard practice in health and nutrition research (11).

Ethical Approval

This study was approved by the Human Research Ethics Committee of University of Muhammadiyah Surakarta (Approval Number: 642/KEPK-FIK/2XI/2024). All participants, including parents or guardians for participants under 18, provided informed consent before participating in the study. Confidentiality of all participants was strictly maintained throughout the research process.

RESULTS

The household characteristics examined in this study was mother's education. Mother's education influences the mother's ability to access, understand, and apply nutritional information to support healthy feeding practices.

Table 1. Distribution of subjects based on mother's education

Category	Private school		Public school		*p-value*
	n	%	n	%	
Mother's education					
No schooling	2	2.9	3	4.3	
Elementary/equivalent	3	4.3	18	25.7	
Junior High/equivalent	1	1.4	8	11.4	
Senior High/equivalent	14	20.0	34	48.6	
University	50	71.5	7	10.0	
Mean ± SD	7.1 ± 1.3		5.4 ± 1.2		
Median (25;75 percentile)	8(6;8)		6(4;6)		0.000

Note: p-value based on Mann Whitney Test. Significant if $p < 0.05$

As shown in Table 1, the educational background of mothers differed notably between private and public elementary school. Most mothers in private school (71.5%) had completed university education, followed by 20.0% who had completed high school. In contrast, nearly half of mothers in public school (48.6%) had only completed high school and only 10.0% had completed university education. This indicated that mothers of children in private school generally had a higher level of education compared to those in public school. Statistical test indicated significant difference in mother's education between private and public elementary school ($p < 0.05$). Higher maternal education is often linked to better nutritional knowledge which may positively impact to children's dietary patterns and nutritional status.

Pocket money plays an important role in shaping children's eating habits, particularly during school hours when they have the autonomy to make their own food choices. Most subjects in private school (31.4%) had pocket money ranging from IDR5,000 - IDR10,000. While, in public school subjects (41.4%) had pocket money ranging from IDR10,000 - IDR15,000. This indicated that in private school subjects had lower pocket money than in public school. Statistical tests found significant differences pocket money between children in private and public schools ($p < 0.05$).

Table 2. Distribution of subject based on pocket money

Category	Private school		Public school		*p-value*
	n	%	n	%	
≤ IDR5,000	18	25.7	3	4.3	
IDR5,000 – IDR10,000	22	31.4	27	38.6	
IDR10,000 – IDR15,000	16	22.9	29	41.4	
IDR15,000 – IDR20,000	10	14.3	11	15.7	
> IDR 20,000	4	5.7	0	0.0	
Mean ± SD	8,557 ± 8,503		9,342 ± 3,866		
Median (25;75 percentile)	5,000 (3,750;10,000)		10,000 (7,000;10,000)		0.011

Note: p-value based on Mann-Whitney Test. Significant if $p<0.05$. * 1 USD = IDR16,345

Nutritional status is a body's condition as determined by dietary intake and how the body utilize nutrients (12). Assessing and understanding the nutritional status of school-aged children can help identify potential nutritional problems early and guide appropriate interventions to support optimal health and development.

Table 3. Distribution of subjects based on nutritional status (BMI for age)

Category	Private school		Public school		*p-value*
	n	%	n	%	
Severely underweight (< -3 SD)	0	0.0	0	0.0	
Underweight (-3 SD to -2 SD)	2	2.9	6	8.6	
Normal (-2 SD to +1 SD)	51	72.9	55	78.6	
Overweight (+1 SD to +2 SD)	6	8.6	6	8.6	
Obesity (> +2 SD)	11	15.7	3	4.3	
Mean ± SD	0.17 ± 1.56		- 0.50 ± 1.27		
Median (25;75 percentile)	-0.25(-1.00;0.95)		-0.70(-1.50; -0.70)		0.016

Note: p-value based on Mann Whitney test. Significant if $p < 0.05$

Based on result of this study (Table 3), it was observed obesity cases were more common in private school (15.7%), while underweight cases were more dominant in public school (8.6%). Statistical analysis indicated significant difference of children's nutritional status between private and public schools ($p < 0.05$).

Most subjects in both private (68.6%) and public (77.1%) schools had moderate level of nutritional knowledge. For nutritional attitude indicator, this study obtained that most subjects in both private (88.6%) and public (94.3%) schools had negative attitude of balanced nutrition. Statistical test showed there was no significant difference on nutritional knowledge between subjects in private and public school ($p > 0.05$). However, there was significant difference in nutritional attitude ($p < 0.05$).

Table 4. Distribution of subjects based on knowledge and attitude of balanced nutrition

Knowledge and attitude of balanced nutrition	Private school		Public school		*p-value*
	n	%	n	%	
Knowledge					
Low (< 60)	4	5.7	2	2.9	
Moderate (60 – 80)	48	68.6	54	77.1	
High (> 80)	18	25.7	14	20.0	

Knowledge and attitude of balanced nutrition	Private school		Public school		*p-value*
	n	%	n	%	
Mean ± SD	76.4 ± 11.0		74.8 ± 9.3		
Median (25;75 percentile)	80(70;85)		75(70;80)		0.131
Attitude					
Positive	8	11.4	4	5.7	
Negative	62	88.6	66	94.3	
Mean ± SD	59.8 ± 14.7		67.7 ± 10.4		
Median (25;75 percentile)	60 (53;67)		67(60;73)		0.000

Note: p-value based on Mann Whitney test. Significant if $p < 0.05$

Knowledge and attitudes toward balanced nutrition guidelines were assessed using a structured questionnaire. The questionnaire was designed to evaluate subject understanding of key concepts related to ten messages of balanced nutrition guidelines included be grateful and enjoy a variety of foods, consume plenty of vegetables and sufficient fruits, regularly consume protein-rich side dishes, diversify staple food intake, limit consumption of sweet, salty, and fatty foods, a habitual breakfast, drink enough and safe water, reading food labels, wash hands with soap and clean running water, regular physical activity to maintain a normal body weight (13). In addition, it measured attitudes by exploring participants' beliefs, motivations, and perceptions regarding healthy eating habits.

Children's energy intake in public school (2.151 kcal) was higher than in private school (1.846 kcal). Adequacy levels of energy, protein, fat, and carbohydrates in both groups were considered sufficient. Adequacy levels are categorized as severely deficient (<70%), mild deficient (70%–80%), moderate deficit (80%–90%), adequate (90%–119%), excessive (>120%) (14). Statistical analysis indicated significant difference in energy, fat, and carbohydrate intakes between children in private and public schools ($p < 0.05$), but there was no significant difference in protein intake ($p > 0.05$).

Table 5 Distribution of subjects based on food intake and adequacy level

Food intake and adequacy level	Private school	Public school	*p-value*
Energy			
Food intake ± SD (kcal)	1846 ± 406	2151 ± 596	0.000
Adequacy level ± SD (%)	98.3 ± 23.6	114.8 ± 31.5	
Protein			
Food intake ± SD (g)	49.5 ± 11.4	52.3 ± 17.5	0.365
Adequacy level ± SD (%)	101.2 ± 27.4	105.8 ± 38.3	
Fat			
Food intake ± SD (g)	56.0 ± 20.9	63.4 ± 33.8	0.003
Adequacy level ± SD (%)	90.1 ± 37.7	101.7 ± 57.2	
Carbohydrate			
Food intake ± SD (g)	268.2 ± 66.4	332.6 ± 106.7	0.000
Adequacy level ± SD (%)	98.6 ± 27.8	112.5 ± 39.4	

Note: p-value based on independent t-test for energy and carbohydrate intake, Mann Whitney test for protein and fat intake. Significant if $p < 0.05$

Consuming a diverse food is necessary to fulfill nutritional needs and supporting optimal growth and development among children (15). Most subjects in both private (56%) and public (60%) schools had moderate level of food diversity. Statistical analysis found no significant difference of food diversity between children in private and public school ($p > 0.05$).

Table 6. Distribution based on food diversity

Category	Private school		Public school		*p-value*
	n	%	n	%	
Low (≤ 3)	21	30	25	36	
Moderate (4 - 5)	39	56	42	60	
High (≥ 6)	10	14	3	4	
Mean ± SD	4,10 ± 1,21		3,93 ± 1,07		
Median (25,75 percentile)	4 (3;5)		4 (3;5)		0.481

Note: p-value based on Mann Whitney test. Significant if $p < 0.05$

DISCUSSION

Interpretation of Key Findings

Mother's education can influence knowledge and understanding of nutritional information. Mother with higher level of education tend to have better nutritional knowledge. Good knowledge supports mother's ability to access, understand, and apply information related to nutrition (16). Mother with higher education level is more aware of the importance of a balanced nutrition diet, as well as the impact of both nutrient deficiencies and excesses on children's growth and development (17). They are also more critical in choosing food, tend to limit low-nutrient food and more frequently provide healthy homemade meals (18).

The amount of pocket money influences children's purchasing power. The higher amount of pocket money can lead to increase purchasing ability, which can encourage a frequent consumption of snacks and beverages that are visually attractive but low in nutritional value (19). In this study, based on interview with private school's headmaster there was school policies that prohibit student to bringing money at school. However, some students still bring a small amount of pocket money. Consequently, pocket money of children in private school was lower than in public school. This is in line with previous study, which found no significant relationship between parental income and the amount of pocket money given (9). The amount of pocket money doesn't always reflect parental income. A high amount of pocket money may also result from parents' lack of nutritional knowledge and habit of skipping breakfast, leading them to give children more money to replace breakfast, even under economic constraints.

Obesity occurs when energy intake exceeds energy expenditure, often due to high consumption of calorie-dense foods and lack of physical activity (20). This study found that children in private school, generally from high or moderate economic status families, are more likely to experience obesity than children in public school. Parental occupation reflects family economic status, with private school parents typically earning more (21). This is in line with previous study, which found significant relationship between parental income and nutritional status of children (22,23). This may be due to students in private schools have more access to high calorie foods, limited parental supervision due to work commitments, and reliance on fast food (24). Previous study has found that children from higher socioeconomic background tend to consume more high calorie foods and sugar-sweetened beverages, contributing to higher calorie intake and body weight (25). In contrast, underweight remains more prevalent among students in public schools, likely reflecting limited food availability and lower dietary diversity linked to economic constraints (26). Additionally, higher socioeconomic status is associated with sedentary behavior, as families can provide devices and conveniences that reduce physical activity (27).

Underweight was more found among children in public school compared to private school. Parents in public school generally have lower income than those in private school. Parental income influences a family's ability to purchase food that meets the nutritional needs of its members (28). Low economic status families often face inadequate food availability, resulting in insufficient dietary intake to meet the nutritional requirements of each family member (29).

Nutritional knowledge refers to individual understanding of food and composition, food safety, and proper methods of food preparation. Adequate nutritional knowledge contributes to the development of positive attitudes toward nutrition (30). Most subjects in both of group had a moderate level of knowledge. This is in line with the previous study, which founded that most elementary school students had a moderate level of nutritional knowledge (54.2%) (31). A positive attitude toward balanced nutrition encourages healthy practices, such as selecting safe and nutritious foods to support optimal growth and development in children. However, in this study, most subjects in both

groups had negative nutritional attitudes. This is in line with previous study, which stated that the most of elementary school children (77%) had negative attitudes toward nutrition (32). These attitudes are mostly caused by a lack of understanding about balanced nutrition, making it difficult for children to choose the right foods for their nutritional needs (33). According to the social ecological model (SEM) emphasizes that nutrition behaviors are shaped not only by individual influence but also by interpersonal, community, organization, and policy influences (34). Elementary school-aged children are typically in the concrete operational phase of cognitive development, which they are not yet fully capable of relating abstract concepts such as the long-term impact of present food decisions (35). Furthermore, based on Bandura's social cognitive theory (SCT), children's attitudes and behaviors are also influenced by observational learning and environmental factors (36).

This study found intakes of carbohydrates, animal protein, and plant-based protein met the recommended portions based on 'My Plate' guidelines of Indonesia balanced nutrition guidelines. However, vegetable and fruit consumption remained below the recommended levels. The recommendation intake of fruits and vegetables is 400 g per day, consisting of 250 g of vegetables and 150 g of fruits (12). Low vegetable intake is attributed to elementary school children's preference for sweet and savory flavors, and their general dislike for the bitter taste commonly associated with vegetables, which leads to low acceptance and intake (37). Inadequate fruit consumption among children is often due to a lack of parental introduction to affordable and locally available fruits (38). Therefore, nutrition education is essential to raise children's awareness of the importance of fruit and vegetable consumption in meeting nutrient requirements and preventing disease.

Based on a food recall 1x24 hour, children in public school consumed more snacks and packaged beverages compared to those in private school. This difference is caused by private school policies that prohibit food seller on school area and provide a catering system offering nutritious meals and snacks. In contrast, the food environment surrounding public schools is often less regulated, with easy access to low-nutrient, energy-dense foods such as fried snacks, sweetened drinks, and processed products. School canteen regulation and healthy food policies play a crucial role in shaping children's dietary behaviors. Schools with established nutrition policies and controlled food environments tend to provide healthier options and promote better eating habits (39). This is in line with previous study, which stated that 72.5% of elementary students frequently consume junk food that often contain high amount of salt, sugar, and fat (40). High consumption of packaged beverages, a major source of simple carbohydrates from sugar (41). It causes higher intake of energy in public school.

Diverse food consumption reflects to high dietary quality, as it provides essential nutrients which required by the body to meet daily nutritional needs and prevent nutrition related health issues (42). In contrast, limited dietary diversity indicates poor food quality, which may lead to nutrient deficiencies and negatively affect children's growth and development (43). The body requires a variety of nutrients that work synergistically in metabolic processes and no single food can fulfill all nutrient requirements, thereby necessitating a varied diet (44). Therefore, promoting diverse food intake in accordance with the Balanced Nutrition Guidelines is essential to support optimal growth in children.

Comparison with Previous Studies

The findings of this study are consistent with those of Rahayu and Anggraini (2018), which found that no significant relationship between parental income and the amount of pocket money given (9). This finding also in line with previous study by Yasirah *et al.* (2024), which found significant relationship between parental income and nutritional status of children (22). In addition, this study is in line with the previous study, which founded that most elementary school students had a moderate level of nutritional knowledge (54.2%). Another study also revealed this study is in line with previous study, which stated that the most of elementary school children (77%) had negative attitudes toward nutrition (28). Furthermore, a previous study found that 72.5% of elementary students frequently consume junk food that often contain high amount of salt, sugar, and fat (34). These differences highlight the complexity of factors influencing children's nutrition and emphasize the need for further research to reconcile conflicting evidence.

Limitations and Cautions

This study has several limitations. First, the food recall 1x24 hours (weekday) method, which may not adequately represent the children's eating habits. The use of recall 1x24 hours can cause recall bias and intra individual variation. Recall bias arises when respondents inaccurately recall or report their food consumption due to memory limitations or social desirability tendencies, potentially resulting in under- or overestimation of energy and nutrient intake (45). Moreover, dietary patterns may fluctuate between weekdays and weekends, as well as across different days, due to variations in school schedules, family eating habits, and social activities (46). Therefore, a single-day recall may not fully represent habitual dietary intake, potentially limiting the precision of nutrient estimates. To enhance accuracy, multiple non-consecutive recalls covering both weekdays and weekends are generally recommended in dietary assessment studies. Second, the pocket money variable was influenced by external factors (private school policies), so it may not accurately represent the family's economic status and well-being. Third, the cross-sectional research design only identifies correlations and cannot demonstrate causal relationships. Fourth, the limited references regarding differences in the implementation of balanced nutrition between private and public elementary school students posed challenges in analyzing the study results. Fifth, variables such as parental income, physical activity, as well as mothers' nutrition-related knowledge, attitudes, and practices were not examined, even though they may be factors influencing children's nutritional status.

Recommendations for Future Research

Future studies should focus on addressing the identified limitations. Future researchers are advised to use the weekday 2×24-hour food recall method to better capture children's dietary patterns. In addition, study on fat, sugar, and salt consumption among school children is necessary to prevent non communicable disease in the future. Moreover, future studies should include additional variables such as parental income, children's physical activity, and mothers' nutrition-related knowledge, attitudes, and practices, as these may significantly influence the nutritional outcomes of school-aged children.

CONCLUSION

This study aimed to analyzed the implementation of balanced nutrition and children's nutritional status in private and public schools. The findings revealed that mother with higher education tend to have better nutritional knowledge and provide healthier food. Students in private school are more vulnerable to obesity due to have more access to high calorie foods, while underweight is more common among public school due to low food availibity. Although average food intake meets dietary recommendations, but fruit and vegetable consumption remain inadequate. Poor nutritional attitudes and frequent consumption of snacks high in sugar, salt, and fat reflect a lack of understanding of balanced nutrition. Notably, this study highlights context-specific findings regarding differences in the application of balanced nutrition between public and private elementary schools. These results underscore the importance of considering school-related factors such as policies, food environment, and economic background in shaping children's nutritional status. These findings emphasize the need for sensitive interventions that integrate nutrition education into school curriculum, strengthen healthy canteen regulations, and restrict the availability of high-calorie snacks and beverages around schools. Translationally, enhancing school meal programs offers a strategic opportunity to promote healthy eating behaviors, reduce disparities in child nutrition, and contribute to broader community health promotion.

While this study provides valuable insights into the implementation of balanced nutrition guidelines in elementary school children, certain limitations should be noted, such as food recal 1x24 hour and cross-sectional study. Future research should focus on using food recall 2x24 hour methods and longitudinal approaches to better capture children's eating habits and establish causal relationships. Such efforts would potentially enhance our understanding of the differences in nutritional status between public and private elementary school students and inform school-based nutrition policies, targeted interventions, and broader theoretical frameworks in child nutrition.

AUTHOR'S CONTRIBUTION STATEMENT

Mikhael Andya was responsible for conceptualization, methodology, data collection, data curation, formal analysis, and writing original draft preparation. While Ali Khomsan was responsible for supervision, validation,

writing review and editing, and project administration. Both authors contributed to the interpretation of the results, critically revised the manuscript for important intellectual content, approved the final version, and agreed to be accountable for all aspects of the work in accordance with ICMJE authorship criteria.

CONFLICTS OF INTEREST

The authors declare no conflict of interest in this research.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors declare that ChatGPT was employed exclusively for linguistic refinement, with no influence on data analysis or interpretation.

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