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The Role of Nutrition in Supporting Physical and Motor Development in Early Childhood

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Abstract

Early childhood (ages 0–6) represents a critical period for multidimensional development that significantly influences long-term quality of life. This study aims to examine the role of nutritional intake in supporting physical and motor development in early childhood, particularly fine and gross motor skills. A mixed-methods approach was employed, integrating both quantitative and qualitative data. The participants consisted of 30 children aged 3–5 years from Al-Ikhsan Islamic Kindergarten and Playgroup in Sidoarjo, Indonesia. The findings revealed that a balanced nutritional intake—especially diets rich in vegetables, fruits, and proteins—had a significant positive correlation with the children's physical and motor development. These results highlight the critical role of appropriate nutritional interventions during early life stages as a foundation for optimal motor development. The study implies the necessity of strengthening nutrition education for parents and early childhood education institutions as part of a holistic strategy to support children's growth and development.

Keywords: *Child Nutrition, Physical-Motor Development, Early Childhood Education.*

Abstrak

Masa kanak-kanak awal (0–6 tahun) merupakan periode kritis bagi pertumbuhan dan perkembangan multidimensional yang menentukan kualitas hidup anak di masa depan. Penelitian ini bertujuan untuk menganalisis peran asupan nutrisi terhadap perkembangan fisik dan motorik anak usia dini, khususnya motorik halus dan kasar. Pendekatan mixed methods digunakan dalam studi ini, yang mengombinasikan data kuantitatif dan kualitatif. Sebanyak 30 anak berusia 3–5 tahun dari Taman Kanak-Kanak dan Kelompok Bermain Islam Al-Ikhsan, Sidoarjo, dilibatkan sebagai partisipan. Hasil penelitian menunjukkan bahwa konsumsi nutrisi yang seimbang, khususnya yang kaya akan sayuran, buah, dan protein, memiliki hubungan yang signifikan terhadap perkembangan fisik dan motorik anak. Temuan ini menegaskan pentingnya intervensi gizi yang tepat pada masa awal kehidupan sebagai fondasi perkembangan motorik yang optimal. Implikasi dari studi ini mendukung penguatan edukasi gizi bagi orang tua dan lembaga PAUD sebagai bagian dari strategi peningkatan kualitas tumbuh kembang anak secara holistik.

Kata Kunci: Nutrisi Anak, Perkembangan Fisik-Motorik, Pendidikan Anak Usia Dini.

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INTRODUCTION

Early childhood is children aged 0-6 years. In this period, children experience very rapid growth and development in physical, cognitive, social-emotional, language and motoric aspects (Aisy et al., 2024; Maromi & Hasibuan, 2024; Yuningsih et al., 2024). This age is often considered a golden period of development, because during this period children's brains develop rapidly and the learning that children receive has a great influence on their future development (Innes et al., 2023; Newcomb et al., 2017). According to the Ministry of Education and Culture of the Republic of Indonesia, "Early childhood is a child in the age range of 0-6 years, which is the golden age of development where children experience very rapid and fundamental development in various aspects of development" (Kemendikbudristek, 2022).

In educational literature, early childhood is often divided into several stages of development, namely: Infancy (0-1 year), Toddler period (1-3 years), Preschool period (3-6 years). During this period, children really need the right stimulation so that their potential can develop optimally (Yuningsih et al., 2022). Early Childhood Education (PAUD) is a program designed to provide appropriate stimulation through various play while learning activities (Muharrahman et al., 2023; Priyanti & Warmansyah, 2021). Early childhood physical motor development refers to changes and improvements in children's ability to control and coordinate their body movements. This development includes two main aspects: gross motor skills and fine motor skills (Meilati et al., 2021). Gross motor skills are abilities that involve large muscles and activities such as walking, running, jumping and kicking. Fine motor skills involve small muscles and activities that require hand-eye coordination, such as grasping, writing, cutting with scissors, and stacking blocks (Harsismanto et al., 2021). The process of physical motor development is greatly influenced by genetic, environmental, nutritional factors and the child's interaction with his environment.

The importance of physical motor development in early childhood is very great because it is the basis for the development of other abilities, including cognitive, social and emotional (Chotimah et al., 2021; Pradipta & Dewantoro, 2019). Early childhood physical and motor development is a crucial aspect that determines children's quality of life in their future growth and development (Chotimah et al., 2021). Various studies show that the initial phase of a child's life is the golden period or commonly referred to as the golden age (Chairilsyah & Kurnia, 2019; Pradipta & Dewantoro, 2019; Widianti & Narotama, 2024; Yeni et al., 2021). During this period, physical and motor development is expected to develop optimally (Sandi & Setyorini, 2018). However, many children in Indonesia still face deficiencies and challenges in terms of adequate nutrition, which directly affects their motor development abilities and physical growth. Therefore, many children still experience malnutrition or malnutrition, which can have a negative impact on their physical and motor development.

According to UNICEF data, the prevalence of stunting in Indonesia was 27.6% in 2019. Nutritional problems in children are not only related to nutritional deficiencies, but also unbalanced eating patterns and parents' lack of understanding of the importance

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of balanced nutrition (W. Nurhayati, 2019). This is a sign that the problem of malnutrition that occurs in Indonesia is still a serious problem or issue that needs attention from all of us, so that we get the next generation who are able to face all the challenges in the future (Intan et al., 2023).

This study aims to highlight the role of nutrition in supporting the physical and motor development of early childhood, by arguing that appropriate nutritional intervention at this time is very crucial. Optimal nutrition not only affects physical growth such as height and weight, but also affects children's fine and gross motor skills. Previous research by Kurniawaty, (2022) confirmed that children who experience malnutrition in the first 1000 days of their lives are at higher risk of experiencing obstacles in cognitive and motor development. In contrast to previous research which emphasized purely physical aspects, this study will explore the direct relationship between specific nutritional intake, such as protein, vitamins and minerals, and children's motoric development. For example, research by Finch et al., (2016), indicated that iron deficiency can inhibit fine motor development in early childhood. Thus, this study will not only identify specific nutritional deficiencies, but also provide practical recommendations for parents and caregivers to ensure balanced nutrition.

Previous research has identified the importance of nutrition for child development, but there is still a gap in understanding how various specific types of nutrition contribute to physical and motor aspects in detail (Gomes et al., 2017). This research will confirm and expand understanding by focusing on certain types of nutrition and their influence on fine and gross motor development in early childhood, which have not been studied in depth in previous research.

Through a comprehensive and evidence-based approach, this research contributes to increasing awareness and understanding of the importance of nutrition in the early stages of life, which is the foundation for the future of future generations (Zahruddin, 2019). And in this context, this research will make an important contribution to the child development literature by focusing on nutritional interventions that can support holistic motor and physical development. The hope is that through a deeper understanding of the role of nutrition, more effective nutrition policies and programs can be implemented for early childhood in Indonesia.

This study aims to analyze the effect of nutritional intake on the physical and motor development of early childhood. Specifically, this study aims to identify the extent to which adequate consumption of nutritious foods, such as vegetables, fruits, and protein sources, contributes to the gross and fine motor skills of children aged 3–5 years. In addition, this study aims to provide an empirical basis for the preparation of nutritional intervention programs that can support optimal child growth and development.

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METHODS

Research Approach and Design

This study employed a mixed-methods approach with a convergent design, integrating both quantitative and qualitative methods simultaneously to obtain a comprehensive understanding of the role of nutrition in supporting the physical and motor development of early childhood. The quantitative component was designed to objectively assess the correlation between nutritional intake and child development parameters, while the qualitative component explored parents' perceptions and contextual understanding regarding nutrition and child development within their sociocultural environment.

Setting, Participants, and Sampling Technique

The research was conducted in the environment of the Al-Ikhsan Islamic Kindergarten and Playgroup, located at Perum IKPN Bumi Koperasi, Jl. Sumatra X-11, Lebo Village, Sidoarjo District. The study population consisted of children aged 3 to 5 years enrolled in the aforementioned institutions. A total of 30 children were selected through random sampling, comprising 10 children from the playgroup, 10 from Group A, and 10 from Group B. Parents or primary caregivers of these children were also involved as respondents for the nutritional intake survey.

Instruments and Data Collection Techniques

Data were collected using two primary instruments: questionnaires and physical-motor assessment tools. Nutritional intake data were obtained through a Food Frequency Questionnaire (FFQ) completed by the parents. The FFQ was developed based on standardized, validated national nutrition research guidelines, encompassing major food groups such as carbohydrates, proteins, fats, fruits, vegetables, dairy, and supplements. Physical development was assessed by measuring body weight with a digital scale (Onemed brand, 0.1 kg precision), and height using a stadiometer (Onemed brand, 0.1 cm precision). Body Mass Index (BMI) was calculated using the formula: weight (kg) divided by height squared (m^2). Motor development was evaluated using standard tests, including a balance beam test, a coordination test involving catching and throwing, and a strength test using a handgrip dynamometer (Onemed brand).

Research Procedure

The research procedures began with training sessions for the research assistants on instrument usage. Parents completed the FFQ, after which anthropometric measurements and motor ability assessments were conducted on-site at the kindergarten and playgroup. Additionally, semi-structured interviews were conducted with selected parents to explore feeding practices and their perceptions of child development more deeply.

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Quantitative and Qualitative Data Analysis

Quantitative data were analyzed using SPSS software. Descriptive statistics such as mean, median, and standard deviation were calculated to summarize nutritional and physical development variables. Pearson or Spearman correlation tests were employed to examine the relationship between nutritional intake and the physical and motor development of children. Furthermore, multiple linear regression analysis was conducted to assess the influence of specific nutritional components on developmental outcomes. The qualitative data were analyzed using a thematic analysis approach, where transcribed interview data were reviewed to identify recurrent themes related to parental understanding and practices.

Ethical Considerations

The study adhered to ethical research standards and obtained informed consent from all participating parents. Confidentiality was strictly maintained, and participation was entirely voluntary, in accordance with ethical principles governing research involving children and families..

RESULTS AND DISCUSSION

This study aimed to assess the relationship between nutritional intake and the physical and motor development of early childhood through both objective measurements and subjective perceptions. The study involved 30 children aged 3-5 years, who were selected from the Kindergarten and Al-Ikhsan Islamic Playgroup at Perum IKPN Bumi Koperasi, Jl. Sumatra X-11, Lebo Village, Sidoarjo District. The participants were randomly chosen from different kindergartens and playgroups, comprising 10 children from the playgroup, 10 from Group A, and 10 from Group B, with their parents filling out a food frequency questionnaire (FFQ). This approach allowed us to investigate the connection between nutritional intake and various physical and motor developmental markers.

Descriptive Statistics

The descriptive statistical analysis revealed valuable insights into the dietary patterns and physical measurements of the children. The frequency of vegetable consumption among the children was, on average, 4 times per week (SD = 1.2), while the frequency of fruit consumption was 3 times per week (SD = 1.0). These figures provide an indication of the children's general dietary habits, particularly their intake of essential nutrients like vitamins and minerals that are crucial for growth and development.

Regarding physical development, the children had an average weight of 15.5 kg (SD = 1.5 kg) and an average height of 98.3 cm (SD = 3.5 cm). These values are consistent with the expected growth patterns for children within this age group. In terms of motor skills, the results of the motor tests indicated an average balance score of 7.5

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(out of 10), coordination score of 8.2, and handgrip strength of 12.3 kg, highlighting varying levels of physical proficiency among the children.

Table 1. Descriptive Statistics of Nutritional Intake, Physical Growth, and Motor Skills in Early Childhood

Variable	**Mean**	**Standard Deviation (SD)**
Vegetable Consumption	4 times/week	1.2
Fruit Consumption	3 times/week	1.0
Body Weight	15.5 kg	1.5 kg
Body Height	98.3 cm	3.5 cm
Balance Score	7.5/10	-
Coordination Score	8.2/10	-
Handgrip Strength	12.3 kg	-

Correlation Analysis

The correlation analysis showed significant relationships between the frequency of nutrient-rich food consumption and various physical and motor development measures. The results of the Pearson or Spearman correlation tests revealed the following key findings:

There was a significant positive correlation between vegetable consumption and body weight ($r = 0.45$, $p < 0.05$), suggesting that children who consumed more vegetables tended to have greater body weight. This finding aligns with the understanding that vegetables, rich in essential vitamins, minerals, and fiber, play a crucial role in supporting overall growth and maintaining a healthy weight.

A positive relationship was found between fruit consumption and body height ($r = 0.40$, $p < 0.05$), indicating that children who consumed more fruits had better height development. Fruits, particularly those rich in Vitamin C and other micronutrients, contribute to bone growth and overall physical stature.

A significant correlation was also observed between vegetable consumption and motor coordination ($r = 0.42$, $p < 0.05$), highlighting that higher vegetable intake was linked to improved motor coordination.

Regression Analysis

The regression analysis aimed to further explore how different nutritional factors influenced children's physical and motor development. The results were as follows:

Body Weight: The consumption of vegetables and protein had a significant impact on children's body weight ($F(2,27) = 5.32$, $p < 0.01$). This suggests that both vegetables and protein play vital roles in supporting healthy weight gain during early childhood, a crucial period for growth.

Body Height: The consumption of fruits and milk significantly influenced children’s height ($F(2,27) = 4.87$, $p < 0.01$). This finding supports the importance of

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dairy products and fruits, which provide calcium and other growth-promoting nutrients, in promoting proper skeletal development.

Motor Skills: The intake of vegetables and milk had a significant effect on motor coordination scores ($F(2,27) = 5.10$, $p < 0.01$). This points to the fact that essential nutrients in vegetables and dairy, such as vitamins, minerals, and protein, are critical for the development of coordination and motor abilities.

Alongside the quantitative data, qualitative insights were gathered through interviews with parents to better understand their perceptions of nutrition and its role in their children's development. The majority of parents acknowledged the importance of nutrition in fostering physical and cognitive growth. Many parents reported making a conscious effort to provide a balanced diet, though they also noted challenges related to limited access to certain healthy food options in their local area.

Several parents expressed concerns about the children's selective eating habits, particularly with vegetables, which are often rejected by young children due to taste preferences. Despite these challenges, parents showed a willingness to learn more about proper nutrition and its role in early childhood development. Some parents mentioned they would benefit from more structured nutritional education and guidance to support their children's health more effectively. This data highlights the need for nutritional interventions at the community level and suggests that parental education can have a significant impact on improving children's dietary habits and, subsequently, their growth and development.

Discussion

The findings of this study provide strong evidence of the critical role that nutrition plays in supporting the physical and motor development of young children. The positive correlations between the consumption of vegetables, fruits, and protein, and physical indicators such as body weight, height, and motor coordination, emphasize the importance of a nutrient-dense diet during the early years.

One of the key findings from this study is the role of vegetable consumption in promoting body weight and motor coordination. This aligns with existing research that suggests a higher intake of vegetables is beneficial for both physical growth and motor skill development. Likewise, the significant relationship between fruit intake and body height underscores the importance of micronutrients in fruit for skeletal growth (A. Nurhayati et al., 2024; Triyanto et al., 2014). Furthermore, the significant effect of milk consumption on body height and coordination reinforces the idea that protein and calcium-rich foods are essential during this period of rapid development.

These findings are important for informing nutritional policies in early childhood education settings. Nutritional interventions aimed at increasing the intake of fruits, vegetables, and dairy products could significantly contribute to improving children’s physical health and motor skills (Fitri et al., 2020; P et al., 2015). Additionally, educating parents about the role of nutrition in child development, as

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indicated by the qualitative data, could enhance their ability to support their children's growth.

Moreover, the study highlights the need for targeted interventions that address both the availability and consumption of healthy foods. While the results are promising, it is essential to consider socio-economic factors that may impact children's access to healthy foods. Ensuring that families, particularly those in underprivileged areas, have access to affordable and nutritious foods is crucial for supporting optimal child development.

CONCLUSION

This research found that there is a significant relationship between nutritional intake and the physical and motor development of early childhood. Adequate intake of vegetables, fruit and protein positively affects body weight and height, as well as motor skills such as balance, coordination and hand strength. Specifically, vegetable consumption was associated with better body weight and coordination scores, while fruit consumption was associated with better height. In addition, regression analysis showed that vegetable and protein consumption significantly influenced body weight, fruit and milk consumption influenced body height, and vegetable and milk consumption influenced coordination scores.

These results emphasize the importance of good nutritional intake in supporting optimal growth and development of early childhood. Therefore, nutritional education for parents and nutritional interventions in early childhood education environments are very necessary to ensure that children get sufficient nutrition to support their physical and motor development. These findings provide a basis for planning more effective nutrition programs and suggest that increasing the frequency of consumption of vegetables, fruit and protein can provide significant benefits for children's growth and development.

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