Original Article

Assessment of nutritional status among preschool-aged children

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Abstract:
Nutritional status during the preschool years is a critical determinant of growth, cognitive development, and long-term health outcomes. However, variations in dietary practices, parental awareness, and socio-environmental factors contribute to diverse nutritional patterns in early childhood. This study aimed to assess the nutritional status of preschool-aged children and examine its relationship with gross motor development. A descriptive cross-sectional study was conducted among 84 children aged 4–6 years enrolled in formal preschool institutions. Respondents were selected based on inclusion criteria, and anthropometric measurements were performed to classify nutritional status using standardized indicators. Gross motor development was assessed using age-appropriate developmental checklists. Data were analyzed using descriptive statistics to determine frequency distributions. The findings showed that most participants were 5 years old (52.4%) and female (59.5%). In terms of nutritional status, half of the children (50.0%) were classified as overnourished, while 27.4% had normal nutrition, and 22.6% were undernourished. No cases of severe malnutrition were recorded. Regarding gross motor development, 67.9% of children demonstrated appropriate development, whereas 32.1% were categorized as doubtful, with no deviations observed. The data highlight the coexistence of overnutrition and undernutrition within the same population, reflecting the double burden of malnutrition. The study underscores the urgent need for targeted nutritional interventions and continuous developmental monitoring in preschool settings. Strengthening parental education and integrating nutrition-sensitive programs in early childhood education are recommended to optimize health and developmental outcomes.

Keywords:
nutritional status, preschool children, gross motor development, early childhood health

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INTRODUCTION

Childhood nutrition is one of the most important determinants of growth, health, and development across the life course. Adequate nutrition during the first years of life is fundamental for supporting physical growth, cognitive function, immune competence, and psychosocial development (Cerf, 2021). The preschool period, commonly defined as ages 4–6 years, represents a critical window in which nutritional needs are elevated, and developmental milestones are rapidly

achieved (Omand et al., 2021; Afandi et al., 2022). Ensuring proper nutritional status at this stage is therefore essential not only for immediate health outcomes but also for long-term well-being, including school readiness, educational attainment, and productivity in adulthood (Pettoello-Mantovani et al., 2025; Afandi et al., 2023).

Globally, child malnutrition remains a pressing public health challenge. The World Health Organization (WHO) estimated that in 2022, approximately 148 million children under the age of five were stunted, 45 million were wasted, and 37 million were overweight (WHO, 2023). These figures illustrate the coexistence of undernutrition and overnutrition, often referred to as the "double burden of malnutrition." While undernutrition remains prevalent in many low- and middle-income countries, overnutrition, characterized by overweight and obesity, is increasingly becoming a significant concern in both developed and developing nations (Popkin, B. M., & Ng, S. W., 2022; Dewanti et al., 2023). This dual challenge reflects the ongoing "nutrition transition," in which traditional diets rich in grains and fibers are being replaced by energy-dense, processed foods high in fats and sugars (Pressler et al., 2022; Kharisma et al., 2023).

Indonesia exemplifies this dual burden. According to the Ministry of Health of the Republic of Indonesia (2022), the prevalence of stunting among children under five remains high, reaching 21.6%. At the same time, the prevalence of overweight in this age group has also been increasing, reaching 7.4% nationwide. These figures highlight the coexistence of both extremes of malnutrition, which is particularly concerning in the preschool population (Khalid et al., 2022; Nurprastiwi et al., 2024). Children in this age group are highly vulnerable because nutritional imbalances can have profound effects on their physical development and functional capacity, potentially impairing gross and fine motor skills, learning readiness, and psychosocial adaptation (Tufail et al., 2025).

Preschool-aged children require adequate amounts of macronutrients and micronutrients to meet their rapid growth and developmental demands. Deficiencies in essential nutrients, such as iron, zinc, and vitamin A, are known to impair physical growth and immune function, whereas excess caloric intake without a balanced nutrient composition contributes to overweight and obesity (Savarino et al., 2021; Afandi et al., 2024). Both undernutrition and overnutrition at this age are strongly associated with immediate and long-term adverse health outcomes. For example, undernutrition increases the risk of infectious diseases, delays motor and cognitive milestones, and leads to poor school performance. Conversely, overnutrition predisposes children to early onset of non-communicable diseases such as type 2 diabetes, cardiovascular disorders, and musculoskeletal problems (Leocadio et al., 2021; Zalzabila et al., 2024).

One of the critical but often overlooked outcomes associated with nutritional status in preschool children is gross motor development. Gross motor skills, including walking, running, jumping, and balance, are fundamental competencies that support children's participation in play, learning activities, and social interaction (Hui et al., 2024). The optimal development of gross motor skills lays the foundation for more complex motor tasks in later childhood and adolescence. However, nutritional imbalances can hinder this developmental trajectory. Undernourished children may experience reduced muscle mass, limited energy reserves, and delays in achieving motor milestones, while overweight children may face difficulties with mobility, balance, and agility due to excess body weight (O'Malley et al., 2021).

A growing body of literature has demonstrated a significant association between nutritional status and gross motor development. For instance, Dubale et al. (2025) reported that preschool children with undernutrition had significantly poorer performance in motor skill assessments compared to their peers with adequate nutrition. Similarly, studies in middle-income countries have shown that overweight children often exhibit limitations in activities requiring coordination and endurance (Verbecque et al., 2022). These findings suggest that both undernutrition and overnutrition can negatively influence children's ability to fully engage in physical and educational activities, highlighting the need for integrated assessments of nutrition and motor development in early childhood health programs.

Despite the growing global attention to child nutrition, there remains limited empirical evidence focusing specifically on preschool-aged children in Indonesia. Much of the existing research has concentrated on stunting and wasting in children under five years old, often neglecting the nutritional challenges of children entering preschool. Furthermore, while gross motor development is widely recognized as a developmental milestone, it has not been consistently examined in conjunction with nutritional status in the Indonesian context. This represents a critical gap in the literature, as understanding the interaction between nutrition and motor skills in preschool-aged children can inform targeted interventions in educational and healthcare settings (Escolano-Pérez, 2021).

The importance of investigating nutritional status in preschool children is further underscored by the role of early childhood education institutions. Preschools serve as a bridge between home environments and formal schooling, providing opportunities for health monitoring, nutrition education, and developmental screening. Teachers and healthcare providers working within these institutions can play a pivotal role in early identification of nutritional problems and developmental delays (Sapiets, 2023). However, without robust data on the prevalence and patterns of malnutrition and its developmental implications, designing effective interventions remains challenging.

From a nursing perspective, assessing nutritional status in preschool-aged children is a vital component of pediatric care. Nurses are often at the forefront of community-based health programs, engaging directly with children and families. Their role extends beyond clinical assessment to include health education, advocacy, and the promotion of healthy lifestyles (Cipta et al., 2024). Understanding the prevalence of malnutrition and its potential impact on gross motor development equips nurses to provide evidence-based care, foster parental awareness, and collaborate with educators in supporting child development.

This study, therefore, addresses a pressing need to examine the nutritional status of preschool-aged children in Indonesia and to explore its relationship with gross motor development. By focusing on this age group, the study contributes to a more comprehensive understanding of the dual burden of malnutrition and its developmental consequences in early childhood. The findings are expected to provide policymakers, healthcare providers, and educators with evidence to design contextually relevant strategies that promote optimal nutrition and development.

In summary, preschool-aged children represent a highly vulnerable population whose health outcomes are significantly influenced by their nutritional status. Both undernutrition and overnutrition pose risks to growth and motor development, with implications that extend into adolescence and adulthood. Although global evidence has established the significance of this issue, data from Indonesia remain limited, particularly in the preschool population. Addressing this gap is crucial to

ensuring that children enter formal schooling with the physical health and motor skills necessary for success.

Based on this background, the present study was conducted to assess the nutritional status of preschool-aged children and to examine its association with gross motor development. Specifically, the study sought to describe the distribution of nutritional status categories, undernutrition, normal, and overnutrition, and to evaluate corresponding patterns of gross motor development. Through this approach, the study contributes new insights into the dual burden of malnutrition in early childhood and its implications for child development and health promotion.

METHOD

This study employed a quantitative descriptive cross-sectional design, which is widely used to assess the prevalence of health-related conditions within a population at a specific point in time. The cross-sectional approach was considered appropriate because the primary aim was to describe the nutritional status and gross motor development among preschool-aged children without attempting to establish causal relationships. This design enables researchers to capture a snapshot of the current health conditions of children, providing a valuable baseline for subsequent longitudinal or interventional studies.

The research was conducted in selected preschools and early childhood education centers located in East Java, Indonesia. The setting was chosen based on accessibility, the presence of an adequate number of preschool-aged children, and institutional willingness to participate. Preschools were considered ideal environments for collecting nutritional and developmental data, as they represent structured learning settings where children's health and growth are routinely monitored. Data collection was conducted between July and August 2024, spanning approximately two months to allow for adequate recruitment, data collection, and verification.

The target population of this study consisted of preschool-aged children between four and six years old who were enrolled in formal early childhood education institutions within the selected region. To be included in the study, children had to meet several eligibility criteria: they were required to be within the specified age range, actively enrolled in preschool or kindergarten during the study period, and attending classes regularly to ensure their availability for data collection. In addition, participation required that parents or legal guardians provide informed consent, thereby ensuring ethical compliance.

Children with congenital abnormalities or chronic health conditions that could influence growth and development were excluded, as were those who, despite being formally enrolled, were absent during the data collection period. After applying these inclusion and exclusion criteria, a total of 84 children were eligible and subsequently included in the final analysis. The determination of this sample size was based on a minimum sample estimation formula appropriate for descriptive studies with categorical variables, thereby ensuring adequate statistical power to detect prevalence patterns in the nutritional status of preschool-aged children. A purposive sampling technique was employed, targeting preschools that represented diverse socioeconomic backgrounds to ensure sample

variability. Within the selected schools, all eligible children were invited to participate. This approach ensured representativeness while maintaining feasibility in terms of logistics and time management.

Nutritional status was assessed using the anthropometric measurement method, following the World Health Organization (WHO) Child Growth Standards. The following parameters were measured: Weight: measured using a digital scale with a precision of 0.1 kg. Children were weighed without shoes and with minimal clothing. Height: measured with a portable stadiometer to the nearest 0.1 cm, with children standing upright, heels together, and head in the Frankfort horizontal plane. The measurements were then converted into nutritional status categories based on Body Mass Index-for-Age (BMI-for-age) Z-scores using WHO Anthro software. Categories included: undernutrition, normal nutrition, overnutrition, and severe malnutrition. Reliability was maintained by calibrating instruments daily and conducting duplicate measurements, with the mean value recorded.

Gross motor development was evaluated using the Denver Developmental Screening Test II (DDST-II), specifically the gross motor subscale. This instrument is internationally recognized and validated for assessing motor development in children aged 0 to 6 years. The assessment included activities such as walking, running, jumping, and ball handling, all of which were adjusted to the child's age. Results were categorized into three groups: appropriate, doubtful, and deviated development. Two trained observers independently assessed each child to minimize inter-rater bias.

Data collection was conducted in collaboration with preschool teachers and parents. After obtaining parental consent, the research team scheduled visits to preschools. Each session began with anthropometric measurements performed in a private and comfortable setting to reduce anxiety in children. Subsequently, gross motor development tasks were conducted in a safe play area. The children were encouraged to perform tasks naturally without pressure. Sociodemographic data, including age and gender, were obtained from school records and confirmed with parents. All data were recorded immediately on structured forms to minimize recall bias and transcription errors. To ensure data accuracy, two research assistants cross-checked the records at the end of each day.

Data were entered into SPSS version 26.0 for statistical analysis. Descriptive statistics, including frequency distributions and percentages, were used to summarize categorical variables (age, gender, nutritional status, and gross motor development). The results were presented in tabular form, accompanied by narrative explanations. Although inferential statistics were not the primary focus of this study, cross-tabulations were conducted to explore preliminary patterns between nutritional status and motor development.

Informed consent was sought from parents or legal guardians prior to inclusion. Assent from children was also considered by explaining the procedures in age-appropriate language and ensuring their comfort during assessments. Confidentiality was strictly maintained, with data coded and anonymized before analysis. Children identified with undernutrition, overnutrition, or uncertain motor development were referred to healthcare providers for further evaluation and management, ensuring that participation contributed directly to the child's well-being.

RESULT

Table 1. Distribution of Respondents by Age

Age (years)	Frequency (f)	Percentage (%)
4 years	17	20.2
5 years	44	52.4
6 years	23	27.4
Total	84	100

Most respondents were 5 years old (52.4%). This finding indicates that children aged 5 years dominated the sample, representing the transitional stage between early and late preschool age, which is a critical period for growth and development. The relatively smaller proportions of 4- and 6-year-old children suggest a concentration of nutritional and developmental observations around the age of five, which may reflect preschool enrollment patterns and nutritional monitoring at this age.

Table 2. Distribution of Respondents by Gender

Gender	Frequency (f)	Percentage (%)
Male	34	40.5
Female	50	59.5
Total	84	100

The distribution shows that female children comprised the majority of respondents (59.5%). This may be related to cultural or social factors that influence preschool participation, where parents may prioritize health check-ups and preschool attendance for daughters. The relatively balanced proportion between male and female children still provides a representative overview of nutritional and developmental conditions across genders.

Table 3. Distribution of Respondents by Nutritional Status

Nutritional Status	Frequency (f)	Percentage (%)
Overnutrition	42	50.0
Normal Nutrition	23	27.4
Undernutrition	19	22.6
Severe Malnutrition	0	0.0
Total	84	100

Half of the respondents (50.0%) were classified as overnourished, while only 27.4% were within the normal nutritional range. Meanwhile, 22.6% of children experienced undernutrition, although none were found with severe malnutrition. This distribution highlights the dual burden of nutrition in preschool-aged children, with a predominance of overnutrition alongside a considerable proportion facing undernutrition. These findings underscore the importance of early nutritional

interventions in preventing long-term health risks, including obesity, stunting, and impaired cognitive development.

Table 4. Distribution of Respondents by Gross Motor Development

Gross Motor Development	Frequency (f)	Percentage (%)
Appropriate	57	67.9
Doubtful	27	32.1
Deviation	0	0.0
Total	84	100

Most children demonstrated appropriate gross motor development (67.9%), while 32.1% showed doubtful development. None were classified as having deviations, which indicates a generally positive developmental pattern in the sample. However, the proportion of children with doubtful motor development suggests the need for closer monitoring, as nutritional imbalances may influence motor skills, coordination, and overall physical activity levels. This relationship reinforces the link between adequate nutrition and optimal child development outcomes.

DISCUSSION

This study assessed the nutritional status and gross motor development among preschool-aged children. The findings provide important insights into the prevalence of overnutrition and undernutrition in early childhood, as well as their potential implications for child development. The discussion will elaborate on four main aspects: (1) age distribution of respondents, (2) gender distribution, (3) nutritional status, and (4) gross motor development, with references to relevant studies and theoretical frameworks.

Age Distribution of Respondents

The results revealed that most respondents were five years old (52.4%), followed by six-year-olds (27.4%) and four-year-olds (20.2%). This distribution highlights that children in the middle of the preschool age spectrum were the most represented in this study. The preschool age, generally defined as between 3 and 6 years, is a crucial developmental period when children experience rapid growth in physical, cognitive, and psychosocial domains (Wang et al., 2021).

Age is closely associated with nutritional needs and growth velocity. Children aged four to five years are typically transitioning from a predominantly milk-based diet to a more diversified food intake. At this stage, their energy and micronutrient requirements increase significantly to support both physical growth and brain development (WHO, 2023). The high proportion of five-year-olds in this study may reflect enrollment patterns in preschool education, where parents often prioritize kindergarten education at this specific age.

Previous studies have also demonstrated that nutritional interventions at the age of five are particularly effective, as this is the period immediately preceding formal schooling (Zhang et al., 2023). Ensuring adequate nutritional status during this period can influence not only physical growth but also readiness for school, including cognitive and motor development. Therefore, the concentration of respondents in this age group provides a suitable foundation for assessing the nutritional and developmental challenges that preschool children face.

Gender Distribution of Respondents

The results showed that 59.5% of respondents were female, while 40.5% were male. This gender imbalance is consistent with some community-based studies, which suggest that parents may be more inclined to enroll their daughters in structured preschool settings (Jobin et al., 2024). Cultural and social perceptions often influence health-seeking behaviors for children, and in certain contexts, girls are more likely to be included in health monitoring and educational programs.

Gender differences may also have implications for nutritional status. Several studies have found that boys tend to have higher energy expenditure due to more vigorous physical activity, while girls may be more prone to dietary regulation influenced by parental feeding patterns (Mahmood et al., 2021). However, the current study found no evidence of severe malnutrition in either gender group, suggesting that gender was not a strong determinant of nutritional extremes in this sample.

In terms of growth and development, gender-related differences in motor skills are often observed. Boys tend to perform better in gross motor tasks involving strength and coordination, while girls often excel in fine motor skills (Cinar et al., 2023). While this study did not disaggregate motor development findings by gender, the overall distribution suggests that both boys and girls in the sample faced similar nutritional and developmental patterns.

Nutritional Status of Respondents

One of the most striking findings was the high prevalence of overnutrition (50.0%) compared to undernutrition (22.6%), with only 27.4% of children classified as having normal nutritional status. This dual burden of malnutrition, characterized by the coexistence of overweight/obesity and undernutrition, reflects a shifting trend in low- and middle-income countries, where dietary transitions and urbanization have led to increased access to high-calorie, yet nutrient-poor, foods (Popkin & Ng, 2022).

The prevalence of overnutrition in this study is consistent with global data indicating a rise in childhood obesity rates. The World Health Organization (2023) reported that more than 39 million children under five years old were overweight or obese worldwide. In many developing countries, obesity now surpasses undernutrition as the main nutritional concern, particularly in urban and semi-urban populations. Factors contributing to overnutrition among preschool-aged children include high consumption of processed foods, increased screen time, reduced physical activity, and parental feeding practices that encourage overeating (Hanifah et al., 2023).

Conversely, the presence of undernutrition in 22.6% of respondents highlights that traditional nutritional challenges remain unresolved. Undernutrition in early childhood is strongly associated

with stunting, wasting, and micronutrient deficiencies, all of which have long-term consequences for growth, immunity, and cognitive function (Suryawan et al., 2022). Although no children in this study were classified as severely malnourished, the relatively high proportion of undernutrition underscores the persistence of inequities in dietary access and household food security.

The coexistence of overnutrition and undernutrition in the same population illustrates the "nutrition transition" phenomenon. As described by Popkin and Ng (2022), this transition reflects a shift from traditional diets rich in grains and fibers toward diets dominated by fats, sugars, and animal-based foods. At the household level, it is not uncommon for siblings to experience contrasting nutritional conditions, with some being overweight while others are undernourished. This dual burden presents a unique challenge for public health interventions, requiring tailored strategies that address both extremes simultaneously.

Gross Motor Development of Respondents

The study also found that 67.9% of respondents demonstrated appropriate gross motor development, while 32.1% were categorized as having doubtful gross motor development. None of the children exhibited gross motor deviations. These findings suggest that while most preschool-aged children are developing normally, a significant minority may require closer monitoring and intervention.

Gross motor development is a critical indicator of overall child health and is closely linked to both nutritional status and physical activity levels. Children with appropriate nutrition generally display stronger motor coordination, endurance, and agility. Conversely, both undernutrition and overnutrition can negatively impact gross motor skills. Undernutrition may lead to muscle weakness and delayed motor milestones, while overnutrition can result in reduced physical agility and endurance due to excess body weight (Lasri et al., 2024).

The proportion of children with doubtful motor development in this study may reflect underlying nutritional imbalances. For example, overweight children may experience difficulties in tasks requiring balance and coordination, while undernourished children may exhibit delayed development due to inadequate energy and nutrient intake. Moreover, environmental factors such as limited opportunities for outdoor play, increased screen time, and reduced parental engagement in physical activities may also contribute to less optimal motor development (Martin et al., 2022).

From a developmental perspective, preschool years are crucial for establishing the foundation of motor skills that will later support more complex activities in school and daily life. Research by Fu et al (2022) emphasized that preschool children with delayed gross motor development are at higher risk for academic difficulties, social integration problems, and long-term physical inactivity. Thus, the findings of this study underscore the importance of integrating nutritional and motor development assessments in early childhood health programs.

Implications for Practice and Policy

The findings of this study carry several implications for nursing practice, community health programs, and policy development. First, the prevalence of overnutrition necessitates targeted

interventions to prevent childhood obesity. Health education for parents and caregivers should emphasize the importance of balanced diets, portion control, and regular physical activity. Preschools can also play a crucial role by incorporating nutrition education and structured physical activities into their daily routines.

Second, the persistence of undernutrition in a notable proportion of children underscores the need for ongoing efforts to ensure food security and access to micronutrient-rich diets. Community-based programs, such as supplemental feeding schemes and nutrition monitoring, remain essential to prevent growth faltering and its long-term consequences.

Third, integrating motor development screening into routine health checks can help identify children at risk of developmental delays. Nurses and healthcare providers can collaborate with educators and parents to design interventions that promote active play and motor skill development.

Ultimately, addressing the dual burden of malnutrition necessitates a multifaceted approach that integrates health, education, and policy interventions. Governments should prioritize early childhood nutrition policies that balance the prevention of both undernutrition and obesity. This includes regulating the marketing of unhealthy foods to children, improving school feeding programs, and ensuring access to affordable, healthy food options.

CONCLUSION

This study revealed that preschool-aged children face a dual burden of malnutrition, with a high prevalence of overnutrition alongside persistent undernutrition. While most children demonstrated appropriate gross motor development, a significant proportion showed doubtful performance, potentially reflecting the impact of nutritional imbalances. These findings highlight the importance of integrated approaches that simultaneously address nutritional adequacy and motor development, ensuring that children enter formal schooling with optimal health and developmental readiness.

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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