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The Relationship Between Nutritional Status and Child Development Among Children Aged 2–5 Years at Puskesmas Seyegan

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ABSTRACT

Developmental disorders in toddlers remain a global concern, particularly in developing countries such as Indonesia. Nutritional problems increase the risk of developmental delay by up to 4.75 times. Data from the Sleman District Health Office (2024) reported that 5.2% of toddlers in the working area of the Puskesmas Seyegan experienced nutritional problems and had never undergone developmental screening. This study aimed to determine the relationship between nutritional status and child development among children aged 2–5 years in this area. This quantitative descriptive study used an analytic cross-sectional design, involving 103 samples selected from a population of 1.581 toddlers using the Slovin formula, recorded in December 2025. Primary data were collected through anthropometric measurements (weight and height) to assess nutritional status and developmental screening using the KPSP instrument. Data were analyzed using univariate and bivariate analyses with the Spearman rank correlation test. The results showed a p-value < 0.001 (p < 0.05), indicating a significant relationship between nutritional status and child development. Most toddlers with normal nutritional status had normal development (84.9%), while those with abnormal nutritional status were more likely to experience doubtful (41.2%) and deviant development (11.8%). In conclusion, nutritional status is significantly associated with toddler development.

INTRODUCTION

Development is a crucial process in a child's life, particularly during the toddler period. It reflects qualitative changes involving improvements in bodily functions, as well as motor, cognitive, language, social, and emotional skills. This process occurs gradually and is influenced by various factors, including genetics, environment, nutritional intake, and stimulation from parents and caregivers (1).

Many parents still perceive child growth and development in a partial manner, with primary attention focused on physical growth indicators such as weight and height. This is reflected in routine visits to posyandu, which are mostly aimed at monitoring these growth parameters. However, awareness of the importance of monitoring child development such as motor, language, and socio-emotional skills remains low. Many parents assume that as long as a child appears physically healthy, their development is also adequate, without considering the possibility of non-obvious developmental delays (2).

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Globally, developmental delays in toddlers remain a significant public health issue, particularly in developing countries. UNICEF reported that one in three children worldwide does not achieve age-appropriate developmental milestones, especially in motor, language, and socio-emotional domains, due to inadequate early stimulation, insufficient nutritional intake, and unsupportive environments [29]. The World Health Organization also stated that more than 200 million children under five years of age fail to reach their full developmental potential, with the highest burden occurring in Asia and Africa [30]. Language delay is one of the most prevalent concerns, with reported rates of 12–16% in the United States, 24% in Thailand, 22% in Argentina, and up to 29.9% in Indonesia [3]. Meanwhile, studies show that 42.5% of preschool children in Indonesia experience developmental delays in motor, language, and personal-social domains [4]. National data from the Indonesian Ministry of Health indicate that 45.12% of infants in Indonesia experience developmental disorders. In Sleman Regency, approximately 25.5% of children experience developmental delays, with around 35% of these cases associated with nutritional problems such as stunting, wasting, and underweight [5]. Nutritional problems during the golden period of early childhood are irreversible and have a direct impact on brain development and children's motor abilities [6]. Meanwhile, globally, the World Health Organization [31] reported the prevalence of stunting among children under five at 22.3%, wasting at 6.8%, and overweight at 5.6%, with higher rates in Southeast Asia, particularly stunting at 26.4% [32].

Dinas Kesehatan Kabupaten Sleman reported that out of 580 toddlers weighed, the proportion of children with wasting was 0.1% and severely wasting was 1.4%, making Sleman Regency one of the areas with the highest nutritional problems in Yogyakarta Province [33]. In the working area of Puskesmas Seyegan, 5.2% of toddlers were identified as undernourished, which is higher than the district prevalence. Nutritional deficiencies in children have broad impacts, including impaired overall growth and development, and increase the risk of degenerative diseases in adulthood, such as diabetes and cardiovascular disease [7]. Therefore, early identification is crucial to enable appropriate interventions. Studies have shown that 50.9% of toddlers with abnormal nutritional status have doubtful results on KPSP developmental screening [8], Other studies have also demonstrated a significant relationship between nutritional status and the development of children aged 1–5 years (p-value = 0.003) [9].

Based on a preliminary study conducted in the working area of Puskesmas Seyegan, out of 1.581 recorded toddlers, 82 were identified as undernourished, and no structured developmental screening had been conducted. As a result, the potential for developmental delays has not been detected early. This condition underlies the researcher's interest in examining the relationship between nutritional status and the development of children aged 2–5 years in the working area of Puskesmas Seyegan.

METHOD

This study aimed to identify the relationship between nutritional status and the development of children aged 2–5 years in the working area of Puskesmas Seyegan. This research employed a descriptive quantitative design using an analytic survey method with a cross-sectional approach, in which the independent variable (nutritional status based on weight-for-height) and the dependent variable (child development aged 2–5 years) were measured simultaneously. The study population consisted of all children aged 2–5 years recorded in the working area of Puskesmas Seyegan in December 2025, totaling 1.581 toddlers. The sampling technique used was proportional stratified sampling, where the sample size was determined proportionally based on the number of toddlers in each village. Sampling was then continued using cluster random sampling through random selection to determine the posyandu as the research sites until the required sample size in each village was achieved. The selected posyandu included the following (n=103) :

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Table 1. Selected Posyandu

Village	Posyandu	Total Respondents
Margoagung	1. Tomat	11
	2. Kenikir	9
Margoluwih	Kantil	23
Margomulyo	1. Nangka	24
	2. Pisang	3
Margodadi	Pete	17
Margokaton	Mawar	16

The study sample consisted of toddlers who met the inclusion criteria, namely children aged 2–5 years who attended posyandu in January 2026, were registered as targets in the working area of Puskesmas Seyegan, and whose parents provided consent for examination. Exclusion criteria included toddlers aged 2–5 years with congenital abnormalities, chronic diseases, and those whose parents had physical or mental impairments. Data collection used primary data, including child characteristics (age, sex, history of exclusive breastfeeding and complementary feeding), parental characteristics (maternal age, parity, and family income), and anthropometric measurements (weight and height). Nutritional status was determined based on weight-for-height (WHZ), while child development was assessed using the Pre-Screening Developmental Questionnaire (KPSP) with categories of normal, doubtful, and deviant. Validity and reliability testing were not performed, as the KPSP instrument is a standardized developmental screening tool developed by the Indonesian Ministry of Health and has been previously validated in terms of its psychometric properties. Therefore, additional testing was considered unnecessary, while weighing scales and stadiometers were calibrated according to applicable standards. The collected data were organized into a master table and analyzed using SPSS. Univariate analysis was performed using frequency distributions, while bivariate analysis employed the Spearman Rank correlation test to determine the relationship between nutritional status and the development of children aged 2–5 years. This study received ethical approval with number 5048/KEP-UNISA/XII/2025.

RESULT AND DISCUSSION

Characteristics of Toddler Respondents

Table 2. Frequency distribution of respondent characteristics (n=103)

Characteristics	Frequency	Percentage (%)
Toddler Age		
24-36 Months	34	33
37-48 Months	31	30.1
49-60 Months	38	36.9
Sex		
Male	38	36.9
Female	65	63.1
Exclusive Breastfeeding		
Yes	80	77.7
No	23	23.3

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Characteristics	Frequency	Percentage (%)
MP-ASI		
Yes	80	77.7
No	23	23.3
Maternal Age		
20-35 years	76	73.8
>35 years	27	26.2
Parity		
Primipara	42	40.8
Multipara	61	59.2
Family Income		
≥ *UMK*	72	69.9
<*UMK*	31	30.1
Nutritional Status (Weight-for-Height)		
Normal	86	83.5
Abnormal	17	16.5
Interpretation of Toddler Development Based on KPSP Result		
Normal	81	78.6
Doubtful	17	16.5
Deviant	5	4.9

Table 1 shows that most toddlers were aged 49–60 months. In terms of sex, the majority were female. Based on the history of exclusive breastfeeding, most toddlers received exclusive breastfeeding. Regarding complementary feeding (MP-ASI), the majority had already received MP-ASI. Based on maternal age, most mothers were in the 20–35 years age group. In terms of parity, the majority of mothers were multiparous. Based on family income, most respondents had an income ≥ minimum wage (UMK). For nutritional status based on weight-for-height, most toddlers had normal nutritional status.

The age distribution of toddlers in this study shows that the 49-60 months group was the largest, followed by those aged 24–36 months and 37-48 months. The age range of 2-5 years represents a critical transitional phase from full dependence on parents toward early independence in physical activities, eating patterns, and social interactions. At this stage, energy and nutrient requirements increase in line with higher motor activity and more complex cognitive development. Toddlers aged 49-60 months, for example, require energy not only for physical growth but also for play, environmental exploration, and increasingly intensive learning processes. If nutritional intake is inadequate, the body adapts by prioritizing essential functions and reducing energy allocation for growth and development, which may lead to impaired nutritional status and developmental delays. Research indicates that the impact of undernutrition during early childhood is cumulative; therefore, as children grow older, its effects on growth and development become more apparent [10]. This is supported by studies indicating that toddlers aged 4–5 years are more frequently identified as having developmental disorders compared to younger children, as the effects of earlier nutritional deficiencies and inadequate stimulation begin to manifest clinically at this stage[11]. Thus, the predominance of toddlers aged 49–60 months in this study is relevant to the findings on the relationship between nutritional status and child development.

Based on sex, the majority of toddlers were female. Differences in sex distribution may be influenced by the characteristics of the study population. In a sociocultural context, girls are often perceived as calmer and easier to guide, leading parents to provide more intensive verbal and social stimulation. In contrast, boys tend to be more physically active and are often given greater tolerance for

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exploratory behavior. These patterns may influence certain aspects of development, although they do not directly determine nutritional status. Research indicates that differences in development between male and female toddlers are more influenced by the quality of caregiving and nutritional adequacy than by biological sex factors [12]. This is consistent with other studies stating that sex is not a primary risk factor for acute malnutrition, but rather a supporting factor that interacts with environmental conditions. Therefore, the predominance of female toddlers in this study reflects population characteristics rather than a direct cause of differences in nutritional status or development.

This study also found that the majority of toddlers received exclusive breastfeeding. Providing exclusive breastfeeding during the first six months of life plays a crucial role in meeting macro- and micronutrient requirements that are easily absorbed, as well as delivering bioactive components that support the maturation of the central nervous system [13]. Toddlers who do not receive exclusive breastfeeding are more susceptible to infections, particularly diarrhea and acute respiratory infections, which can disrupt nutrient absorption and increase energy demands . If these conditions occur repeatedly, they can negatively impact the child's nutritional status and developmental outcomes. Research indicates that a history of not receiving exclusive breastfeeding is associated with an increased risk of growth and developmental impairments during toddlerhood[14]. Other studies confirm that children with a history of exclusive breastfeeding are more likely to achieve age-appropriate developmental milestones because their nutritional needs are adequately met from the early stages of life[15]. This pathway demonstrates that exclusive breastfeeding not only has short-term benefits but also influences the overall quality of growth and development in children aged 2–5 years. The majority of toddlers in this study had also received complementary feeding (CF) appropriate for their age. Timely introduction of CF, starting at six months, is essential to meet the energy and nutrient requirements that breast milk alone can no longer provide. Inadequate, untimely, or monotonous CF may lead to deficiencies in key nutrients such as protein, iron, and zinc, directly affecting linear growth and brain development. Children with insufficient CF intake tend to show decreased activity levels, fatigue easily, and are less responsive to environmental stimulation. Research shows that inappropriate CF practices are associated with an increased incidence of acute malnutrition in toddlers[16]. Other studies also highlight that the quality of CF is crucial in supporting cognitive and motor development. Therefore, the high proportion of toddlers receiving CF in this study contributes to the predominance of normal nutritional status observed[17].

The majority of mothers in this study were aged 20–35 years, which is considered a healthy reproductive age. Within this age range, mothers generally possess better physical and psychological readiness to fulfill their caregiving roles. Maternal age is associated with the ability to make informed decisions regarding feeding practices, utilization of health services, and provision of developmental stimulation. Mothers who are either very young or older may face limitations in experience or physical capacity, which can affect the quality of caregiving. Research indicates that mothers aged 20–35 are more capable of meeting their children's nutritional and health needs compared to mothers in higher-risk age groups[18]. This finding is further supported by other studies showing that mature maternal age is linked to more responsive caregiving practices that promote child development[19].

Based on parity, the majority of mothers in this study were multiparous. Multiparous mothers generally have more experience in caring for and nurturing children compared to primiparous mothers. This experience contributes to enhanced maternal knowledge and skills regarding feeding practices, growth monitoring, and early detection of developmental disorders in toddlers. This pathway indicates that caregiving experience improves maternal knowledge and skills, leading to better caregiving practices and, consequently, more optimal nutritional status and development in children[20]. This aligns with research showing that previous childbirth and child-rearing experience increases maternal confidence in caregiving practices[21].

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Based on family income, the majority of respondents reported earnings at or above the regional minimum wage (UMK). Higher family income plays a significant role in enhancing the family's ability to provide sufficient, nutritious, and diverse foods, as well as access adequate health services. Favorable economic conditions support the sustainable fulfillment of toddlers' nutritional needs, which in turn positively impacts their growth and development. Research by [22] indicates that families with adequate income have a lower risk of malnutrition and developmental delays in toddlers. Further studies emphasize that income indirectly influences child development through its effect on nutritional status [23].

The study results indicate that the majority of toddlers had normal or good weight-for-age/height-for-age (W/A or H/A) nutritional status. W/A or H/A status reflects the acute nutritional condition of toddlers, which is directly related to the short-term balance between nutrient intake and energy requirements. Good nutritional status indicates that the food intake received by the toddler is relatively balanced with the body's needs. The high proportion of toddlers with normal W/A or H/A in this study may be influenced by several supporting factors, such as the majority of toddlers receiving exclusive breastfeeding and age-appropriate complementary feeding (CF). Exclusive breastfeeding contributes to enhancing toddlers' immunity and reducing the incidence of infections that can lead to weight loss, while timely and high-quality CF provides energy and protein that can no longer be sufficiently supplied by breast milk alone [24]. This pathway demonstrates that proper feeding practices from early life directly contribute to maintaining normal W/A or H/A status. This finding aligns with research indicating that the appropriateness of breastfeeding and CF is associated with better acute nutritional status in toddlers[14].

In addition to child-related factors, parental characteristics also influence weight-for-age/height-for-age (W/A or H/A) nutritional status. The majority of mothers were aged 20–35 years and multiparous, indicating greater maturity and caregiving experience in fulfilling children's nutritional needs. From a socioeconomic perspective, most families had incomes at or above the regional minimum wage (UMK), enabling the provision of nutritious food and access to adequate health services. Toddlers with nutritional problems exhibit an imbalance between nutrient intake and bodily requirements, which may result from inadequate quality or quantity of food, as well as infectious diseases that disrupt nutrient absorption. Suboptimal nutritional conditions in the short term can reduce energy levels, immunity, and activity in toddlers, and if persistent, may adversely affect growth and developmental processes. This aligns with research indicating that toddlers with W/A or H/A nutritional problems are at a higher risk of health complications and developmental delays compared to those with normal nutritional status[12].

The Relationship Between Nutritional Status and the Development of Children Aged 2–5 Years

Table 3. The relationship between nutritional status and the development of children aged 2–5 years (n=103)

Nutritional Status	Toddler Development						Total		p-value	r	r^2
	Normal		Doubtful		Deviant						
BB/TB	f	%	f	%	f	%	f	%			
Normal	73	70.9	10	9.7	3	2.9	86	83.5			
Abnormal	8	7.8	7	6.8	2	1.9	17	16.5	0.001	0,340	0,116
Total	81	78.6	17	16.5	5	4.9	103	100			

Table 3 shows that among toddlers with normal weight-for-height nutritional status, the majority had normal development (73 children), followed by doubtful development (10 children) and

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deviant development (3 children), with a total of 86 children. Meanwhile, among toddlers with nutritional problems, 8 had normal development, 7 had doubtful development, and 2 had deviant development, with a total of 17 children. The statistical test results showed a p-value of 0.001 ($p < 0.05$), indicating a significant relationship between weight-for-height nutritional status and the development of children aged 2–5 years at posyandu in the working area of Puskesmas Seyegan. The correlation coefficient (r) of 0.340 indicates that the strength of the relationship is in the low to moderate category with a positive direction. The coefficient of determination (r^2) of 0.116 shows that nutritional status contributes 11.6% to toddler development.

The study results indicate a significant relationship between weight-for-age/height-for-age (W/A or H/A) nutritional status and the development of toddlers aged 2–5 years, as evidenced by the correlation test yielding a p-value of 0.001 ($p < 0.05$). These findings confirm that W/A or H/A nutritional status is an important biological factor closely associated with the development of toddlers aged 2–5 years; however, its influence does not act in isolation. This is further illustrated by the statistical analysis in this study, which not only shows a statistically significant relationship but also provides insight into the magnitude of W/A or H/A's contribution to child development. The Spearman correlation coefficient (r) of 0.340 indicates a positive relationship, and based on this value, the coefficient of determination (r^2) is 0.116 or 11.6%. This means that W/A or H/A nutritional status contributes 11.6% to the development of toddlers aged 2–5 years, while the remaining variance is likely influenced by factors other than nutritional status. Therefore, these results suggest that toddler development is a multifactorial phenomenon, influenced by more than just nutritional status alone..

Weight-for-age/height-for-age (W/A or H/A) nutritional status reflects the acute nutritional condition of toddlers, which is directly related to the short-term balance between nutrient intake and energy requirements. Adequate intake of energy, protein, and essential micronutrients such as iron, zinc, and iodine plays a crucial role in the myelination of nerve fibers, formation and maintenance of synapses, and maturation of the neuromuscular system. These biological processes form the foundation for the development of gross motor, fine motor, language, and cognitive skills in toddlers. Toddlers with normal W/A or H/A nutritional status have sufficient energy reserves to engage in activities, explore, and interact with their environment, allowing developmental stimulation to be optimally received. This aligns with research indicating that normal W/A or H/A nutritional status is significantly associated with developmental achievement in toddlers, as assessed by the KPSP screening tool [25].

In toddlers with abnormal weight-for-age/height-for-age (W/A or H/A) nutritional status, the imbalance between intake and energy requirements can lead to weakness, fatigue, and reduced exploratory activity[26]. This condition diminishes the toddler's opportunities to receive adequate developmental stimulation; they tend to be less responsive to stimuli, more irritable, and exhibit limited social interactions due to low energy and reduced motivation to play. Such conditions may result in delays in problem-solving abilities and age-appropriate social interactions. Research indicates that toddlers with abnormal nutritional status are at a higher risk of delays in personal-social and cognitive domains, as assessed by the KPSP [27]. These findings are consistent with other studies reporting that toddlers with acute malnutrition have a higher risk of questionable to deviant developmental outcomes compared to those with normal nutritional status[9].

The results of this study indicate that toddler development is influenced not only by nutritional status but also by the history of breastfeeding and complementary feeding (CF). It was found that 4 out of 17 toddlers with questionable KPSP outcomes had not received exclusive breastfeeding and had not received age-appropriate CF. This condition suggests the presence of a nutritional deficit during the critical early period of life, which may have long-term impacts on developmental processes. Exclusive breastfeeding plays a crucial role in meeting macro- and micronutrient requirements, providing immunological benefits, and supporting the growth and maturation of brain tissue during the first six months of life. Failure to provide exclusive breastfeeding, as well as delayed or inappropriate CF, can

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result in cumulative deficits in energy and micronutrients, thereby increasing the risk of developmental delays in toddlers. This aligns with research indicating that a history of non-recommended breastfeeding and CF practices is associated with suboptimal developmental outcomes in children[28].

In more detail, among the four toddlers with questionable KPSP outcomes, it was observed that they were unable to achieve several developmental milestones appropriate for their age, such as riding a tricycle, dressing themselves, eating neatly, and standing on one leg. The inability to ride a tricycle and stand on one leg reflects delays in gross motor skills, which heavily depend on muscle strength, balance, and neuromuscular coordination. Meanwhile, the inability to dress independently and eat neatly indicates delays in fine motor skills and self-care, which require hand-eye coordination and the maturation of central nervous system functions. Research indicates that deficits in energy and protein intake during the early life period can impede the development of muscle strength and movement coordination, thereby contributing to delays in both gross and fine motor skills[11]. Beyond nutritional factors, developmental delays are also influenced by inadequate stimulation. Limited opportunities for practice—for example, a child unable to ride a tricycle due to not owning one and only occasionally trying a friend's—can prevent optimal development of gross motor skills. This aligns with the Stimulation, Detection, and Early Intervention for Child Growth and Development (SDIDTK) guidelines from the Indonesian Ministry of Health (2020), which emphasize that stimulation must be provided routinely, repeatedly, and age-appropriately to support the optimal development of motor skills, independence, and neuromuscular function in children.

In addition to nutritional factors and feeding practices, socioeconomic factors and maternal characteristics also play a role in toddler development. In this study, it was found that 1 out of 5 toddlers with developmental deviations came from families with incomes below the regional minimum wage (UMK) and had multiparous mothers. Low family income can limit a household's ability to provide nutritious food, access health services, and supply resources for developmental stimulation. Meanwhile, multiparous mothers may face constraints on time and attention in providing optimal caregiving and stimulation to each child, particularly if not supported by adequate family resources. This underscores the concept that toddler development is influenced by the interaction of biological factors, caregiving practices, and the family's socioeconomic conditions. These findings align with research [27] indicating that low economic status and high caregiving burdens increase the risk of developmental deviations in toddlers.

These findings provide opportunities for future researchers to investigate additional factors contributing to toddler development beyond nutritional status, such as sociodemographic and family environmental factors, including maternal parity, maternal education level, parental income, caregiving practices, and the provision of developmental stimulation.

CONCLUSION

The nutritional status of toddlers aged 2–5 years in the working area of Puskesmas Seyegan was predominantly normal based on weight-for-height z-scores (WHZ), with most children demonstrating normal developmental outcomes. Toddlers with abnormal nutritional status were more likely to exhibit questionable and deviant development. A statistically significant relationship was found between nutritional status (WHZ) and child development ($p = 0.001$; $p < 0.05$). Based on these findings, parents are encouraged to provide consistent, age-appropriate stimulation to support child development, while healthcare professionals at Puskesmas Seyegan should strengthen communication, information, and education programs on child growth and development to improve parental knowledge, attitudes, and practices.

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