PROFESIONAL HEALTH JOURNAL
Volume 7, No. 1, December 2025 (Page. 79-90)
Available Online at https://www.ojsstikesbanyuwangi.com
E-ISSN 2715-6249

The Relationship Between Physical Activity Levels, Nutritional Status, and Preschool Child Development

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ARTICLE INFORMATION

Article history
Received (11 January 2025)
Revised (16 January 2025)
Accepted (22 Janury 2025)

Keywords
Physical activity, nutritional status, child development, and preschool children.

ABSTRACT

Introduction*:The preschool a long time are a basic stage in a child's advancement. Agreeing to the World Wellbeing Organization (WHO, 2021), the predominance of formative clutters is higher in moo- and middle-income nations. In Indonesia, the child* ***improvement list*** *stands at 88.3%, which is lower than Thailand (93%) and Laos (89%) . Furthermore, around 6.5 million out of 22 million children under the age of five are not regularly assessed for their growth and development.. Both growth and development are closely interrelated, with factors like physical activity and nutritional status playing key roles in ensuring optimal development.* ***Objective****: This consider points to analyze the relationship between physical movement levels, wholesome status, and child improvement in preschool-aged children .* ***Methods****: A cross-sectional observational study was carried out at a Posyandu (community health center) involving 82 children who met the inclusion criteria. Consecutive sampling was employed in the selection process. Data were gathered using a 24-hour physical activity recall, along with anthropometric measurements (weight and height) to evaluate nutritional status, and the Pre-Screening Developmental Questionnaire (KPSP) to assess child development .****Results****: Spearman's test uncovered a noteworthy relationship between physical movement and child improvement (P = 0.001, r = 0.380), as well as a more grounded relationship between wholesome status and child improvement (P = 0.001, r = 0.610).* ***Conclusion****: Higher levels of physical action and way better dietary status are emphatically related with age-appropriate child improvement. These discoveries highlight the significance of advancing physical action and appropriate sustenance for supporting ideal improvement in preschool-aged children.*

Introduction

The preschool years are a crucial stage in a child's life in Indonesia, characterized by rapid growth in physical development, as well as significant progress in psychomotor, cognitive, and social functions. However, data reveals that approximately 6.5 million out of 22 million children under five years of age do not receive adequate monitoring of their growth and development (Kemenkes RI, 2022). Furthermore, data from UNICEF highlights that Indonesia's child development index (88.3%) is lower than that of neighboring countries such as Thailand (93%) and Laos (89%) (UNICEF, 2023). Recent research highlights a concerning trend: data is showed that more the world's stage of youthful child and adolescent were physically inactive (not active enough) and sedentary/screen time was on the rise (80%). Other reports demonstrate that 5-10% of children encounter delays in common improvement, motor improvement issues, hearing disabilities, and discourse delays Children and adolescents should steer clear of excessive sedentary behavior (SB) and replace or break up periods of inactivity with engaging physical activities. This approach is essential for effectively preventing or lessening the bad effects of

Sedentary habit on both their mentally and physical well-being, promoting healthier and more active lifestyles (Wang et al., 2024). The estimated prevalence of developmental abnormalities in children under five in Indonesia is 7.51% per 100,000 population, with 1-3% of children in this age group experiencing overall developmental delays (Aswan & Ridwan, 2023).

Formative disarranges can make a significant impact on a child's future. Delayed development may affect key areas such as critical aspects such as large muscle coordination, fine motor abilities, language acquisition, social interactions, and self-reliance or independence. Just like physical growth, development is essential in shaping the overall quality of an individual's future life. (Susilowati et al., 2022). This underscores the importance of early identification and intervention in addressing developmental delays, ensuring that children are provided with the support they need to thrive in later stages of life.

Improvement of child is shaped by various factors, both from within the individual and from external sources. Internal factors include genetics, race, age, sex, and chromosomal abnormalities, while external factors encompass nutrition, environmental influences, cultural context, socio-economic status, climate or weather conditions, and physical activity, all of which act as stimuli for a child's development (Suhartanti et al., 2019).

Good nutritional is basic in supporting a child's development and improvement. In Surabaya, the prevalence of stunting is relatively low, at just 4.8%, with approximately 923 children under five affected. However, nutritional status cannot be assessed based solely on stunting data. Other indicators, such as weight-for-height (W/H), still show concerning prevalence rates of underweight (7.5%), wasting (6.1%), and overweight (3.4%) (Kemenkes, 2022). The majority (62.5%) of preschool children with severe malnutrition experience developmental delays. Adequate nutrition is determined by the intake of essential nutrients, and as such, children who suffer from nutritional deficiencies are at risk of experiencing physical, mental, and intellectual growth impairments (Ulfa et al., 2022). In this study, the prevalence of nutritional status among toddlers at the Putat Jaya Health Center revealed that 9.3% of toddlers were classified as severely stunted and 13.1% as stunted. As for physical activity levels, the prevalence could not be determined specifically; however, based on nutritional status data, the prevalence of overweight toddlers in Surabaya was found to be 3.4%, which may be influenced by physical activity levels. The prevalence of developmental status was not found specifically, as the health facilities primarily focus on monitoring children's growth, resulting in a lack of accurate data on child development prevalence. The Putat Jaya Health Center does not maintain specific data on child development within its jurisdiction, providing only nutritional status data.

One of the key variables affecting child advancement is physical action. Physical movement plays a significant part within the by and large improvement of children. For children matured 3 to 5 a long time, stationary behavior and inertia are unequivocally disheartened. The World Wellbeing Organization (WHO) has issued rules suggesting different physical exercises from early childhood, with the objective of making strides wellbeing and supporting improvement. Agreeing to (WHO, 2020) Children especially around preschool should make a new habit to improve lifestyle in at least 60 minutes of middle stage activity standard to high activity standard physical activity every day to support their physical advancement.

Inquire about has illustrated a strong connection between physical movement and the improvement of motor skills and cognitive growth in youthful children (Carson et al., 2017). Furthermore, motor skills and activity levels in children have been shown to positively influence their physical, social, and psychological development (Cohen, 2015).

Surabaya is the most densely populated city in East Java, with 63 health centers (Puskesmas) serving its population (Dinkes Kota Surabaya, 2020). The Putat Jaya Health Center, located in the densely populated Putat Jaya subdistrict (Badan Pusat Statistik, 2022) provides Maternal and Child Health (KIA) services. However, Early Identification of Growth and Improvement Aspect

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E-ISSN 2715-6249

(DDTK) screenings for children have not been fully optimized. The Putat Jaya area has 59 integrated health posts (Posyandu), yet developmental assessments at these posts are infrequently conducted, with a primary focus on growth weight, tallness and measurements.

Developmental screenings are mainly based on counseling and interviews, lacking objective developmental evaluation metrics.This gap in developmental monitoring highlights the need for a comprehensive approach to child development assessment in the region. Therefore, this consider points to analyze the connection or link variable between physical movement stage, dietary status, and the advancement of preschool-aged children. The primary objective is to improve monitoring by parents, healthcare providers, and Posyandu cadres regarding child development screenings, ensuring early identification of developmental issues and enhancing intervention efforts. By increasing awareness and action on developmental monitoring, this research seeks to contribute to better developmental outcomes for children in Surabaya.

Methods

This article research of variable independece and dependence utilized an expository observational plan with test a cross-sectional approach. The populace comprised of 2,243 children who visited Posyandu in the Putat Jaya Health Center, Surabaya, between August and September 2024. This study employed consecutive sampling, a method in which samples are selected sequentially based on predefined inclusion criteria within a specified timeframe. Data collection for this research was conducted from August to September, aligning with the scheduled administration of Vitamin A for toddlers at community health posts (posyandu) within the Putat Jaya Health Center area, as well as the visits of midwives to several posyandu locations. This timing facilitated the use of the Ministry of Health's child development questionnaire, which was administered by trained healthcare professionals, thereby optimizing the accuracy and reliability of the data. A total of 82 children were selected as the sample using consecutive sampling, based on the following inclusion criteria: healthy children aged 36–60 months, children whose parents lived in the same household, both boys and girls, and those willing to participate with parental consent. Exclusion criteria included children with congenital abnormalities (e.g., Down syndrome, orofacial clefts, clubfoot), congenital hypothyroidism, intellectual disabilities, asthma or other respiratory conditions, heart disease, genetic disorders, or those born prematurely or with birth complications. The process in this study involves analyzing the relationship between variables through several steps as follows:

a. Identifying the research sample, which consists of toddlers who visit community health posts (posyandu) and meet the predetermined inclusion and exclusion criteria.
b. Collecting data on physical activity levels using an activity table without any specific questions in the questionnaire. The guardian or parent of the research sample records the child's activities over a 7-day, 24-hour period, which did not require validity and reliability testing.
c. Collecting data on nutritional status by measuring weight using a scale and height using a microtoise.
d. Collecting data on child development using the Preschool Development Screening Questionnaire (KPSP), based on the Ministry of Health's guidelines, which did not require validity and reliability testing. Data collection was carried out by trained healthcare professionals.
e. Processing the collected data and conducting data analysis to explore the relationships, starting with a normality test. This was followed by Spearman's test to assess the linkand to know the connection between the topic of this study.

The independent variables in this study were physical activity levels and nutritional status, while the dependent variable was preschool-aged child development. The questionnaire was

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obtained from previous studies and does not include any questions related to the variables, this validity and reliability testing were not required, anthropometric measurements to assess nutritional status, and the Pre-Screening Developmental Questionnaire (KPSP) with 10 items based on the child's age. Measurable examination was performed utilizing the Spearman's rho test, with a 95% certainty interim (CI) to guarantee the unwavering quality of the comes about. A p-value of < 0.05 was utilized as the edge to decide measurable centrality within the examination.

Results

Table 1 Frequency Distribution of Parent Characteristics of the Study Subjects

Characteristic	Category	Total	
		Frequency (n)	Percentage (%)
Age	20-35 years	52	63,4
	>35 years	30	36,6
Education	Secondary Education	17	20,7
	High Education	43	52,4
	Diploma Education	4	4,9
	Bachelor's Degree	11	13,4
	Other (Elementary)	7	8,5
Occupation	Unemployed	53	64,6
	Private Sector	18	22
	Entrepreneur	9	11
	Civil Servant (ASN)	2	2,4
Income	Insufficient	15	18,3
	Sufficient	65	79,3
	Very Sufficient	2	2,4
Child Number	1	27	32,9
	2	32	39
	3	15	18,3
	4	8	9,8

This study involved 82 preschool-aged children as research subjects, with parents/guardians serving as respondents to make decisions regarding the participation of the subjects. Table 1 presents the frequency distribution of the parents' characteristics, including age, education level, occupation, income, and the position of the child in the family. The comes about appear that the lion's share of respondents drop inside the 20-35 year age bunch (63.4%). In terms of education, most respondents had completed high school (52.4%), and a significant proportion were homemakers or unemployed (64.6%). Regarding income, the majority reported having sufficient earnings (79.3%). Furthermore, a notable percentage of the children in the study were second-born (39%).

Table 2 Frequency Distribution of Parenting Characteristics

Characteristic	Category	Total	
		Frequency (n)	Percentage (%)
Childcare Provider	Mother	62	75,6
	Father	3	3,7
	Family/Guardian	17	20,7

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The results in this table number 2 Indicate that most of the respondents belong to the group of child caregivers, with mothers being the predominant category (75.6%).

Table 3 Frequency Distribution of Environmental Characteristics

Characteristic	Category	Total	
		Frequency (n)	Percentage (%)
House Ownership	Own	15	18,3
	Parents	45	54,9
	Rented/Lease	22	26,8
Play Area	Available	43	52,4
	Not Available	39	47,6
House Condition	Healthy	81	98,8
	Not Healthy	1	1,2

The results in Table 3 show that, among the total sample of 82 around (52.4%) of households have a designated play area for children. Additionally, (54.9%) of the homes are owned by the parents. These findings emphasize the importance of connection with variable

Table 4 Frequency Distribution of Study Subject Characteristics

Characteristic	Category	Total	
		Frequency (n)	Percentage (%)
Gender	Male	43	52,4
	Female	39	47,6
Age of Children	3	39	47,6
	4	32	39
	5	11	13,4
Early Childhood Education (ECE)	Iya	49	59,8
	Belum	33	40,2

The results in Table 4 reveal that the majority of preschool-aged children in the study are male (52.4%). In terms of age, most children are 3 years old (47.6%). Additionally, a significant proportion of the children are enrolled in Early Education of Child (PAUD) programs, with 59.8% participating. These discoveries give profitable bits of knowledge into the statistic characteristics of the preschool populace, highlighting gender distribution, age distribution, and access to early childhood education, all of which play a key role in shaping developmental outcomes.

Table 5 Frequency Distribution of Study Subject Characteristics

Variable	Category	Total	
		Frequency (n)	Percentage (%)
Physical Activity Level	Active	26	31,7
	Inactive	56	68,3
Nutritional Status	Poor	34	41,5
	Good	48	58,5
	Appropriate	36	43,9

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Preschool Child Development	Doubtful	12	14,6
	Possible Deviations	34	41,5

The results in Table 5 indicate that more than half of the preschool-aged children in the sample have low levels of physical activity (68.3%). In terms of nutritional status, the higher of analysis of respondents were having normal nutrition (58.5%). Furthermore, most of the preschool-aged children showed age-appropriate development (43.9%).

Table 6 Examination of the Connection Between Physical Movement and Nutritional Status.

Variable	Category	Physical Activity Level				Total	*p value*	r
		Active		Inactive				
		(n)	(%)	(n)	(%)			
Nutritional Status	**Poor**	6	23,1	28	50	100	0,021	0,254
	Good	20	76,9	28	50	100		
Total		26	31,7	56	68,3	100		

The results of analysis from SPSS Table 6, the bivariate analysis using SPSS test the correlation spearman test yielded a p-value of 0.021, which is below the significance threshold of α = 0.05, indicating a statistically significant relationship. The correlation coefficient (r = 0.254) suggests a weak association between daily activity of youthful child and nutritional status

Table 7 Examination of the Link Between Physical Movement and Child Improvement

Variable	Category	Preschool Child Development						Total	*p value*	r
		Appropriate		Doubtful		Possible Deviations				
		(n)	(%)	(n)	(%)	(n)	(%)			
Physical Activity Level	Active	18	69,2	4	15,4	4	15,4	100	0,001	0,379
	Inactive	17	30,3	9	16,1	30	53,6	100		
Total		35	42,7	13	15,8	34	41,5	100		

Based on the results in Table 7, the bivariate investigation utilizing the SPSS test Spearman's rank relationship test yielded a p-value = 0.001, which is less than the noteworthiness level of α = 0.05, showing a measurably noteworthy relationship. The correlation coefficient (r = 0.379) indicates a middle strength of the connection between physical of daily child activity and child improvement. While the strength of the relationship is relatively modest, this research analysis the most importance of physical daily activity in supporting the developmental progress of youthful child.

Table 8 Analysis of the Relationship Between Nutritional Status and Child Development

Variable	Category	Preschool Child Development						Total	*p value*	*r*
		Appropriate		Doubtful		Possible Deviations				
		(n)	(%)	(n)	(%)	(n)	(%)			

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Nutritional Status	**Poor**	5	14,7	2	5,9	27	79,4	100	0,001	0,610
	Good	31	64,6	10	20,8	7	14,6	100		
Total		36	43,9	12	14,6	34	41,5	100		

Based on the results in Table 8, the bivariate investigation utilizing the SPSS test spearman's rank relationship test show a significant status a p-value = 0.001, which is less than the noteworthiness level of α = 0.05, showing a measurably noteworthy relationship. The relationship coefficient (r = 0.610) recommends a solid relationship between wholesome status and child advancement. This finding implies that better nutritional status in preschool-aged children is associated with more optimal, age-appropriate developmental outcomes. The solid quality of this relationship highlights the basic part of legitimate nourishment in supporting the generally advancement of youthful children.

Discussion

The Relationship Between Physical Movement Levels and Nutritional Status

Physical activity is considered to have a good and more significant aspect of impact the individual's nutritional status, as it provides numerous benefits to the skeletal muscles, cardiovascular, respiratory, and endocrine systems. Regular physical activity can enhance overall quality of life and reduce the risk of many leading causes of disease and death. It plays a crucial role in energy balance, linking directly to nutrition and energy intake, with the goal of lowering the potential for childhood obesity (Alkaririn et al., 2022). The research findings indicate that low levels of physical activity, particularly sedentary or inactive behavior, can lead to obesity and a reduction in fat oxidation processes in children, resulting in the accumulation of body fat. Sedentary behavior can contribute to an increase in body fat. Additionally, children who doing in little physical movement tend to have more high of body mass index and are at greater risk of developing overweight even obesity (Anggraini & Mexitalia., 2014). Around 20-50% of energy can be expended during physical activity. A lack of physical activity in adolescents can be attributed to technological advancements that promote a sedentary lifestyle. Poor nutritional status often occurs due to an imbalance and not same between energy intake and energy expenditure. In individuals with low physical activity, excess energy is stored as fat tissue, leading to fat accumulation that can increase body weight. Achieving a balance between nutritional status and physical activity is crucial, especially in children, as this is a period of rapid growth of body and improvement function brain.

The Relationship Between Physical Movement Levels and Child Advancement

Physical movement in preschool-aged children is basic for the improvement of bones, muscles, and fat tissue. Participating in physical movement or daily physical activity during the early stages of life plays a crucial role in shaping a child's long-term health, especially regarding their body composition. To support optimal growth and health outcomes, it is essential to incorporate physical activity from the earliest stages of life (Fraser et al., 2017).

Physical activity exerts both biological and psychological effects on young children. Biologically, it enhances cerebral blood flow, maximizes oxygen consumption, and facilitates oxygen delivery to brain tissues. It also reduces muscle tension, increases the concentration of serum endocannabinoid receptors, induces structural changes in the brain, and boosts levels of neurotransmitters such as serotonin and beta-endorphins. These physiological benefits help improve overall brain function and physical health. Psychologically, physical activity fosters self-confidence, emotional stability, cognitive function, and a positive body image (Mandolesi et al., 2018).

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Active children tend to have better emotional regulation, enhanced cognitive abilities, and a healthier perception of themselves, which in turn supports better social interactions and academic performance. Moreover, physical activity plays a crusial aspect in preventing and managing childhood obesity. By helping children maintain a healthy weight, regular exercise can prevent adverse effects on brain function and cognitive development associated with obesity (Shao et al., 2022). This underscores the need for early intervention and consistent encouragement of physical daily activity of youthful child, not only to support their physical health but also to promote long-term cognitive and emotional well-being.

These elements are essential for brain plasticity, promoting the development and connection of neurons, which enhances cognitive abilities and emotional control. Grey matter in the brain, essential for every facet of human function, is component aspect to processing information and enhancing cognitive skills (Mercadante & Tadi, 2023). In particular, research on the genu of the corpus callosum—a major pathway of white matter interfacing the cleared out and right sides of the equator of the brain—has appeared that expanded fragmentary anisotropy (FA) and diminished spiral diffusivity (RD) in this locale are related with more effective integration of cognitive, motor, and sensory improvement. These white matter pathways are critical for cognition and behavior, and their development is influenced by physical activity (Chaddock-Heyman et al., 2018)

According to the findings in Table 4, a significant proportion of preschool-aged children, 49 respondents (58.75%), are enrolled in in Early Education of Child (PAUD) programs. In these early childhood in education environment settings, the learning approach integrates physical activity as a fundamental element. This approach optimizes various aspects of child development, particularly motor skills, by stimulating the child's physical, cognitive, and emotional needs. The active engagement of children in physical activity within educational programs ensures that their developmental milestones are supported across multiple domains, enhancing not just physical health but also cognitive abilities and emotional well-being.

The part of physical movement in early childhood instruction is urgent, because it not as it were bolsters the physical improvement of children but also contributes to the strengthening of neural pathways, which is essential for long-term cognitive and emotional development. The integration of movement and play in educational settings offers a holistic approach to child improvement of quality aspect, ensuring that children have the necessary support to thrive academically, socially, and emotionally. This study supports earlier findings, like those from (Gao et al., 2019), which showed that physical daily of movement can notably improve cognitive functions in children, such as cognitive flexibility aspect and working memory of brain. Research further suggests that regular physical activity contributes to improved concentration, mental cognition, and a reduction in anxiety or self-stimulatory behaviors among children. These cognitive benefits emphasize the critical role that physical movement plays in shaping a child's mental development, enhancing both academic performance and emotional regulation.

Similarly, (Verswijveren et al., 2020) found that physical activity middle stage to higher stage (MVPA) increments as child stage, driving to a lessening in stationary behavior. However, their study also pointed out that while physical activity positively influences general physical health and activity levels, it does not necessarily correlate strongly with cognitive development outcomes, such as working memory or overall cognitive abilities. This proposes the require for assist investigate to investigate the fundamental components that interface physical action with cognitive advancement, especially in understanding how particular sorts of physical engagement can bolster diverse cognitive spaces.

The Relationship Between Nutritional Status and Child Improvement

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Child advancement is affected by a run of components, with nourishment playing a vital part in forming physical, cognitive, and enthusiastic results. According to the data presented in Table 5, more than half of preschool-aged children have normal nutritional status. Assessing a child's nutritional status involves multiple indicators, as outlined in the Indonesian Ministry of Health Regulation No. 2/2020 regarding child anthropometric standards. These measurements provide critical insights into a child's growth trajectory and nutritional adequacy.

Nutritional status and growth indicators are essential tools in monitoring a child's nutritional intake and overall health. Appropriate sustenance is foundational for the ideal development and advancement of children, guaranteeing that they meet key formative turning points. As highlighted by (Septikasari, 2018) satisfactory nourishment amid early childhood is vital for both physical and cognitive development. Wholesome lacks or lopsided characteristics can lead to formative delays and wellbeing issues, whereas adjusted sustenance underpins the arrangement of solid bones, tissues, and neural associations.

Nourishment plays a basic part in forming the anatomical structure and work of the brain, particularly through signaling pathways like the one aspect is mammalian target of rapamycin (mTOR) pathway, which regulates essential metabolic components such as amino acids, iron, glucose, and oxygen, while coordinating signals from various systems through kinase-driven mechanisms. This pathway is essential for processes such as cell growth and differentiation, particularly in the development of neural structures (Georgieff et al., 2018). Past auxiliary advancement, sustenance moreover impacts the work of neurons inside the central anxious framework (CNS), which oversees different formative spaces in children. The CNS is mindful for controlling tactile recognition, motor control, cognitive forms, passionate control, autonomic work, and social behavior (Gunasekaran, 2023).

One of the most crucial neurotransmitters influenced by nutrition is serotonin, a monoamine neurotransmitter that plays a central role in regulating several biological functions, including mood, sleep, and appetite. Serotonin is particularly important for brain function, as it modulates synaptic communication and neuronal plasticity. Role of Serotonin Hormone has a significant impact on the gastrointestinal in human system, further linking nutrition in both brain and body health (A, Bakshi; Prasana, 2022). In the context of child development, serotonin's role in emotional regulation, mood stabilization, and cognitive function makes it a key player in developmental outcomes.

The results in Table 5 show that (41,5%) of the children have suboptimal nutritional status. This classification includes undernutrition, at-risk nutritional status, overweight, and obesity. Obesity has been progressively connected to modifications in brain structure, counting changes in gray matter aspect has volume to make impact, white matter keenness, and cortical thickness, all of which can affect cognitive functions of the brain children. Studies comparing obese children with those of normal weight have shown significant differences in brain anatomy. Specifically, research has demonstrated a marked reduction in the volume of regional gray matter, particularly in the right middle temporal gyrus, in children with obesity (Jiang et al., 2023)

According to the results in Table 4, the lion's share of the respondents were male children (51.25%), and the biggest gather of children were 3 a long time ancient (47.5%). The early a long time of life are a basic period for brain improvement and working, which altogether impacts a child's by and large advancement. As children age, their physical and motor capacities develop, driving to more progressed improvement (Hanifah et al., 2024). It has been suggested that as children's development becomes more age-appropriate, it positively impacts their ability to progress through subsequent developmental stages.

In any case, the ponder moreover found that sex did not essentially connect with the improvement of net engine abilities or socio-emotional improvement. Typically in line with past inquire about (Chen et al., 2021), which recommends that sex isn't an autonomous calculate

impacting the advancement of youthful children. While gender may contribute to certain biological and social aspects of development, it does not appear to be a decisive factor in the trajectory of motor or emotional development in preschool-aged children.

The discoveries of this ponder adjust with past investigate by (Fauzi, 2014), this study examined the connection between nutrition stage of child and the advancment of children aged 1 to 5 years at the Dempok Utara Posyandu in Diwek District, Jombang. The analysis from SPSS Show a p-value of 0.000, indicating a strong and meaningful positive link between nutritional status and child development. The discoveries of this ponder moreover are steady with those of Sari (2018), Who highlighted the detail data a significant connection and link between nutritional status and the development of preschool-aged children. A p-value of 0.00 ($p < \alpha = 0.05$) was observed, indicating a statistically significant relationship between these two factors. This relationship can be attributed to the fact that good nutrition stage supports optimal brain function, which, in turn, promotes age-appropriate developmental progress. When children receive adequate nutrition, their neural development is enhanced, leading to better cognitive, motor, and emotional outcomes. Conversely, poor nutritional status can impair brain function and hinder proper development, highlighting the importance of ensuring children's nutritional needs are met to support their growth and developmental milestones (Sari, 2018).

Conclusion

1. The majority (68.3%) of preschool-aged children at the Posyandu in the Putat Jaya Health Center, Surabaya, exhibit low levels of physical activity, while (31.7%) are categorized as physically active.
2. Most preschool-aged children (58.5%) at the Posyandu in the Putat Jaya Health Center, Surabaya, have good nutritional status, while (41.5%) have suboptimal nutritional status.
3. Among the preschool-aged children at the Posyandu in the Putat Jaya Health Center, Surabaya, (43.9%) show age-appropriate development, (14.6%) display questionable developmental progress, and (41.5%) are at risk of developmental deviations.
4. There's a frail relationship between physical movement levels and preschool-aged child improvement. Children who lock in in higher levels of physical action tend to show improvement that's more steady with their age-related breakthroughs.
5. Nutritional status is unequivocally related with preschool-aged child advancement. Children with superior dietary status are more likely to illustrate age-appropriate formative advance, whereas those with poorer wholesome status are at a better chance for formative delays.

Ethics approval and consent to participate

This study has undergone and received approval from an ethical review board by the Health Research Ethics Committee, Faculty of Medicine, Universitas Airlangga with no. 117/EC/KEPK/FKUA/2024

Acknowledgments

The author would like to express sincere gratitude to the Head of Putat Jaya Health Center for granting the opportunity to conduct this research. A heartfelt thanks also goes to the Posyandu cadres and midwives who assisted in the examination process. Special appreciation is extended to the children who participated in this study, as well as to their parents for their willingness to take part in this research. Your support has been invaluable, and this study would not have been possible without your contributions.

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