MAJALAH ILMIAH FISIOTERAPI INDONESIA

ORIGINAL ARTICLE

Volume 12, Number 3 (2024), Page 241-247
P-ISSN 2303-1921, E-ISSN 2722-0443

Nutritional Status and Toddler Development: Cross-Sectional Study at Mawar Health Post, Tegal Harum Village

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Diajukan: 18 April 2024 | Diterima: 1 Mei 2024 | Diterbitkan: 25 September 2024
DOI: https://doi.org/10.24843/mifi.2024.v12.i03.p02

ABSTRACT

Introduction: Development is an integral part of the human life cycle, and the under-five years old (toddlers) period is crucial in this process. A child's nutritional status is one aspect that influences development across various domains. However, stunted development and malnutrition persist, particularly in Indonesia. Bali province, especially Denpasar City, exhibits a high level of good nutritional conditions. Nevertheless, some children still face problems, including excessive, inadequate, or poor nutrition. This study aims to determine the relationship between nutritional status and toddler development at the Mawar Integrated Health Post in Tegal Harum Village.
Methods: The research employed an analytical observational approach with a cross-sectional design. Purposive sampling was used to select 58 children under five as subjects. Data collection involved measuring nutritional status using Weight-for-Age (WAZ) and toddler development using the Pre-Screening Development Questionnaire (PSDQ).
Results: A chi-square test was conducted to analyze the relationship between nutritional status and toddler development. The results showed a significant relationship with a p-value of 0.000 < 0.05.
Conclusion: Based on the findings, it can be concluded that there is a significant relationship between nutritional status and toddler development at the Mawar Integrated Health Post in Tegal Harum Village.

Keywords: nutritional status, development, toddlers

INTRODUCTION

Biological, cognitive, and social processes influence development in each human life cycle. Biological processes are reflected in physical changes driven by brain development, inherited genes from parents, gross and fine motor skills, and hormonal changes during puberty. An individual's adulthood is closely related to childhood development and is influenced by these three processes.[1] The under-five (toddlers) period is considered the golden age in an individual's development process. Development is a process of quantitative and qualitative changes in bodily abilities and functions. It can be viewed through four aspects: gross motor skills, fine motor skills, speech and language, and social and independence skills. These four aspects are closely interrelated in a child's maturation process.[2] Toddler's ability to use large body parts for movement constitutes gross motor skills. Fine motor skills refer to a toddler's ability to use specific body parts with precision and complex coordination, such as hand-eye coordination, when touching, drawing, or manipulating small objects. The ability of a child to process and interpret information obtained from the senses is language proficiency. It is commonly observed how a child responds to sounds, hears, understands others' words, and expresses feelings through words. Social persona and independence entail a toddler's ability to socialize, adapt, and interact with their surroundings.[3]

The World Health Organization states that over 200 million children worldwide, mainly in Africa and Asia, fail to reach their full developmental potential by age five. The prevalence of developmental delays in various areas, including language, behaviour, and motor skills, continues to rise. In the United States, 12–16% of children experience developmental delays, while in Thailand and Argentina, the figures are approximately 24% and 22%, respectively.[4] Toddlers in America typically begin walking at around 11-12 months old, while in Europe, the average age is 12-13 months.[5] It's undeniable that Indonesia faces similar challenges, with the incidence of developmental disorders among children under five years old reaching 7.51% in 2016, as reported to the WHO in 2018. Estimates suggest that 5-10% of toddlers experience developmental delays.[6] Stimulation, detection, and intervention regarding toddler development require collaboration among families, communities, and professional caregivers. [5] One example of such cooperation is family participation in Integrated Health Posts (Posyandu), which provides health services, monitoring, and child care education.[7] According to the WHO, managing risk factors, promoting growth, enhancing cognitive and socio-emotional development, and improving long-term health and competency are achievable goals.[5] The fundamental knowledge that must be understood includes factors and aspects related to child development, both intrinsic and extrinsic. Intrinsic

factors of child development include age, gender, history of premature birth, and low birth weight (LBW). Nutritional status and stimulation are extrinsic factors influencing the growth of toddlers.

In facilitating optimal child development, nutritional status is not only a component but also an indication of a child's health. However, dietary problems persist, particularly in Southeast Asia. According to the WHO, in 2022, approximately 8.1 million children in Southeast Asia experience severe wasting, and 49.8 million toddlers suffer from stunting.[8] Nutritional issues in Indonesia still require attention. According to the 2018 Basic Health Research (Riskesdas) results, 17.7% of toddlers suffer from malnutrition, consisting of 3.9% severe and 13.8% moderate. In Bali Province, 2.04% of toddlers experience severe malnutrition, 11.09% suffer from moderate malnutrition, and 3.12% have overnutrition. In Denpasar City, 2.77% of toddlers experience severe malnutrition, 9.83% suffer from moderate malnutrition, and 2.77% have overnutrition.[9]

Toddlers with malnutrition may experience barriers and disruptions in the child development process due to suboptimal nutrient intake.[10] A child's nutritional status directly impacts their ability to learn and grow in various domains, including motor skills (both fine and gross), language development, socialization, and independence. Motor activities require optimal functioning of bodily organs and systems, and when nutritional needs are met, motor development progresses optimally.[11] Good dietary status indicates a child's health and ability to socialize and interact. This can influence language skills, social abilities, and independence.[12]

Based on this background, the researchers are interested in conducting a study hypothesizing a relationship between nutritional status and the development of toddlers and aim to prove this relationship. The researchers observed several Integrated Health Posts (Posyandu) in the Denpasar area. Among these are several Integrated Health Posts in Tegal Harum Village, one of which is the Mawar Integrated Health Post in Sapta Bumi Hamlet.

The results of observations and brief interviews indicated that out of 67 children aged 0-60 months, approximately 50 regularly attend the Integrated Health Post every month. According to the explanation from the Integrated Health Post staff, the current method for monitoring child development involves interviewing parents or guardians using the Healthy Growth Card (KMS). Direct measurements of the indicators children need to achieve have yet to be implemented.

While the relationship between nutritional status and the development of toddlers has been studied before, there has yet to be any recent research on a similar topic in Bali, particularly in Denpasar. The last study examining a similar topic in Denpasar was conducted in the service area of Public Health Center II South Denpasar in 2013. In contrast, this study will focus on the Mawar Integrated Health Post in Tegal Harum Village, part of West Denpasar. This study aims to measure toddlers' development and non-KMS nutritional status to determine if there is a relationship between the two variables at the Mawar Integrated Health Post in Tegal Harum Village.

METHODS

This study utilised a cross-sectional design based on observational analysis and obtained approval from the Research Ethics Commission of the Faculty of Medicine, Udayana University, with number 0195/UN14.2.2.VII.14/LT/2024. All research variables were assessed only once without further evaluation. Using a cross-sectional approach, the research design tests the relationship between the independent variable (nutritional status) and the dependent variable (toddler development). Initial observations were conducted in December 2022. Permit application, socialisation, and measurement of nutritional status and child development were carried out from October 2023 to January 2024 at the Mawar Integrated Health Post in Tegal Harum Village, West Denpasar, Bali.

The target population of this study was early-age children in Tegal Harum Village aged between 0 and 60 months. The research population included children in this age range who were registered as members of the Mawar Integrated Health Post in Tegal Harum Village. The accessible population comprised children from the Mawar Integrated Health Post in Tegal Harum Village who met the study's inclusion, exclusion, and dropout criteria. This study utilized non-probability sampling based on purposive sampling to select subjects according to the research objectives, time availability, and limited resources.

The use of purposive sampling ensures the relevance and accuracy of the collected data by specifically selecting toddlers, the target population of the study area. It saves time and resources by directly selecting subjects based on predefined criteria without random selection. However, selecting subjects based on existing criteria reduces the reflection of actual variation in the population, thus reducing the generalisation of research results to a broader population.

To ensure the relevance and accuracy of the data according to the research objectives, the researchers established inclusion criteria, namely, children aged 0-60 months residing in Sapta Bumi Hamlet, Tegal Harum Village, and registered as members of the Mawar Integrated Health Post with regular health conditions based on average pulse rate, blood pressure, respiratory rate, and temperature.

Additionally, both the child and the parents or guardians of the subjects consented by signing an informed consent. Children with a history of premature birth, low birth weight (LBW), and undergoing rehabilitation (physical, occupational, and speech therapy) would still be measured but could not be included as subjects. If children and their less cooperative parents were absent or withdrew for various reasons on the implementation day, they would not be included as research subjects.

According to the Slovin formula, 40 children under five years of age from the Mawar Integrated Health Post, Tegal Harum Village, were required for this study. However, the researchers added 10% to the calculated findings to ensure an adequate sample. Therefore, 44 toddler samples from the Mawar Integrated Health Post in Tegal Harum Village were required.

Parents or guardians of children were provided with explanations regarding data measurements and asked to fill out informed consent forms. Then, anamnesis was conducted, which included identifying information about the toddlers and other details adjusted to the inclusion and exclusion criteria.

In addition to these criteria, discussions were held regarding subject rejections to prevent bias, as the findings of this research could directly impact the design of health programs focusing on nutrition fulfilment and optimisation of toddler development in the study area. Toddler weight measurements were performed using hanging and digital scales by the research team, assisted by Integrated Health Post staff, followed by calculations for nutritional status categorization. Toddler development measurements were conducted using the KPSP Form according to procedures performed by the research physiotherapists.

Statistical analysis was performed on a laptop using SPSS 27.0. One of the data analysis methods was univariate analysis using age, gender, history of premature birth, low birth weight (LBW), nutritional status, and child development. Univariate analysis aims to provide a basic overview of research participants. Percentage graphs and frequency distribution tables provide a general overview of the topic.

This study describes the relationship between children under five years old and their nutritional status and development, as indicated by bivariate analysis using the chi-square test to ensure the relationship between independent and dependent variables. The chi-square test is suitable for evaluating the relationship between nutritional status and toddler development with a predetermined significance level. The significance level of 95% is represented by $\alpha = 0.05$. At the Mawar Integrated Health Post in Tegal Harum Village, toddlers were found to have a relationship between nutritional status and their development if $p < \alpha$.

RESULTS

Characteristics of Research Subjects

The subjects in this study were children aged 0–60 months (toddlers) who were registered and recorded as members of the Mawar Integrated Health Post in Tegal Harum Village. Sampling was conducted using purposive sampling, with 58 toddlers selected as subjects, all meeting the inclusion, exclusion, and dropout criteria. The identification stage of research subjects can be seen in Figure 1.

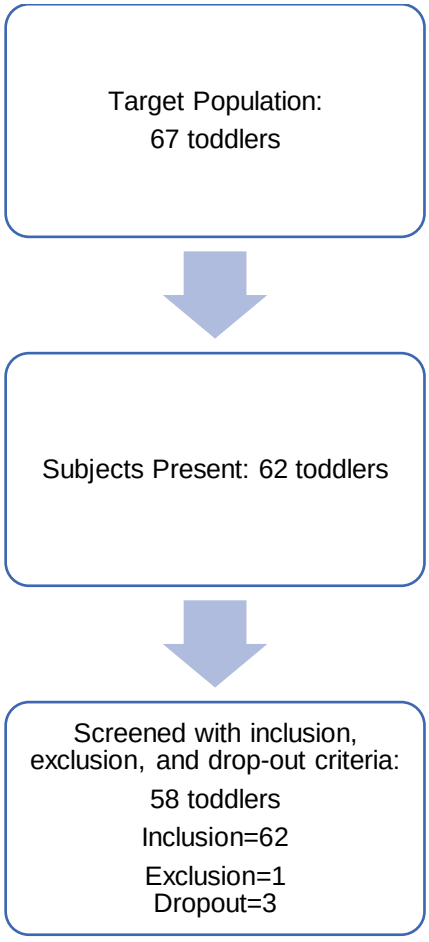

Figure 1. Research Subject Identification Stage

Based on Figure 1, the total number of research subjects is 58, which met the sample calculation results using the Slovin formula. The characteristics of research subjects are displayed in Table 1.

Table 1. Frequency of Research Subject Characteristics

		Frequency (n)	Percentage (%)
Age	0-3	1	1.7
	4-6	1	1.7
	7-9	6	10.3
	13-15	4	6.9
	16-18	5	8.6
	19-21	2	3.4
	22-24	2	3.4
	25-30	10	17.2
	31-36	3	5.2
	37-42	2	3.4
	43-48	9	15.5
	49-54	4	6.9
	55-60	9	15.5
Gender			
	Male	12	44.8
	Female	32	55.2
Birth Weight (grams			
	Normal (≥2500–4000)	58	100
Gestational Age (weeks)			
	Normal (37-42)	58	100
Nutritional Status			
	Underweight	9	15.5
	Normal	36	62.1
	Overweight	13	22.4
Toddlers' Development			
	On Track	37	63.8
	Questionable	12	20.7
	Deviant	9	15.5
	Total	**58**	**100**

Reviewing Table 1 indicates that the age range of toddlers from the Mawar Integrated Health Post in Tegal Harum Village included in the sample is consistent with the inclusion criteria of 0-60 months. The highest number of samples falls within the age range of 25-30 months, with ten children (17.2%). There are 32 female toddlers (55.2%), outnumbering the male subjects, 26 children (44.8%). All research subjects, totalling 58 children from the Mawar Integrated Health Post in Tegal Harum Village, have average birth weights and gestational ages, i.e., ≥2500–4000 grams and 37-42 weeks, respectively. Therefore, 58 children (100%) did not experience low birth weight (LBW) or premature birth. There are nine children (15.5%) classified as having malnutrition, 36 children (62.1%) with good nutritional status, and 13 children (22.4%) classified as overweight. Information regarding the development of toddlers can also be observed from the table, where 37 children (63.8%) have age-appropriate development, 12 children (20.7%) have doubtful development and nine children (15.5%) exhibit development that deviates from their age.

Analysis of the Relationship between Nutritional Status and Toddler Development

By employing the chi-square test on both the independent variable (child nutrition status) and the dependent variable (toddler development), this study aims to determine if there is a correlation between them. The author combines normal and abnormal nutritional status categories, namely malnutrition, undernutrition, and overnutrition, to meet the chi-square test criteria. Additionally, the categories of toddler development are simplified into appropriate and deviation, which were previously doubtful and deviant. The merging of these categories allows the chi-square test in this study to use a 2x2 table, and any cell with a frequency value below five is considered to have an expected frequency less than 5.

Table 2. Relationship between Nutritional Status and Toddler Development

Nutritional Status	Toddlers' Development				Total		p-value
	On Track		Deviant				
	n	%	N	%	N	%	
Normal	35	60.345	1	1.724	36	62.069	0.000
Abnormal	2	3.448	20	34.483	22	37.931	
Total	**37**	**63.793**	**21**	**36.207**	**58**	**100.0**	

Based on Table 2, the p-value of 0.000, more diminutive than 0.05, indicates a significant relationship between nutritional status and toddler development at the Mawar Integrated Health Post in Tegal Harum Village.

DISCUSSION

Characteristics of Research Subjects

The subjects of this study are toddlers (0-60 months old) registered in the Mawar Integrated Health Post in Tegal Harum Village, located in West Denpasar. Sampling was conducted using purposive sampling, with 58 toddlers selected as subjects, all meeting the inclusion, exclusion, and dropout criteria. Most samples fall within the age range

of 25-30 months, with 27 months being the dominant age based on accurate data from Mawar Integrated Health Post members. Furthermore, the research subjects consist of more females than males, with 32 female and 26 male toddlers. None of the toddlers from the Mawar Integrated Health Post included in this study experienced Low Birth Weight (LBW), as they were born within the normal weight range of ≥2500–4000 grams. Additionally, none of the research subjects were born prematurely, as the actual data indicates that the gestational age of all 58 sampled children falls within the normal range (37-42 weeks).

The nutritional status of toddlers registered in the Mawar Integrated Health Post varies. A total of 9 children (15.5%) are classified as having malnutrition, 36 children (62.1%) have good nutritional status, and 13 children (22.4%) are classified as overweight. Based on this data, it is evident that most (62.1%) toddlers at the Mawar Integrated Health Post in Tegal Harum Village have good nutritional status, and none suffer from malnutrition. These findings are consistent with the Indonesian Ministry of Health's Basic Health Research (Riskesdas) in 2018, which showed that the prevalence of good nutritional status (weight-for-age) among toddlers in Denpasar City was dominated by 84.63%. The Mawar Integrated Health Post in Tegal Harum Village routinely provides Supplementary Feeding Programs (SFP) such as green beans, milk, eggs, and other nutritious foods. Providing Supplementary Feeding Programs (SFP) is essential for meeting the nutritional needs and improving the nutritional status of toddlers. However, there are still some children with malnutrition. According to UNICEF, malnutrition in children is caused by insufficient nutrient intake, illness, socio-economic factors, demographics, maternal factors, and behaviours.[13]

According to Table 1, 37 children (63.8%) exhibit age-appropriate development. Additionally, 12 children (20.7%) show questionable development, while nine children (15.5%) experience developmental delays. Nadia (2023) found that 61.8% of toddlers exhibit normal development, 32.6% have abnormal growth, and 5.6% are considered outliers, aligning with these findings. The Pre-Screening Development Questionnaire (KPSP), tailored to age and consisting of ten questions regarding children's developmental skills, was used to assess toddler development at the research site, namely the Mawar Integrated Health Post in Tegal Harum Village.[14]

The Relationship between Nutritional Status and Toddler Development

The bivariate chi-square test examining the relationship between nutritional status and toddler development yielded a p-value of 0.000, indicating a p-value less than 0.05. In the Mawar Integrated Health Post in Tegal Harum Village, toddlers exhibit a significant relationship between nutritional status and their growth, as evidenced by rejecting the null hypothesis and accepting the alternative hypothesis.

The findings of this research are supported by Kusriani's study (2016) on the influence of maternal nutritional status on toddler development in the vicinity of the Kelayan Dalam Community Health Center in Banjarmasin.[15] The research results indicate that the nutritional status of children significantly influences their development up to the age of five. A p-value of 0.000, as generated by the chi-square test, validates this relationship. Fauzi's study (2019) on the nutritional status and development of toddlers (aged 1–5 years) at the Dempok Utara Integrated Health Post in the Diwek Jombang District supports this notion.[16] The two variables have a statistically significant relationship, as indicated by the research p-value of 0.000. The correlation between nutritional status in toddlers and their growth and development has also been found by Boik et al. (2021) and Pratama et al. (2023), with the p-values in each study being 0.022 < 0.05 and 0.000 < 0.05, respectively. This suggests that children under five have a relationship between nutritional status and development.[1718]

In this study, one child (1.724%) with normal nutrition status experienced developmental abnormalities, while most children with normal nutrition status (35 toddlers, 60.34%) had development appropriate for their age.

Meanwhile, developmental abnormalities were found in 20 children (or 34.483%) under the age of five who had unhealthy nutrition status. Two children, or 3.448% of the total, experienced nutritional status disorders but developed usually. These findings indicate a correlation between nutritional status and the maturation and growth of children under five, as they show that children with normal dietary status have appropriate development. In contrast, those with abnormal nutritional status are more likely to experience developmental abnormalities.

According to this study, nutrition significantly influences the development of children up to the age of five. Toddlers' development is best when their nutritional status is standard, including their fine and gross motor skills and language and social development. Appropriate nutrition for children is crucial for their healthy development and maturation. Good (normal) nutritional status indicates that children are receiving adequate nutrition. This nutritional intake is vital in optimising brain development, affecting cognitive development, including sensory abilities, motor skills, and mental processes. [19] Good dietary status also indicates the fulfilment of nutrients for tissue development and bodily functions. [20] Intake influencing child development includes carbohydrates, fats, proteins, vitamin D, and calcium. Carbohydrates and fats serve as the body’s energy source needed by children to engage in activities and interact with their environment, thus influencing their development in fine and gross motor skills and social independence. All nutrients, including vitamins, optimise brain function and sensory perception required for fine motor skills and language development. Additionally, proteins, vitamin D, and calcium aid in children’s muscle, bone, and physical development to achieve optimal gross motor skills. [21]

Poor or inadequate nutritional status can act as a hindrance to achieving proper developmental milestones. Toddlers with excessive dietary status are also at risk of developmental deviations. Brain development issues are prevalent among children with a diet lacking essential nutrients, who tend to appear less active than their peers with a nutrient-rich diet. [22] Inadequate nutrition hurts the development of motor skills in children as it disrupts brain function and nerve impulse transmission. The production of neurotransmitters, essential for nerve impulse transmission, is inhibited by insufficient food intake. [23]

The data collection in this study indicates that children with excess nutrition experience lower abilities in gross motor aspects. This aligns with Handayani's (2016) statement, showing that delays or abnormalities in gross motor

development occur twelve times more often in overweight or obese children compared to those with average weight or other nutritional statuses. [24] Children with better nutritional status frequently receive more nutrients than needed. Children with better nutritional health tend to have more energy because the body converts food into energy. Excess energy is converted into fat reserves, leading to obesity and potential health problems in the motor system. [19]

The data analysis revealed that one toddler (1.724%) with normal nutritional status had developmental deviations, while two toddlers (3.448%) with abnormal nutritional status had appropriate development. These findings suggest that nutritional status is not the sole factor influencing toddlers' growth. This is supported by the research of Boik et al. (2021), which found that 33 children had normal nutrition but experienced developmental issues, while 32 children had nutritional problems but showed normal development. [17] The research conducted by Pratama et al. (2023) further indicates that several variables contribute to developmental issues reported by some children with normal nutritional status. Additional factors include suboptimal child health, lack of parental and family stimulation, and exposure to electronic devices and video games. [18]

The importance of monitoring and paying attention to nutritional status to optimise child development is highlighted by the findings of this research. However, it should be noted that some children with normal dietary status experience developmental deviations and vice versa, indicating the complexity of factors influencing child development besides nutritional status. The researchers encountered several limitations in this study, including the need for follow-up to assess changes in nutritional status and child development beyond the study day. In contrast, both nutritional status and development are dynamic. Additionally, the number of respondents was only 58 toddlers, making the findings of this study relatively weak for generalisation to larger subject groups, such as other populations of toddlers in Posyandu Mawar Desa Tegal Harum. Therefore, the researchers recommend further research to conduct longitudinal studies with larger samples and integrate analysis of different factors that may influence toddler development besides those attempted in this study, such as genetic and environmental factors.

CONCLUSION

The study found that most subjects, namely toddlers registered at the Mawar Integrated Health Post in Tegal Harum Village, have good nutritional status and normal development according to their age. With a p-value of 0.000 based on the chi-square test, a relationship between nutritional status and toddler development at the Mawar Integrated Health Post in Tegal Harum Village was identified. This underscores the importance of understanding the significance of good nutritional status in achieving optimal toddler development.

These findings are expected to serve as a reference for future research development and as an educational resource for raising awareness among the community about the importance of monitoring and paying attention to the nutritional status and development of toddlers. Thus, the study confirms the importance of monitoring nutritional status in supporting optimal toddler development.

ACKNOWLEDGEMENT

We want to express our gratitude for the support and contributions from all parties involved in the research on "The Relationship between Nutritional Status and Toddler Development at the Mawar Integrated Health Post in Tegal Harum Village". We sincerely hope that this study's findings will serve as valuable information and education for the community.

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