Journal of Epidemiology and Public Health (2025), 10(02): 134-147
Masters Program in Public Health, Universitas Sebelas Maret

Research
Open Access

Stunting and Its Implications on Cognitive Ability and Language Development

Roy Romey Daulas Mangunsong

Department of Speech Therapy, Health Polytechnic of the Ministry of Health, Surakarta, Indonesia

Received: 12 February 2024; Accepted: 22 March 2025; Available online: 16 April 2025

ABSTRACT

Background: Stunting, a chronic nutritional disorder from prolonged inadequate intake, affects not only physical growth but also cognitive and language development. Mid-upper arm circumference (MUAC) and maternal education are important predictors of stunting risk. Guided by early childhood development theory, this study aims to analyze the implications of stunting on children's cognitive abilities and language development in Karanganyar Regency to inform effective intervention strategies.
Subjects and Method: This was a cross-sectional study conducted in Karanganyar Regency, Central Java, from April to August 2024. A total of 112 children were selected through purposive sampling. The independent variables were stunting status, cognitive ability, mid-upper arm circumference, and maternal education, while the dependent variable was language development. Data were collected through standardized measurements and structured interviews. Logistic regression analysis was performed using Stata 13 to examine the associations between variables.
Results: Bivariate analysis revealed that delayed language development was significantly associated with stunting (OR=19.05; p<0.001), poor cognitive ability (OR=18.63; p<0.001), MUAC <13 cm (OR=9.41; p<0.001), and low maternal education (OR=21.21; p<0.001). Multivariate analysis showed that stunting (b=2.09; 95% CI=1.02 to 3.16; p<0.001) and poor cognitive ability (b=2.06; 95% CI=0.99 to 3.13; p<0.001) had direct effects on delayed language development.
Conclusion: Stunting directly impairs children's cognitive ability and language development. Additionally, maternal education and mid-upper arm circumference have indirect effects on these outcomes through their influence on stunting. These findings highlight the need for integrated nutritional and educational interventions to promote optimal child development.

Keywords: Cognitive ability, language development, stunting, maternal education, upper arm circumference

Correspondence:
Roy Romey Daulas Mangunsong. Department of Speech Therapy, Health Polytechnic of the Ministry of Health, Surakarta, Indonesia. Mojosongo, Kec. Jebres, Kota Surakarta, Jawa Tengah, Indonesia 57127. Email: roypoltekstw@gmail.com. Mobile: +6281578950035.

Cite this as:
Mangunsong RRD (2025). Stunting and Its Implications on Cognitive Ability and Language Development: A Study in Karanganyar Regency. J Epidemiol Public Health. 10(02): 134-147. https://doi.org/10.26911/jepublichealth.2025.10.02.01.

BACKGROUND

Stunting is a chronic nutritional problem caused by a lack of nutritional intake over a long period of time. This condition causes disruption of physical growth in children, so that the child's height growth is not in accor-

dance with his age. The prevalence of stunting in Indonesia is quite high. This can be seen in data from the WHO in 2020, Indonesia is in the second highest position in Southeast Asia after the country of Laos, with 36.4% of children under five experiencing stunting. Basic Health Research in 2018 showed that 30.8% of children under five in Indonesia suffer from stunting, which illustrates that 1 in 3 children under five in Indonesia are stunted. Meanwhile, in 2021, the stunting rate in Indonesia was 24.4%. In 2023, the stunting rate was recorded at 21.5% (Lestarini et al., 2024). In the Karanganyar area itself in 2022, there were 1,603 cases of stunting in toddlers, or around 3.33% of the total under five. This figure decreased compared to 2021, which reached 4.48%.

The factors that influence the incidence of stunting are very complex, including inadequate nutritional intake, recurrent infectious diseases, hormonal factors, and exposure to cigarette smoke (Ekariani, 2022; Hanifah et al., 2022). In addition, socioeconomic factors, parental education, exclusive breastfeeding, immunization status, access to health care facilities, and inadequate parenting also play an important role (Adhyatma et al., 2022). Nutritional interventions that focus on the First 1,000 Days of Life (HPK), from the fetus in the womb to the age of 2 years, are very important to reduce the incidence of stunting and improve children's cognitive abilities (Andriani et al., 2023; Rini, 2022).

One of the indicators that is often used to assess nutritional status and stunting risk in toddlers is upper arm circumference (LILA). LILA measurement is a simple and effective method to detect the risk of malnutrition in toddlers. Low upper arm circumference can indicate the presence of nutritional problems that have the potential to cause stunting (Windiyani et al., 2024). Based on the research of Junus et al. (2022), Setiawati and Maulana (2024) show that upper arm circumference has a significant relationship with stunting incidence, where children with LILA below a certain threshold are more susceptible to stunting. Furthermore, Wiryawan et al. (2021) investigated the impact of upper arm circumference on the incidence of stunting in children under five. It used a case-control design and found that lower upper arm circumference was significantly correlated with higher rates of stunting, with an odds ratio of 9.57 suggesting that children with abnormal upper arm circumference were at 9.57 times greater risk of stunting.

In addition to the factors of toddlers themselves, other factors can affect the incidence of stunting in toddlers, namely, maternal education. According to research by Willyanto and Ramadhani (2023), mothers who are more educated are also better at implementing parenting practices that support child growth. They tend to choose nutritious foods and follow recommended health guidelines, thus reducing the risk of stunting. In contrast, mothers with low education often lack an understanding of the importance of good nutrition for child development. Parallel research shows that in several regions in Indonesia, such as Jambi and Banjarbaru, research shows a significant relationship exists between maternal education level and the incidence of stunting in toddlers.

In Jambi, for example, the prevalence of stunting reaches 22.4%, and research shows that maternal education is a major risk factor (Salsabila et al., 2023). Consistent research shows that children under five years old whose mothers have a low level of education are 3.01 times more at risk of stunting compared to those whose mothers have higher education. This correlation underscores the importance of maternal

knowledge of nutrition and health during pregnancy and early childhood. Mothers with lower educational attainment often lack essential knowledge about nutritional needs, which can lead to inadequate dietary practices before, during, and after pregnancy. This deficiency contributes significantly to the incidence of stunting in their children (Azizah et al., 2022). Higher maternal education is associated with better overall health care practices, improved hygiene, and healthier diets for children, which collectively contribute to better growth outcomes (Rahayuwati et al., 2023). While improving maternal education is beneficial, some studies suggest that simply increasing education levels may not be enough to reduce stunting. Effective interventions must also focus on improving parenting practices and providing targeted nutrition education (Nurwasilah, 2024).

Stunting does not only have an impact on physical growth, but also affects children's cognitive development (Andriani et al., 2023). Stunting can interfere with children's cognitive, motor, and intellectual development (Mangunsong et al., 2024). Disruptions in the maturation process of scrambled neurons as well as changes in brain structure and function due to stunting, can cause permanent damage to cognitive development. This results in children's thinking and learning abilities being disrupted, which can reduce the level of attendance and learning achievement (Andriani et al., 2023; Yadika et al., 2019).

A study in Bandarharjo Village, Semarang, found a significant link between stunting and cognitive development, suggesting that stunting can inhibit the maturation of nerve cells in the brain, potentially causing permanent damage to cognitive development. The average Intelligence Quotient (IQ) of children with stunting is reported to be 11% lower than normal children (Sari, 2022). Stunting can affect a child's thinking ability, potentially causing permanent damage to cognitive development and leading to suboptimal intellectual development. Limited vocabulary, which is related to thinking skills, can also result from stunting, affecting a child's ability to adapt to their environment and lowering self-confidence (Nazidah et al., 2022). Research in Bangladesh showed a significant correlation between age-appropriate height Z scores and cognitive development, suggesting that stunted children are more likely to experience delayed cognitive development (Hossain et al., 2024).

Stunting in children also has a negative impact on their language development (Mangunsong et al., 2024). Stunting can cause brain development disorders that affect children's ability to acquire language to communicate, so children who experience speech delay (Ratnawati and Alam, 2023). Stunting can lead to deficits in children's cognition, which in turn affects language skills in children. Children who experience stunting in early childhood can have limited vocabulary skills (Selawati, 2022).

An analytical study with a cross-sectional design involved 109 toddlers at the Bangkalan City Health Center in January-May 2022. The results showed that stunting had a significant effect on language development in toddlers (p= 0.002). Stunted toddlers had higher suspicious language development (19.3%) compared to non-stunted toddlers (8.3%) (Wardani, 2022). In addition, a study conducted in Ngawonggo Village screened toddlers using the Denver Developmental Screening Test and found that language delay was the most common developmental delay in stunted toddlers, affecting 30% of the sample. This study showed a significant relationship between stunting and children's language development (Setianingsih et al., 2020). Research

by Hanum and Khomsan (2016) revealed significant differences in language and cognitive development scores between normal and stunted toddlers. Dwarf toddlers can only achieve simple language development tasks and struggle with more complex tasks due to lower cognitive abilities.

Based on the long-term impact of stunting on cognitive ability and language development, this study aims to further analyze stunting and its implications on children's cognitive ability and language development in Karanganyar Regency. This research is expected to provide useful information for more effective stunting intervention and prevention efforts, so as to improve the quality of life of children in the region.

SUBJECTS AND METHOD

1. Study Design

This cross-sectional study was conducted in Karanganyar, Central Java, Indonesia, from April to August 2024.

2. Population and Sample

The target population consisted of preschool-aged children in Karanganyar Regency, Central Java. The accessible population included preschool-aged children available during the study period. A purposive sampling technique was used to recruit 112 preschool children. The inclusion criteria were preschool-aged children, while the exclusion criteria were children with congenital developmental disorders.

3. Study Variables

The dependent variable in this study was language development ability. The independent variables were cognitive ability, stunting status, mid-upper arm circumference, and maternal education.

4. Operational Definition of Variables

Language Development Ability: The level of language skills of the child, assessed through a structured questionnaire.

Cognitive Ability: The mental capability of the child, measured through a validated cognitive screening tool.

Stunting Status: Classified based on height-for-age Z-scores (HAZ) according to WHO standards, where stunting was defined as HAZ < -2 SD.

Mid-Upper arm circumference (MUAC): A measurement of the circumference of the child's upper arm to assess nutritional status.

Maternal Education: The highest level of formal education completed by the mother.

5. Study Instrument

Data were collected using a structured questionnaire administered to the participants' guardians during the research period (April to August 2024). The questionnaire included items on demographic information, language development ability, cognitive ability, MUAC, stunting status, and maternal education.

6. Data Analysis

Univariate analysis was performed to describe the characteristics of each variable, including language development, cognitive ability, stunting status, MUAC, and maternal education, resulting in distributions and percentages. Bivariate analysis was conducted to examine the relationship between each independent variable (cognitive ability, stunting status, MUAC, and maternal education) and the dependent variable (language development ability) using Chi-square tests and calculation of odds ratios (OR) with 95% confidence intervals (CI). Multivariate analysis was employed to determine the influence of multiple independent variables on the dependent variable using logistic regression analysis. Data analysis was performed using Stata version 13.

7. Research Ethics

This study obtained ethical approval from the Health Research Ethics Committee of the Health Polytechnic of the Ministry of

Health, Surakarta, with reference number: DP.04.04/F.XXV/4183/2024.

RESULTS

1. Sample Characteristics

Based on table 1, it can be seen that more than half of the respondents were female (54.46%), the child's weight at birth was ≥2500 grams (79.5%), with the child's upper arm circumference ≥13 cm (50.89%), mothers with basic education (52.68%), children with stunting and poor cognitive development of 52.6%.

Table 1. Characteristic distribution in pre-school children in Karanganyar Regency (n=112)

Characteristics	Category	Normal		Delayed	
		n	%	n	%
Gender	Woman	25	40.98	36	59.02
	Man	26	50.98	25	49.02
Birth Weight (grams)	<2500	8	34.8	15	65.2
	≥2500	43	48.3	46	54.7
MUAC	<13	11	20.00	44	80.00
	≥13	40	70.18	17	29.82
Mother's Education	Low	9	15.25	50	84.75
	High	42	79.25	11	20.75
Stunting	Yes	9	15.52	49	84.48
	No	12	22.22	42	77.78
Cognitive Ability	Poor	10	16.67	50	83.33
	Normal	41	78.85	11	21.15

2. Bivariate Analysis

The bivariate analysis describes the influence of each independent variable on the dependent variable (children's language development). The method used was the chi-square test. Table 2 shows that delayed language development in children was significantly associated with stunted status (OR= 19.05; p< 0.001), poor cognitive ability (OR = 18.63; p< 0.001), a mid-upper arm circumference <13 cm (OR= 9.41; p< 0.001), and low maternal education (OR= 21.21; p< 0.001).

Table 2. The Chi-Square Test Results Affecting Language Development in Pre-school Children

Variable	Language Development				OR	95%CI		p
	Normal		Delayed			Lower limit	Upper limit	
	n	%	n	%				
Stunting								
Yes	9	15.52	49	84.48	19.06	7.31	49.64	<0.001
No	42	77.78	12	22.22				
Cognitive Ability								
Poor	10	16.67	50	83.33	18.64	7.20	48.22	<0.001
Normal	41	78.85	11	21.15				
MUAC								
<13	11	20.00	44	80.00	9.41	3.94	22.48	<0.001
≥13	40	70.18	17	29.82				
Mother's Education								
Low	9	15.25	50	84.75	21.21	8.02	56.05	<0.001
High	42	79.25	11	20.75				

3. Path-Analysis

The pathway diagram was constructed based on theoretical evidence that maternal factors and child nutritional status critically influence early developmental outcomes. Maternal education was positioned as an upstream determinant, reflecting its established role in shaping health behaviors, resource utilization, and caregiving practices that impact child growth and development.

Stunting was modeled as a central mediating variable, representing the cumulative effects of early nutritional deficiencies and maternal influences. It was hypothesized to mediate the relationship between maternal factors (education and upper arm circumference) and child cognitive and language outcomes, aligning with prior studies linking chronic undernutrition to impaired neurodevelopment.

Upper arm circumference was incorporated as a proxy for maternal nutritional status, directly influencing the risk of stunting in children, given the strong association between maternal undernutrition and adverse birth and growth outcomes.

Cognitive ability was positioned as a subsequent mediator between stunting and language development. This reflects the understanding that early cognitive delays, often arising from malnutrition, can lead to subsequent impairments in language acquisition and communication skills.

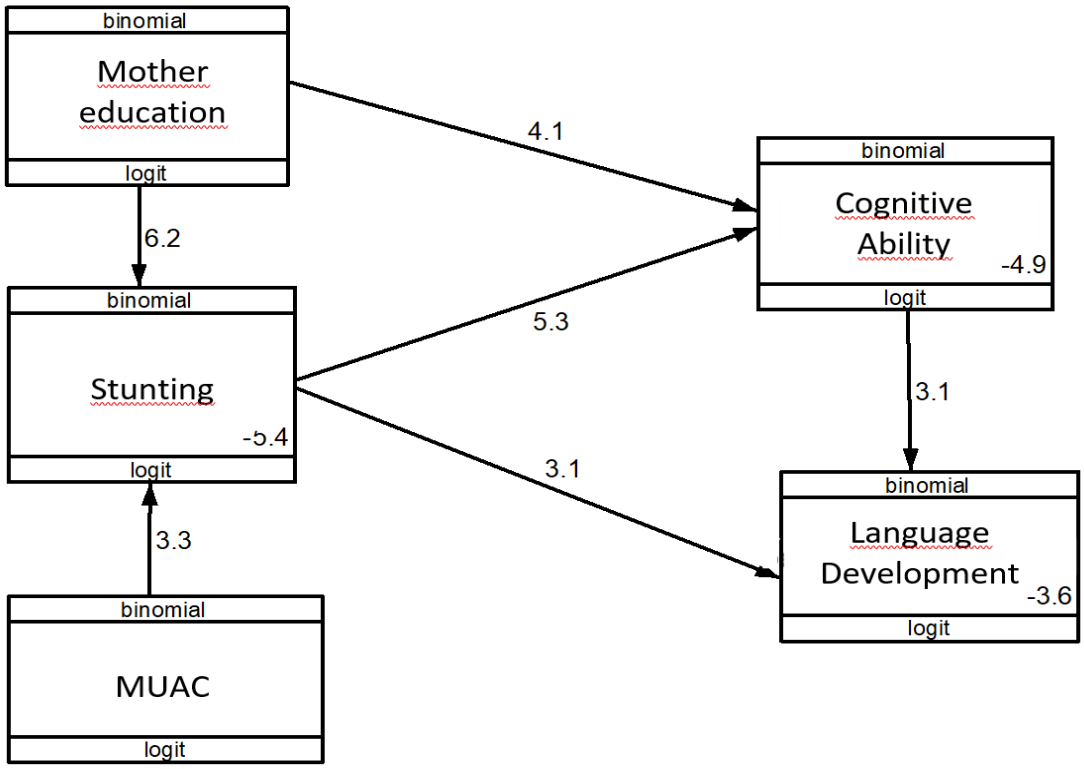

Figure 1. Path Analysis Model

Table 3 shows that the path analysis model has met the specified criteria and is stated according to the empirical data. Children with stunting (b=2.09; CI 95%=1.02 to 3.16; p <0.001) and having poor cognitive ability have a direct effect on increasing the

occurrence of language development delays in children (b=2.06; CI 95%=0.99 to 3.13; p <0.001). There are several variables that have an indirect and statistically significant effect, namely, maternal education and the child's upper arm circumference < 13 cm on the development of children who are late through stunting. As well as maternal education and stunting through children's cognitive abilities.

Table 3. Analysis of pathways on factors that influence language development

Dependent variable		Independent variable	b	95%CI		p
				Lower limit	Upper limit	
Direct Influence						
Language	←	Stunting	2.09	1.02	3.16	<0.001
development	←	Cognitive Ability	2.06	0.99	3.13	<0.001
Indirect Influence						
Stunting	←	Mother's Education	2.4	1.40	2.4	<0.001
	←	MUAC	1.06	0.02	2.19	0.044
Cognitive Ability	←	Mother's Education	3.03	1.86	4.19	<0.001
	←	Stunting	1.65	0.99	3.13	<0.001
n observation = 112						
Log Likelihood = -138.63						

DISCUSSION

1. Implications of Stunting on Cognitive Ability

Stunting, a condition caused by chronic malnutrition, has a significant impact on children language development. This disorder is mostly caused by the negative effects of stunting on brain growth and cognitive abilities. In its direct implications, stunting adversely affects the structure and function of brain nerve cells. These disorders can lead to a decrease in intellectual capacity, inhibiting children's ability to absorb information effectively. Stunted children often show lower levels of learning achievement, reduced thinking skills, and impaired cognitive performance. Physical manifestations of stunting, such as a smaller head size, are an indication of biochemical deficiencies in the brain that correlate with reduced brain cell counts (Daracantika et al., 2021a; Maulina et al., 2023).

Research by Maulina et al (2023) suggests that stunted children may have an IQ that is 2.14 times lower than their non-stunted peers, highlighting significant cognitive gaps that can affect their educational outcomes. In addition, stunting is associated with limited vocabulary development, which is crucial for language acquisition and overall cognitive development (Daracantika et al., 2021a).

Meanwhile, the long-term implications of stunting, where children who experience stunting tend to face persistent cognitive deficits that persist into adulthood. Research by Lestari et al. (2024) and Rambe et al. (2023) shows that these children often have lower educational attainment and are at risk of delay. In particular, stunting has been associated with a decline in non-verbal cognitive abilities and overall academic performance. In addition, the impact of stunting can extend beyond childhood and affect an individual's intelligence throughout their lives. While some cognitive abilities can improve with age, the underlying deficits caused by early stunting often result in lower overall educational achievement (Lestari et al., 2024).

2. Implications of Stunting on Language Development

Stunted children usually show lower cognitive abilities, which directly affects their language development. They are often only able to achieve basic language tasks and struggle with the more complex language skills expected at their age. This is because their cognitive development is stunted, making it difficult for them to process and use language effectively (Akbar et al., 2023; Setianingsih et al., 2020).

As children grow, the complexity of the language they are expected to understand and produce increases. Research by Sukiman et al. (2023) shows that stunted toddlers can only achieve a fraction of the vocabulary expected for their age. For example, while 50% of normal toddlers can achieve certain vocabulary abilities, only about 20% of stunted toddlers can do the same. Another supportive study involving 82 toddlers found a significant association between stunting and language development, with a p-value of <0.001 showing strong evidence of impact. In this study, 30% of stunted toddlers showed language delay compared to only 25% in the non-stunting group (Setianingsih et al., 2020).

Mangunsong et al. (2024) conducted a study in Karanganyar Regency, Central Java, analyzing factors influencing language development in preschool children. Their findings revealed that stunting significantly increases the risk of language development delays, with a regression coefficient of b = 2.82 and a p= 0.006. This indicates that stunted children are more than twice as likely to experience language delays compared to their non-stunted peers. The study emphasizes that stunting not only affects physical growth but also impairs brain development, leading to challenges in vocabulary acquisition and information processing. These cognitive impairments hinder children's ability to understand and use language effectively. The long-term implication is that children who are stunted may face long-term challenges in education and social integration due to impaired cognitive and linguistic skills. This can lead to difficulties in school performance and lower educational attainment later in life (Mbabazi et al., 2024).

3. The Influence of Cognitive Abilities on Language Development

Cognitive development provides the basis for language acquisition. As children grow, their ability to think, understand, and process information increases their capacity to learn language. For example, Jean Piaget's theory emphasizes that children learn about their environment through cognitive processes such as adaptation and schema formation, which are essential for understanding language. Cognitive skills allow children to understand verbal instructions, remember vocabulary, and use grammar effectively (Cahyaningsih et al., 2025).

Language development is highly dependent on basic cognitive processes, including verbal and non-verbal abilities. Research shows that children with lower cognitive abilities often show delays in language skills. For example, studies have shown that performance IQ scores are often lower in children with language developmental disorders compared to their peers with good language development. This suggests that cognitive deficits can inhibit the ability to process and use language effectively (Liao et al., 2015).

Conversely, delays in language development can also adversely affect cognitive function. Children with speech and language delays may have difficulty in problem-solving, attention, and interaction of social skills that are essential for cognitive development. This deficiency can create a cycle in which poor language skills lead to reduced cognitive engagement, which in turn inhibits

further language acquisition (Marrus and Hall, 2017).

4. The Influence of Maternal Education on Cognitive Ability through Stunting

Maternal education plays an important role in children's cognitive development, especially in the context of stunting, which is a global health problem that results in a child's physical and mental growth. Stunting occurs as a result of chronic malnutrition, especially during the first 1,000 days of life, and can inhibit brain development, negatively impacting children's cognitive abilities in the future. Research by Rahmawati and Agustin (2020) shows that the level of maternal education is related to the incidence of stunting. Mothers with low education tend to lack knowledge about child nutrition and health, which can lead to inadequate feeding practices and a lack of attention to the child's health. A study in Indonesia found that mothers with low levels of education have a higher risk of having children who are stunted. This is due to a lack of understanding of the importance of good nutrition and how to take care of children optimally.

A literature review noted that interventions to improve nutritional status during this critical period are essential to prevent stunting and improve children's cognitive abilities. Programs that educate mothers about nutrition and health, as well as provide support for good feeding practices, can help reduce stunting rates. Maternal education serves not only as a risk factor but also as a protective factor; Educated mothers are more likely to seek out information about health and nutrition and apply that knowledge in their child's care (Daracantika et al., 2021b).

Overall, the relationship between maternal education, stunting, and children's cognitive abilities demonstrates the importance of a multidimensional approach in addressing this issue. Interventions that focus on improving maternal education and access to information on nutrition can be an effective strategy to reduce the prevalence of stunting and improve the quality of children's cognitive development around the world (Shoofiyah et al., 2024).

5. Effect of Upper Arm Circumference on Cognitive Ability through Stunting

Upper arm circumference is one of the anthropometric indicators used to assess nutritional status, especially in the context of protein energy deficiency. Research shows that MUAC measurements can reflect a child's nutritional status and are closely related to their cognitive development. In this context, MUAC serves as an important indicator to identify children who are at risk of stunting. Research by Masdalis et al. (2022); Rohim et al. (2024) showed that children with low MUAC tend to have smaller head sizes, which are related to brain volume and thinking ability. This is reinforced by research showing that stunted children have lower learning and arithmetic skills compared to their non-stunted peers.

Appropriate nutrition during the first 1,000 days of life is essential for brain development. Proper nutritional interventions can help improve nutritional status and, at the same time, support a child's cognitive development. Research by Pitriani et al. (2021) shows that improving nutritional status through nutritious feeding can improve MUAC size and support cognitive development. Overall, the association between MUAC and cognitive ability through stunting suggests that attention to a child's nutritional status is essential to support their optimal development. Stunting prevention efforts through nutrition interventions and education for parents can help

improve long-term health outcomes for children.

6. The Influence of Maternal Education on Language Development through Stunting

Maternal education has a significant influence on children's language development, especially in the context of stunting. Stunting, which is a condition of failing to grow due to chronic malnutrition, affects not only physical growth but also cognitive and language development. Research shows that stunted children tend to have delays in language development compared to children who are not stunted. This is due to several factors, including a lack of psycho-social stimulation and support from the mother. One relevant study shows that maternal education plays an important role in providing the necessary stimulation for children's language development. Mothers with higher levels of education tend to have better knowledge of the importance of language stimulation and how to do it. They are better able to create an environment that supports language development through rich interactions, such as speaking, reading, and playing with their child. This study indicates that there is a significant relationship between a mother's knowledge of language stimulation and a child's language development, where more educated mothers are more likely to provide appropriate stimulation (Ruswiyani and Irviana, 2024).

Other research shows that although a child's nutritional status is important, the mother's knowledge of language stimulation has a greater influence on a child's language development. The study found that there was a significant relationship between maternal knowledge and children's ability to use language, while the relationship between nutritional status and language development did not show the same significance (Berlian et al., 2023). This emphasizes the importance of the role of maternal education in facilitating children's language development, especially for those who are stunted.

Overall, the relationship between maternal education and children's language development through stunting suggests that interventions focused on improving maternal parenting knowledge and skills can help reduce the negative impacts of stunting. By improving maternal education and providing support in the form of training on appropriate stimulation for children, we can contribute to improving language development outcomes for children affected by this condition. More research is needed to explore this relationship in depth and to design more effective interventions (Longa et al., 2021).

7. The Effect of Upper Arm Circumference on Language Development through Stunting

Upper arm circumference is often used as an indicator of a child's nutritional status, where inadequate measurements can indicate a risk of stunting. Children who experience stunting, especially at an early age, are at high risk of delays in language development. Research by Rahmidini (2020) indicates that children with stunting are up to 11.98 times more likely to experience below-average motor development and also experience delays in language skills. This is due to the lack of nutritional intake necessary for optimal brain growth and neural development. Stunting can inhibit the formation of neurons and synaptic connections that are important for cognitive and language development (Daracantika et al., 2021b).

Octavia's (2017) research shows that children who experience severe stunting have a much lower non-verbal IQ compared to children who are not stunted. They are at risk of having an IQ below 89, as well as showing significant declines in verbal and

motor abilities. This delay in language development can be seen from the child's ability to express themselves verbally, understand simple instructions, and interact with their social environment.

Upper arm circumference serves as a measuring tool to assess a child's nutritional status. A lack of MUAC size can indicate ongoing nutritional deficiencies, potentially leading to stunting. Therefore, regular MUAC monitoring is very important in the early detection of stunting and nutritional interventions. Appropriate nutritional interventions early in life can help prevent the long-term negative impact of stunting on children's language and cognitive development (Meilani et al., 2024). Overall, the relationship between upper arm circumference, nutritional status, and language development in children is very close. Measurable malnutrition through MUAC can lead to stunting, which in turn negatively impacts a child's language and cognitive abilities. Therefore, attention to nutritional intake and monitoring of children's nutritional status from an early age is essential to support their optimal development.

Based on the analysis and discussion that has been carried out, it can be concluded that stunting has direct implications for cognitive ability and language development. Children with stunted conditions tend to have lower cognitive abilities compared to normal children. Likewise, in language development, stunted children often have difficulty understanding and using language effectively.

This is due to the limitations in environmental stimulation and social interaction necessary for optimal language development. Delays in language development can result in difficulties in communication and social interaction, which in turn affects a child's academic achievement and social abilities in the future. In the results of the data analysis, indirectly maternal education and upper arm circumference in infants affect cognitive ability and language development through stunting. Maternal education and MUAC have a significant impact on children's cognitive abilities and language development through their influence on stunting. Improving health education for mothers and paying attention to nutritional status from infancy can help prevent stunting and support optimal child development.

AUTHOR CONTRIBUTION

Roy Romey, as the principal investigator, is responsible for data collection, data processing, formulating the research framework, supporting theories, and contributing to the research discussions.

ACKNOWLEDGMENT

We are grateful to all informal workers who are willing to participate and are willing to be the subjects of the research.

FUNDING AND SPONSORSHIP

This research received no external funding or sponsorship.

CONFLICT OF INTEREST

There were no conflicts interest in this study.

REFERENCE

Adhyatma AA, Laska Y, Putri DA (2022). Faktor-faktor yang mempengaruhi kejadian stunting pada balita umur 24-59 bulan. Med J Al-Qodiri. 7(2):84–95. doi: 10.52264/jurnal_stikesalqodiri.v7i2.166.

Akbar RR, Kartika W, Khairunnisa M (2023). The effect of stunting on child growth and development. Sci J. 2(4): 153–160.doi:10.56260/sciena.v2i4.118

Andriani L, Nisa S, Aprihatin Y, Hamka J (2023). Pengaruh negatif stunting terhadap perkembangan kognitif dan

motorik pada anak balita. J Med. 3:1–10.

Azizah AM, Nurmala I, Devy SR (2022). Meta analisis: pengaruh tingkat pendidikan ibu terhadap kejadian stunting pada anak balita. Amerta Nutr. 6(4): 369–375. doi:10.20473/amnt.v7i4.2022.369-375.

Aurellia BW, Hapsari A, Ekawati R (2023). Hubungan status gizi anak dan pengetahuan ibu tentang stimulasi bahasa dengan perkembangan bahasa anak di TK Aisyiyah Bustanul Athfal VI Kota Kediri. J Anestesi. 2(1):13–25. doi: 10.59680/anestesi.v2i1.727.

Cahyaningsih T, Gunarsih I, Abdurrauf NLR, Rahmadhani N, Islamiyah N, Saodi S (2025). The influence of cognition on children's language development: the relationship between comprehension, memory and language. Dev Psychol E-J.

Daracantika A, Ainin A, Besral B (2021a). The negative effect of stunting on children's cognitive development. J Biostat Kependik Inform Kesehat. 1(2):113. doi:10.7454/jbi.v1i2.4647.

Daracantika A, Ainin A, Besral B (2021b). Systematic literature review: pengaruh negatif stunting terhadap perkembangan kognitif. J Bikfokes. 1(2):1–12.

Ekariani NW (2022). Pemberdayaan masyarakat sebagai strategi percepatan penurunan stunting. AT-Tawassuth: J Ekon Islam. 8(1):1–8.

Hanifah QA, Pasune D, Runtunuwu KS (2022). Strategi pencegahan stunting dengan mengoptimalkan perawat: studi literatur. Angew Chem Int Ed. 6(11):951–952.

Hanum NL, Khomsan A (2016). Pola asuh makan, perkembangan bahasa, dan kognitif anak balita stunted dan normal di Kelurahan Sumur Batu, Bantar Gebang Bekasi. J Gizi Pangan. 7(2):81–88. doi: 10.25182/jgp.2012.7.2.81-88.

Hossain SJ, Hamadani JD, Tofail F, Fisher J, Rahman MA, Rahman SM (2024). Factors associated with children's cognitive, language, and motor development in deprived urban settings in Bangladesh. Child Care Health Dev. 50(1). doi: 10.1111/cch.13225.

Junus R, Langi GK, Paruntu OL, Ranti IN (2022). Usia saat hamil dan lila dengan kejadian stunting pada anak balita di wilayah kerja Puskesmas Ratatotok. E-Pros Semnas Poltekkes Kemenkes Manado. 1(2):381–391.

Lestari E, Siregar A, Hidayat AK, Yusuf AA (2024). Stunting and its association with education and cognitive outcomes in adulthood: A longitudinal study in Indonesia. PLoS One. 19(5). doi: 10.1371/journal.pone.0295380.

Lestarini PA, Yuniarti LNL, Sudiarta IK, Lestari MPL, Agustina KS (2024). Pencegahan stunting melalui edukasi pada masyarakat di Desa Cepaka Kecamatan Kediri Kabupaten Tabanan Bali. J Sinergi Kesehat Indones. 2(1):1–9. doi: 10.55887/jski.v2i1.18.

Liao SF, Liu JC, Hsu CL, Chang MY, Chang TM, Cheng H (2015). Cognitive development in children with language impairment, and correlation between language and intelligence development in kindergarten children with developmental delay. J Child Neurol. 30(1) :42–47. doi: 10.1177/0883073814535486.

Longa K, Ita E, Ngura ET. (2021). Hubungan stunting dengan perkembangan kognitif anak usia 4–6. J Citra Pendidik.

Mangunsong RRD, Sutanto AV, Sudarman (2024a). Generasi terhambat:mengungkap pengaruh stunting pada kemampuan kognitif dan perkembangan bahasa anak. Sukoharjo: Tahta Media Grup.

Mangunsong RRD, Sutanto AV, Sudarman (2024b). Factors Influencing Language Development in Preschool Children in Karanganyar Regency, Central Java. Int J Public Health Excellence. 3(1): 89–96. doi: 10.55299/ijphe.v4i1.1125.

Marrus N, Hall L (2017). Intellectual Disability and Language Disorder. Child Adolesc Psychiatr Clin N Am. 26(3). doi: 10.1016/j.chc.2017.03.001.

Masdalis AN, Nurhaedar J (2022). Pengaruh Pemberian Biskuit Dangke terhadap Status Gizi dan Perkembangan Kognitif Baduta Gizi Kurang. Nutr Sci Health Res. 1(1):17–24. doi: 10.31605/nutrition.v1i1.1819.

Maulina R, Qomaruddin MB, Prasetyo B, Indawati R, Alfitri R (2023). The Effect of Stunting on the Cognitive Development in Children: A Systematic Review and Meta-analysis. Stud Ethno-Med. 17(1–2):19–27. doi: 10.31901/24566772.2023/17.12.661.

Mbabazi J, Pesu H, Mutumba R, Bromley K, Ritz C, Filteau S, et al. (2024). Correlates of early child development among children with stunting: A cross-sectional study in Uganda. Matern Child Nutr. 20(2). doi: 10.1111/mcn.13619

Meilani N, Setiyawati N, Santi MY, Sulistyani IA (2024). Penguatan kader dalam deteksi dini kurang energi kronis (KEK) sebagai upaya pencegahan stunting di Kecamatan Sawangan, Kabupaten Magelang. Gemakes J Pengabdi Masy. 4(3):337–344. doi: 10.36082/gemakes.v4i3.1805.

Nazidah MDP, Fauziah R, Hafidah R, Jumiatmoko J, Nurjanah NE (2022). Pengaruh Stunting pada Kognitif Anak Usia Dini. Yinyang: J Studi Islam Gender Anak. 17(1):59–72. doi: 10.24090/yinyang.v17i1.4964.

Nurwasilah, Sahadewa AD (2024). The Relationship Between Maternal Education Level and Family Income on the Incidence of Stunting in Toddlers. J Ners. 8(2):1422–1429. doi: 10.29303/jppipa.v10i10.9495.

Octavia NR (2017). Hubungan Status Gizi dengan Perkembangan Motorik Anak Usia 3–5 Tahun di PAUD Desa Bibrik Kecamatan Jiwan Kabupaten Madiun. [Skripsi]. Stikes Bhakti Husada Mulia Madiun.

Pitriani LD, Nirmalasari R, Muzakki M (2021). Hubungan Status Gizi dengan Perkembangan Kognitif Anak Usia 5–6 Tahun. Al-Hikmah: Indones J Early Child Islam. Educ. 5(2):112–121. doi: 10.35896/ijecie.v5i2.198.

Rahayuwati L, Komariah M, Hendrawati S, Sari CWM, Yani DI, Setiawan AS, Ibrahim K, et al. (2023). Exploring the relationship between maternal education, parenting practice, and stunting among children under five: Findings from a cross-sectional study in Indonesia. F1000Res. 12:722. doi: 10.12688/f1000research.133916.1.

Rahmawati D, Agustin L (2020). Hubungan Tingkat Pendidikan Ibu dan Pemberian Informasi Tentang Stunting dengan Kejadian Stunting. Media Ilmu Kesehat. 9(1):80–85.

Rahmidini A (2020). Hubungan stunting dengan perkembangan motorik dan kognitif anak. Seminar Nasional Kesehatan. 2(1):90–104.

Rambe NL, Hutabarat EN, Hafifah R (2023). The Effect of Stunting on Children's Cognitive Development: Systematic Review. Contagion: Sci Period J Public Health Coastal Health. 5(2):360.doi: 10.30829/contagion.v5i2.14807.

Ratnawati R, Alam FSN (2023). Metode Bibliotherapy sebagai Upaya Penanganan Speech Delay pada Anak Stunting. J Obsesi: J Pendidik. Anak Usia Dini.

7(5):6483–6492.doi: 10.31004/obsesi-.v7i5.5332.

Rini CIP (2022). Program Pencegahan Stunting Masyarakat Indonesia. J Econ Perspect. 2(1):1–4. doi: 10.1080/2332-2039.2017.

Rohim AN, Mursali DAF, Ashilah SH, Fidrayanti (2024). Hubungan Status Gizi Terhadap Perkembangan Kognitif Anak Usia Dini. Madani: J Il. Multi-disipline. 2(6):234–243.

Ruswiyani E, Irviana I (2024). Peran Stimulasi Psikososial, Faktor Ibu, dan Asuhan Anak dalam Meningkatkan Perkembangan Anak Stunting: Tinjauan Literatur. J Parenting Anak. 1(2):8. doi: 10.47134/jpa.v1i2.313.

Salsabila S, Noviyanti RD, Kusudaryati DPD (2023). Hubungan Tingkat Pendidikan Ibu Dan Pola Asuh Orang Tua Dengan Kejadian Stunting Pada Balita Usia 12–36 Bulan Di Wilayah Puskesmas Sangkrah. Profesi: Media Publikasi Penelitian. 19(2):143–152. doi: 10.2657-6/profesi.v19ino.2.103.

Sari VNP (2022). Hubungan Antara Stunting Dengan Perkembangan Kognitif Anak Usia 24–59 Bulan Di Kelurahan Bandarharjo Semarang. Universitas Islam Sultan Agung.

Selawati (2022). Hubungan perkembangan motorik, bahasa, dan sosial emosional dengan derajat stunting pada balita di Desa Lokus Stunting Kecamatan Mauk Tahun 2022. UIN Syarif Hidayatulah Jakarta.

Setianingsih, Permatasari D, Sawitri E, Ratnadilah D (2020). Impact of Stunting on Development of Children Aged 12–60 Months. ICoSHEET 2019. 27: 186–189. doi: 10.2991/ahsr.k.2007-23.047.

Setiawati I, Maulana T (2024). Effect of hemoglobin levels and upper arm circumference of pregnant on stunting in toddlers. Media Ilmu Kesehat. 13(2):199–205.

Shoofiyah S, Pelawi AMP, Dedu BSS (2024). Hubungan Stunting Dengan Perkembangan Kemampuan Kognitif Anak Balita. J Penelit Perawat Prof. 6(5).

Sukiman, Andriyani, Herayati T, Umila, Wara LW, Yunaini (2023). The effect of stunting on early childhood language skills. International Conference Early Childhood. 245-278.

Wardani NEK (2022). The Effect of Stunting on the Level of Language Development in Toddlers. J. Voice Midwifery. 12(2).

Willyanto R, Ramadhani M (2023). Hubungan Pendidikan Ibu Terhadap Kejadian Stunting pada Anak Bayi Lima Tahun; Sistematik Review. J Health Manag Adm Public Health Policies. 1(1):1–7. doi: 10.52060/healthmaps.v1i1.1135.

Windiyani W, Sundari SW, Nurhikmah TS, Imani AN (2024). Pengukuran lingkar lengan atas dalam pemantauan gizi pada balita. Commun Dev J. 5(5).

Wiryawan IG, Oktava H, Mulyadi E, Destarianto P, Agustianto K (2021). Analysis of Upper Arm Circumference Using Statistical Approach as a Risk Factor of Stunting Cases. Proc. 1st Int. Conf. Soc. Sci. Humanit. Public Health. 514:69-73. doi: 10.2991/assehr.k.210101.016.

Yadika ADN, Berawi KN, Nasution SH (2019). Pengaruh stunting terhadap perkembangan kognitif dan prestasi belajar. J Majority. 8(2):273–282.