

## Systematic Review Of Relationship Stunting With Intelligence Of Elementary School Children

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### ABSTRAK

Satu dari tiga anak di Indonesia mengalami stunting. Stunting dapat berdampak pada perkembangan motorik dan verbal, meningkatkan penyakit degeneratif, morbiditas dan mortalitas. Selain itu, stunting akan menyebabkan pertumbuhan dan perkembangan sel neuron terhambat, sehingga mempengaruhi perkembangan kognitif pada anak. Dampak yang ditimbulkan oleh stunting terhadap perkembangan kognitif pada anak berbeda-beda, oleh karena itu penelitian ini bertujuan untuk mengetahui apa saja dampak stunting terhadap kemampuan kognitif pada anak. Metode yang digunakan adalah tinjauan literatur sistematis yang diambil dari jurnal nasional dan internasional. Berdasarkan hasil review, ditemukan bahwa stunting memiliki implikasi biologis terhadap perkembangan otak dan neurologis yang diterjemahkan ke dalam penurunan nilai kognitif. Stunting yang parah dengan Z-skor <-3SD dari indeks panjang badan menurut umur atau tinggi badan menurut umur anak memiliki dampak negatif terhadap tumbuh kembang anak. Selain itu, anak yang mengalami stunting pada 2 tahun pertama kehidupannya cenderung memiliki IQ non-verbal di bawah 89 dan IQ 4,57 kali lebih rendah dari IQ anak yang tidak mengalami stunting. Disimpulkan bahwa stunting memberikan pengaruh negatif terhadap kemampuan kognitif anak yang berdampak pada prestasi belajar.

**Kata Kunci** : Stunting, Kognitif, anak sekolah, sistematik literatur review

### ABSTRACT

One in three children in Indonesia is stunted. Stunting can impact motor and verbal development, increase degenerative diseases, morbidity and mortality. In addition, stunting will cause the growth and development of neuron cells to be inhibited, thus affecting cognitive development in children. The impact caused by stunting on cognitive development in children varies, therefore this study aims to find out what impact stunting has on cognitive abilities in children. The method used is a *systematic literature review* taken from national and international journals. Based on the results of the review, it was found that stunting has biological implications for brain and neurological development which translates into a decrease in cognitive value. Severe stunting with a *Z-score* <-3SD of the child's length-for-age or height-for-age index has a negative impact on child development. In addition, children who are stunted in the first 2 years of life are likely to have a non-verbal IQ below 89 and an IQ 4.57 times lower than the IQ of children who are not stunted. It is concluded that stunting has a negative influence on children's cognitive abilities which have an impact on learning achievement.

**Keywords** : stunting, cognitive, child, *systematic literature review*

## I. PENDAHULUAN

### 1. Latar Belakang (Background)

*Stunting* is a condition where children are too short for their age due to growth failure caused by poor nutrition and health before and after birth. *Stunting* is defined as height-for-age below -2 standard deviations according to the growth curve. (UNICEF). *Stunting* is considered a failure of linear growth in children due to prolonged malnutrition. Stunting is still a major problem in developing countries such as Indonesia due to its high prevalence (Fikawati *et al.*, 2017). According to the Decree of the Minister of Health Number 1995 /MENKES / SK / XII /2010 concerning Anthropometric Standards for Child Nutrition Status Assessment, a toddler is said to be stunted if the threshold value (z- score) is -3SD to less than -2SD and is categorized as very short if the z-score value is less than -3SD from the body length index or height for age (Ministry of RI). Based on WHO data, 22.2% or around 150.8 million toddlers were *stunted* in the world in 2017. This figure has decreased when compared to 2005 of 29.3%, in 2010 as much as 26.1%, and in 2015 it continued to decline up to 23.2% (WHO, 2018). In 2017, *stunted* children worldwide comprised 29% in Africa and 55% in Asia. The incidence of *stunting* in South Asia has the largest proportion of 58.7%, followed by Southeast Asia (14.9%), East Asia (4.8%), West Asia (4.2%), and Central Asia (0.9%) with the smallest proportion. Indonesia ranked third among Asian countries with a stunting rate of 36.4%, after Timor-Leste (50.2%) and India (38.4%) (4). The prevalence of stunting in Indonesia fluctuates from year to year. Based on Basic Health Research data in 2018, the prevalence of *stunting* among children under five in Indonesia was 30.8%. This figure has decreased compared to 2013 (37.2%) and 2010 (35.6%) (Ministry of RI). According to WHO, a public health problem can be considered chronic if the prevalence of stunting is more than 20 percent. This means that nationally, the problem of stunting in Indonesia is classified as chronic, especially in Indonesia. 14 provinces where the prevalence exceeds the national rate. Children who experience *stunting* have stunted growth and are *irreversible*. The impact of *stunting* can last a lifetime and affect the next generation (WHO). One of the impacts of stunting is the suboptimal cognitive ability of children which will affect their lives in the future. According to Yusuf, cognitive ability is the child's ability to think more complexly and perform reasoning and problem solving, the development of cognitive abilities will make it easier for children to master broader general knowledge. This will allow children to function reasonably in social life (Sandjaja *et al.*, 2013). While cognitive abilities according to Yusuf, are the ability of children to think more complexly and do reasoning and problem solving, the development of cognitive abilities will make it easier for children to master broader general knowledge (Sandjaja *et al.*, 2013). *Stunting* is a complex problem caused by several factors, both direct and indirect. Trihono revealed that the factors that cause stunting directly are the lack of nutritional intake and the presence of diseases, especially infectious diseases. While indirect causes consist of family food security factors, parenting and family diet as well as environmental health and health services. The underlying cause of all these factors is education poverty, disparity, socio-culture, government policy and politics (Trihono *et al.*, 2015). Maternal health is very influential on the health of the children they give birth to. The process of stunting starts from the pre-conception period where the mother experiences malnutrition and anemia plus during pregnancy the mother's nutritional intake is insufficient (Ministry of RI).

### 2. Perumusan Masalah

This paper discusses about knowing and memorizing concisely and clearly about the relationship between the incidence of stunting and cognitive work of primary school children.

### 3. Tujuan Penelitian

The purpose of writing this article is to describe the memorizing concisely and clearly about the relationship between the incidence of stunting and cognitive work of primary school children

### 4. Manfaat Penelitian

This paper is expected to be useful for researchers, health practitioners and medical teams as well as medical supporters in implementing and implementing

## II. METODE (Method)

This study uses a *systematic literature review* using the PRISMA method (*Preferred Reporting Items for Systematic Reviews and Meta-analyses*) through four stages, namely identification, screening, eligibility and accepted results. Literature searches were conducted by accessing electronic databases online from Pubmed and Google Scholar. At the beginning of the search with a database using inclusion criteria, namely journals and articles that examine the association of the impact between stunting and child cognition. Then using the criteria exclusion by looking at the publication time with a range of 2010 - 2020. In the final stage, the assessment was carried out by removing journals that had the same title and author, incomplete text and verifying research results such as sample adequacy, anticipation of bias, comparison groups, and the suitability of statistical tests from the literature list.

## III. HASIL PENELITIAN (Result and Discussion)

From the results of the literature search with a *systematic literature review*, 23,130 journals and articles were obtained with the keywords stunting, children, cognitive, cognitive development. Then using the exclusion criteria by looking at the publication time and suitability of the study, 8840 literature were obtained. In the final stage, the assessment was carried out by removing journals with the same title and author, incomplete text and verifying research results such as sample adequacy, anticipation of bias, comparison groups, and suitability of statistical tests from the literature list. The author obtained 12 literatures with complete texts and in accordance with criteria, consisting of 5 literature in Indonesian and 7 literature in English (Figure 1).

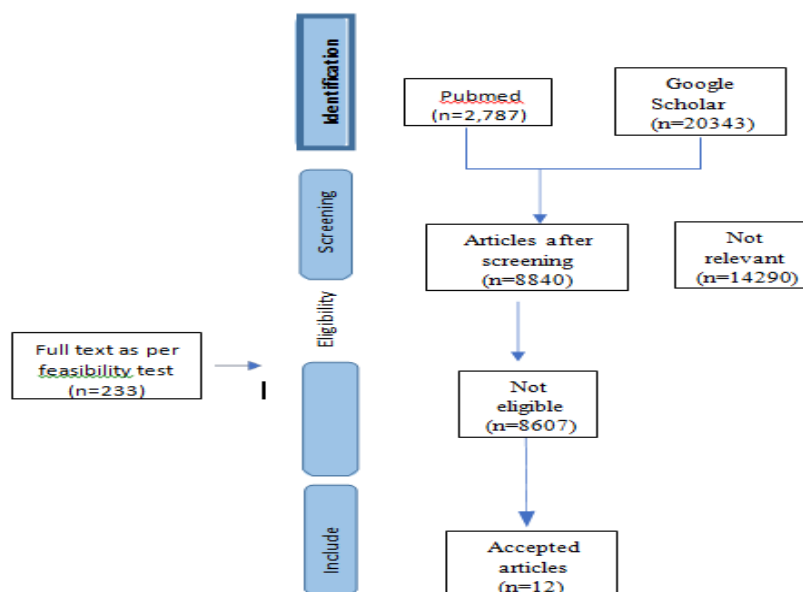


Figure 1. Flow of *systematic review* with the PRISMA Method

### Article Review

*Stunting* is a condition of growth failure in children under five years old (infants under five years old) due to chronic malnutrition, recurrent infectious diseases, and inadequate psychosocial stimulation (4). Here are some research results that are used as references in this study. The results of the literature review of the 12 journals show that in the results of the research by Miller, et.al, it was found that children who were severely stunted with a Z-score  $< -3SD$  from the child's length or height-for-age index. has a negative impact on child development based on the *Early Childhood Development Index* (ECDI) (OR=0.75; 95% CI=0.67-0.83) (WHO). In line with Haile's research which found a statistically significant positive relationship between the correlation of all cognitive test scores and academic achievement as seen by of math scores ( $P < 0.05$ ) (Haile *et al.*, 2016). Supported by research from Ekholuenetale, et al that children with stunting experience a 7% decrease in cognitive development compared to children who are not stunted (Ekholuenetale *et al.*, 2020). In line with research conducted by Pantaleon, et al, namely 12% of children who are stunted have more potential for cognitive development cognitive development less than 8% of children who are not stunted (Pantaleon *et al.*, 2016).

### Discussion

The results of the study by Sandjaja, et all. show that children with low Z score values according to BB/U are likely to have a non-verbal IQ  $< 89$ . Likewise, children who have low BMI/U and TB/U are likely to have a non-verbal IQ  $< 89$  compared to children who are not stunted. It can be concluded that children who experience stunting in the first 2 years of life are likely to have an IQ  $< 89$  compared to children who do not experience stunting. (Sandjaja *et al.*, 2013). Meanwhile, according to Aurora, et al that stunted children get an IQ score 4.57 times lower than the IQ of children who are not stunted. Where stunted children with IQ scores below the average were 48 children (64%). Whereas in children who are not stunted who get an average IQ score above is 72% and those who get an average IQ score below is 28% (Aurora *et al.*, 2020). Research conducted by Woldehanna, et al stated that children with stunting showed a 16.1% lower score in the *Picture Peabody Vocabulary test* (PPVT) and 48.8% lower in the quantitative assessment test at the age of eight years (Woldehanna *et al.*, 2017). Another study conducted by Picauly, et al on schoolchildren in Kupang and East Sumba showed that students with stunting had more poor learning achievement, while students who were not stunted had more good learning achievement. It can be concluded that children who are stunted will experience obstacles in their thinking and memory processes so that they have an impact on the lack of learning achievement (Martony *et al.*, 2020).

No	Researcher Name	Research Title (Country of Origin)	Place of Research, Methods, Sample Size, Instrument	Results
1	Haile, et.al., (2016) (9)	<i>Height for age z score and cognitive function are associated with Academic performance among school children aged 8-11 years old</i>	<ul style="list-style-type: none"> <li>Goba town, Bale zone, Oromiya region, Southeast Ethiopia</li> <li>Cross sectional</li> <li>131 elementary school-aged students in Goba city</li> </ul>	There is a positive relationship between height based on Z score and math score in stunted children whose math score is 2.11 lower than children who are not stunted. ( $\beta = 2.11$ 95% CI=0.002-

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			• Socio-demographic characteristics: structured questionnaire.Food	
			intake: 24-hour food re- call qualitative method. Cognitive assessment: Kaufman Assessment Battery for Children (KABC- II) and Raven's Colored Progressive Matrices (RCPM).	4,21).
2	Miller et al., (2016) (10)	<i>How consistent are associations between Stunting and child development? Evidence from a meta-analysis of associa</i>	Countries with Multiple Indicator Cluster Surveyround 4 (MICS-4) data Meta-analysis	Severely stunted children with a Z-score <-3SD of the child's length-for-ageindex or height-
		<i>tions between stunting and multidimensional child development in fifteen low-and middle-income countries</i>	Using UNICEF's Multiple Indicator Cluster Surveyround 4 (MICS-4) 58,513 children aged 36-59 months. Stunting, maternal education, family wealth, books in the home, parenting and child gender: fifteen	for-age index have a negative impact on child development (OR=0.75; 95% CI=0.67-0.75). 0,83).
			<i>Multiple Indicator Cluster Survey (MICS)</i>	
			items. Physical, learning, literacy/numeracy and socio-emotional development domains: ten- item	
			<i>Early Childhood Development Index</i>	
3	Sandjaja, et al.,2013 (11)	<i>Relationship between anthropometric indicators and cognitive performance in Southeast Asian school-age children</i>	• South-East Asian Nutritio Survey (SEANUTS) - Indonesia, Malaysia, Thailand and Vietnam • Cross sectional • 6746 primary school-age children Nutritional status:	Children with low Z score according to IMT/U and low TB/U are more likely to have non-verbal IQ <89 compared to children who are not stunted.

			anthropometric measurements according to WHO criteria. IQ assessment: <i>Raven's Progressive Matrices (RPM)</i> (for children aged 6-12 years) and <i>Test of Non-Verbal</i>	
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#### IV. KESIMPULAN (Conclusion)

From all the literature that has been reviewed, it can be concluded that stunting has a negative influence on cognitive abilities in children, such as lower IQ and lack of academic achievement results. Stunting has biological implications for brain and neurological development which translates into cognitive impairment that impacts learning achievement. Stunting is along process that starts from the preconception period where the mother's health greatly affects the health of the child she gives birth to. Stunting is not just a problem of malnutrition but is a multi-factor and multi-sector problem. To prevent stunting, parents need to fulfill children's nutritional needs, provide exclusive breastfeeding for six months, conduct early detection by consulting and regularly measuring children's weight and height. So that healthy children are formed and become the next generation of quality. In addition, cooperation from various sectors is needed so that healthy children will be formed and become the next generation of quality.

#### DAFTAR PUSTAKA

- Aurora WID, Sitorus RJ, Flora R. (2020). Comparison of IQ (Intellectual Question) Score in Stunting and Normal Children. *JAMBI Med J* "Journal of Medicine and Health." 2020;8(1):19
- Fikawati S, Syafiq A, Veratamala A. (2017). Child and adolescent nutrition. Depok: PT Rajagrafindo Persada; 2017.
- Haile D, Nigatu D, Gashaw K, Demelash H. (2016). Height for age z score and cognitive function are associated with academic performance among school children aged 8-11 years old. *Arch Public Heal.* 2016;74(1).
- Indonesian Ministry of Health. National Riskesdas Report 2018. Lap Nas RI Skesdas 2018. 2018;
- Martony, O., Lestrina, D. and Amri, Z. (2020). 'Pemberdayaan Ibu Untuk Perbaikan Pola Konsumsi Ikan Terhadap Peningkatan Asupan Protein, Kalsium, Zink dan Z Score Tinggi Badan Menurut Umur Pada Anak', *Jurnal Keperawatan Silampari*, 3(2), pp. 672-686. doi: <https://doi.org/10.31539/jks.v3i2.1188>.
- Miller AC, Murray MB, Thomson DR, Arbour MC. (2016). How consistent are associations between stunting and child development? Evidence from a meta-analysis of associations between stunting and multidimensional child development in fifteen low- and middle-income countries. *Public Health Nutr.* 2016;19(8):1339-47.
- Ministry of Health RI. 1 from Indonesia's toddlers suffer from stunting - Directorate of P2PTM [Internet]. (2018). Indonesian Ministry of Health. 2018. Available from: <http://www.p2ptm.kemkes.go.id/artikel-health/1-of-3-toddlers-indonesia-derita-stunting>
- Ministry of Health RI. (2010). Decree of the Minister of Health Republic of Indonesia No. 1995 /Menkes/SK/XII/2010 about Standard Anthropometric Standards for Child Nutrition Status Assessment. Jakarta: Directorate General of Nutrition and Maternal and Child Health, Ministry of Health; 2011.

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- Onifade OM, Otegbayo JA, Akinyemi JO, Oyedele TA, Akinlade AR. (2020). Nutritional status as a determinant of Health Survey. *Egypt Pediatr Assoc.. Gaz.* 2020;68(1):1-11.
- Pantaleon MG, Hadi H, GamayantiIL. (2016).Stunting is associated with child motor development in Sedayu sub-district, Bantul, Yogyakarta. *Indonesian J Nutr Diet and Nutrition.* 2016;3(1):10.
- Probosiwi H, Huriyati E, Ismail D. (2016). cognitive development among Stunting and childhood development preschool children in South-Western Bikfokes Volume 1 Issue 2 Year 2021 139 12-60 months in Kalasan. *Ber Kedokt Nigeria. Br Food J. Masy.* 2017;33(11):559. 2016;118(7):1568-78.
- Sandjaja S, Poh BK, Rojroonwasinkul N, Le Nyugen BK, Budiman B, Ng LO, et al. (2013). Relationship between anthropometric indicators and cognitive performance in Southeast Asian school-aged children. *Br J Nutr.*2013;110(SUPPL.3).
- Solihin RDM, Anwar F, Sukandar D. Relationship between nutritional status, cognitive development, and motor development in preschool children. *The J Nutr Food Res.* 2013;36(1):62-72.
- Trihono, Atmarita, Tjandrarini DH, Irawati A, Utami NH, Nurlinawati I, et al. (2015). Stunting in Indonesia, Problems and Solutions. Publishers Institute of Balitbangkes. Jakarta: Publishing House of the National Institute of Health; 2015.
- UNICEF.(2020). Malnutrition prevalence remains alarming: stunting is declining too slowly while wasting still impacts the lives of far too many young children [Internet]. UNICEF.2020.Available from:<https://data.unicef.org /topic /nutrition / malnutrition/>
- Warsito O, Khomsan A, Hernawati N, Anwar F.(2012). Relationship between nutritional status, psychosocial stimulation, and cognitive development in preschool children in Indonesia. *Nutr Res Pract.*(2012). 6(5):451-457
- Woldehanna T, Behrman JR, Araya MW. (2017).The effect of early childhood stunting on children's cognitive achievements: Evidence from young lives Ethiopia. *Ethiop J Heal Dev.* 2017;31(2):75-84
- World Health Organization. (2018). Levels and trends in child nutrition key findings of the 2018 edition of the joint child malnutrition estimates. Geneva: World Health Organization; 2018

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