

STUNTING: EARLY DETECTION WITH ANTHROPOMETRIC MEASUREMENTS AND MANAGEMENT

(STUNTING : DETEKSI DINI DENGAN PENGUKURAN ANTROPOMETRI DAN PENATALAKSANAANNYA)

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ABSTRACT

Stunting is a condition of short stature in which the length or height of the body is not appropriate for the age when compared to the growth curve. Stunting is also known as a condition of failed growth in children (body and brain growth) caused by long-term malnutrition related to low socioeconomic status, poor maternal nutrition and health, history of recurrent illness, and inappropriate infant and child feeding practices. One way to detect initial stunting is through anthropometric measurements. Early detection prevents stunting with periodic measurements of weight and height according to age, which can help prevent and manage stunting. This research method is a literature review. Literature searches use online databases such as Google Scholar, including PubMed, DOAJ, and GARUDA, for articles published in the

last ten years. Keywords related to the theme are applied during the article search process. A total of 14 articles or journals were selected as study materials. The results of the literature review explain the epidemiology, aetiology, risk factors, anthropometric measurements, and prevention of stunting in children. In conclusion, early detection through anthropometric measurements can prevent stunting and ensure more optimal management.

Keywords: anthropometric measurements; stunting

ABSTRAK

Stunting adalah suatu kondisi perawakan pendek dimana panjang atau tinggi badan yang tidak sesuai jika dibandingkan dengan usianya dilihat berdasarkan kurva pertumbuhan. Stunting juga dikenal sebagai suatu kondisi gagal pertumbuhan pada anak (pertumbuhan tubuh dan otak) yang diakibatkan kekurangan gizi dalam waktu yang relatif lama yang berhubungan dengan status sosioekonomi rendah, asupan nutrisi dan kesehatan ibu yang buruk, riwayat sakit berulang, dan praktik pemberian makan pada bayi dan anak yang tidak tepat. Salah satu cara untuk melakukan deteksi dini stunting adalah melalui pengukuran antropometri. Deteksi dini cegah stunting dengan pengukuran berkala berat badan dan tinggi badan sesuai umur, dapat membantu upaya pencegahan stunting dan penataksanaanya. Metode penelitian ini adalah dengan telaah pustaka. Pencarian literatur menggunakan data base online google scholar diantaranya Pubmed, DOAJ, dan GARUDA pada artikel yang terbit dalam 10 tahun terakhir. Kata kunci sesuai tema diterapkan selama proses pencarian artikel. Total terdapat 14 artikel atau jurnal yang dijadikan bahan studi literatur terpilih. Hasil telaah pustaka menjelaskan tentang epidemiologi, etiologi, faktor risiko, pengukuran antropometri, dan pencegahan stunting pada anak. Kesimpulannya adalah dengan deteksi dini melalui pengukuran antropometri maka dapat mencegah kondisi stunting dan penatalaksanaan lebih maksimal.

Kata kunci: pengukuran antropometri; stunting

INTRODUCTION

Stunting is a condition of short stature where the length or height is not appropriate when compared to his age based on the WHO growth curve, which has a value of less than -2 standard deviations (SD). Stunting is also known as a condition of growth failure in children (body and brain growth) caused by malnutrition for a relatively long time associated with low socioeconomic status, poor nutritional intake and maternal health, a history of repeated illness, and improper feeding practices in infants and children.¹

Based on data from WHO and UNICEF, in 2020, there were 149.2 million children under the age of 5 who suffered from stunting.^{2,3} Indonesia is a country with nutritional problems in toddlers, especially stunting, that has not been resolved. Riskesdas in 2013 showed that the prevalence of toddlers with concise status in Indonesia was 37.2%, and it decreased to 30.8% in 2018. The Indonesian Nutritional Status Study (SSGI) in 2021 stated that in 34 provinces, the national stunting rate decreased from 27.7% in 2019 to 24.4% in 2021. The prevalence may appear to be decreasing. However, based on WHO criteria, the prevalence rate is still in the

high category (20 - < 30%).^{4,5} The total number of toddlers with short stature in West Java in 2019 reached 94,165 toddlers. Meanwhile, the incidence of toddlers with short stature in the city of Cimahi, West Java, Indonesia, reached 888 toddlers in 2019.⁶

METHOD

The method used is narrative review. A literature search using Google Scholar online database including Pubmed, DOAJ, and GARUDA in articles published in the last ten years by entering keywords according to research titles such as "stunting, anthropometric measurements, prevention". A total of 59 articles or journals were abstracted into 14 articles as study material.

DISCUSSION

Stunting Etiology

Stunting begins with inadequate weight gain (weight faltering). Weight faltering that is not managed optimally will slow the linear growth rate as the body tries to maintain nutritional status. This slowdown in linear growth will continue to become stunting (chronic malnutrition). The condition of weight faltering in infants

and toddlers has potential factors as a cause, namely inadequate calorie intake, impaired absorption, or increased body metabolism due to certain diseases. Patients with thalassemia major who receive repeated blood transfusions experience an increase in ferritin levels to above normal with an average of >1000 ng / mL. It causes problems in the endocrine glands and is supported by conditions of severe anaemia, hemochromatosis, and tissue hypoxia. It can interfere with growth, such as stunting due to inadequate absorption processes, especially those caused by severe anaemia.^{7,8,9} Here's Table 1 of potential causes of slowing growth in infants and toddlers.⁴

Table 1. Potential causes of slowing growth in infants and toddlers

Potential causes	Condition
Causes of inadequate calorie intake	- Gastroesophageal reflux
	- Inadequate breast milk intake or ineffective attachment
	- Incorrect weaning of formula
	- Mechanical disorders in breastfeeding (cleft lip palate)
	- Child neglect or abuse
	- Bad eating habits
	- Impaired oral neuromotor coordination
	- Gastrointestinal disorders are followed by toxins (such as elevated lead levels causing anorexia, constipation, or abdominal pain).

Inadequate absorption	- Anaemia, iron deficiency
	- Atresia biliary
	- Celiac disease
	- Chronic gastrointestinal disorders (for example, irritable bowel syndrome) and infections
	- Congenital metabolic disorders
	- Cow's milk allergy
	- Cholestasis and liver disease
	- Chronic infections (HIV-AIDS, tuberculosis)
	- Congenital heart defects
	- Chronic lung disease (in infants with a history of prematurity)
Increased metabolism	- Violence
	- Renal failure
	- Hyperthyroid
	- Inflammatory conditions (such as asthma and inflammatory bowel disease)

Source: Indonesia Ministry of Health concerning National Guidelines for Medical Services for Stunting Management.⁴

Stunting Pathophysiology

Stunting is a condition of short stature where the length or height is not appropriate when compared to his age and seen from his nutritional status, which is included in the category of malnutrition and even malnutrition. Stunting is also known as a condition of growth failure in children (body and brain growth) caused by malnutrition for a relatively long time associated with low socioeconomic status, nutritional intake, especially protein, poor maternal health and nutritional intake, history of repeated illness, improper feeding practices in infants and children. Unbalanced food intake, related to the

content of nutrients in food, namely carbohydrates, proteins, fats, minerals, vitamins, and water, is one of the factors associated with stunting.⁴

Protein is a vital nutrient because it is most closely related to life processes. Various enzymes, hormones, transporters of nutrients and blood, intracellular matrix and so on are proteins. Proteins are formed from a wide variety of amino acids; amino acids can be classified as essential. Essential amino acids are amino acids that cannot be produced by the body and can only be obtained from food consumed. Non-essential amino acids are amino acids that can be synthesized by the body and are not produced through food. Protein is also used for the growth and repair of cells. Sufficient protein will be able to perform its functions for the growth process.^{1,4}

Interrelated genetic and environmental factors influence the process of growth and development in children. Growth can take place in the presence of mechanisms from the nervous system and endocrine system. The endocrine system has one part, the pituitary gland, which plays a significant role in the process of growth and development.¹⁰ Part of the pituitary gland, the anterior lobe, releases growth hormone, prolactin, gonadotrophin, and adrenocorticotrophic. Growth hormone (GH) will release IGF-1, which affects

skeletal muscle fibres and cartilage cells, to increase the absorption of amino acids and then incorporate them into proteins that affect the growth process during childhood.^{10,11} Lack of nutritional intake, especially protein, will affect protein intake in the body, which will later affect the production and work of the IGF-1 hormone. IGF-1, also known as Somatomedin, is a polypeptide hormone that functions as a mitogen and stimulator of cell proliferation and plays an essential role in the process of tissue repair and regeneration. IGF-1 also mediates anabolic protein processes and increases GH activity for growth. In addition to food intake, especially protein, the level of knowledge of parents regarding children's nutritional needs also affects children's health and well-being and can inhibit growth; *stunting* conditions can appear after children are two years old.^{4,10}

Stunting Risk and Impact Factors

Three risk factors can cause stunting, namely maternal factors, child factors, and environmental factors. Maternal factors include low BMI and weight gain during pregnancy, low education, and short maternal and paternal genetics. Child factors include breastfeeding and complementary foods, immunizations, development, and a history of recurrent infectious diseases.⁴

Environmental factors include home environmental conditions and low socioeconomic conditions.^{4,12}

Deficiency or excess of nutrients in the age period of 0-2 years is irreversible, so it has an impact on the short-term and long-term quality of life of a child. A previous study found that 53,809 children in Africa, Asia, and South America showed significantly increased mortality in stunting. Infectious diseases such as diarrhoea, respiratory infections, and measles were the leading causes of mortality in this study.

Stunting will affect long-term brain development, which will further impact cognitive abilities and school achievement. In addition, disruption of linear growth will affect the body's resistance and working capacity. Long-term effects are also associated with decreased fat oxidation ability, so there is an increased risk for obesity and degenerative diseases, such as hypertension, type 2 diabetes mellitus, and cardiovascular diseases.⁴

Stunting Diagnosis

Stunting can be diagnosed through a combination of medical history (anamnesis), physical examination, and anthropometric measurements. Laboratory tests and other supporting examinations are only conducted based on indications

following the initial assessment. Pathologically short stature can be categorized as proportional, resulting from prenatal or postnatal factors, or disproportional, resulting from genetic disorders. Furthermore, if short stature is found in individuals with excellent or excessive nutritional status, additional examinations are necessary to rule out stunting and as well to evaluate the genetic potential based on the heights of both parents, prenatal and postnatal history, growth faltering, and previous malnutrition.⁴

Anthropometric Criteria and Measurement

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2020 concerning Child Anthropometry Standards, nutritional status assessment is carried out by conducting anthropometric measurements as a reference for health workers.¹³ Anthropometric criteria for stunting are based on the body length index or height according to age and sex (PB / U or TB / U) < -2 SD based on the WHO curve in 2007 and in determining the state of chronic malnutrition to support the enforcement of stunting diagnosis can be through the measurement of upper arm circumference based on the World Health Organization-

National Center for Health Statistics (WHO-NCHS) (Table 2).⁴ Upper arm circumference (MUAC) is one method for determining nutritional status by giving an idea of the state of muscle tissue and the layer of fat under a person's skin. Thalassemia patients often experience an enlarged organ (organomegaly), especially hepatosplenomegaly. This results in the inability to measure body weight to determine nutritional status in thalassemia patients because it can cause bias. Therefore, MUAC measurement can be used to avoid bias that occurs due to hepatosplenomegaly in thalassemia patients. (Table 3) (Table 4).

Here's how to measure height using microtoise and upper arm circumference using a measuring tape.

A. Height measurement using microtoise.

- 1) Microtoise installation requires at least two people.
- 2) One person put microtoise on a flat floor and stick to a flat wall
- 3) Another person pulls the tape perpendicular up until the number on the reading window shows zero. The chair can be used so that the microtoise can be installed correctly. To ensure that the microtoise is attached

perpendicularly, a pendulum can be used that is placed near the microtoise.

- 4) The top of the tape is glued to the wall by means of nails or with duct tape or tape that sticks firmly and is unlikely to shift.
- 5) Then the microtoise head can be shifted up.
- 6) The child's footwear, hair ornaments, and headgear were removed.
- 7) The master gauge positions the child standing perpendicular under the microtoise with his back to the wall, looking straight ahead. The head should be in an imaginary line position.
- 8) The gauge ensures that five parts of the child's body are attached to the wall, namely: the back of the head, back, buttocks, calves, and heels. In children with obesity, at least 2 parts of the body stick to the wall, namely the back and buttocks.
- 9) The assistant positions the child's knees and heels tightly while pressing the child's stomach to stand upright.
- 10) The assistant pulls the microtoise head until it touches the top of the

child's head in a position perpendicular to the wall.

- 11) The meter reads the number in the rear window exactly on the red line with the reading direction from top to bottom.¹³

Table 2. Categories and thresholds of children's nutritional status according to LB/you or H/A for children 0-5 years.

Index	Nutritional Status Categories	Threshold (Z-Score)
Body Length or Height by Age (BL/A or H/A) children of age 0 – 60 months	Very short (<i>severely stunted</i>) Short (<i>stunted</i>) Normal Height	<-3 SD -3 SD s/d <-2 SD -2 SD s/d +3 SD >+3 SD

Source: Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2020 concerning Children's Anthropometry Standards.⁴

B. Measurement of upper arm circumference using a measuring tape.

- 1) Make sure the arm to be measured is not covered by clothing.
- 2) Determine the midpoint of the upper arm by bending the arm to form an angle of 90 o, palm facing up, find the midpoint between the tip of the shoulder (*acromion*) and the tip of the elbow (*olecranon*), mark the middle point using a pen.
- 3) Straighten your arms and align with your body

- 4) Loop the MUAC ribbon around the marked midpoint.

- 5) Make sure the MUAC band sticks flat around the skin and is not too tight or too loose.

- 6) Read and state the measurement results up to the nearest 0.1 in centimeters (cm)

- 7) Record the measurement results.¹³

Table 3. Mid-upper arm circumference Standard (MUAC) according to WHO-NCHS.

WHO-NCHS Age	Standard (MUAC)	
	Men	Women
1 – 1.9	15.9	15.6
2 – 2.9	16.2	16
3 – 3.9	16.7	16.7
4 – 4.9	17.1	16.9
5 – 5.9	17.5	17.3
6 – 6.9	17.9	17.6
7 – 7.9	18.7	18.3
8 – 8.9	19	19.5
9 – 9.9	20	20
10 – 10.9	21	21
11 – 11.9	22.3	22.4
12 – 12.9	23.2	23.7
13 – 13.9	24.7	25.2
14 – 14.9	25.3	25.2
15 – 15.9	26.4	25.4
16 – 16.9	27.8	25.8
17 – 17.9	28.5	26.4
18 – 18.9	29.7	25.8
19 – 24.9	30.8	26.5
25 – 34.9	31.9	27.7
35 – 44.9	32.6	29
45 – 54.9	32.2	29.9
55 – 64.9	31.7	30.3
65 – 74.9	30.7	29.9

Source: WHO-NCHS.¹⁴

MUAC calculations can use the standard formula as follows:¹⁴

$$\% \text{ MUAC percentiles} = \frac{\text{MUAC measurement}}{\text{MUAC standard value}} \times 100\%$$

Table 4. Interpretation of nutritional status based on MUAC/A

Nutritional status	% Percentiles MUAC
Obese	>120%
Overweight	110% - 120%
Good Nutrition	85% - 110%
Malnutrition	70.1% - 84.9%
Malnutrition	<70%

Source: WHO-NCHS.¹⁴

Stunting Management

Nutrition management, Physical Activity, and Sleep Duration

Stunting management is carried out by a pediatrician who will cover three aspects, namely nutrition management in the form of proper feeding and sufficient energy (protein energy ratio, PER 10–15%), regular sleep schedule with night sleep time starting at 09.00 pm to achieve *deep sleep*) at 11.00 pm – 03.00 am and do sports/physical activity at least 30-60 minutes at least 3-5 days a week. The purpose of nutrition management itself is to achieve *catch-up growth* to obtain optimal growth speed. The strategy to accomplish this goal is to provide nutritional management in accordance with pediatric nutrition care steps consisting of assessment, determination of nutritional needs, determination of ways/routes of administration, selection of food types, and monitoring.⁴

a) Assessment

The assessment is carried out,

including history, anthropometric measurements, physical examination, and supporting examinations.

b) Determining nutritional needs

Calorie needs in children who are not critically ill are determined based on *Recommended Dietary Allowance* (RDA) or Daily Value (RDA). Total calorie needs are calculated based on ideal body weight multiplied by RDA according to height and *age*. The RDA values can be seen in Table 5.

Table 5. RDA estimates based on age according to height

Age	Necessity Energy (Kkal/Kg/day)	
0 – 6 months	120	
6 – 12 months	110	
1 – 3 years	100	
2 - 6 years	90	
7 – 9 years	80	
	Men	Women
10 – 12 years	60 – 70	50 – 60
12 – 18 years	50 - 60	40 - 50

Source: Indonesia Ministry of Health: National Guidelines for Medical Services for Stunting Management.⁴

c) Determination of the Giving Route

The route of administration can be oral, enteral, and parenteral. Oral nutrition is the primary choice because it is in accordance with

normal physiological processes. Indications for enteral nutrition through a tube are if there is poor acceptability (<80%) or certain conditions that make oral intake difficult or even not allowed.

d) Determination of Food Type

In *stunting*, processed food for special medical conditions (PSMC) is given in full or partially (oral or parenteral) along with foods with a balanced composition that prioritizes animal protein sources. The administration of PSMC must be based on indications and prescribed by a pediatrician. Its use should also be under the supervision of a paediatrician. WHO recommends that 10-15% of energy intake comes from protein to support growth and pursuit. Most animal proteins are proteins that achieve excellent protein quality category with a digestible Indispensable Amino Acid Score (DIAAS) score of ≥ 100 .

Further administration of one source of animal protein will reduce the incidence of *stunting*.

e) Monitoring and Evaluation

Monitoring and evaluation are carried out every two weeks, which includes assessing the acceptability, tolerance,

and effectiveness of nutritional therapy. Acceptability is an evaluation of whether the amount of food consumed is in accordance with the dietary prescription. In enteral nutrition, acceptability is said to be good so that it can gradually return to the oral diet if >80% of nutritional needs are met, accompanied by adequate and consistent growth.⁴

Developmental Stimulation

Children with stunting will experience developmental delays, follow-up examinations, and multidisciplinary interventions, including medical rehabilitation programs. Growth and development management in *stunted* children with typical development or no developmental delays is carried out through stimulation according to the child's age and ability to be combined with nutritional management.⁴

Immunization in Infants and Toddlers

Immunization in cases of stunting has no specific contraindications. Stunted children are more susceptible to infection. Immunization and booster administration are indicated in all cases of stunting. Immunization in age-appropriate stunting will provide immunity against Immunization-Preventable Diseases.⁴

Appropriate treatment and management are carried out if there are comorbidities.⁴

Stunting Prevention

Primary Prevention

Primary or promotive prevention is carried out starting from the cadre level at the Posyandu. Posyandu cadres monitor growth and the measurement of body length or height and weight using standard measurement tools and methods, as well as provide education to parents/caregivers about exclusive breastfeeding and complementary foods with complete nutritional content, especially animal protein. Suppose a child with LB or Height is obtained based on age and sex <-2 elementary school. In that case, W/A <-2 elementary school, or *weight faltering* (inadequate child weight gain) and *growth deceleration* (slow growth slowdown), then the child must be referred to the First Health Facility or Public Health Center (Puskesmas). Weighing and measuring body length at Posyandu must be done every month to detect weight faltering early.⁴

Secondary Prevention

Secondary prevention is carried out by doctors at First Level Health Facilities (FLHF). The doctor confirms previous

anthropometric measurements and traces the potential causes of *stunting*. Children with low body weight, *weight faltering*, or malnutrition but not short stature (LB / you or H / A ≥ -2 SD) can be given Food for Special Dietary Purposes (FDP) according to indications and energy-dense foods that have nutritional compositions that meet the requirements of FDP and are scientifically proven to overcome undernutrition effectively. This action also aims to prevent children with malnutrition from continuing to become *stunted*. Processed foods included are standard formula milk for ages 0-12 months and growth milk for ages 1-3 years. FDP is prescribed and monitored for use by doctors at a first health center.⁴

In the first health center, basic supporting tests can be carried out, such as routine blood tests, urinalysis, routine feces, and Mantoux tests for possible tuberculosis infection. If an underlying medical cause or complication is identified, such as congenital heart disease, and management

with PKGK does not show an adequate response for one week, the child is referred to a pediatrician at an Advanced Referral Health Facility. In cases of uncomplicated malnutrition, F-75 and F-100 formulas based on milk, sugar, oil, and mineral mix can be given. If there are medical complications and the evaluation results are not as targeted, or there is no improvement in clinical condition within one week, the patient is referred to a pediatrician at ARHF. Children with confirmed short stature (BL/A or H/A < -2 SD) with/without an underlying potential cause should be referred to a pediatrician at ARHF. Doctors and field nutrition officers at Puskesmas continue to provide counseling and education to parents. Counseling is conducted to convey information to parents/caregivers about the results of the child's growth assessment and the reasons for referral to the hospital. Education includes recommendations on how to feed according to the age and condition of the child, how to prepare formulas, instructions on choosing the type of food ingredients, and the implementation of feeding rules.⁴

Tertiary Prevention

Pediatricians carry out tertiary prevention at ARHF. The pediatrician confirms the diagnosis of stunting. Screening of short stature in children is

divided into normal or pathological variations. In children aged < 2 years, the value of the increase in body length (length increment), while in children aged two years or more, bone age is checked.⁴

Counseling is provided to convey information to parents/caregivers about the examination, diagnosis of comorbidities, and causes of stunting in children. Education is also carried out to parents/caregivers by providing recommendations on how to feed according to the age and condition of children and the application of feeding rules. In addition, it is necessary to educate people about the type of nutritional therapy provided and teach them how to make it according to food safety rules.

CONCLUSION

Stunting is a condition of short stature in children due to long-term malnutrition associated with low socioeconomic factors, poor nutritional intake, a history of repeated illnesses, and improper feeding practices. Anthropometric measurements are used to diagnose stunting by measuring a child's height and comparing it to WHO growth standards. Stunting prevention includes early nutritious feeding, good breastfeeding practices, increased access to health

services, and improved sanitation and environmental hygiene.

CONFLICT OF INTEREST

The author declared no conflicts of interest or potential commercial background in this research.

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