

Energy and Protein Intake-Related Risks Affected the Occurrence of Stunting Among Young Children

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ABSTRACT

Alang river has been one of the river banks to contribute the most to fish production in the Banjar district. However, despite the seemingly protein-rich diet of its inhabitants, this area still has a high prevalence of stunting. This research was therefore conducted to identify the factors that might affect the occurrence of stunting among young children within the area. This cross-sectional research conducted from May to July 2019 recruited 96 dyads of mother and her young child as participants. The children were then analyzed for their adequacy of energy and protein intake based on the recommended dietary allowances (good vs. poor adequacy) and the occurrence of stunting based on the 2006 World Health Organization anthropometry standard (stunted vs. not stunted). Other variables of the children (sex, history of low birth weight, history of exclusive breastfeeding) and variables related to family members (total number of family members, maternal height, paternal height, family income, maternal educational level, and paternal educational level) were also analyzed. Young children with poor adequacy of energy intake had 9.133 times higher risk of stunting than young children with good adequacy of energy intake ($p=0.001$). The young children's energy and protein intake played a significant role in determining the occurrence of stunting, implying the importance of this macronutrient for the growth and development of young children. The education about the children's nutritional needs for mothers with young children should be delivered with a better design that includes easy-to-remember and immediately applicable local wisdom based methods for the children's nutritional fulfillment of the children's nutritional need.

Keywords: *young children, stunting, energy intake, riverbank*

1. INTRODUCTION

The development of a nation aims to improve the welfare of every citizen. The problem of lack of protein energy (PEM) as one of the main nutritional problems that occur in infants (under five years). The implications of long-standing nutritional deficiencies in toddlers are called stunting. Stunting toddlers will experience stunted growth in body length / height according to age [1] Toddler with a stunting

condition, will one day become an adult human with low quality. If this condition occurs in toddlers aged 0-2 years, then it is probable that toddlers cannot reach the expected height, toddlers will experience imperfect brain development, thus impacting on difficulties in meeting academic grades [2] The first two years of life is a time that is very sensitive to the environment and this period lasts very short and cannot be repeated anymore, so the period of infancy is referred to as the "golden period" (golden period) or the Window of Opportunity or a critical period. There is a tendency for stunting prevalence to increase with age.

Low birth weight at birth, infants are not exclusively breastfed, age and type of complementary milk are not suitable, toddlers have short parents, low socioeconomic levels, are some risk factors for toddlers experiencing shortage [3]. The poor who have low education affect their nutritional status. This risk factor is related to the inability of people to buy and choose food that meets the requirements of balanced nutrition. As a result the intake of foods that meet gizipun reduced [4] Likewise, the level of education of fathers and mothers is a strong determinant of short events in toddlers in Indonesia and Bangladesh [5]. In addition to the above risk factors, parenting, parental height and maternal nutrition knowledge are some of the risk factors that also influence the short occurrence in infant [3, 6].

The results of the 2013 South Kalimantan Province Riskesdas found that the IPKM (Community Health Development Index) aspect of toddler health was 0.5899 and the national IPKM was 0.6114. From the Riskesdas data it is known that the prevalence of toddlers who experience short and very short in South Kalimantan is greater than 7.03% compared to the National respectively 44.24% and 37.21%. Likewise, other indicators in the health aspects of children under five, such as the prevalence of children under five who suffer from malnutrition and malnutrition are also greater than the national that is equal to 27.40% and 19.63% or a difference of 7.77% and high short events at ages 24-36 month (41.4%). Based on data from the Health Office, Banjar District is one of the districts contributing the largest short cases in South Kalimantan, and the largest case was found in the working area of the Sungai Alang puskesmas as much as 41.7%.⁷ This region is located on a riverbank that can be used to cultivate fish, so the area should not be included in the category of areas with very poor public health problems with a short prevalence of $\geq 40\%$ [2, 7, 8]. The first two years is a golden period for optimal brain growth and development, so short improvement efforts are needed when toddlers are < 2 years old. In order to know the risk factors for the low IPKM of South Kalimantan Province the health aspects of children under five are lower than the national IPKM, it is necessary to analyze the risk factors that influence the incidence of stunting in toddlers in the Alang River, so that nutritional problems in the future can be prevented as early as possible by suppressing the risk factors.

2. METHOD

This study uses an analytic observational design that is a quantitative study with a cross sectional design. Subjects in this study were mothers who had children under the windows of opportunity period (age 6-59 months). in Sungai Alang, numbering 96 people. The sample selection in this study used a purposive sampling technique. Inclusion criteria used are as follows: 1) Is a resident who lives in a riverbank, working area of Sungai Alang Health Center, 2). Mothers who have toddlers (age 6-59 months), 3). Toddlers (6-59 months old) are biological toddlers, 4). If there are two toddlers (6-59 months old) in a family, then the sample

is the youngest toddler, 5). In a state of physical and spiritual health, 6). Willing to be a respondent, by signing an informed consent, 7). Mothers who have toddlers do not have a history of congenital abnormalities (physical disabilities), 8). Mothers who have toddlers do not suffer from diseases that can interfere with food absorption (tuberculosis, hepatitis, measles, helminthiasis, diarrhea), 9). The subject was in place at the time of data collection.

The selection of regions is based on a purposive because of the large incidence of stunting in the region. The population is mothers who have children under five in the Alang River, Banjar Regency. The sampling technique is from the number of mothers who have toddlers as many as 127 people, then the sample size is calculated using the Slovin formula with the results of 96 samples. Referring to the predetermined sample inclusion criteria, the sample was chosen randomly at three posyandu that were scattered in the Sungai Alang Health Center area. Posyandu A totaled 33 samples, Posyandu B totaled 28 samples, and Posyandu C totaled 35 samples. Data collected are, history of Low Birth Weight (LBW), history of exclusive breastfeeding, family size, family income, father's height, maternal height, type, sex, adequacy of energy nutrient intake, adequacy of protein nutrient intake, level of father's education, mother's education level, and stunting events. This stunting event is categorized as very short if the body length according to age (z-score < -3.0 SD), short if the body length according to age (-3 SD to < -2 SD) and not / normal if the body length according to age (-2 SD) based on the anthropometric 2006 World Health Organization (WHO) reference standard. The number of family members is the number of family members closely related to the distribution in the amount of food consumed by family members which is categorized into a large category, if the number of family members is ≥ 3 people and the category is small, if the number of family members is < 3 people. Mother and father's height is the skeletal length of the parent's body based on height measurements by age. According to Hizni et al, that father's height can be categorized into < -2 elementary school (< 160 centimeter) and -2 elementary school (160 centimeter), and according to Riskesdas results that maternal height can be categorized into < -2 elementary school (150 centimeter) and -2 elementary school (150 centimeters) in mothers [9] LBW category if birth history $< 2,500$ gram, and not LBW if 2,500 gram birth history. Family income is income earned by the family to fulfill all the necessities of family life in 1 (one) month, community income is divided into 2 (two) categories according to the Regional Minimum Wage of Banjar Regency, namely the category of Rp $< 1,126,000$ and the category of Rp. 1,126,000. Exclusive breastfeeding history is a way for mothers to give milk to their babies ranging from 0-6 months without interspersed with other food / drinks. History of exclusive breastfeeding is categorized into 2 (two), namely exclusive, if 0-6 months only breast milk, and not exclusive, if 0-6 months there are at least food / drinks other than breast milk. Adequacy of energy intake is the adequacy of the amount of energy consumed by toddlers through daily food is categorized into 2 namely good and not good. The category is good if the energy intake is -1 80-100% RDA and not good if (> 100

RDA, $\geq 70-79\%$, $<70\%$ RDA). Adequacy of protein intake is the adequacy of a number of proteins consumed by infants through daily food. Categorized into 2 (two), which is a good category if protein intake protein 80-100% RDA and not good if (> 100 RDA, $\geq 70-79\%$ RDA, $<70\%$ RDA). The formal education level followed by the respondent's parents. This level of education is classified into the level of education (education law) categorized into 2 (two) categories, namely High, if SMA-PT and low, if SD-SMP.

3. RESULTS AND DISCUSSION

Table 1 shows that the majority of respondents had toddlers who were female by 57 people (59.4%), had the majority of family members totaling ≥ 3 people by 84 people (87.5%). Respondents have a husband (father of toddlers) with height <160 centimeters of 45 people (46.9%). As for the

respondents themselves (the height of the mother of children under five) there are still <150 centimeters a number of 60 people (62.5%). In this study still found respondents who have toddlers under five with a history of low birth weight (LBW) that is equal to 12 people (12.5%). In addition, still found respondents did not exclusively breastfeed their toddlers in the amount of 15 people (18.8%). Family income is still there $<UMR$ (Rp. $<1,126,000$ per month), which is 45 (46.9%). Still found respondents who have toddlers with energy intake category is not good (less than the recommended nutritional adequacy rate) of 34 people (35.4%) and also found that most of the protein intake is not good by 54 people (56.3%). The level of education of family heads in this study still has a low category of 33 people (34.4%) and the majority of respondents have a low education level of category that is 75 people (78.1%). Respondents who were under five with stunting were 33 people (34.4%).

Table 1. Frequency distribution of toddler identity and family characteristics

Variable	Category	n	%
Gender	male	39	40,6
	female	57	59,4
Number of family members	≥ 3 person (large)	84	87,5
	< 3 person (small)	12	12,5
Father's height	<-2 SD (<160 centimeter)	45	46,9
	≥-2 SD (≥ 160 centimeter)	51	53,1
Mother's height	<-2 SD (< 150 centimeter)	60	62,5
	≥-2 SD (≥ 150 centimeter)	36	37,5
LBW history	LBW	12	12,5
	No LBW	84	87,5
History of exclusive breastfeeding	No exclusive	15	18,8
	exclusive	78	81,3
Family income	$< UMR$ (Rp. $<1.126.000,-$)	45	46,9
	$\geq UMR$ (Rp. $\geq 1.126.000,-$)	51	53,1
Adequate energy intake	In adequate (deficit)	34	35,4
	Adequate	62	64,6
Adequate protein intake	In adequate (deficit RDA)	54	56,3
	Adequate	42	43,8
Father's education level	Low	33	34,4
	High	63	65,6
Mother's education level	Low	75	78,1
	High	21	21,9
Stunting status	stunting	33	34,4
	no stunting	63	65,6

Table 2. Relationship between toddler's identity and family characteristics with stunting status

Characteristic	category	Case of stunting				PR (95% CI)	p-value
		stunting		no stunting			
		n	%	n	%		
Gender	Male	24	61,5	15	38,5	8,533 (3,265-22,303)	0,0001
	Female	9	15,8	48	84,2		
Number of family members	≥ 3 person (large)	33	39,3	51	60,7	0,607 (0,511-0,721)	0,007
	< 3 orang (small)	0	0	12	100		
Father's height	<-2 SD (<160 centimeter)	18	40,0	27	60,0	1,600 (0,685-3,735)	0,276
	≥-2 SD (≥ 160 centimeter)	15	29,4	36	70,6		
Mother's height	<-2 SD (< 150 centimeter)	21	35,0	39	65,0	1,077 (0,450-2,577)	0,868
	≥-2 SD (≥ 150 centimeter)	12	33,3	24	66,7		
LBW history	≥-2 SD (≥ 150 centimeter)	3	25,0	9	75,0	0,917 (0,394-2,134)	0,536
	≥-2 SD (≥ 150 centimeter)	30	35,7	54	64,3		

History of exclusive breastfeeding	LBW	27	34,6	51	65,4	1,059	0,918
	No LBW	6	33,3	12	66,7	(0,358-3,135)	
Family income	No exclusive	15	33,3	30	66,7	0,917	0,840
	exclusive	18	35,3	33	64,7	(0,394-2,134)	
Adequate energy intake	< UMR (Rp.<1.126.000,-)	26	76,5	8	23,5	25,536	0,0001
	≥ UMR (Rp.≥1.126.000,-)	7	11,3	55	88,7	(8,361-77,989)	
Adequate protein intake)	5	11,9	37	88,1	(2,718-23,365)	
	In adequate (deficit RDA)	24	72,7	9	27,3	16,000	0,0001
	Adequate	9	14,3	54	85,7	(5,646-45,338)	
Father's education level	Adequate	30	40,0	45	60,0	4,000	0,028
	In adequate (deficit RDA)	3	14,3	18	85,7	(1,083-14,775)	
Mother's education level	Adequate						
	Low						
	High						
	Low						
	High						

Table 2 shows that the majority of children under five who experienced male stunting were 24 toddlers (61.5%). Statistical test results obtained that the value of $p = 0.0001$ ($p < 0.05$) which indicates that gender plays a positive role in determining the incidence of stunting in a toddler. Potential factors that play a role in it is a period of rapid growth and development of men when entering adolescence, besides that men have a high level of activity compared to women. This study found that the number of family members of toddlers who experienced stunting was mostly orang 3 people (large), namely 33 people (39.3%) with a value of $p = 0.007$ ($p < 0.05$). This p value means that there is a relationship between the large number of family members and the incidence of stunting in infants. The potential factor for this condition occurs because it is related to the intensity of care, care for infants, in addition it is also likely to be caused by disproportionate distribution of food among family members.

The study also found that the majority of respondents still did not exclusively breastfeed their toddlers and experienced stunting by 27 people (34.6%). Value of $p = 0.918$ ($p > 0.05$). This shows that there is no relationship between toddlers who are not exclusively breastfed with stunting. Stunting toddlers still have families with <UMR income (Rp. <1,126,000) - 15 people (33.3%) with $p = 0.840$. This means that a small family income does not necessarily have a toddler with a stunting condition because there are still other factors such as parents' knowledge even though they have a small income but are able to provide enough food for their family. Still found respondents who have stunting under five with energy categorized as not good (less than the recommended nutritional adequacy rate) in the amount of 26 people (76.5). The results of statistical analysis obtained the value of $p = 0.0001$ ($p < 0.05$). This

means that there is a significant relationship between the adequacy of energy intake with the incidence of stunting in infants. This condition is potential because the toddler period requires a large energy intake to support its growth. In addition, this study also found toddlers who were stunted with poor protein intake (less than the recommended nutritional adequacy rate) in the amount of 28 toddlers (51.9%). The results of statistical analysis obtained the value of $p = 0.0001$ ($p < 0.05$). This means that there is a significant relationship between the adequacy of protein intake with the incidence of stunting in infants. Protein nutrients play a role in growth, so if the amount of these substances is less potential will affect the skeletal growth of infants.

This study also found that respondents had husbands (toddlers fathers) with low category education had stunting toddlers of 24 people (72.7%). The results of statistical analysis obtained a value of $p = 0.0001$ ($p < 0.05$). This means that the education factor of the head of the family has the potential to influence the conditions of growth in the development of their toddlers and find respondents (mothers of toddlers) with low-category education having toddlers with a stunting condition of 30 people (40.0%). The results of statistical analysis obtained a value of $p = 0.028$ ($p < 0.05$). This shows that there is a relationship between the level of education of respondents with the incidence of stunting in infants. Some variables of family characteristics and toddler identity based on test results are statistically significantly related to the incidence of stunting in toddlers. Therefore to determine the most dominant factor among these risk factors, it is necessary to further analysis in the form of a logistic regression statistical analysis. The results of the logistic regression analysis are shown in Table 3.

Table 3. Dominant Factors Affecting Stunting in Toddlers in Sungai Alang Village, Karang Intan District

Variable	β	Sig	Exp(B)
Gender	1,531	0,015	4,624
Adequate energy intake	2,212	0,001	9,133
Father's education level	1,622	0,017	5,065
<i>Constant</i>	-3,968	0,0001	0,019

Based on Table 3, it is known that gender, adequacy of energy intake and father's education level are related to the incidence of stunting after further statistical analysis with logistic regression ($p < 0.05$). But among these 3 variables, the adequacy of energy intake is the dominant factor associated with the occurrence of stunting. Respondents who have toddlers with energy intake less than the recommended nutritional adequacy are 9,133 times more likely to experience stunting than respondents who have toddlers with enough energy intake. Consumption of food that is lacking will cause an imbalance of metabolic processes in the body, if this happens continuously there will be a disruption of growth and development. Additional food given after toddlers aged 6 months in the form of breast milk and added with solid foods adjusted to their age such as mashed foods, filtered foods, soft foods, or adult food but limited by no gasses and sharp spices that can be made alone plus side dishes, vegetables, and fruit, so we need good nutritional knowledge. Food consumption for everyone, especially toddlers aged 1-5 years must always meet the needs [10, 11].

Fond of behavior of consuming fish in the community is still difficult to do. Parents who have never introduced or accustomed their toddlers to eat fish from the beginning, so they develop an attitude of not eating fish, so introducing fish early on in infants will be very eneficial for their growth. The low level of fish consumption per capita in Indonesia seems to be caused by the assumption among the public that eating fish is less prestigious or identical to poverty, fishy body odor and if mothers who are breastfeeding consume, the milk becomes less pleasant. In addition there are mothers who are less willing to cook fish because they have to clean their stomach contents, remove scales and thorns, giving rise to the impression that cooking fish is very troublesome [12, 13,14]

Difficulties of mothers in providing their toddlers to process and familiarize their toddlers to eat fish as a result toddlers have difficulty to like eating food from fish is more experienced by the community in the Banjar District. Despite the local potential of fish, observations show that toddlers boys tend to prefer chicken meat. Gender also determines the size of a person's nutritional needs. Men need more energy and protein than women. Men are more able to do heavy work that is not normally done by women. During infancy and toddlers, girls under five tend to be less likely to become stunted and severe stunted than boys under five, besides that baby girls can survive in greater numbers than boys. Table 1 found that toddlers who experienced stunting were more common in toddlers with male sex that is equal to 61.5%. This is in line with research conducted by Rosha et al (2012) and Hadju et al (2015) that female

toddlers have a protective effect or 29% lower risk of stunting compared to male toddlers with an odd ratio of 0.71 (0, 53-0.96). This is allegedly due to factors of anxiety or maternal concern and the closeness of the mother to a toddler girl. Female toddlers are considered weak toddlers so that they get extra attention compared to boys who are considered stronger. Besides toddlers boys tend to have more active play activities compared to toddlers girls so that a lot of energy comes out. If not balanced with adequate nutrition and food can trigger stunting [15,16]

In addition, the stunting condition can be started from the height of the parents, either the height of the father or the height of the mother which can be genetically decreased to the toddler. Parental genetic factors are factors that influence stunting in children under five living in rural and urban areas. One or both parents who are short due to pathological conditions and have genes in chromosomes that carry short traits can cause toddlers to inherit the gene and grow to be short or stunting. In accordance with the results of this study which found that 40% of fathers who have a height < 2 elementary school (< 160 centimeters) have a toddler with a stunting condition.¹⁷ Parental height is related to the incidence of stunting. Short mothers have the possibility of giving birth to short babies. The theory shows that parents of relatively short height tend to have stunted toddlers, and vice versa. In parents with a relatively high height, the toddlers grow normally. Short mothers are associated with stunting in infants. Genetic factors are the basic capital in achieving the final results of the process of growth and development of infants. Through genetic instructions contained in fertilized eggs, the quality of growth can be determined. However, genetic composition is not a major factor determining a person's height, because environmental and nutritional constraints are far more important issues.⁹ The condition can be known from the results of this study which found that mothers with height < 150 centimeters mostly had toddlers who did not experience stunting of 65.0%.

This result is in line with research conducted by Candra et al (2011), that there is no relationship between father's height ($p = 0.082$) and maternal height ($p = 0.935$) and stunting status in infants. The results of research in the city of Semarang with a sample of toddlers aged one to two years also showed the same results, namely the height of the mother is not a risk factor for stunting. If the mother and father are classified as short, a toddler has the potential to risk having a short body as well because the toddler inherits genes in the chromosomes that carry stunting. However, height is influenced by various factors, not only genetic factors (parental height), but also influenced by nutrition and illness. If toddlers experience stunting due to lack of

nutritional intake since childhood, then stunting in their offspring can still be overcome. The absence of a relationship between maternal height and stunting in infants in this study could possibly be due to the small number of samples studied. [17,18].

The level of education, especially the level of mother's education affects the degree of health. This is related to its role most in the formation of toddler eating habits, because the mother who prepares food starts to arrange the menu, shop, cook, prepare food, and distribute food. The level of education, especially the level of mother's education affects the degree of health. This is related to its role most in the formation of toddler eating habits, because the mother who prepares food starts to arrange the menu, shop, cook, prepare food, and distribute food. In addition, mothers who have education \geq SMP tend to be better in parenting and are better in choosing toddler food types. This is because mothers with education \geq SMP have greater opportunities in accessing information about the nutritional status and health of children under five so that their knowledge increases. Then the information is practiced in the process of caring for infants who will impact on the nutritional status and health of toddlers better [15]. This is in line with the results of research in Mexico that maternal education is very important in relation to nutritional knowledge and fulfillment of family nutrition, especially toddlers, because mothers with low education, among others, will be difficult to absorb nutritional information, so toddlers can be at risk of stunting.^{9,19} Mother's education level determines many attitudes in dealing with various problems. Toddlers from mothers who have a higher education background will have the opportunity to live and grow better than the mother's low level of education. Their openness to accept changes or new things for the maintenance of toddlers' health will also differ based on their level of education [3]. Immediate factors (immediate factors), namely health status and diet. Health status, which is a history of toddlers who suffer from chronic diseases will be disrupted growth and education. Metabolic functions, metabolic processes according to age in each toddler are different, then the need for various nutrients must be based on an accurate calculation or at least adequate [4].

Parents with good socioeconomic tend to have high education. With higher education it is easier and faster to get access to information media and easy to absorb health information that is good for the growth and development of infants. Conversely, toddlers in families with low economic levels are more at risk of being stunted because because in addition to being limited to obtaining access to health services, families also have low nutritional fulfillment capabilities thereby increasing the risk of malnutrition. In addition, the low economic status is related to family limitations in meeting the need for nutrients both macro and micro. The low economic status of the family will affect the quality and quantity of food consumed by the family. The food obtained will usually be less varied and few in number, especially in food that serves for the growth of children under five such as sources of protein, vitamins and minerals thereby increasing the risk of malnutrition in toddlers. In addition, the condition of the low quality and quantity of

food consumed by pregnant women has the potential to also affect milk production. As a result of the production of breast milk that is not smooth and even less, then the toddler does not get enough intake of nutrients that are important for growth and development through breast milk, consequently the risk of experiencing undernutrition and impaired growth and development. In line with the results of previous studies that families who have an established socioeconomic tend to consume more snacks that contain high energy compared to families who have low socioeconomic groups who only choose the consumption of low-calorie snacks. [20, 21,22,23].

4. CONCLUSION

The most dominant risk factor influencing stunted toddlers is energy intake that is less than the nutritional adequacy rate recommended for this risk by 9,133 times greater than toddlers whose energy intake is sufficient. Further research is needed to examine the suitability history of complementary feeding (MPASI) according to age, level of mother's nutritional knowledge in choosing the type, parenting style of toddlers who experience stunting. Considering that stunting is a past nutritional history, it is also necessary to retrospectively examine the history of the active role of the mother during pregnancy in monitoring the growth and development of the fetus conceived and nutritional intake during pregnancy and knowledge of nutrition related to the right diet for the mother during pregnancy.

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