LOW BIRTH WEIGHT AND INAPPROPRIATE FEEDING VARIATION CAUSED NUTRITIONAL DISORDERS BASED ON THE COMPOSITE INDEX OF ANTHROPOMETRIC FAILURE (CIAF)

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ABSTRACT

Nutritional disorders in children apart from causing morbidity and death also cause diseases that can be inherited. Early detection by measuring a child's growth regularly is one way of prevention and early treatment. One way to detect growth failure is to use the Composite Index of Anthropometric Failure (CIAF) by specifying and combining various growth failures that occur so the risks are easier to predict. This research aims to find the determinants of nutritional disorders based on CIAF. This research is a descriptive-analytical study with a cross-sectional approach which was carried out for 10 months starting from January until October 2024 in Belitung Regency, Bangka Belitung Islands Province. The sample in this study consisted of 198 children aged 6 months to 5 years old. Samples were taken using a simple random sampling technique. Children will be examined to obtain weight and height data and then their nutritional status will be categorized based on the WHO 2006 graph. The questionnaires contain questions about parental characteristics, the child's birth weight, parents' height, family economics, family awareness about nutrition (regularly weighing children, exclusive breastfeeding, iodized salt, appropriate feeding variation, supplements during pregnancy and childhood), and clean and healthy living behavior (delivery assisted by health workers, exclusive breastfeeding, regularly weighing children, washing hand behavior, healthy latrines, eliminating mosquito larvae, appropriate feeding variation, physical activity, and smoking behavior). The results of the study showed that almost half of the respondents (40.4%) experienced growth failure. None of the characteristics of children and parents has a significant relationship with growth failure. Childbirth weight had a difference between children with growth failure and normal (p=0.048) as well as variations in the feeding menu had a significant relationship with stunting (p=0.009). Furthermore, other determinants tested such as mother's height (p=0.318), father's height (p=0.213), family income (p=1.000), and the indicators of family awareness about nutrition (p=0.438), and clean and healthy living behavior (p=1.000) were not proven to have a statistically significant relationship. Low birth weight is related to the incidence of growth failure in children and variation in feeding menu has a significant relationship with stunting.

Keywords*: CIAF, growth failure, inappropriate feeding variation, nutritional disorders, stunting*

INTRODUCTION

The issue of growth disorders in children is a form of malnutrition that is prevalent globally, particularly in impoverished and developing nations (Santosa et al., 2022). Worldwide, children under the age of 5 are considered to be at risk and prone to various issues, particularly in the area of nutrition. Generally, nutritional deficiencies and malnutrition have a greater impact on children compared to any other group (Amoah et al., 2024).

Nutritional deficiencies and malnutrition generally affect children (Amoah et al., 2024). Malnutrition especially stunting is often linked to chronic malnutrition, resulting in children being shorter than their expected height for their age. The consequences of stunting are detrimental not only for the affected children but also for the future of a nation. Children who have experienced stunting may undergo harmful effects, such as decreased physical and cognitive abilities, impaired neurodevelopment, and an increased risk of metabolic diseases into adulthood. Undoubtedly, these effects can place an economic strain on families and lead to a loss of skilled human capital for the country (Santosa et al., 2022).

Malnutrition in children under 5 is caused by a complex combination of factors related to the availability, accessibility, and utilization of

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food and healthcare services. Insufficient food consumption, inadequate caregiving and parenting, inappropriate food practices, and infectious comorbidities are specific nutritional factors. Food insecurity and limited economic resources at the individual, household, and community levels are examples of nutrition-sensitive factors. Other factors that negatively impact the nutritional status of children under 5 include limited or inadequate access to education, healthcare services, and infrastructure, as well as poor hygienic environments (Clark et al., 2020; Drammeh et al., 2019). Apart from that, parents' height was also found to have an influence on children's height and the risk of stunting (Wu et al., 2021).

Indonesia has a stunting prevalence of 21.5% in 2023. This figure is only reduced by 0.1% compared to the results of a survey conducted in 2022. This number is still slightly higher than the maximum limit for stunting prevalence set by WHO, which is 20%. Other malnutrition categories that were assessed were underweight (15.9%), wasting (8.5%), and overweight and obese (4.2%). Meanwhile, the number of malnutrition in Bangka Belitung respectively is stunting at 20.7%, underweight at 13.4%, wasting at 8%, and overweight and obese at 7.9%. Except for obesity, other figures are lower than the national figures. However, this number has not decreased significantly in the last few years (Badan Kebijakan Pembangunan Kesehatan, 2024). Belitung Regency has the second highest prevalence of stunting in Bangka Belitung in 2022 in Belitung, namely 7.1% (Ditjen Bina Pembangunan Daerah - Kementerian Dalam Negeri, 2022).

Belitung Regency has experienced a significant increase in stunting in the last two years. In 2020, only one village in Belitung Regency originally had a stunting prevalence of above 20 percent, increasing to eight villages in 2021. These villages are Kacang Butor Village (23.20%), Pulau Gersik Village (26, 76%), Air Selumar Village (21.76%), Sungai Padang Village (20.71%), Batu Itam Village (21.60%), Tanjung Binga Village (22.27%), Keciput Village (21.13 %), Tanjung Tinggi Village (25%) (Nurmalitasari, 2021).

Malnutrition causes morbidity and mortality. In malnourished children, these two risks are usually detected with conventional tools which generally only look at weight or height according to age. Over time, a categorization of malnutrition was discovered which was considered to better understand the phenomenon of nutritional disorders that occur in society, namely the composite index of anthropometric failure (CIAF). This method can specify and combine nutritional disorders that occur (Preedy, 2012). Although CIAF has not been officially validated as a method for assessing nutritional status in Indonesia, four main categories (stunting, underweight, wasting, and overweight) are surveyed every year. Several studies use the CIAF method as a way to see the picture of malnutrition that occurs in communities such as West Bangka, Bogor, Semarang and several other cities in Indonesia (Andini et al., 2020; Permatasari & Chadirin, 2022; Yanti et al., 2022).

CIAF is an anthropometric index that combines the three indicators of weight per age, height per age, and weight per height to determine the nutritional status of children. Nutritional status categories based on CIAF are divided into growth failure and normal. The CIAF category was originally recognized in 2000 by Svedberg and in the beginning divided into six categories: normal; stunting; wasting; underweight and stunting; underweight and wasting, underweight, stunting and wasting. In 2005, Sailen Nandy and the team added a seventh group, the Y category, or the underweight category only (Preedy, 2012; Svedberg, 2000). Over time, the emergence of a "double burden of malnutrition", a condition where the problem of undernutrition occurs simultaneously with overnutrition and obesity, makes the CIAF model with seven categories no longer sufficient. The model only detects children with weight and height below the population average based on WHO and the Centers for Disease Control and Prevention (CDC). This model does not show the condition of children with multiple nutritional problems where stunting and overweight can occur simultaneously. In fact, like wasting, underweight, and stunting, overweight children can suffer from many diseases. Therefore, two additional categories were proposed, namely overweight and overweight and stunting (Kuiti & Bose, 2018).

In this study, CIAF was divided into nine categories where growth failure was a combination

of eight categories namely normal; underweight; stunting; wasting; underweight and stunting; underweight and wasting, underweight, stunting and wasting; overweight; overweight and stunting. Underweight, stunting, and wasting are determined based on Z score < -2SD, while normal if Z score ≥ -2SD (Rahmadini et al., 2013). This model is used considering the increasing trend of obesity in Indonesia, especially in Bangka Belitung. Obesity is the only category of malnutrition that has increased in number compared to other categories which have experienced a decrease, although not significant (Badan Kebijakan Pembangunan Kesehatan, 2024).

Belitung Regency in particular and Bangka Belitung Islands Province in general have not classified malnutrition based on CIAF. Reviewing the annual survey data, the prevalence of malnutrition in Bangka Belitung has not decreased significantly, there are even categories of malnutrition that have increased. To see a more comprehensive picture of the incidence of malnutrition, the CIAF method is needed because it combines four main categories of malnutrition (stunting, underweight, wasting, and obesity). Apart from that, it is necessary to know the factors that underlie malnutrition to carried out specific treatment to reduce the rate of malnutrition appropriately and quickly. This research aims to determine the determinants of malnutrition based on the Composite Index of Anthropometric Failure (CIAF) in Belitung.

METHODS

This study is a descriptive-analytical study with a cross-sectional approach in Belitung Regency, Bangka Belitung Islands Province. This research was carried out for 10 months starting from obtaining permits from the health department and local government, exploring the research area, data collection to research evaluation. Another factor that caused the long duration of the research was the sample collection was adjusted to the Posyandu schedule in all Community Health Centers in Belitung Regency. The total time for collecting sample data was 2 months (July – September 2023).

All community health centers in Belitung Regency (a total of 9 community health centers) were used as research locations and one Posyandu was taken from each community health center using a simple random sampling technique. The population in this study were all families with toddlers aged 6 to 59 months in Belitung Regency. The sample consisted of 198 toddlers whose parents agreed to be respondents by signing informed consent. Respondents will be excluded if the toddler was born prematurely and has congenital abnormalities.

Respondents who meet the criteria to be sampled in this study will undergo an anthropometric examination to determine nutritional status. The child's age and the type of measuring instrument used will be taken into account in anthropometric measurements. A child's age is calculated in full months, in other words, age is considered one month old if it is full 30 days. The scales used can measure up to an accuracy of 100 grams and height measurement lying down (for children under two years old) or standing upright (for children over two years old).

Assessment of children's nutritional status using the 2006 WHO growth chart. Anthropometric results are then compared by looking at body weight based on age (weight for age), height based on age (height for age) and body weight based on height (weight for height). The results will be categorized into nine types: normal; underweight; stunting; wasting; underweight and stunting; underweight and wasting, underweight, stunting and wasting; overweight; overweight and stunting.

Furthermore, the child's parents will be asked using the questionnaire. The questionnaires contains questions about parental characteristics, child's birth weight, parents' height, family economics, family awareness about nutrition, and clean and healthy living behavior.

In detail, family awareness about nutrition contains questions about regularly weighing children for the last 4 months, exclusive breastfeeding, use of iodized salt, vegetables/ fruits and animal protein on the diet for the last three days, and government program supplements for children under five years of two doses of Vitamin A per year and 90 iron tablets for pregnant women.

Meanwhile, data on clean and healthy living behavior is assessed from mothers who give birth in health workers, exclusive breastfeeding, children being weighed regularly, washing hands with clean water and soap, using healthy latrines, eliminating mosquito larvae every week, eating fruit and vegetables every day, physical activity at least 30 minutes every day and family members do not smoke in the house.

The results obtained were then edited, coded, tabulated, and then analyzed using the statistic program. The Ethics Commission of Health Research of the Poltekkes Kemenkes Pangkal Pinang, acceded to this study (approval number 056/EC/KEPK-PKP/VI/2023). The Health Office of Belitung Regency and all community health centers in the study area also provided approval. Every participant in this research gave their written consent and signed the consent form after receiving full information about the study. Personal identifiers were excluded from the data collection form to ensure the confidentiality of the information provided by the participants. During data collection, priority was given to participant convenience, and their rights were respected.

RESULTS AND DISCUSSIONS

Based on Table 1, the prevalence of nutritional disorders based on CIAF with nine categories found that 40.4% or almost half of children experienced growth failure in Belitung. This data is similar to that obtained by research conducted in Ethiopia where the CIAF nutritional disorder rate was 48.5% (Endris et al., 2017). Growth failure is most common in the stunting category (11.6%) and least in the underweight category (1%). In Indonesia, malnutrition detection using CIAF has also been carried out in Bangka Barat Regency, another region in Bangka Belitung province, although using seven categories. The results obtained were that 48.4% of children experienced growth failure. This shows that in general, in Bangka Barat, almost half of the children experience nutritional disorders (Yanti & Permata, 2023).

Table 1. Prevalence of nutritional disorders based on CIAF in children under five in Belitung

	CIAF Category	Frequency (%)
I	Normal	118 (59.6)
II	*Underweight*	2 (1.0)
III	*Stunting*	23 (11.6)
IV	*Wasting*	8 (4.0)
V	*Underweight* dan *Stunting*	14 (7.1)
VI	*Underweight* dan *Wasting*	7 (3.5)
VII	*Underweight, Stunting,* and *Wasting*	4 (2.0)
VIII	*Overweight*	16 (8.1)
IX	*Overweight* dan *Stunting*	6 (3.0)
Total		198 (100)

Growth Failure (II + III + IV + V + VI + VII + VIII + IX) = 40.4%.

What is interesting is that overweight is the second highest category of nutritional disorders after stunting (8.1%) and there are 3% of children who are both overweight and stunted (double burden of malnutrition). This shows that children's nutritional disorders do not only occur due to lack of intake but can occur due to inappropriate feeding of children in terms of portions, variety, and nutrients. Furthermore, stunting occurs not only in children who experience a lack of food intake, but can also occur in children who are overweight, the cause of which may be due to inappropriate feeding methods or genetic factors (Prasetyo et al., 2023). Research finds that children with low socio-economic backgrounds have a double burden of malnutrition (especially stunting and obesity). However, in this study no correlation was found between parental education, parental occupation, or family income on the occurrence of malnutrition in children (Modjadji et al., 2022).

Malnutrition assessed using conventional methods only detects a small percentage of nutritional disorders compared to CIAF. (Dasgupta et al., 2014; Pei et al., 2014). The number of malnutrition based on the CIAF, growth category, will appear significantly higher when compared with the national level. This is because the malnutrition survey is classified separately, unlike the CIAF which sums up all combinations of malnutrition. When compared per category, the numbers obtained in this study are similar to the national survey and are even slightly lower, because there are children who experience malnutrition in more than one category (double-burden malnutrition) will be included in two categories of malnutrition at the national level.

Children with both stunting and overweight, for example, in CIAF will be included in category IX (table 1) but will be counted respectively in the stunting and overweight/ obese categories in the national survey.

Based on the research results obtained (table 2), more children in this study were female (52%) than male (48%). Statistical tests show there is no difference in nutritional status between the two genders, both boys and girls. This is contrary to research conducted in India and in sub-Saharan Africa where boys were found to have a higher risk of experiencing malnutrition although further research into this finding is needed. The possible cause is due to children's nutritional needs not being met as they get older (Porwal et al., 2021;

Table 2. Characteristics of Respondents and Their Relationship with Nutritional Status

Respondent Characteristics	Mean ± SD Frequency (%) n=198	p
Child's Gender		
Female	103 (52)	0.138[a]
Male	95 (48)	
Child's Age (months)	**28.03 ± 14.534**	0.117[a]
6 – 11	31 (15.7)	
12 – 23	55 (27.8)	
24 – 35	43 (21.7)	
36 – 47	47 (23.7)	
48 – 59	22 (11.1)	
Mother's age (years)	**29.42 ± 6.848**	0.561[b]
< 20	7 (3.5)	
20 – 35	156 (78.8)	
> 35	35 (17.7)	
Mother's Education		
High (university level)	17 (8.6)	0.223[b]
Advanced (senior high school)	102 (51.5)	
Basic (first nine years of schooling-elementary until junior high school)	78 (39.4)	
No Education	1 (0.5)	
Father's Education		
High (university level)	27 (13.6)	0.183[b]
Advanced (senior high school)	78 (39.4)	
Basic (first nine years of schooling-elementary until junior high school)	91 (46.0)	
No Education	2 (1.0)	
Mother's Occupation		
Government employees	8 (4.0)	0.773[b]
Laborer	2 (1.0)	
Self-employed	2 (1.0)	
Private employees	4 (2.0)	
Housewife	182 (91.9)	
Father's Occupation		
Government employees	11 (5.6)	0.440[b]
Laborer	104 (52.5)	
Self-employed	27 (13.6)	
Private employees	29 (14.6)	
Fisherman	24 (12.1)	
Farmer	3 (1.5)	

notes: [a]Chi-Square
[b]Mann-Whitney

Thurstans et al., 2020; Wamani et al., 2004). Boys are more susceptible to undernutrition starting from the fetal stage, even though they are larger at birth and during infancy. This vulnerability is more evident in severe cases of undernutrition and in socioeconomically disadvantaged settings. Their increased vulnerability to infectious diseases may be attributed to variations in their immune and endocrine systems (Thurstans et al., 2020).

The average age of the children in the study was 28.03 ± 14.534 months (table 1). The largest age categories for children are in the age range 12-23 months (27.8%) and 36-47 months (23.7%). No significant differences were found between the child's age and the child's nutritional status in this study (p=0.117). The results of this study contradict research conducted in Ethiopia and the Oromia region (Endris et al., 2017; Mengistu & Alemu, 2013; Rahman & Chowdhury, 2007; Wamani et al., 2004). The findings from these previous studies demonstrate a clear connection between age and malnutrition. Additionally, they indicate a strong correlation between age and gender. Furthermore, the influence of gender on nutritional status, which used to be significant, may alter with age (Garenne et al., 2021; Myatt et al., 2018).

In theory, maternal age plays a significant role in influencing a child's nutritional status because in the household the mother is the main actor in raising children. The average mother's age in this study was 29.42 ± 6.848 years. Statistical results show that there is no significant difference between maternal age and child nutritional status (table 2). Different results were found in Russia where the mother's age greatly influenced the baby's first year of life (Moiseeva Karina et al., 2020). Children with teenage mothers have three times the rate of child malnutrition than adult mothers in Ghana. For young mothers, ensuring their child's nutrition is adequate, access to clean water and ensuring that hygiene conditions are maintained are more difficult. Apart from that, this young mother was also considered psychologically unprepared for the process of raising children (Wemakor et al., 2018).

Parental education influences their child's growth. Mother's education was found more frequently at the advanced level, while father's education was found more at the elementary level (table 2). Statistical results show that there is no significant relationship between mothers' and fathers' education on the incidence of nutritional disorders in children. This is contrary to research analyzed from the Demographic and Health Surveys (DHS) which found that the level of parental education was related to the incidence of nutritional disorders in children, where the higher education of the father and mother resulted in a lower incidence of nutritional disorders in children (Vollmer et al., 2017).

Other study analyses also found the educational level of mothers has a clear and important impact on the nutritional status of children. Addressing this factor is crucial for preventing or improving childhood malnutrition (Iftikhar et al., 2017). Mothers' level of education significantly influences their knowledge and capability in managing healthcare, particularly in understanding maternal nutritional intake before, during, and after pregnancy. Educated women are more likely to have intelligent children, alleviate poverty, and better support their families, thereby reducing the risk of children being born stunted (Azizah et al., 2022).

Parental employment was not found to have a significant relationship with the incidence of nutritional disorders in children (p>0.05). The same results were also found in other research conducted in Indonesia. It is suspected that the knowledge on which parents base their care for their children can be influenced by various other factors, not only education, work, and income (Toyibah et al., 2023).

In this study, the characteristics of children and parents were not determinants that caused nutritional disorders. It can be concluded that in this study the respondents had similar or homogeneous background characteristics both in terms of mother's age, parents' education, and parents' occupation. Based on Table 3, it appears that there is no statistical relationship between nutritional status and the mother's height, father's height, household income, family awareness about nutrition, and clean and healthy living behavior. The only factor that had a significant relationship was birth weight (p<0.05). It can be seen in the table that the mean birth weight in the group with normal growth was higher (3010.25 ± 458.964) compared

Table 3. Analysis of Determinants of Nutritional Disorders Based on CIAF and Children's Nutritional Status

	Total n=198	Normal n=118 (59,5)	Growth Failure n=80 (40,4)	p
Birth Weight (gram)	2952.78 ± 528.835	3014.49 ± 456.515	2861.75 ± 612.099	0.048[a]
Mother's Height (cm)	154.50 ± 5.483	154.77 ± 5.120	154.10 ± 5.991	0.318[a]
Father's Height (cm)	164.34 ± 6.838	163.99 ± 6.793	164.85 ± 6.914	0.213[a]
Household Income				
Equal or more than the regional minimum wage	100 (50.5)	60 (60)	40 (40)	1.000[b]
Less than the regional minimum wage	98 (49.5)	58 (59.2)	40 (40.8)	
Family awareness about nutrition				
Yes	101 (51)	58 (63)	34 (37)	0.438[b]
No	97 (49)	60 (56.6)	46 (43.4)	
Clean and healthy living behavior				
Yes	54 (27)	32 (59.3)	22 (40.7)	1.000[b]
No	144 (73)	86 (59.7)	58 (40.3)	

notes: [a]Mann-Whitney
[b]Chi-Square

to the growth failure group (2880.50 ± 592.519). The same results were also found in research conducted in Gowa which found that children with a birth weight below 2,500 grams had a 5.96 times higher risk of experiencing stunting (Lukman et al., 2021).

One of the factors related to stunting in children is the parents' height. When compared with children born to short mothers and fathers, children born to tall mothers and fathers have a lower risk of stunting (Wu et al., 2021). Although other studies show that it is the mother's height that has a significant influence on stunting in children (Sindhughosa & Arimbawa, 2020). Parental height was not found to have a significant influence on respondents in this study (p>0.05). This may be due to other factors that influence the child's growth which makes him fail to grow as he gets older.

The economic situation of the household plays an important role in the nutritional status of children. This study found that more respondents had incomes equal to or above the Regional Minimum Wage for the Bangka Belitung Islands Province, even though there is no relationship between income and children's nutritional status statistically. These results are contrary to research obtained by research obtained in India where there was an increase in the incidence of stunting and malnutrition in children in less developed districts (S. Singh et al., 2019). This accumulation also occurs in poor communities as measured by income (S. K. Singh et al., 2020). However, the same results were also shown by research conducted in other regions of Indonesia, where income was found to have no significant relationship with parents' knowledge of children's feeding patterns (Toyibah et al., 2023).

Family awareness about nutrition and clean and healthy living behavior were assessed in this study. These two things show how aware the family is of being able to meet its nutritional needs and maintain the cleanliness and health of its family. Statistically, these two factors did not show a significant relationship with the occurrence of growth failure in children (p>0.05), although when analyzed further on the indicators assessed, variations in feeding were the only factor that had a relationship with the occurrence of stunting (table 4).

Based on Table 4, family behavior in implementing nutritional awareness and clean and healthy living habits is assessed. Several questions were asked to assess regularity in weighing children, history of breastfeeding children, use of iodized salt, variety of meals, consumption of supplements for pregnant women and children, eradication of mosquito larvae, physical activity of family member for 30 minutes per day, and appropriate smoking behavior. Apart from comparing nutritional disorders based on CIAF categories, researchers also compared the incidence

Table 4. Analysis of Family Awareness about Nutrition and Clean and Healthy Living Behavior with Child Nutritional Status (Based on CIAF and Stunting)

	CIAF Category			Stunting		
	Normal n=118 (59.5)	Growth Failure n=80 (40.4)	p	Normal n=153 (77.3)	Stunting n=45 (22.7)	p
Weight measurement						
Regularly	111 (60.0)	74 (40.0)	0.885[a]	143 (77.3)	42 (22.7)	0.601[b]
No	7 (53.8)	6 (46.2)		10 (76.9)	3 (23.10	
Breastfeeding						
Eksklusif	69 (61.1)	44 (38.9)	0.735[a]	84 (74.3)	29 (25.7)	0.334[a]
No	49 (57.6)	36 (42.4)		69 (81.2)	16 (18.8)	
Iodine salt						
Yes	112 (59.6)	76 (40.4)	0.625[b]	147 (78.2)	41 (21.8)	0.168[b]
No	6 (60.0)	4 (40.0)		6 (60.0)	4 (40.0)	
Feeding's Menu Variation						
Yes	106 (60.9)	68 (39.1)	0.424[a]	140 (80.5)	34 (19.5)	0.009[a]*
No	12 (50.0)	12 (50.0)		13 (54.2)	11 (45.8)	
Supplementation						
Yes	114 (60.0)	76 (40.0)	0.414[b]	148 (77.9)	42 (22.1)	0.263[b]
No.	4 (50.0)	4 (50.0)		5 (62.5)	3 (37.5)	
Eradicating mosquito larvae						
Yes	111 (59.4)	76 (40.6)	0.521[b]	145 (77.5)	42 (22.5)	0.475[b]
No	7 (63.6)	4 (36.4)		8 (72.7)	3 (27.3)	
Physical Activity						
Yes	99 (59.6)	67 (40.4)	1.000[a]	126 (75.9)	40 (24.1)	0.210[b]
No	19 (59.4)	13 (40.6)		27 (84.4)	5 (15.6)	
Smoking Behavior						
Appropriate	72 (58.1)	52 (41.9)	0.675[a]	95 (76.6)	29 (23.4)	0.911[a]
No	46 (62.2)	28 (37.8)		58 (78.4)	16 (21.6)	

notes: [a]Chi-Square
[b]Fisher's Exact
*Statistically significant

of stunting. Feeding variations are the only family indicator that influences the occurrence of stunting ($p<0.05$), although if measured using the CIAF category this indicator has no effect like the other indicators.

Contrary to the hypothesis in this study, family awareness about nutrition and clean and healthy living behavior did not influence the occurrence of malnutrition. However, when analyzed in more detail in the sectors assessed, eating variations have a significant correlation with the occurrence of stunting. Different results were obtained by other studies where family awareness about nutrition (the same sector was assessed) had a significant relationship with the incidence of stunting in toddlers (Rahmah et al., 2023). Different results were also obtained from research conducted in Samarinda where mothers' knowledge and behavior to live a clean and healthy life was related to the occurrence of stunting (Dhefiana et al., 2023).

This study found that appropriate feeding variation were related to stunting but not CIAF. On the other hand, the same findings were also found by Indahsari et al., (2023). regarding the influence of feeding variations on the occurrence of stunting. There was a significant relationship between dietary diversity and stunting but not food quantity (Indahsari et al., 2023). Children who were fed a variety of foods (four groups or more) were significantly associated with stunting and became a protective factor. Furthermore, consuming staple

food for children actually increases the risk factor for stunting (Mufida Wulan Sari et al., 2023).

CONCLUSION

Almost half of the respondents (40.4%) were children with growth failure based on CIAF with nine categories, where the highest cases were in the stunting (11.6%) and overweight (8.1%) categories. The variable that has a significant relationship to the occurrence of cases of growth failure is the child's birth weight while feeding variation is the factor that has a relationship to the occurrence of stunting.

This research has taken samples from all areas in the Belitung Regency. However, this research has several limitations. Anthropometric measurements have a risk of being inaccurate, including parental height data. Data may suffer bias in recalled information. The lack of detailed data regarding the type of food, amount of food, and how to feed children can be investigated further in future studies.

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