Original Research

Determinants Of Malnutrition Based On The Composite Index Of Anthropometric Failure (CIAF)

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ABSTRACT

Background: *Malnutrition in toddlers (under five years) is known to cause disturbances in growth and development. The Composite Index of Anthropometric Failure (CIAF) is an alternative anthropometric that specifying and combining various growth failures that occur.*

Methods: *A descriptive quantitative study with a cross-sectional approach was carried out for 10 (ten) months in 2022. A total of 155 samples of toddlers (aged 6 months to 5 years) were taken using the multistage random sampling technique. The instruments used include questionnaires about the characteristics of parents, family economy, family awareness about nutrition, and health seeking behavior. The tools to detect malnutrition are a calibrated digital stature meter and weight scales. The data was analyzed through Chi Square, and Mann-Whitney is used as an alternative if the data found does not meet the requirements.*

Results: *Of the 155 children under five examined, 48.4% or almost half of the respondents experienced growth failure. Most growth failure was in the stunting and underweight category (21.3%) and the least was in the wasting only category (1.3%). Family awareness about nutrition and health seeking behavior were not found to be related to the nutritional status of children, where statistically the prevalues obtained were 0.217 and 0.173, respectively.*

Conclusion: *Based on the CIAF, none of the factors studied were found to have an association with malnutrition. Further research is needed by examining a wider scope of variables and providing more intensive training to survey officers to obtain more accurate data.*

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INTRODUCTION

Malnutrition is the most important public health problem because it affects more than 900 million people worldwide. Undernutrition is a condition where there is not enough nutritional intake, including inadequate food intake both quantitatively and qualitatively. This is important to know because the consumption of energy-dense foods with poor nutritional quality can lead to malnutrition (Martins et al., 2011). Malnutrition

is a global problem that has an important impact on survival, the incidence of acute and chronic disease, healthy development, and the economic productivity of individuals and communities (Black et al., 2013).

Malnutrition in toddlers (under five years) is known to cause disturbances in growth and development. Malnutrition causes high mortality in children and has long-term effects on the body. Malnutrition can lead to increased susceptibility to fat accumulation, especially in the midsection, lower fat oxidation, insulin resistance in adulthood, hypertension, and dyslipidemia. Some of these effects appear to be epigenetic, meaning they are passed down from generation to generation.

Malnutrition in children has been associated with poor mental development and school performance as well as behavioral disorders. However, there is still debate in the literature as to whether some of these effects are permanent or reversible. Stunting children who have experienced growth spurts have verbal vocabulary and quantitative test scores that are no different from those of children who are not stunted.

Children admitted to the hospital before the age of six years recovered from stunting and had normal body composition, bone mineral density, insulin production, and sensitivity (Martins et al., 2011). A chart made by the United Nations Children's Fund (UNICEF) states that the basic and underlying causes of malnutrition are environmental, economic, and sociopolitical factors, with poverty playing the most important role. These factors lead to household food insecurity, inadequate maternal and child care, an unhealthy household environment, and inadequate health services (Black et al., 2008).

Based on Riskesdas data in 2018, the prevalence of stunting under five in Indonesia shows 30.8% or around 7 million children under five suffer from stunting. This situation is greater than the maximum stunting prevalence limit set by WHO, which is 20%. The prevalence of stunting under five in the province of the Bangka Belitung Islands was 23.37%, and this decreased compared to the results of Riskesdas in 2013, which were 28.66%. As for wasting toddlers (thin), based on the results of Riskesdas 2013, the province of the Bangka Belitung Islands is in the serious category, which is 10–14% based on WHO, 2010. However, based on Riskesdas 2018, the prevalence has decreased to 9.87% (Badan Penelitian dan Pengembangan Kesehatan, 2019).

The Bangka Belitung Islands Province has 8 districts. West Bangka Regency has the highest cases of malnutrition compared to other regions. In 2020, West Bangka has 15.12% undernourished toddlers (weight/age), 16.96% short toddlers (height/age), and 5.69% thin under-fives (weight/height). These figures are quite high compared to the coverage of malnutrition in the province, which is only 6% undernourished, 7.46% short, and 2.75% thin (Dinas Kesehatan Provinsi Kepulauan Bangka Belitung, 2020).

The Composite Index of Anthropometric Failure (CIAF) is an anthropometric index that combines the three indices of weight/age, height/age, and weight/height to determine the nutritional status of toddlers. The category of nutritional status based on the CIAF is divided into growth failure and normal. Growth failure is a combination of six categories, namely undernourished, short, thin, short and thin, undernourished and underweight, and undernourished, short, and thin. Toddlers are declared normal if they are not malnourished, not short, and not thin. Undernourished, short, and underweight were determined based on a Z score < -2 SD, while normal toddlers if Z score -2 SD (Rahmadini, Sudiarti, & Utari, 2013).

It is widely known that malnutrition can cause morbidity and mortality. Conventional tools are often used to predict this risk. The classification of nutritional disorders using nutrition that shows specificity as well as a combination of growth failure may be able to predict the risk experienced better than conventional methods (Preedy, 2012). West Bangka Regency in particular and the Province of the Bangka Belitung Islands in general have not classified malnutrition that occurs based on CIAF. The aim of this study was to determine the factors associated with malnutrition based on the CIAF.

MATERIALS AND METHOD

This research is a descriptive quantitative study with a cross-sectional design that was conducted for 10 (ten) months in West Bangka Regency, Bangka Belitung Islands Province, in 2022. The population in this study were all families with toddlers from the ages of 6 to 59 months in West Bangka Regency. The sample of 155 toddlers was taken using the multistage random sampling technique.

The sample was selected based on the inclusion criteria, namely, being willing to become research respondents. Respondents will be excluded if it turns out that the toddler was born prematurely, has a history of Low Birth Weight (LBW) and has congenital abnormalities. Sampling was carried out in two stages: first selecting Puskesmas in West Bangka Regency, then selecting Posyandu and PAUD in the working area of the Puskesmas.

The instruments used include questionnaires about the characteristics of parents, family economy, family awareness about nutrition, and health seeking behavior. The tools to detect malnutrition are a calibrated digital stature meter and weight scales. The data was analyzed through Chi Square, and Mann-Whitney is used as an alternative if the data found does not meet the requirements. This research has passed the ethical review by the Health Research Ethics Commission of the Poltekkes Kemenkes Pangkalpinang with the number 01/EC/KEPK-PKP/V/2022.

RESULTS

Based on table 1, it was found that the rate of growth failure in children from all categories was 75 children (48.4%), or nearly half of the total number of respondents. Meanwhile, 80 children (51.6%) had normal growth. The most growth failure was in the stunting and underweight categories, namely 33 children (21.3%), while the least was in the wasting only category, namely 2 children (1.3%).

Table 1. Prevalence of malnutrition based on CIAF in West Bangka

Group	CIAF category	Frequency (%)
I	Normal	80 (51,6)
II	Wasting only	2 (1,3)
III	Stunting only	19 (12,3)
IV	Underweigt	5 (3,2)
V	Stunting and Underweight	33 (21,3)
VI	Wasting and Underweight	5 (3,2)
VII	Wasting, Stunting and Underweiight	11 (7,1)
	Total	**155 (100)**

CIAF (II + III + IV + V + VI + VII) = 48,4%.

Table 2. Characteristics of respondents based on growth failure

Variable	Growth Failure Frequency (%) n=75	Normal Frequency (%) n=80	Total Mean ± SD Frequency (%) n=155
Sex of Child			
Female	27 (40,9)	39 (59,1)	66 (100)
Male	48 (53,9)	41 (46,1)	89 (100)
Child Age (months)			**35,49 ± 14,794**
6 – 11	2 (16,7)	10 (83,3)	12 (100)
12 – 23	16 (64)	9 (36)	25 (100)
24 – 35	13 (43,3)	17 (56,7)	30 (100)
35 – 47	26 (56,5)	20 (43,5)	46 (100)
48 – 59	18 (42,9)	24 (57,1)	42 (100)
Mother age (years)			**28,35 ± 5,781**
< 20	2 (66,7)	1 (33,3)	3 (100)
20 – 35	66 (48,9)	69 (51,1)	135 (100)
> 35	7 (41,2)	10 (58,8)	17 (100)
Mother's education			
None education	7 (63,6)	4 (36,4)	11 (100)
Basic education	50 (50)	50 (50)	100 (100)
Advanced Education	18 (40,9)	26 (59,1)	44 (100)
Household Income			
< Rp.3.264.884	41 (50)	41 (50)	82 (100)
≥ Rp.3.264.884	34 (46,6)	39 (53,4)	73 (100)

Based on table 2, it can be seen the characteristics of the respondents based on their growth failure. The group of girls had fewer cases of growth failure (40.9%) than boys (53.9%). The group of children with the highest cases of growth failure was in the age range of 12 to 23 months old (64%). But in total, the growth failure category is mostly 35-47 months old.

Mothers who were in the age category less than 20 years old had children with higher cases of growth failure (66.7%) than mothers in other age groups (20 to 35 years old, and over 35 years old) where cases of growth failure were fewer in same age range group. Children whose mothers had no education experienced more cases of growth failure (63.6%) compared to the group of mothers who had basic and advanced education. The last two groups have more children who could grow normally.

Family income has the same amount for groups of families who have an income of less than 3,264,884 rupiah. However, in the group of families with higher incomes, more children were able to grow normally (53.4%) than those who have growth failure (46.6%).

Table 3. Relationship of family awareness about nutrition and health seeking behavior with nutritional status

Variable	Nutritional Status							p
	Normal	Wasting Only	Stunting Only	Under weight	Stunting, Underweight	Wasting, Underweight	Wasting, Stunting, Underweight	
Family awareness about nutrition								0,217*
Yes	30 (46,2%)	0	11 (16,9%)	1 (1,5%)	17 (26,2%)	2 (3,1%)	4 (6,2%)	
No	50 (55,6%)	2 (2,2%)	8 (8,9%)	4 (4,4%)	16 (17,8%)	3 (3,3%)	7 (7,8%)	
Health seeking behaviour								0,173*
Yes	5 (35,7%)	0	3 (21,4%)	0	5 (35,7%)	1 (7,1%)	0	
No	75 (53,2%)	2 (1,4%)	16 (11,3%)	5 (3,5%)	28 (19,9%)	4 (2,8%)	11 (7,8%)	

*Mann-Whitney

Based on the results in Table 3, it can be seen that the group of families with less awareness of nutrition has the most complex combination of growth failure (wasting, stunting, and underweight) at 6.2% compared to the opposite group at 7.8%. Even so, family awareness about nutrition was statistically found to have a non-significant effect on the incidence of malnutrition experienced by children (p = 0.217). In table 3, it can also be seen that data on health seeking behavior in families shows that families implementing health seeking behavior do not have complex cases of growth failure (wasting, stunting, and underweight) compared to the opposite group (11%). However, statistically, health-seeking behavior is not a factor that has a relationship with the nutritional status of children (p = 0.173).

DISCUSSION

The issue of malnutrition by assessing it based on the CIAF by combining various growth failures that occur has not been widely carried out in Indonesia. Generally, the assessment of malnutrition is only based on one indicator, including stunting only, underweight only, or wasting only. This type of assessment cannot show actual cases of malnutrition. This was proven in the results of this study (table 1), where of all cases of growth failure (48.4%), the most were in the stunting and underweight combination group (21.3%), while the least growth failure was in the wasting only group (1.3%). These data are similar to those obtained by a study conducted in Ethiopia, where the CIAF malnutrition rate was 48.5% (Endris, Asefa, & Dube, 2017).

Stunting and underweight illustrate that a child experiences stunting and underweight at the same time. Children with a combination of both growth failure have height and weight that are not appropriate for their age. Stunting and being underweight but not wasting are not linked to developmental delays in children. Other factors that were found to have an effect were the mother's occupation and the pattern of administration, which were predictors of the risk of developmental delays in children (Oumer et al., 2022).

The number of growth failures discovered in this study (table 1) demonstrates that malnutrition remains an unresolved issue in West Bengal. West Bangka has been the locus of stunting since 2018 (Fitrajaya, 2021). Various efforts have been made by the local government, including forming a Team for the Acceleration of Stunting

Reduction, which is included in the Regional Medium-Term Development Plan (Angga, 2022). Despite the handling from various local, provincial, and even national governments as well as the various programs that have been implemented, West Bangka is still one of the areas with the highest prevalence of stunting in Bangka Belitung (10.3%) (Ditjen Bangda, 2022).

This is of particular concern, and it is necessary to evaluate the handling of the stunting that has been carried out. The government must also focus on overcoming stunting, not only by intervening in food adequacy but also by looking for the causes of the malnutrition problem that occurs. Thus, in addition to the food that is carried out being more specific to the causes experienced, it can also prevent malnutrition that has not yet occurred.

The results of this study show that many children with stunting are also underweight. This, of course, has not been seen from the data released by the official website for calculating nutritional disorders from official government institutions. Wasting and stunting are the most common indicators for assessing a child's nutritional status, designing programs, and assessing the impact of malnutrition. Stunting is considered to reflect chronic nutritional disorders or long-term conditions of malnutrition in children, while wasting is usually used to reflect acute situations related to illness or a lack of food intake.

Stunting is the most common type of malnutrition in Indonesia. However, that does not mean that wasting and underweight can be ruled out. Often, one nutritional disorder is followed by another. As a result, the effects of malnutrition experienced by children will also be more severe than if they experienced only one type of malnutrition (stunting only, wasting only, or being underweight only).

Children with malnutrition can affect their academic performance at school. Stunting was especially found to have a significant and prolonged negative effect on language, mathematics, and average grades (Haywood & Pienaar, 2021). Stunting and underweight may be affected by the cumulative effect of intermittent wasting. Children with multiple malnutrition are reported to have higher mortality compared to children who only have one type of malnutrition (McDonald et al., 2013).

Malnutrition occurred more frequently in the group of boys (53.9%) in this study. These results are consistent with previous studies conducted in India and sub-Saharan Africa where boys were found to be more at risk of experiencing malnutrition (Porwal et al., 2021). However, other studies suggest that gender and age are interrelated. The sex previously at risk of experiencing malnutrition may change with age (Garenne et al., 2021). Boys are more at risk of experiencing malnutrition in the first year of life, but girls are more at risk in the following years (Adair & Guilkey, 1997).

Mother's age plays an important role in the first year of children's life (Moiseeva Karina, Ivanov Dimitry, Alekseeva Anna, Kharbediya Shalva, & Berezkina Elena, 2020). This study found that mothers in the age category of less than 20 years old had more children with growth failure than normal ones. Whereas in other age ranges (20 to 35 years and over 35 years old), there are more children who can grow normally.

This is in accordance with research conducted in Ghana, where teenage mothers have a three times higher risk of having children with cases of malnutrition. This is because it is more difficult for young mothers to meet the nutritional adequacy of their children and to meet the needs of clean water and good sanitation. Teenage mothers are also considered psychologically unprepared for the parenting process that occurs (Wemakor, Garti, Azongo, Garti, & Atosona, 2018).

Mothers who have no education have more children with growth failure compared to mothers who have basic and advanced education. This is consistent with previous research conducted in Indonesia, where stunting and underweight were found to be associated with mothers who had never received formal education (Rachmi, Agho, Li, & Baur, 2016). Mothers who have education will have good knowledge. A mother with good knowledge will raise children well. One way to care for children is to ensure that their nutrition is fulfilled properly.

Families who have an income above the minimum standard wage in Bangka Belitung (above Rp. 3,264,884) have fewer cases of growth failure than normal. This is in accordance with research conducted in India, where cases of malnutrition, especially stunting, often occur in areas where residents have low incomes (Singh, Srivastava, & Chauhan, 2020). To have a good nutritional status, nutrition must be fulfilled properly. Fulfillment of nutrition requires financial support to buy nutrients. Families with low incomes will not be able to meet the nutritional needs of their family members.

Based on table 3, it can be seen that there is no statistical relationship between nutritional status with family awareness about nutrition and health seeking behavior. In the family awareness about nutrition variable, more respondents had normal nutritional status (46.2%), and the highest nutritional disorders experienced were stunting and underweight (26.2%). Family awareness about nutrition or what is often called a family-aware nutrition, is the government's effort in overcoming nutritional problems. In this study, data obtained that statistically levels of nutritional problem in children under five.

Families that are awareness of their nutritional condition are able to recognize, prevent, and overcome nutritional problems that occur in their family members. The indicators used are regular weighing, exclusive breastfeeding, food menus, use of iodized salt, and nutritional supplements consumed. In this study, there was no statistical relationship between family awareness of nutrition and the nutritional status of children under five (p = 0.217).

This is contrary to the research conducted by Wahyuni and Febry, (2019), which showed that there was a relationship between the nutritional status of toddlers based on the CIAF and nutrition-aware family (Wahyuni & Febry, 2019). This may be due to other factors that have not been studied by researchers that play an important role in influencing the nutritional status of children under five. This study also found that health seeking behavior did not have a significant effect on determining the nutritional status of children under five (p = 0.173), although in general it can be seen in Table 3 that most of the respondents who did not have health seeking behavior had more nutritional disorders than families who did.

The family has an important influence on the nutritional status of the children in it. Children who have malnourished mothers, uneducated parents, poor household sanitation, and live in rural areas are more at risk of experiencing malnutrition than children with the opposite condition (Fenta, Zewotir, & Muluneh, 2021). The results of the study contradict research conducted in Bangladesh, where socio-economic variables such as household economic status, parental education, maternal health behavior, sanitation, fertility, and height have a role in stunting prevention (Huda, Hayes, El Arifeen, & Dibley, 2018).

The results of this study that are different from previous studies may be due to other variables that affect the nutritional status of children under age five but were not examined by the researchers. It is possible that the data collected is assessed inappropriately by the survey officer, which can also be one of the factors that occur due

to human error. Factors that are wider in scope and holding special activities to make the understanding of survey officers more comprehensive are the next steps that researchers will take for future activities.

CONCLUSION

None of the factors studied were found to have an association with malnutrition based on the CIAF. Further research is needed by examining a wider scope of variables and providing more intensive training to survey officers in order to obtain more accurate data. Thus, variables that affect the occurrence of malnutrition based on CIAF in toddlers can be found.

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