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Household Food Insecurity and Stunting among Infants Aged 6-23 Months: A Cross-sectional Study in Indonesia

Magnis Asaluna [1], * Tantut Susanto [2], Latifa Aini Susumaningrum [2]

[1] Nursing Study Program, Faculty of Nursing, Universitas Jember, Jember, Indonesia.

[2] Department of Community, Family & Geriatric Nursing, Faculty of Nursing, Universitas Jember, Jember, Indonesia.

Abstract

Background: Stunting is a form of malnutrition that remains a significant global health problem. Household food insecurity is associated with poor dietary diversity and contributes to inadequate nutrition in children, which is linked to higher rates of stunting. This study aimed to analyze the relationship between household food insecurity and the prevalence of stunting among infants aged 6-23 months in Jember Regency.

Materials and Methods: A cross-sectional study was conducted among 211 families with infants aged 6-23 months using total sampling. Food insecurity levels were assessed using the Household Food Insecurity Access Scale (HFIAS), while the infants' anthropometric measurements were taken using a digital baby scale and a length board.

Results: Of the 211 households, 92.4% experienced food insecurity, with 55.5% facing moderate food insecurity. The incidence of stunting was categorized into two mutually exclusive groups: 63% of infants were moderately stunted, and 34% were severely stunted. A Chi-square test revealed a significant association between household food insecurity and stunting incidence (χ^2 = 9.853; p-value = 0.020). Compared to infants from food-secure households, those from severely food-insecure households were more likely to be stunted (OR = 1.782; 95% CI: 0.575-5.525). However, as the confidence interval includes 1, the risk estimate for this subgroup lacks strict statistical precision despite the overall significant association.

Conclusion: Household food insecurity is associated with stunting among infants aged 6-23 months. Therefore, this study recommends that families utilize local resources to reduce dependence on expensive foods while meeting infants' nutritional needs.

Key Words: Children, Family, Household food insecurity, Malnutrition, Stunting.

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****Corresponding Author:***

Tantut Susanto; MN, RN, PHN, PhD. Department of Community, Family & Gerontic Nursing, Faculty of Nursing, Universitas Jember, Jember, Indonesia. Jalan Kalimantan 37 Jember, Jawa Timur, Indonesia 68121, Tel: +62 331323450; E-mail: tantut_s.psik@unej.ac.id

1- INTRODUCTION

Malnutrition in children is a significant global health problem, with stunting continuing to be one of the main issues (1). This is in stark contrast to the World Health Assembly (WHA) target to reduce stunting rates by 40% by 2025, and the Sustainable Development Goals (SDGs) target to eliminate malnutrition by 2030 (2). This is because stunting is a multifactorial phenomenon (3), one of the contributing factors being the family's socioeconomic status (4,5). A poor family's socioeconomic status is linked to inadequate infant nutrition, leading to stunting (6,7). According to the World Health Organization (WHO) (8), by 2022, the stunting rate for infants under five (toddlers) will reach 22.3%, or an estimated 148.1 million. The results of the Indonesian Nutritional Status Survey (SSGI) indicate that the incidence of stunting among toddlers in Indonesia reached 21.6% in 2022, with the prevalence in Jember Regency reaching 34.9% (9). This places Jember Regency at the highest stunting rate in East Java.

Stunting can be optimally prevented if infant nutrition is met. Poor families have limited resources and low incomes. At the family level, poor socioeconomic status is associated with food insecurity. This results in families being unable to purchase sufficient food, leading to food insecurity and impacting the nutrition of families, including toddlers (10). Food insecurity can prevent families from achieving a healthy and active lifestyle. This leads to poor dietary diversity and micronutrient deficiencies in food in developing countries (11). Low micronutrient intake can hinder physical growth in children, leading to stunting (12). Food insecurity due to poor family socioeconomic status is related to Friedman's theory (13) on family function, namely the economic function that should include the availability of adequate family resources, both financially, spatially, and materially.

Meeting toddler nutrition needs through preventing food insecurity can reduce the insecurity rate, which globally reached 11.3% at the level of severe food insecurity and 29.6% at the level of moderate food insecurity in 2022 (14). The role of families in providing adequate parenting during the child's growth period, both physically, mentally, and psychologically, is very important (4), especially in meeting children's nutritional needs (15), including food security. This aligns with one of the pillars of stunting eradication in the fourth National Strategy for the Acceleration of Stunting Prevention I (Stranas Stunting), namely increasing access to nutritious food and supporting food security (2). Therefore, in this study, the author aims to determine whether there is a relationship between family food insecurity and the incidence of stunting in infants aged 6-23 months in Jember Regency, Indonesia.

2- MATERIALS AND METHODS

This descriptive analytical study with a cross-sectional approach was conducted in Jember, Indonesia. The study took place in the work areas of three community health centers in Jember Regency: the Rambipuji Community Health Center, the Sumberjambe Community Health Center, and the Ledokombo Community Health Center. A total of 211 infants aged 6-23 months were selected for the study using a total sampling method. The inclusion criteria were as follows: 1) stunted infants aged 6-23 months who were registered at the Posyandu in the targeted work areas, 2) stunted infants who lived with their families and were cared for by their families, and 3) families who lived with their immediate or extended family. The exclusion criteria used in this study are as follows: 1) infants with congenital limb abnormalities, physical disabilities, or

intellectual disabilities; 2) infants born prematurely or with low birth weight (LBW); 3) infants who moved residences; 4) families unwilling to participate; and 5) families who could not be interviewed due to specific disabilities (e.g., deafness or speech impairment) without a representative.

Data collection for this study was conducted using questionnaires about the respondents' sociodemographic characteristics and family characteristics, including the parents' gender, age, education level, occupation, total family income, and family size, as well as the infant's characteristics, such as age, gender, height, weight, edema status, and history of exclusive breastfeeding. Another questionnaire used was the Household Food Insecurity Access Scale (HFIAS), which measured experiences of food insecurity in the past four weeks. The HFIAS consisted of nine questions about general food insecurity events and nine questions regarding the frequency of occurrences. Infant anthropometric measurements were taken with a length board and digital scales. Infant stunting measurements were classified as stunted or severely stunted based on the Child Anthropometric Standards stipulated in the Indonesian Minister of Health Regulation. The height-for-age (H/A) Z-score was calculated using WHO Anthro software.

The infant stunting measurements were classified into mutually exclusive categories: moderately stunted (height-for-age Z-score between -3 and -2) and severely stunted (height-for-age Z-score below -3). The data were analyzed using the Chi-Square test in SPSS version 25 (p-value <0.05). Since this study used bivariate analysis, it did not adjust for potential confounding variables, such as parental education or income.

Data were collected by meeting with midwives at the Rambipuji, Sumberjambe, and Ledokombo Community Health Centers. The researchers then met with the cadres and conducted home visits. They explained the research objectives to the respondents and obtained their consent through an informed consent form. This research was ethically reviewed by the Health Research Ethics Committee (KEPK) of the University of Jember's Faculty of Nursing with the approval number 433/UN25.1.14/KEPK/2024. The data were entered into Microsoft Excel 2019 and analyzed using the Chi-Square test in SPSS version 25 (p-value <0.05).

3- RESULTS

As shown in Table 1, the stunted infants in the three community health centers had an average age of 17.8 months, a median age of 18 months, and were predominantly male (62.1%). Most of the stunted infants also had a history of exclusive breastfeeding for six months (95.3%). The table also shows that most of the participating parents were female (96.2%) with an average age of 28.38 years and a median age of 28 years. While this indicates that most infants' parents were of productive age, the table shows that most parents were housewives (85.3%). Most of the parents who participated in the study had a junior high school education or equivalent (32.2%), while some did not attend school (2.4%). Meanwhile, the majority of families in this study had a total income below the Jember regional minimum wage (UMR) (84.4%), and the majority lived with extended families of more than four members (64%). Family food insecurity data were collected through the HFIAS questionnaire, which has three indicators and 18 questions in total.

The results revealed a significant difference in family food insecurity (Mean= 5.19, SD= 2.27, Z = 0.239, p-value <0.001).

Table-1. Distribution of family characteristics and infants aged 6-23 months (n=211).

Variable	Parent	Infant
Age		
Mean (SD)	28.38 years (6.565)	17.80 months (4.417)
Md (P_{25}-P_{75})	28 years (23−32)	18 months (15−22)
Gender f(%)		
Male	8 (3.8)	131 (62.1)
Female	203 (96.2)	80 (37.9)
History of Exclusive Breastfeeding f(%)		
Yes		201 (95.3)
No		10 (4.7)
Parents' Education Level f(%)		
No Schooling	5 (2.4)	
Elementary School/Equivalent	68 (32.2)	
Junior High School/Equivalent	76 (36)	
Senior High School/Equivalent	54 (25.6)	
Diploma	1 (0.5)	
University Graduate	7 (3.3)	
Parent's Occupation f(%)		
Housewife	180 (85.3)	
Entrepreneur	13 (6.2)	
Self-Employed	10 (4.7)	
Farmer	2 (0.9)	
Laborer	5 (2.4)	
Civil Servant	1 (0.5)	
Total Family Income f(%)		
Less than regional national income Rp 2,665,392,00		
More than Jember regional national income Rp 2,665,392,00	178 (84.4)	
	33 (15.6)	
Family Size f(%)		
>4 members	135 (64)	
≤4 members	76 (36)	

Notes: f(%): Number of participants (percentage); **Mean :** Average; **Md (P_{25}-P_{75}) :** median (25th-75th percentile).

There were also significant differences in each indicator of family food insecurity, including uncertainty or anxiety about food availability (Mean= 0.87, SD= 0.35, Z = 0.239, p-value <0.001), inadequate food quality in the terms of diversity and preferences (Mean= 2.39, SD= 1.02, Z = 0.393, p-value <0.001), and inadequate food intake and its physical consequences (Mean= 1.93, SD= 1.34, Z = 0.223, p-value <0.001).

An overview of family food insecurity levels in the working areas of the Rambipuji, Sumberjambe, and Ledokombo community health centers in Jember Regency showed that most families experience uncertainty or anxiety about food availability (87.2%), inadequate food quality (87.7%), and inadequate food intake and its physical consequences (86.7%). Furthermore, most families in the working areas of the Rambipuji, Sumberjambe, and Ledokombo health centers experience moderate food insecurity (55.5%).

As shown in Table 2, there is a significant difference in height among stunted infants in the three community health center work areas (Z = 0.066, p-value = 0.025). However, this is inversely proportional to

the weight of stunted infants, which shows no significant difference (Z = 0.045, p-value = 0.200). Additionally, the study results show a significant difference in infant stunting status as measured by height or height-for-age (Z= 0.130, p-value = 0.000). However, there is no significant difference in infant nutritional status obtained through weight-for-age measurements (Z = 0.042, p-value = 0.200). Similar results were obtained when measuring infant nutritional status based on weight-for-height (Z = 0.059; p-value = 0.072) and body mass index (BMI-for-Age) (Z = 0.051; p-value = 0.200).

Figures 1(a), 1(b), 1(c), and 1(d) show the prevalence of stunting and nutritional status in infants aged 6-23 months in the working areas of Rambipuji Community Health Center, Sumberjambe Community Health Center, and Ledokombo Community Health Center in Jember Regency. The results show that most stunted infants in the three community health centers' working areas fall into the stunting category (63%). Meanwhile, nutritional status based on weight-for-height indicates that most infants are of normal weight (48.8%). Furthermore, nutritional status based on weight-for-height and BMI-for-Age indicates that most infants are well-nourished (70.6% and 73.5%, respectively).

An inferential analysis using the Chi-Square test was conducted to answer the research question. Table 3 shows a relationship between family food insecurity and stunting in infants aged 6-23 months in the working areas of the three community health centers in Jember Regency (χ^2 = 9.853, p-value 0.020).

The table also shows the odds ratio (OR) calculation for each category of family food insecurity. Infants from families experiencing severe food insecurity were up to 1.7 times more likely to be stunted compared to infants from food-secure families (OR = >1, 95% CI: 0.575-5.525).

Table-2. Nutritional status of infants aged 6-23 months (n=211).

Nutritional Status	Mean (SD)	Md (P_{25}-P_{75})	Z	p-value
Physical Measurements				
Height	73.84 (4.190)	74.20 (71.10−77.20)	0.066	0.025∗
Weight	8.50 (1.151)	8.56 (7.66−9.23)	0.045	0.2
Z-Score Indicators				
Height-for-Age (HAZ)	−2.83 (0.738)	−2.68 (−3.22—2.18)	0.13	0.000∗
Weight-for-Age (WAZ)	−2.05 (1.022)	−2.01 (−2.75—1.41)	0.042	0.2
Weight-for-Height (WHZ)	−0.86 (1.362)	−0.89 (−1.81—0.14)	0.059	0.072
BMI-for-Age (BAZ)	−0.43 (1.413)	−0.41 (−1.30—0.36)	0.051	0.2

Notes: Mean: Average; **SD:** Standard Deviation; **Md (P_{25}-P_{75}):** median (25th-75th percentile); **Z:** calculated value for Kolmogorov-Smirnov Test; **p-value:** Significance of Kolmogorov-Smirnov Test

Table-3. Level of family food insecurity and stunting in infants aged 6-23 months (n=211).

Level of Family Food Insecurity	Stunted f(%)	Severely Stunted f(%)	χ2	p-value	OR	95% CI
Food Secure	10 (4.74)	6 (2.84)				
Mildly Food Insecure	10 (4.74)	8 (3.79)	9.853	0.02	1.333	0.337−5.270
Moderately Food Insecure	84 (39.81)	33 (15.64)			0.655	0.220−1.946
Severely Food Insecure	29 (13.74)	31 (14.69)			1.782	0.575−5.525

Notes: χ2: Pearson Chi-square value; **P-value:** Chi-square Significance; **f(%):** Number of participants (percentage); **OR:** Odds Ratio; **CI:** Confidence Interval.

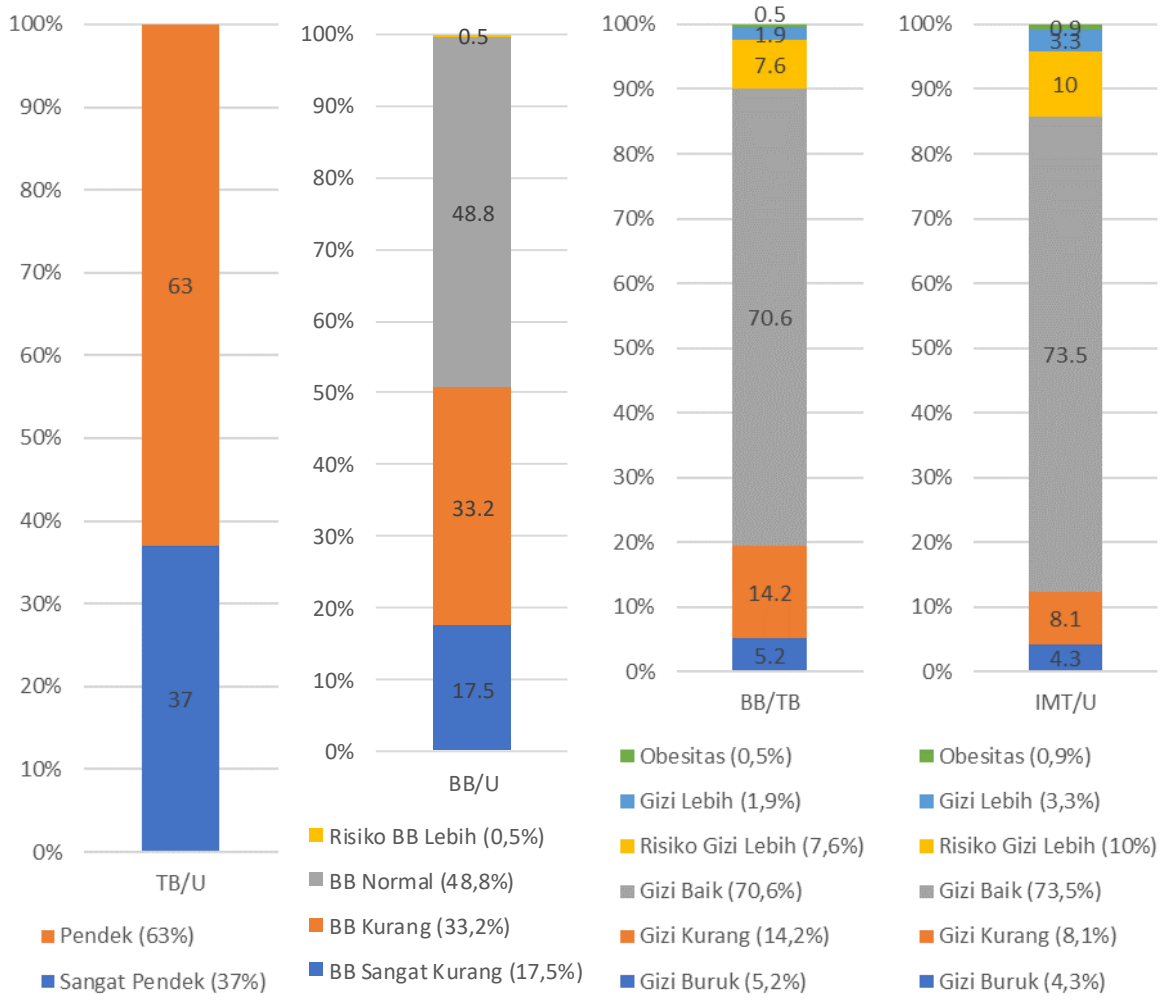

Figure-1: Incidence of stunting in infants aged 6-23 months.

4- DISCUSSION

Family food insecurity is associated with stunting in infants aged 6-23 months in Jember Regency. Food insecurity leads to low dietary diversity, resulting in decreased micronutrient content essential for children (11). Research in India (16) indicates that a significant percentage of children experiencing very low food security are stunted. Therefore, it is necessary to further identify the relationship between family food insecurity and infant stunting in Jember Regency.

4-1. Family Food Insecurity

The results of this study indicate that most families in Jember Regency experience food insecurity, particularly moderate (55.5%) and severe (28.4%) food insecurity. This is likely due to differences in parental education levels. The majority have a junior high school education (36%), and some did not attend school (2.4%). Families with low education levels are perceived as less skilled and more vulnerable to poverty (17), which impacts their ability to understand and access information and employment opportunities. According to Friedman (13), the economic function of the family involves the adequacy of family resources, including financial, spatial, and material resources. Low levels of education result in most families having unpredictable incomes, making it difficult to meet their food needs.

Other results from this study indicate that families in Jember Regency experience food insecurity. In fact, 87.2% of families reported feeling uncertain or anxious about food availability. This may be related to the fact that most families rely on only one parent for income, and the majority of parents are homemakers (85.3%). A large number of unproductive family members increases the dependency ratio and impacts food insecurity within families. Family members who do not contribute to the family's income increase the risk of food insecurity because they become consumers and an additional financial burden (18). According to Friedman's nursing theory, the working class significantly influences how people perceive health and illness. They generally recognize few symptoms of illness; an may wait until they are unable to function before viewing their condition as a disease (13).

Most families in Jember Regency experience inadequate food quality in terms of both diversity and preferences (87.7%). This may be due to the fact that most families have incomes below the Jember minimum wage (84.4%). This contributes to inadequate food quality. Higher family incomes would enable them to access and provide healthy, nutritious food, reducing the risk of food insecurity (19). One way to address this issue is to utilize agricultural products grown by the respondents themselves, as some earn a living as farmers or own businesses producing tofu and tempeh. Most farming families in rural areas process their food using their own agricultural produce or obtain food as compensation for work (20).

In Jember Regency, 86.7% of families experience inadequate food intake and its physical consequences. This may be due to the fact that the majority of families live with extended families of more than four members (64%). Another study found that families with more than five members are up to 2.68 times more likely to experience mild to moderate food insecurity (21). The study further explained that large families are vulnerable to food insecurity due to limited employment opportunities, physical barriers, and inadequate social safety nets. Therefore, health workers must assess families' economic conditions and provide supportive interventions to address factors causing food insecurity, such as family size.

4-2. Infant Stunting Incidence

This study shows that 63% of infants aged 6-23 months in Jember Regency are short, while 37% are very short. This result may be influenced by the fact that 95.3% of infants in the three regions were exclusively breastfed for six months. Exclusive breastfeeding can protect infants against stunting (22). Breast milk provides children with energy and the nutrients that support their long-term development. Conversely, infants who are not exclusively breastfed for six months are at a higher risk of stunting (23). In this regard, families play a crucial role in maintaining children's health. Their perspective on health and illness, as well as their motivation to improve health, is crucial in supporting child growth, particularly through exclusive breastfeeding to prevent stunting (13).

Another factor contributing to stunting in infants in Jember Regency is family income. The majority of families in Jember earn less than the minimum wage (84.4%). A family's economic condition determines its ability to meet all needs, including the infant's nutritional needs. Poor families are at a higher risk of stunting than families of middle to upper economic status (7). A family's economic situation can lead to food insecurity due to limited access to food and healthcare facilities. This makes it difficult for families to monitor their children's nutritional status, which makes them vulnerable to stunting if their nutritional

needs are not met. Furthermore, limited economic resources may cause families to choose less nutritious foods, resulting in micronutrient deficiencies in children. Some important micronutrients include vitamins A and C, thiamine, riboflavin, niacin, and minerals such as iron, calcium, and zinc (24).

The results of this study indicate that the nutritional status of infants aged 6-23 months in Jember Regency falls within the normal category. Figure 4.2 shows that the nutritional status calculated based on infant weight-for-age (WAZ/A) falls within the normal weight category (48.8%). Nutritional status calculated based on BW/H and BMI/A falls within the good nutrition category at 70.6% and 73.5%, respectively. These results are supported by research conducted in Kenya, which showed no significant association between BMI/A and BMI/H calculations for children experiencing food insecurity (25). Other research indicates no association between children's nutritional status, calculated based on BMI/A, and family food security status (26). This may be due to the influence of other factors on nutritional status, such as family size, access to health services, zinc supplement consumption, maternal parity, and dietary diversity (27). Therefore, further study through health research related to risk factors for nutritional status problems is needed.

Good supplementary feeding (PMT) practices, such as providing complementary foods starting at six months of age, feeding frequency, and dietary diversity, will have a positive impact on infant nutrition (28). Inadequate nutritional interventions for infants can be one of the causes of suboptimal nutritional fulfilment. In this study area, it was reported that PMT for children was not implemented optimally. Good PMT practices will provide children with the necessary nutrients, including macronutrients and micronutrients. Thus, it is necessary to reaffirm the PMT program for children in the three research areas so that children's nutritional needs can be met.

4-3. The Relationship Between Family Food Insecurity and Infant Stunting

The final results of this study indicate an association between family food insecurity and stunting in infants aged 6-23 months in Jember Regency (χ^2 = 9.853, p-value = 0.020). Families experiencing food insecurity tend to adjust their diets by choosing cheaper, high-energy, but nutrient-poor foods. This inadequate dietary diversity directly decreases the intake of essential macronutrients and micronutrients, increasing the child's vulnerability to recurrent infections and ultimately restricting linear growth (stunting). These mechanisms align with previous literature. Research conducted in Aligarh, India, emphasized that a large proportion of children from food-insecure families suffer from chronic undernutrition due to the inability to afford protein-rich foods. Similarly, Turkish research by Selcuk et al. (2023) showed that family food insecurity is related to unhealthy eating habits and reliance on high-fat, low-nutrient foods, which fail to support optimal child growth (29).

The findings of this study are consistent with research conducted in Aligarh, India, which revealed that most of the children experiencing stunting come from food-insecure households (16). Turkish research by Selcuk et al. (2023) indicates that family food insecurity is related to unhealthy eating behaviors, such as a preference for high-fat foods (29). Food insecurity within families leads to limited access to food, resulting in unmet nutritional needs for children (30). Therefore, efforts to prevent food insecurity among families are crucial.

Families play a vital role in addressing nutritional issues (31).

Research has shown that infants in families experiencing severe food insecurity are 1.7 times more likely to be stunted. Other findings indicate that infants with families experiencing mild or moderate food insecurity are 1.3 and 0.6 times more likely to be stunted, respectively. This is because the likelihood of food insecurity is closely related to family income. Higher family income is associated with a lower risk of food insecurity and greater access to healthy, nutritious food (19). In 2023, the average per capita expenditure of Jember residents was Rp 569,040, 54.01% of which was spent on food consumption. This suggests that higher household incomes are associated with lower needs for meeting family food requirements (32,33). High food prices limit access to food, necessitating assistance such as Non-Cash Food Assistance (BPNT). This assistance is used to meet basic nutritional needs, including carbohydrates, animal protein, vegetable protein, and vitamins and minerals (34,35). Therefore, identifying family food insecurity is crucial because it relates to a family's economic capacity to provide for its children's nutritional needs.

4-4. Study Limitations

Due to the cross-sectional design, it is not possible to draw causal conclusions regarding household food insecurity and stunting. The findings strictly emphasize an association between these variables at a single point in time. Additionally, the bivariate analysis (Chi-Square) did not control for potential confounders, such as family income, parental education, and historical feeding practices. These factors should be considered in future longitudinal or multivariate studies.

5- CONCLUSION

The majority of families in Jember Regency experience moderate food insecurity, and infants aged 6-23 months in all three regions are stunted. There is a relationship between family food insecurity and stunting in this age group in Jember Regency. Severe family food insecurity increases the risk of stunting. Families experiencing food insecurity tend to have low dietary diversity, resulting in inadequate intake of essential micronutrients for infants and leading to stunting. Therefore, families are encouraged to utilize local resources to reduce their dependence on purchased food and to prepare varied complementary foods to meet their infants' nutritional needs.

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8- CONFLICT OF INTEREST

The authors declared no conflicts of interest.

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