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Relationship Between Economic Status, Infectious Diseases and Urinary Iodine Excretion with Stunting Incidence of Elementary School Children in IDD Endemic Areas, Enrekang Regency

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Abstract

This study aimed to determine the relationship of economic status, infectious diseases, and Urinary Iodine Excretion (UIE) with the incidence of stunting in elementary school children in IDD endemic areas, Enrekang Regency. This research was an observational analytic study with a cross-sectional approach. Subjects in this study were taken by purposive sampling as many as 100 children aged 6-12 years. Research data were collected using a questionnaire, microtoise, and UIE Lab Test and then processed using the chi-square test. The results showed that the proportion of stunting was 72.2% and normal was 28.0%, the low family economy was 82.0%, infectious disease was 79.0%, and low urinary iodine deficiency was 21.0%. The chi-square test showed that there was a significant relationship between economic status (p=0.045) and infectious diseases (p=0.012) with the incidence of stunting, but there was no relationship between UIE and stunting (p=1,000). The economic status of parents and a history of infectious diseases contribute to the incidence of stunting. Modification of parents' crops by harvesting crops in a short time is recommended to increase family income and increasing children's healthy and clean behaviour is considered necessary to prevent infectious diseases.

Keywords: Stunting, School children, Family Economics, Infectious Diseases, UIE

Key Messages:

- Clean and healthy living behavior of children is very important to prevent the emergence of infectious diseases in children.

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1. Introduction

Human growth, from fetal life to adolescence, is dynamic and is a marker of good health (1). Growth monitoring is an important part of primary health care in children and short stature is often considered an early sign of ill health (2). Globally, in 2019, it was reported that around 144 million children under five (21.3%) were stunted. The 144 million children under five in the world who experience stunting, more than half come from lower-middle-income countries and only a quarter come from low-income countries. It is estimated that 1 in 4 children under five is stunted (3). Indonesia is one of the developing countries with a high prevalence of stunting despite a decline from 2018 to 2019. The prevalence of stunting under five in 2019 was 27.3%, down by 3.5%

from 30.8% in 2018. In 2019, South Sulawesi had 30.1% stunting under five and Enrekang district was the district with the highest stunting prevalence at 44.8%. Both figures are above the national average (4).

Stunting or low height for age is caused by chronic nutritional intake and frequent infections (5). Height for age reflects linear achievement of growth, and the deficit (stunting) indicates long-term cumulative health and nutritional deficiencies. Stunting in older children is a legacy of malnutrition during early childhood (6). The most common impact of poverty on children is malnutrition (7).

Reducing stunting in children is the first of the six goals of the Global Nutrition Targets for 2025. The government through the RPJMN has targeted to reduce stunting from 30.8% (2018) to 14% in 2024. Enrekang Regency is the area with the highest stunting and is an endemic area for Iodine Deficiency Disorders (IDA) which is thought to be correlated with the incidence of stunting. Based on the description above, the researcher is interested in knowing the relationship between economic status, infectious diseases, and EIU with the incidence of stunting in elementary school children in IDD endemic areas, Enrekang Regency.

2. Methods

This research is an observational analytic with a school-based cross-sectional design. This research was conducted from July to August 2021, located in Enrekang Regency, South Sulawesi, Indonesia with 3 villages (Buntu Mondong Village, Potokullin Village, and Latimojong Village). 100 total samples were obtained using purposive sampling. The dependent variable in the study was the incidence of stunting and the independent variables were family economy, infectious disease, and EIU. Height data was measured using microtoise and processed using WHO AnthroPlus 2007 to determine nutritional status. Family economics and infectious disease data were collected using a structured questionnaire. Analysis of iodine levels in urine using the Ammonium Persulphate Digestion Method with a spectrophotometer at BP2K Magelang, Central Java. All data collected were analyzed using the SPSS version 24 program with a chi-square test.

3. Results

The characteristics of the subjects presented data on age, gender, nutritional status, and parental employment status. Table 1 shows that most subjects were 10 years old, namely, 31 people (31.0%), female subjects (49%) almost as many as men (51%), as many as 72 people (72.2%) with stunting status, almost all of them were stunted. the head of the family works as a planter and more than half of the subject's mothers do not work, namely, 90 people (90.0%), while most of the mothers did not work, namely 53 people (53.0%).

Table 1 Characteristics of the subjects

Characteristics of the subjects	n	%
Age (years)		
7	11	11,0
8	15	15,0
9	26	26,0
10	31	31,0
11	15	15,0
12	2	2,0
Sex		
Male	51	51,0
Female	49	49,0
Stunting incident		
Stunting	72	72,0
Normal	28	28,0
Job of Head Family		
Do not work	3	3,0
Planter	90	90,0
Laborer	1	1,0
Goat herder	1	1,0

Characteristics of the subjects	n	%
Private employees	1	1,0
Civil servant	2	2,0
Others	2	2,0
Status Pekerjaan Ibu		
Do not work	53	53,0
Planter	27	27,0
Merchant	4	4,0
Laborer	2	2,0
Craftsman	1	1,0
Private employees	2	2,0
Civil servant	9	9,0
Others	2	2,0
Total	**100**	**100,0**

Table 2 presents data on the relationship between economic status and nutritional status. As many as 76.8% of subjects from families with low economic status have stunting status and 50% of subjects from large economies are also stunted. The results of the Chi-Square Test showed that the family economy contributed to the incidence of stunting (p=0.045).

Table 2 Relationship between economic status and nutritional status

Economic status	stunting incident				Total		*p*
	Stunting		Normal				
	N	%	n	%	n	%	
Low	63	76,8	19	23,2	82	100,0	
High	9	50,0	9	50,0	18	100,0	0,045
Total	**72**	**72,0**	**28**	**28,0**	**100**	**100,0**	

Table 3 presents data on the relationship between the history of infectious disease and nutritional status. A total of 78.5% of subjects with a history of infectious diseases with stunting status and subjects without a history of infectious diseases with normal nutritional status (52.4%) were higher than those with stunting status. The results of the Chi-Square test showed that infectious diseases contributed to the incidence of stunting (p=0.012).

Table 3 Relationship history of infectious diseases and nutritional status

History of infectious diseases	stunting incident				Total		*p*
	Stunting		Normal				
	n	%	n	%	n	%	
Ever	62	78,5	17	21,5	79	100,0	
Never	10	47,6	11	52,4	21	100,0	0,012
Total	**72**	**72,0**	**28**	**28,0**	**100**	**100,0**	

Table 4 presents data on the relationship between urinary iodine excretion (UIE) and nutritional status. Subjects with insufficient intake of iodine (72.7%) or sufficient (71.8%) with stunting nutritional status were much greater than subjects with normal nutritional status (27.3% and 28.2%). The results of the Chi-Square Test showed that UIE contributed to the incidence of stunting (p=0.012).

Table4 Relationship between urinary iodine excretion (UIE) and nutritional status

Urinary Iodine Excretion	stunting incident				Total		*p*
	Stunting		Normal				
	N	%	n	%	n	%	
Lack of Iodine Intake	16	72,7	6	27,3	22	100,0	1,000
Adequate Iodine Intake	56	71,8	22	28,2	78	100,0	
Total	**72**	**72,0**	**28**	**28,0**	**100**	**100,0**	

4. Discussion

Relationship between Economic Status and Stunting

The term economy is often referred to as income by the majority of the world's people. Income is several goods and services that will meet a person's level of life. While income in a month is income or rewards or remuneration for the past month, either in the form of money or goods received by someone. The results showed that there was a significant relationship between family economy (p=0.045) and the incidence of stunting in elementary school children. This research is in line with the Beal et al (2018) review study on children in Indonesia which shows that low socioeconomic status is a determining factor for stunting (8). The same study in Palopo City, South Sulawesi showed that family income was a determining factor for stunting (OR=6.30). Low-income families have a 6.30 times greater risk of having stunted children than families with high or medium incomes (9). A recent study in Ethiopia showed that the household wealth index was significantly associated with severe stunting in children (10).

Income level will determine the type and variety of food to be purchased. Family purchasing power for nutritious food is influenced by family income because determining the type of food to be purchased depends on the level of income. The purchasing power of household food follows the level of family income. The study of Binte et al (2019) in rural Bangladesh showed that the Dietary diversity score (DDS) was strongly positively related to household wealth status (11). Children from food-insecure households have a 26% higher DDS compared to children from food-insecure households. The low purchasing power of food causes the lack of fulfilment of nutritional needs. The Large Epidemiological Study in Peru found lower socioeconomic status was associated with lower HAZ scores (12). 82 families had low incomes (<Rp. 2,000,000). Low income greatly affects household purchasing power. The study of Binte et al (2019) revealed that children from non-food insecure households had a higher diversity of food than children from food-insecure households (11). Children from wealthier households have increased dietary diversity and lower rates of malnutrition. Wealthier households often use additional income to purchase non-staple foods, thereby increasing household food diversity.

The family's economic capacity is one of the important factors that describe the purchasing power of the family for their needs, especially for sufficient and safe food. The Wicaksono & Harsanti (2020) Study on Children in Indonesia which analyzed the individual, family and community levels found that the household economy was a risk factor for stunting in children (13). Stunting in children is caused by low family income. Low economic status is generally associated with cheaper food consumption and a low diversity diet. With a high income, it is possible to fulfil the food needs of all family members.

Although evidence showing a link between food insecurity and child stunting is abundant, there is a dearth of evidence relating food insecurity to the double burden of malnutrition. Mahmudiono et al (2018)'s study in urban Indonesia found that food insecurity was significantly associated with a double burden of malnutrition. This is not surprising, as 11% of Indonesia's 252 million people live below the national poverty line of $1 per day, with an additional 40% slightly above that line (14). Studies have shown that poverty is closely related to food insecurity. Mild food insecure households increase the risk of double burden more than three times, having moderate food insecurity households increase the risk more than three times, and having a household that is very food insecure increases the risk more than twofold. Therefore, children from low-income families, due to the lack of family ability to provide nutritious food, tend to be more vulnerable to the risk of malnutrition (15). Some studies show the opposite result. A study in Bantul found that household economic status was not associated with stunting (16). A recent study in Palu, Central Sulawesi showed the same thing that there was no relationship between family economic status (p=0.444) and the incidence of stunting (15).

Relationship of Infectious Diseases with Stunting

Based on the WHO framework, infections are divided into 2, namely clinical and subclinical infections. Clinical infections include enteric infections (diarrhoea, environmental enteropathy, and helminths), respiratory tract infections, malaria. While subclinical infections include lack of appetite due to infection and inflammation. Infectious diseases are health problems caused by organisms such as viruses, bacteria, fungi and parasites. These organisms can attack and cause health problems.The results showed that there was a significant relationship between infectious diseases and the incidence of stunting in children (p = 0.012). This research is in line with the Mediani review study (2020) which shows that infectious diseases are one of the predictors of stunting in children in Indonesia (17). The same finding in Palopo, South Sulawesi found that a history of infection (OR=2.53) was a determinant of stunting in children. This shows that a history of infectious diseases such as diarrhoea and ARI has a 2.53-fold risk of stunting (9). The study in Pangkalpinang, Bangka Belitung found the same thing between a history of infection (p=0.013, OR=2.27) and stunting in children. Infectious diseases can be caused by several things, such as poor environment and sanitation (18). Infection is a factor that directly affects nutritional status in addition to adequate nutrition. Infection reduces food intake, impairs nutrient absorption, causes direct nutrient loss, increases metabolic demand or nutrient catabolic loss, and interferes with nutrient transport to target tissues, including food intake. One of the infectious diseases, including diarrhoea, is a symptom of gastrointestinal disease or other diseases outside the digestive tract (19).

Stunting has been shown to have high morbidity and mortality, especially in infectious diseases such as pneumonia and diarrhoea (19). Research in Kulon Progo, Yogyakarta found that children who often suffer from diarrhoea have a 1.38 times greater risk of experiencing stunting, meaning that diarrheal infection is a risk factor for stunting. Acute Respiratory Infection (ARI) is an acute inflammation of the upper and lower respiratory tract caused by bacterial, viral, or rickets infection, either with or without inflammation of the lung parenchyma. Childhood is an age that is vulnerable to health problems, especially ARI because the immune system is not yet developed (19).

The Wicaksono & Harsanti (2020) study in Indonesia shows that children living in urban areas are 15% less likely to experience stunting compared to children living in rural areas (13). A study by Webb et al (2021) in Peru found stunting in children was more common in rural areas and the highlands (12). Enrekang Regency is a rural area located in the highlands. Some studies show the opposite result. The study of Sulistyaningsih et al (2018) in Semarang City found that there was no significant relationship between infectious diseases and body length (20). However, there is a negative correlation direction, meaning that the more frequent infectious diseases occur, the shorter the body length and vice versa.

Relationship of Urinary Iodine Excretion with Stunting

Assessment of iodine status using the urinary iodine excretion method is an indicator of recent iodine intake (days). Most of the iodine absorbed by the body eventually appears in the urine. In individuals, urinary iodine excretion may vary from day to day and even within a given day. However, this variation tends to be evenly distributed among populations. >90% of ingested iodine appears in the urine over the next 24 to 48 hours (21). The results showed that there was no significant relationship between urinary iodine excretion and the incidence of stunting (p=1,000). This study is in line with research conducted in Norway which showed evidence of no correlation between growth and iodine deficiency. This study is the first study to look at the iodine status of children who are allergic to cow's milk protein. This suggests that children have a prevalence of iodine deficiency and poor growth, but the two conditions are not connected (22).

Data analysis showed as many as 22 children (100.0%) with less iodine intake. While the majority of children were 78 people (100.0%) with sufficient iodine intake. There were 1 child (1.0%) severe iodine deficiency, 1 child (1.0%) moderate iodine deficiency (1.0%), mild iodine deficiency 19 children (19.0%), and adequate iodine intake 50 children (50.0%), whereas there were 25 children (25.0%) hyperthyroidism in the range group, and there was 4 children (4.0%) very excessive/risk of adverse health consequences.

Iodine is an important element that is carried to the body through food intake. Urinary iodine excretion (UIE) reflects the current concentration of iodine (23). Iodine in urine depends on the child's food consumption pattern for 24-48 hours. These findings seem to indicate adequate intake of iodine in children's diets. Our findings are inconsistent with a recent study by Abbag et al (2021) in Saudi Arabia which found a significant association

between median UIE and HAZ in primary school children (p=0.001) (24). This study revealed that IDD is a predictor of stunting. Iodine deficiency impairs thyroid hormone production, including growth hormone expression. The role of IDD in developing stunting is likely to be multifactorial. Low thyroid hormone levels cause hypothyroidism which can lead to serious functional and developmental disorders which are collectively termed iodine deficiency disorders (25).

5. Conclusion

The results showed that the family's economic status and infectious diseases contributed to the incidence of stunting in elementary school children, while urinary iodine excretion had no significant relationship with the incidence of stunting. The main natural resource of the Enrekang community is plantations. The majority of people grow salak and coffee, these can be harvested in a long time. We suggest to the agriculture office to distribute plant seeds that can be harvested in a short time. so that these efforts accelerate family income. Furthermore, increasing children's healthy and clean behaviour is very important to prevent the emergence of infectious diseases in children. This can be done by health workers and school teachers by carrying out health promotion movements, these efforts can improve the quality of children's health.

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Conflicts of Interest: The authors declare no conflict of interest.

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