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**| RESEARCH ARTICLE**

## **Correlation between Mother's Self-Efficacy, Nutrient Intake, and Height of Age Z-Score (HAZ)**

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**| ABSTRACT**

Nutritional status in children under five years is one of the important factors that determine the growth and development of children. Factors affecting the nutritional status of children are divided into two categories: direct and indirect factors. One of the direct factors is intake, and the indirect factor is maternal self-efficacy. Nutritional deficiency can be a concern in developing countries when children are young because it affects their cognitive development. Good self-efficacy in mothers can increase the quantity and quality of children's food intake so that nutritional needs can be met according to nutritional adequacy recommendations. The purpose of this study was to determine the relationship between maternal self-efficacy, nutrient intake, and nutritional status in children based on the height-for-age index (HAZ). The research design used was a cross-sectional approach. This study involved 148 children aged 2–5 years, and the child's data was asked of the child's guardian, in this case, the subject's mother. Data on the characteristics and self-efficacy forms of mothers were obtained using a questionnaire, while nutritional intake data were obtained using a 2x24-hour food recall. Data analysis in this study used Spearman's Rank for bivariate analysis and logistic regression for multivariate analysis. The results of the data analysis showed that there was a relationship between nutritional status (HAZ) and maternal self-efficacy with the intake of macronutrients and micronutrients, except for zinc. Variables that affect the height-for-age index are maternal self-efficacy and protein intake. The study concluded that there is a significant relationship between maternal self-efficacy and nutrient intake, and nutritional status based on the height-for-age index (HAZ).

**| KEYWORDS**

Height for Age Z-Score (HAZ), maternal self-efficacy, nutrient intake, nutritional status.

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### **1. Introduction**

Nutritional status in toddlers is one of the important factors that determine the growth and development of children. Factors affecting the nutritional status of children are divided into two categories: direct and indirect factors. Direct factors that can affect nutritional status are food consumption and the state of infection. Food consumption directly affects nutritional status, in addition to the body's ability to absorb and use these nutrients. The main types of nutrients needed by children under the age of five include energy, protein, carbohydrates, fat, vitamin A, vitamin C, calcium, iron, and zinc. Nutritional deficiency can be a concern for children in developing countries because it affects their growth and cognitive development. Generally related to children's eating habits, such as consuming low-energy foods and not including fruits and vegetables in their diet, the most common deficiency is a lack of vitamins and minerals such as iron and vitamin C, as well as a low intake of animal protein (López-Sobaler et al., 2019).

In addition to direct factors, one other indirect factor that can affect nutritional status is the mother's self-efficacy, in this case, self-efficacy related to family health, especially children's health, one of which is mother's self-efficacy in terms of feeding children,

which includes healthy food, variety of food, amount of food given, eating cues, providing food according to child development, and general efficacy around children's health. The nutritional status of a toddler is related to the mother's self-efficacy in feeding practices and the toddler's food preferences (Hendriyani et al., 2020; Solikhah & Ardiani, 2019). Self-efficacy in mothers plays a role in promoting healthy eating behaviors in children, so self-efficacy is an important factor in predicting nutritional behaviour in mothers and children (Doaei et al., 2015). Self-efficacy in feeding behavior, especially in the time after exclusive breastfeeding, and how it affects a child's nutritional status are still not talked about much. The goal of this study was to find out how maternal self-efficacy, nutrient intake, and nutritional status (based on the height-for-age index, or HAZ) are related to each other in children. The goal of this study is to figure out how maternal self-efficacy, nutrient intake, and the nutritional status of children under five in two sub-districts of the Sragen Regency are connected.

## **2. Literature Review**

Malnutrition during infancy has short- and long-term effects that are detrimental to children's growth and development, such as susceptibility to disease and impaired cognitive and emotional functioning, which can affect the quality of life as adults. Malnutrition can trap children, families, communities, and nations in intergenerational cycles of malnutrition, disease, and poverty (UNICEF et al., 2021). Toddlers' nutritional status is influenced by both direct and indirect factors. Direct factors are the main factors that affect nutritional status, namely food intake and infectious diseases. Indirect causative factors include parenting style, access to food, family income, or family socioeconomic status (Khomsan et al., 2013; Lowe et al., 2021). In addition, in early childhood, the role of the mother greatly influences children's food intake because the mother determines the decisions and food choices for children (Camfferman et al., 2019).

According to Blaney et al. (2015), there are only a few hundred parents in Indonesia who have a good understanding and practice of feeding their children, despite the fact that the majority of parents have good skills (Blaney et al., 2015). This self-confidence is referred to as "self-efficacy." Self-efficacy is an individual's confidence in his ability to organize and complete a task to achieve a certain thing. Mother's self-efficacy, in this case, is self-efficacy related to family health, especially children's health, one of which is mother's self-efficacy in terms of feeding children, which includes healthy food delivery, food diversity, amount of food given, eating cues, giving food according to child development, as well as general efficacy around children's health. The nutritional status of a toddler is related to the mother's self-efficacy in feeding practices and the toddler's food preferences (Goodwin, 2017; Hendriyani et al., 2020). Good self-efficacy in mothers can increase the quantity and quality of children's food intake so that nutritional needs can be met according to nutritional adequacy recommendations (Ernawati et al., 2016; Rohde et al., 2018).

Food intake directly affects nutritional status, in addition to the body's ability to absorb and use these nutrients. Everyone's nutritional needs are different, depending on age, gender, level of activity (light, moderate, and heavy), and physiological state of the body. Everyone needs to consume nutrients according to their needs based on predetermined nutritional standards. Nutrient intake is strongly influenced by food consumption patterns, which can be called eating habits. Eating habits in each region vary according to the habits of the local population. Wrong methods or eating habits can have a negative impact on growth rates, resulting in nutritional disorders and decreased work productivity (Global Nutrition Report, 2018). The main types of nutrients needed by children under the age of five include energy, protein, carbohydrates, fat, vitamin A, vitamin C, calcium, and iron. All of these nutrients are needed in children under five to support growth, activity, and basal metabolic needs. Energy can be obtained from carbohydrates, fats, and proteins in food (Gibson, 2022).

Energy and protein play an important role in terms of growth in children. At the age of five, fat can be consumed up to 40% of the total daily energy intake because fat is needed for neurological development, with monounsaturated and polyunsaturated fat sources being preferred, while protein intake can be given between 5% and 20% of daily energy intake and dietary intake. Carbohydrates can be provided at 45–60% of daily intake, with complex carbohydrate sources taking precedence over simple carbohydrates. A balanced composition of macronutrients is important during infancy because several studies have shown a tendency for children to have excess nutritional status in the future when given a diet low in fat and high in protein and not containing balanced nutrition (Riley et al., 2018; Sandjaja et al., 2013). In addition to macronutrients, the intake of micronutrients also plays a role in child growth. Calcium is essential for bone growth and bone mass gain. The recommended daily intake is 600–1000 mg in toddlers. Non-dairy sources of calcium include green leafy vegetables, legumes, nuts, and fortified cereals. Adequate iron intake prevents children from suffering from iron deficiency anemia because if they are iron deficient, toddlers have the potential to experience neurodevelopmental disorders, which hamper their growth and development (Hanum et al., 2014; Jun et al., 2019). Multivitamin supplementation is usually not necessary when toddlers are healthy, eating a balanced diet, and having normal growth. Intake of vitamins and minerals is preferred through food intake and not from supplementation, except in children with certain conditions such as chronic diseases or faltering growth (Riley et al., 2018).

### 3. Methodology

#### 3.1 Design study

This study used a cross-sectional design. A representative sample of children was selected using a purposive sampling method. Inclusion criteria for subjects were children aged 2–5 years, biological children, living with family (with parents), healthy for at least the last 3 months, and living at the study site for at least 6 months. While the exclusion criteria were moving houses, being sick, and resigning, The sample size of the study was 148 children, calculated using the Lemeshow formula. The children's parents, in this case, the mother or caregiver who had been approved by the parents, provided written and verbal informed consent.

#### 3.2 Children's Nutritional Status

The nutritional status of children is measured based on the 2020 Ministry of Health standards with indicators of height for age (HAZ) according to the WHO Growth Chart 2005 through anthropometric measurements with digital scales and microtoises. Height was measured following a standard protocol with microtoises to the nearest 0.1 cm. Body weight was measured using a digital scale with an accuracy of 0.1 kg. Nutritional status was calculated using the WHO Anthro 2005 software. The Z-Score calculation results were then categorized according to the 2020 Minister of Health Regulations.

#### 3.3 Nutrient Intake

Data on child intake using the 2x24H food recall method is calculated on average. The calculated nutrients are energy, protein, carbohydrates, fat, vitamin A, vitamin C, calcium, iron, and zinc. Nutrients calculated using Nutrisurvey Software.

#### 3.4 Subject Characteristic

Data on subject characteristics such as age, weight, and height, as well as the mother's self-efficacy, were collected through a questionnaire by interviewing the mother. The efficacy questionnaire takes the type of questionnaire from Decker (2012) with adjustments after testing the validity and reliability.

#### 3.5 Analisis Data

A univariate analysis is used to determine the description of a variable. In this study, univariate analysis was used to describe subject characteristics (gender, weight, and height), maternal self-efficacy, nutrient intake, and nutritional status in children under five. The data is grouped and tabulated into frequency distribution tables and then described. Homogeneity (Levene-Test) and normality (Kolmogorov-Smirnov) tests were performed. In this study, a bivariate analysis will be conducted to determine the relationship between the independent variables and the dependent variable, namely maternal self-efficacy, nutrient intake, and nutritional status of children under five. The statistical tests used are the Rank-Spearman test and logistic regression.

## 4. Results and Discussion

**Table 4.1. Subject Characteristic**

Variabel	F	%
<b>Age (year)</b>		
2-3 years	62	41.9
4-5 years	86	58.1
<b>Gender</b>		
Male	77	52
Female	71	48
<b>Maternal self-efficacy</b>		
Severe	33	22.3
Good	58	39.2
Very good	57	38.5
<b>Nutritional Status</b>		
<b>Height for Age (HAZ)</b>		
Stunting	28	18.9
Normal	120	78.4

In table 4.1, it is known that the highest percentage for the age category of children aged 2–5 years is 4-5 years old (58.1%), with the sex of the majority being male (52%). It is known that as many as 39.2% of mothers have good self-efficacy. In terms of nutritional status, the majority of children under the age of five (78.1%) fall into the normal category according to the height-for-

age index (HAZ). The toddler period is often stated as a critical period in order to produce quality human resources, especially in the first two years of life. Toddlers enter early childhood. Early childhood begins when infancy ends and continues until the age of 5 or 6 years; sometimes, this period is called the preschool year (Riley et al., 2018). Toddler age is an age that is vulnerable to malnutrition status. Malnutrition in toddlers is caused by interactions between various factors, but the main factor is due to inadequate food consumption, both in quantity and quality (Emillia, 2016). The adequacy of nutrient intake, both macro- and micronutrient intake, is important in toddlers' nutritional status (Sandjaja et al., 2013). Chronic malnutrition will cause problems known as stunted growth. Mothers play an important role in the provision and selection of food for toddlers. A literature study by Blaney et al. (2015) states that only some mothers and caregivers in Indonesia have the right knowledge and behavior regarding how to feed their children but still lack confidence in being able to adopt appropriate feeding behaviors (Blaney et al., 2015). If a mother's self-efficacy is closely related to behavior that supports healthy weight, then how can she solve problems such as her preference for healthy foods compared to practical but minimal nutrition? Parents' self-efficacy regarding control, limits, discipline, behavior change, and healthy eating patterns are important in overcoming the problem of obesity in children (Sosa, 2012; Vaughn et al., 2013).

**Table 4.2 HAZ, Maternal Self-Efficacy Score, Macronutrient Intakes**

<b>Variables</b>	<b>Mean ± SD</b>	<b>Minimum</b>	<b>Maximum</b>
HAZ	-0.88 ± 1.24	-2.97	3.27
Maternal Self-efficacy score	129.30 ± 26.60	66.00	175.00
Energy (Kkal)	1319.30 ± 232.50	725.00	1780.00
Protein (gr)	23.40 ± 4.50	12.00	34.00
Fat (gr)	46.30 ± 8.30	25.00	61.00
Carbohydrate (gr)	193.40 ± 38.53	107.00	275.00
Vitamin A (IU)	505.40 ± 194.05	118.00	1009.00
Vitamin C (mg)	35.70 ± 13.00	4.00	57.00
Ca (mg)	702.40 ± 345.00	42.00	2285.00
Fe (mg)	7.60 ± 2.50	3.00	13.00
Zn (mcg)	3.30 ± 1.50	0.30	8.00

In Table 4.2, it is known that the average Z-score of children's height is -0.88, and the average self-efficacy score of mothers is 129.27 points, which is included in the category of good self-efficacy. It is known that the average intake of macronutrients is as follows: energy intake in toddlers is 1319 kcal, protein intake is 23.4 g, fat intake is 46.3 g, and carbohydrate intake is 193.4 g. The average intake of micronutrients was 505.4 IU of vitamin A, 35.7 mg of vitamin C, 702.4 mg of calcium, 7.6 mg of iron, and 3.3 mcg of zinc. Intake of nutrients is one of the direct causes that can affect the nutritional status of toddlers (Supariasa et al., 2016). Nutrient intake can be obtained from several nutrients, including macronutrients such as energy, carbohydrates, protein, and fat. Macronutrients are nutrients that are needed in large quantities by the body and play a major role in providing energy. The level of consumption of macronutrients can affect the nutritional status of toddlers. The energy intake and distribution of the required macronutrients correspond to the rapid development and growth at this stage, in which carbohydrates are essential for energy and the main contributor of glucose to the brain, while fats facilitate the absorption of fat-soluble vitamins and support neurodevelopment (López-Sobaler et al., 2019). The intake of these micronutrients includes the intake of vitamin A, vitamin C, iron, calcium, and zinc. Calcium is essential for bone growth and bone mass gain. The recommended daily intake is 600–1000 mg in toddlers. Non-dairy sources of calcium include green leafy vegetables, legumes, nuts, and fortified cereals. Adequate iron intake prevents children from suffering from iron deficiency anemia because if they are deficient in iron, toddlers have the potential to experience neurodevelopmental disorders so that their growth and development are hampered (Hanum et al., 2014; Jun et al., 2019).

In Table 4.3, which is the result of bivariate analysis, it is known that maternal efficacy and the intake of macronutrients (vitamin A, vitamin C, calcium, and Fe) have a significant relationship with the HAZ index in children, while Zn intake has no such relationship. These results are in line with the research of Marvicsin and Danfort (2013), which found that parents' self-efficacy is significantly related to the nutritional status of children (Marvicsin & Danford, 2013). In addition, other studies have also found that there is a relationship between maternal efficacy and nutritional status in children. Mothers who have less self-efficacy are 0.091 times more likely to have an abnormal nutritional status than mothers who have good self-efficacy. The quality of consumption in children aged 2 to 5 years is closely related to maternal self-efficacy. Maternal self-efficacy is an important construct in the development of healthy dietary habits in children, and supporting parenting programs aimed at higher self-efficacy can improve the quality of healthy diets in children (Tarro et al., 2022).

The results of this study are in accordance with Solihin's (2013) research in Bogor Regency, which reported that the level of energy adequacy of toddlers is positively related to their nutritional status. The higher the level of energy adequacy, the better the nutritional status of toddlers. For every one percent increase in the energy adequacy level of toddlers, it will increase the z-score of the children's height/age by 0.032 units. Furthermore, this study found a significant positive relationship between the level of protein adequacy and the nutritional status of children under five; that is, for every one percent increase in the protein adequacy level of toddlers, the z-score of the children's height/age will increase by 0.024 points (Malateki Solihin et al., 2013) whereas another study found no significant relationship between the level of energy adequacy and the nutritional status. This is presumably because the level of adequacy of energy obtained only describes the current state of consumption of children, while the current nutritional status of children is an accumulation of previous eating habits so that consumption only on certain days does not directly affect their nutritional status, while the adequacy of protein is in line with this research that there is a relationship between protein adequacy and nutritional status (Hanum et al., 2014).

Inadequate quality food intake is one of the main factors contributing to children's nutritional status, especially when food intake is insufficient for children, so it is closely related to the incidence of stunting in children. A recent study in Indonesia showed that 60.5% of children aged 2–5 years experienced inadequate energy intake, while 35.8% experienced inadequate protein intake. The proportion of intake of micronutrients such as Ca, Fe, Vitamin A, and Vitamin C even shows that more children experience inadequate consumption of micronutrients, namely as much as 80.9% (Nur Hasan Syah et al., 2020). Protein is an important nutrient to get optimal results for the growth and development of children. Zinc, Fe, and folic acid intake are closely related to nutritional status at height and age (Taufiqurrahman et al., 2021).

Total protein intake has a significant relationship with height and weight in children; a significant increase in height in children with high protein intake (Braun et al., 2016). Zinc deficiency affects 17% of the world's population, and due to rapid growth during the childhood period, it increases the risk of deficiency, which can lead to stunting. It is known that special zinc supplementation alone does not have a significant effect on children's growth because supplementation is not just zinc but various kinds of micronutrients that can prevent children from becoming stunted, but other studies have found that there is a positive effect on children's nutritional status according to weight and age; body weight according to height with the use of iron and zinc according to daily doses, but not on height/age and body mass index in children (Petry et al., 2016; Stammers et al., 2015). Another study found that intake of fat, calcium, phosphorus, vitamin D, riboflavin, and vitamin B12 (nutrients normally found in milk) correlated positively with Z-scores of height and age and was significantly lower in stunted children than non-stunted children ( $p = 0.05$ ) (van Stuijvenberg et al., 2015).

**Table 4.3. Bivariate analysis between Maternal Self-efficacy, Nutrient Intakes and HAZ Index**

Variables	HAZ	
	r	p
Maternal Self-Efficacy	0.179	0.029*
Energy Intake	0.407	0.000*
Protein Intake	0.196	0.017*
Fat Intake	0.294	0.000*
Carbohydrate Intake	0.303	0.000*
Vitamin A Intake	0.183	0.026*
Vitamin C Intake	0.238	0.004*
Ca Intake	0.292	0.000*
Fe Intake	0.225	0.006*
Zn Intake	0.139	0,092

**Table 4.4. Multivariate Analysis**

Variable	B	S.E	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Upper
Maternal Self-Efficacy	.025	.010	6.575	1	.010*	1.025	1.006	1.044
Protein Intake	.236	.074	10.171	1	.001*	1.266	1.095	1.464
Fe Intake	-.229	.130	3.081	1	.079	.796	.616	1.027

Based on the multivariate test analysis in Table 4.4, it is known that the most influential factor in the nutritional status of children based on the height/age index is maternal self-efficacy ( $p = 0.010$ ; 95% CI = 1.006–1.044) with an effect coefficient value of 0.025 and protein intake ( $p = 0.001$ ; 95% CI = 1.095–1.464) with an effect coefficient value of 0.236, while other variables do not affect

the TB/U index. From  $\exp(B)$ , it can be seen that an increase in maternal self-efficacy will affect an increase in the nutritional status of children based on the height/age index of 1,025 times, and then it can be seen that if the protein adequacy in children increases, it will affect the increase in nutritional status based on the height/age index of 1,266 times. Parents' self-efficacy strengthens eating habits in children, not only in children with excess weight but in normal children as well (Möhler et al., 2020). Parents have a significant influence on food intake in children, which can affect the quality of food consumption and nutritional status in children (Decker, 2012; Goodwin, 2017). In addition, other studies have found that maternal self-efficacy is closely related to the incidence of malnutrition in children. In children, maternal self-efficacy was positively related to fruit and vegetable intake and also showed a protective effect on reducing soft drink consumption. Parents' self-efficacy strengthens eating habits in children, not only in children with excess weight but in normal children as well (Möhler et al., 2020). In particular, protein intake is important because it provides the essential amino acids required for protein synthesis, which are necessary for growth when intake is too low (Bhargava, 2016). The results of our study are consistent with other studies, which state that higher protein intake is associated with higher child height. A 10 g/day increase in protein intake is associated with an increase in height trajectory up to 9 years of age (Braun et al., 2016). In addition, toddlers who lack protein experience a 3.1-fold increased risk of becoming malnourished when their protein intake is lacking. Protein is a nutrient that affects the structure and development of the brain, so a lack of protein can cause cognitive growth and development to be hampered (Bhargava, 2016; Diniyah & Susila Nindya, 2017).

## 5. Conclusion

Maternal self-efficacy, intake of macronutrients, and vitamins A, C, and Fe have a significant relationship with the nutritional status of children under five according to the height-for-age index (HAZ). The factors that most influence height with age are protein intake and maternal self-efficacy.

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