https://doi.org/10.20473/mgi.v20i3.363–373

THE INFLUENCE OF MATERNAL KNOWLEDGE, ATTITUDES AND PARENTING PRACTICES ON THE INCIDENCE OF STUNTING IN THE CAPITAL CITY OF CENTRAL LAMPUNG REGENCY, INDONESIA

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ABSTRACT

The World Health Organization (WHO, 2021) classifies stunting as a major global health issue with a prevalence of 22% or around 149.2 million children in 2020. Factors such as maternal knowledge about nutrition, maternal attitudes towards meeting children's nutritional needs, and parenting practices are important in determining children's nutritional status and the risk of stunting, which can hurt adulthood. This study aims to examine the impact of maternal knowledge, attitudes, and childcare practices on the incidence of stunting in Central Lampung Regency. This study used a cross-sectional survey design involving 360 children aged 0–59 months selected by purposive sampling from six sub-districts. The data collected included child characteristics, nutritional status, maternal nutritional knowledge, attitudes, and practices using a validated questionnaire from previous studies. The LAZ/HAZ, WLZ/WHZ, and WAZ indicators measured children's nutritional status. Data analysis was done using the Partial Least Square Structural Equation Modelling (PLS-SEM) method with SmartPLS 3.0. The results showed maternal knowledge significantly affected attitudes (p = 0.001 for Attitude1; p = 0.026 for Attitude2) but not parenting practices (p = 0.986). Maternal parenting practices had a significant effect on children's meal frequency (p = 0.000) but not on the incidence of malnutrition (p = 0.259) and stunting (p = 0.174). These findings emphasize the importance of interventions that improve maternal knowledge and parenting practices to reduce the risk of stunting.

Keywords: *children nutrition, maternal knowledge and attitudes, parenting practices, stunting*

INTRODUCTION

Stunting's effects can persist throughout adulthood, raising the possibility of chronic illnesses and lowering general productivity. Early intervention is crucial to preventing long-term effects and promoting children's healthy development (Raiten & Bremer, 2020). A child's physical and cognitive development may suffer significantly from inadequate nutrition, which may have long-term effects on their general health and wellbeing (Victora et al., 2008). Children with stunting may have delayed growth, weakened immune systems, and cognitive deficits that can hinder their capacity to learn and succeed in school (Tang et al., 2021). The consequences of stunting can extend into adulthood, increasing the risk of chronic diseases and impacting overall productivity (Dewey & Begum, 2011). It is essential to address stunting early on to prevent long-term consequences and support healthy development in children.

Globally, 149.2 million children were reported to have stunting with an indication of length/height according to age z-score less than -2 SD; of them, roughly 22% were represented by all children under the age of five (WHO, 2021). With a population of over a million and situated in the province of Lampung, Central Lampung is an agrarian area rich in natural resources, where the majority of people work in the agricultural sector. Despite this, the frequency of stunting remains high, standing at 20.8% in 2018 (BAPPEDA, 2022).

To combat stunting and encourage children's healthy growth and development, it is essential to comprehend the aspects of mother knowledge,

 Received 15-01-2025, Accepted 30-04-2025, Published online 30-09-2025.

https://doi.org/10.20473/mgi.v20i3.363–373

attitude, and childrearing methods. Studies have demonstrated the significant influence a mother's understanding of proper diet, hygiene, and childcare techniques may have on her child's health results (Fadare et al., 2019). Additionally, a mother's attitude towards seeking healthcare, following recommended guidelines, and providing a nurturing environment for her child can also play a significant role in preventing stunting and ensuring optimal growth (Duijster et al., 2015). Therefore, maternal knowledge, attitudes, and practices can be key in breaking the cycle of malnutrition and stunting in vulnerable populations. For example, a study in a low-income community found that mothers who received education on proper nutrition and hygiene practices were more likely to feed their children nutrient-rich foods and maintain good personal hygiene habits (Aguayo & Menon, 2016). This resulted in lower rates of stunting and improved overall health outcomes among their children compared to those whose mothers did not receive such education (Prasetyo et al., 2023).

On the other hand, a different study in a similar low-income community showed that despite receiving education on proper nutrition and hygiene practices, some mothers still struggled to afford nutrient-rich foods or lacked access to clean water for maintaining good personal hygiene (Kabir & Maitrot, 2017). As a result, their children continued to experience high rates of stunting and poor health outcomes, highlighting the complex interplay of socioeconomic factors in addressing malnutrition in vulnerable populations (Sah et al., 2024; Soliman et al., 2024). These findings underscore the importance of addressing not only knowledge gaps but also structural barriers to improving nutrition and health outcomes in low-income communities (Akseer et al., 2022). Without addressing the underlying issues of poverty, lack of access to resources, and inadequate infrastructure, education alone may not be sufficient to combat malnutrition(Vilar-Compte et al., 2021). It is crucial for interventions to take a holistic approach that considers the broader social determinants of health in order to effectively reduce rates of malnutrition and improve overall well-being in vulnerable populations (Govender et al., 2021).

Despite the increasing number of studies on maternal knowledge, attitudes, and parenting practices, research that explicitly investigates their interrelationships and direct or indirect influence on stunting in rural agrarian settings like Central Lampung remains limited. Prior research often isolates these factors or is conducted in urban contexts, which may not reflect the socio-economic realities and health behaviours of rural populations. Hence, this study aims to fill this research gap by exploring how maternal knowledge, attitudes, and parenting practices interact and influence child stunting in this region.

To address this gap, the study poses the following research questions: – How do maternal knowledge and attitudes influence parenting practices in the context of child nutrition? – To what extent do maternal parenting practices directly or indirectly affect the incidence of stunting in children?

This research aims to analyze the influence of maternal knowledge, attitudes and parenting practices on the incidence of stunting in the capital area of Central Lampung Regency.

METHODS

Study design and participants' characteristics

In six districts of the Central Lampung Regency in Sumatra, Indonesia, children ages 0 to 59 months participated in a cross-sectional household survey. To put it briefly, purposive sampling methods were used to recruit 360 children under the age of five. The inclusion criteria included children aged 0–59 months who were not suffering from congenital abnormalities or acute illness at the time of the study. Stunting infants between the ages of 0 and 59 months, as well as children who were not malformed or unwell, were registered from six districts: Padang Ratu and Pubian in the capital; Gunung Sugih and Trimurjo in the vicinity of the city; and Seputih Banyak and Way Seputih in the farthest from the capital. There are 28 districts in Central Lampung Regency. The districts and research villages were thoughtfully placed, namely in six districts that met the requirements of districts A, B, and C. A total of thirty children under five were taken from each village (the minimum required for statistical testing), and the population of all households in Central Lampung Regency with children under five was gathered. Two villages were specifically chosen from each district.

Data Collection Methods and Instruments

The age, gender, and nutritional status of the child were among the data gathered for this study. Body Length and Height according to Age (LAZ/HAZ), Body Weight Based on Body Length and Height (WLZ/WHZ), and Body Weight for-Age (WAZ) were also included. Maternal knowledge, attitudes, and practices were assessed using a structured questionnaire adapted from Khomsan (2000) and Anida et al. (2015). The questionnaire consisted of 10 items for knowledge (multiple choice), 7 items for attitudes (using a 3-point Likert scale: agree, unsure, disagree), and 8 items for practices (yes/no responses). The adaptation was made to suit the local cultural and linguistic context.

Prior to the data collection, the questionnaire was pre-tested on 30 mothers in a similar demographic to ensure clarity and applicability. Reliability testing using Cronbach's alpha showed values of 0.81 for knowledge, 0.79 for attitude, and 0.84 for practice, indicating acceptable internal consistency (Hair et al., 2019). Content validity was evaluated by a panel of three experts in maternal and child health and nutrition. Six knowledgeable enumerators in the field of nutrition collected the data. Questionnaires on knowledge, attitude, and practice were acquired from the previous study (Anida et al., 2015).

Anthropometry

The Republic of Indonesia's Minister of Health's Regulation No. 2 of 2020 about Anthropometric Standards serves as the basis for the manual classification of anthropometric data using national references (Kemenkes RI, 2020). Using an electronic personal scale from GEA Medical, weight was determined to the closest 0.1 kg. The kids had taken off their shoes and were clothed as lightly as possible for the measurement. Youngsters who could stand and were at least two years old were weighed while standing on a level scale. For kids who can't stand up on their own, their reading will automatically be recorded on the scale when they are placed on the weighing bowl or when their mother stands on the scale first, resetting the reading, and then the mother holds the child. The youngster under the age of two was measured for height using a stature meter while they were in a supine or recumbent position. The weight-for-age (underweight), weight-for-length/height (wasting), and stunting assessment (LAZ/HAZ) national reference classifications (Kemenkes RI, 2018) were used to classify the nutritional status. Measurement errors were shown to be decreased by adherence to the recording and measuring protocols.

Data analysis

Partial Least Square Structural Equation Modelling (PLS-SEM) is often used for analysing structural relationship between variables, especially in situations where there are interdependencies among variables. Because PLS itself is a soft modelling approach to SEM with no assumptions about data distribution (Wong-Ken, 2013). The study about newborn health also use PLS-SEM method, concluded that the interaction between maternal nutrition status had a positive impact on newborn health and children nutrition problems (Nenogasu & Juwa, 2024). This PLS-SEM mode also effectively demonstrated that the environmental and health services had a significant effect of children health (Eliani et al., 2023). Thus, PLS-SEM statistical method with the SmartPLS 3.0 program will be used to look at the influencing factors, knowledge, attitudes, and practices of mothers on the stunting status of children in Central Lampung Regency.

At its core, PLS-SEM operates through several sequential steps to assess and validate theoretical models. A conceptual model is first required, along with latent formation indicators and also determines the direction of causality between construct. The data evaluation method was carried out in two steps. The first step is Outer Model (measurement model), essential to ensure that the indicators reliably and validly represent the latent variable. Outer model involves checking internal consistency, convergent validity to verify that indicators adequately represent the construct, and discriminant validity to ensure that constructs are distinct from one another. The second step is Inner Model (structural model), assesses the relationships between variables and understand to prioritize the most significant relationship. Following model evaluation, a fit model is also present to evaluate how well the entire PLS-SEM model fits the data (Sarstedt et al., 2021). Finally, hypothesis testing is performed to statistically validate relationships specified in the theoretical model.

RESULTS AND DISCUSSIONS

To strengthen the transparency and robustness of our findings, we present detailed statistical results including path coefficients, p-values, and R^2 values, as shown in Table 4. These values provide empirical evidence of the direct and indirect relationships among the constructs. Additionally, the structural model and measurement model are visually presented in Figure 1 and Figure 2, respectively, to enhance clarity. To evaluate the overall model fit, we report the Standardized Root Mean Square Residual (SRMR = 0.054) and Normed Fit Index (NFI = 0.840), indicating that the model achieves acceptable goodness-of-fit based on established thresholds.

Table 1. Data Variables

Latent Variable	Indicator	Description
Knowledge	Knowledge	Mother's knowledge of the nutritional needs of children, starting from breast milk, complementary foods for breast milk, and food storage techniques.
Attitude1	A1, A2, A3, A4, & A5	Mother's attitude towards children nutrition, such as the importance of breast milk, cleanliness in serving food, and paying attention to the children growth.
Attitude2	A6 & A7	Mother's attitude regarding the importance of breakfast and protein consumption in daily meals.
Practice	Practice	Mother's practice of knowledge an attitude they have to regulate the family's nutritional habits and needs.
Stunting	Stunting	Children stunting level as measured by body length divided by height.
Nutrition	Malnutrition & Underweight	Level of malnutrition (weight/height) and underweight (weight/age) conditions of children.
Food	Food Consumption	Children food frequency, such as cereals, meat, nuts, vegetables, and fruit.

A case study for researching the factors affecting children's nutritional status was conducted using the PLS-SEM mode. The study utilizes primary data collected through a questionnaire, with a total of 360 respondents, resulting in seven latent variables and their respective indicators. Prior to the PLS-SEM analysis, a conceptual mode was required, as shown in Figure 1. This framework was developed based on prevailing phenomena, theoretical foundations, and prior research studies.

The SmartPLS output diagram displays the structural model with blue circular shapes representing latent variables and yellow rectangular boxes representing their corresponding indicators. According to Figure 2, the arrows between the latent variables indicate hypothesized relationships, and the values along these paths represent the path coefficients, which reflect the strength and direction of the relationships between constructs. Higher path coefficients (close to +1 or -1) indicate stronger relationships.

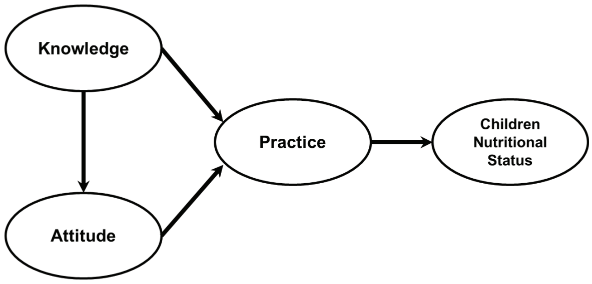

Figure 1. Conceptual Model Framework.

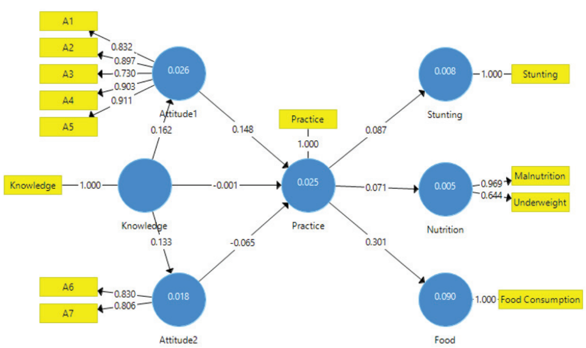

Figure 2. Structural Path Diagram based on PLS-SEM Results.

https://doi.org/10.20473/mgi.v20i3.363–373

Table 2. Cross Loadings

Variable	Attitude1	Attitude2	Food	Knowledge	Nutrition	Practice	Stunting
A1	0.832	0.049	0.097	0.132	-0.060	0.151	-0.069
A2	0.897	0.011	0.108	0.134	-0.073	0.120	0.029
A3	0.730	0.047	0.096	0.119	-0.097	0.128	-0.033
A4	0.903	0.094	0.149	0.161	-0.120	0.126	-0.009
A5	0.911	0.091	0.140	0.147	-0.123	0.081	-0.018
A6	0.082	0.830	0.129	0.118	-0.034	-0.032	0.024
A7	0.028	0.806	0.020	0.099	0.007	-0.059	0.013
Food Consumption	0.138	0.093	1.000	-0.021	0.063	0.301	-0.084
Knowledge	0.162	0.133	-0.021	1.000	-0.047	0.014	0.022
Malnutrition	-0.123	-0.027	0.066	-0.042	0.969	0.076	-0.252
Underweight	-0.020	0.020	0.022	-0.041	0.644	0.024	-0.232
Practice	0.144	-0.055	0.301	0.014	0.071	1.000	0.087
Stunting	-0.024	0.023	-0.084	0.022	-0.277	0.087	1.000

Table 3. Average Variance Extracted

Variable	Composite Reliability (CR)	Average Variance Extracted (AVE)
Attitude1	0.932	0.735
Attitude2	0.802	0.669
Food	1.000	1.000
Knowledge	1.000	1.000
Nutrition	0.801	0.677
Practice	1.000	1.000
Stunting	1.000	1.000

Note: CR = Composite Reliability, AVE = Average Variance Extracted. CR values > 0.7 and AVE values > 0.5 indicate acceptable reliability and validity (Hair et al., 2019).

Table 4. Path Coefficients

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Statement
Attitude1 -> Practice	0.148	0.151	0.053	2.812	0.005	Valid
Attitude2 -> Practice	-0.065	-0.067	0.067	0.978	0.328	Invalid
Knowledge -> Attitude1	0.162	0.164	0.050	3.275	0.001	Valid
Knowledge -> Attitude2	0.133	0.140	0.060	2.229	0.026	Valid
Knowledge -> Practice	-0.001	0.000	0.054	0.018	0.986	Invalid
Practice -> Food	0.301	0.302	0.050	6.017	0.000	Valid
Practice -> Nutrition	0.071	0.082	0.063	1.129	0.259	Invalid
Practice -> Stunting	0.087	0.082	0.064	1.362	0.174	Invalid

Note: O = Original Sample, M = Sample Mean, STDEV = Standard Deviation. P-values < 0.05 indicate statistically significant relationships between constructs.

https://doi.org/10.20473/mgi.v20i3.363–373

A. Outer Model

1. Convergent Validity
   Testing the validity of indicators is carried out by looking at the loading factor values. It is said that a variable has good convergent validity if the loading value is more than 0.7, but > 0,5 is still acceptable (Hair et al., 2019). Table 2 shows that all indicators under latent variable meet the minimum loading value. So, overall it can be considered that the model indicators have good validity.
   The convergent validity value will be better if the correlation between indicators that make up the construct is also high. AVE value more than 0.50 indicates a good measure of convergent validity (Hair et al., 2019). Table 3 shows that AVE value of all variables is good, which means latent variable of children stunting data can explains more than half of the variance of the indicators.
2. Discriminant Validity
   Discriminant validity can also be tested at the indicator level, called cross loadings, where the loading value of the indicator of variable must be greater than the loading value of the indicator on other variables (Purwanto & Sudargini, 2021). It can be seen from Table 2 that all loadings meet the condition, so it can be said that there are no problems in testing discriminant validity. Discriminant validity of the model can also be determined through the Fornell-Larker Criterion value (Henseler et al., 2015). The result shows that the values of all variables are greater than other variables. For example, the Nutrition variable has a number of 0.823, which is the largest compared to other variables, it can be said that Nutrition variable meets discriminant validity, the same goes for other variables. Overall, discriminant validity can be accepted for this measurement.
3. Reliability
   Internal consistency, Composite Reliability (CR), can be utilized for evaluating reliability. Composite Reliability values range from 0 to 1, with limit value CR more than 0.7 are acceptable and values more than 0.8 are very satisfactory (Purwanto & Sudargini, 2021). Achieving high construct reliability involves validating that the items on the measurement tool are consistently aligned with the construct. Based on the Composite Reliability value in Table 3, all variables have CR values more than 0.8, it can be concluded that all variables are reliable. Therefore, the statement items can also be used as variables for further research.

B. Inner Model

The Variance Inflation Factor (VIF) statistical measure is often used to test for collinearity problems (Hair et al., 2019). A latent variable has a good VIF value if its value is less than five (5.000). All indicator variables, A1-A7, Food Consumption, Knowledge, Malnutrition, Underweight, Practice, and Stunting have VIF value between 1.000 until 4.397, implies that there are no issues with multicollinearity in this research model. The R-square value is also calculated for model evaluation to measure how much the dependent latent variable can be explained by the independent latent variable. The test results show that the R-Square value of the research is far below the standard. However, more complex SEM models with many latent variables may have a lower R-square than simpler models. This is because more complex models may not be able to explain all the variation in endogenous variables well but can still provide insight into important relationships between variables. Therefore, it is also necessary to look at measures of model suitability from other values, such as the result of model fit.

C. Model Fit

According to Hu and Bentler 1999, Standardized Root Means Square (SRMR) value less than 0.08 are considered fit. SRMR is a fit measure for PLS-SEM that can be used to avoid model specification errors. The SRMR value for this model is 0.054, so the model can be said to be fit. The fit model can also be seen from the NFI value. The Normed Fit Index (NFI) has a value that ranges from 0 to 1. An NFI value > 0.90 indicates good fit, while 0.80 < NFI < 0.90 is called marginal fit (Dash & Paul, 2021). However, there is also another theory that an NFI value above 0.50 indicates that the model being studied is good. Based on research results, this model has a high NFI value, 0.840. So, both from the SRMR and NFI values, the research model for children nutritional status is fit.

https://doi.org/10.20473/mgi.v20i3.363–373

Hypothesis Test

The research hypothesis is H0: there is no influence, while H1: there is an influence. H0 will be rejected if the P-value is less than 0.05. Table 4, in the first row, we can see the hypothesis results for Attitude1 and Practice. Testing Attitude 1 against Practice. The P-value of influence is 0.006 < alpha (0.05), so rejecting H0 means there is a significant positive influence between Attitude1 and Practice. Stated differently, the way a mother approaches meeting her children nutritional needs, for example, emphasizing the value of breast milk, maintaining hygienic food preparation practices, and being aware of her children development has a beneficial impact on the way the mother raises her child (Mohamed Ahmed Ayed et al., 2021; Pedroso et al., 2019). The better the mother's attitude, the better the practice she carries out(Assefa et al., 2021; Momoh et al., 2022).

The Attitude2 test findings indicate that there is no significant positive relationship between Attitude2 and Practice, with a P-value of 0.328 > alpha (0.05) rejecting H0. Therefore, it may be concluded that a mother's beliefs about the importance of breakfast as well as animal protein in their daily menu have little bearing on how she raises her children (Bleszynski & Angkat, 2023). This implies that despite the mother's negative attitude toward these things, the quality of her practice or the way she fulfils her position as a mother to children will not be diminished. The test results for the knowledge variable with other variables show that a mother's knowledge has a positive effect on a mother's attitude toward caring for children and families. However, it turns out that a mother's knowledge does not have a positive effect on practice. In other words, a mother who is weak in knowledge regarding children nutrition does not necessarily have bad practices or treatment in caring for children (Shahid et al., 2022).

Meanwhile, the Practice variable demonstrates that children's dietary intake is positively impacted by maternal practice. Put in another context, the more a mother practices nutritious eating, the more often her children eat fruits, vegetables, milk, and other wholesome meals (Caso et al., 2024; Liu et al., 2021). However, maternal practices do not have a positive effect on nutrition (malnutrition and underweight) and on stunting. Thus, it may be concluded that improper behaviour on the part of the mother does not always cause malnutrition, underweight, or stunting in children (Saleh et al., 2021; Santosa et al., 2022). Hence, there is a possibility that the problem is not about maternal parenting, but external factors such as the cleanliness of the living environment, access wot health services, or congenital diseases(Sundas et al., 2024).

The indirect impact hypothesis is tested with the hypothesis that H0: does not significantly moderate the relationship between variables, should be rejected if the P-value is less than 0.05. Practice (P-value = 0.018) significantly mediates the link between Attitude1 and Food, "Attitude1 → Practice → Food" (the arrow is the same as the arrow on the model path in Figure, which describes the relationship between variables). In other words, parenting practices indirectly influence the relationship between maternal attitudes and children's dietary intake (Lopez et al., 2018; Tengilimoglu-Metin & Kabasakal-Cetin, 2024). The results for "Knowledge → Attitude1 → Practice," where Attitude significantly mediates the relationship between Knowledge and Practice, are similar, with a P-value of 0.049. It can also be argued that knowledge has an indirect impact on a mother's attitude, since the mother's attitude in turn affects her practices (Suharto, 2022; Widyahening et al., 2021). Conversely, according to path model in Figure 2, the other results from the Specific Indirect Effects calculation do not significantly moderate the relationship, P-value more than 0.05. For example, "Knowledge → Practice → Stunting" with a P-value of 0.989, parenting practices indirectly influence the relationship between maternal knowledge and the incidence of stunting in children. This is in line with previous research that parenting practices indirectly influence the relationship between maternal knowledge and the incidence of stunting in toddlers (Rohmawati et al., 2019).

CONCLUSION

Stunting remains a critical public health concern in Indonesia, particularly in rural regions such as Central Lampung Regency. This study highlights the significant influence of maternal knowledge and attitudes on parenting practices, and their indirect effect on child nutrition through feeding frequency. While no direct association was found between parenting practices and the incidence of stunting, the findings underscore the importance of maternal behavioural factors in early childhood nutrition.

To address this issue, we recommend that public health efforts focus on strengthening maternal knowledge and attitudes through targeted, culturally appropriate interventions. These may include structured nutrition education integrated into antenatal and postnatal care services, interactive community-based workshops, and involvement of trained community health workers (e.g., Posyandu cadres) to provide ongoing guidance on proper feeding practices, hygiene, and growth monitoring.

In addition, policy-level support is essential to sustain and scale these interventions. Local governments should consider embedding maternal nutrition modules into routine maternal and child health (MCH) programs, and ensuring that health facilities are equipped to deliver both informational and practical support to mothers in underserved areas.

Limitations

This study was cross-sectional in nature, limiting the ability to infer causality. Furthermore, the data relied on self-reported maternal responses, which may be subject to recall bias or social desirability bias. Finally, the study was conducted in a specific rural region, which may restrict the generalizability of the findings to other geographic or socio-economic contexts.

ACKNOWLEDGEMENT

The author would like to thank the Central Lampung Health Service and Community Health Center: Padang Ratu, Pubian, Gunung Sugih, Trimurjo, Seputih Banyak, and Way Seputih for permission to conduct research and guidance. The authors also thank the study participants and their parents. Thank you we convey to (HETI Project) and the Faculty of Medicine, University of Lampung which has funded this research.

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