Original Research

Determinant of Stunting among Toddler in East Nusa Tenggara, Indonesia

Uly Agustine1*, Shelfi Dwi Retnani Putri Santoso1, Grasiana Florida Boa1, Sri Mugianti2, & Yosephina Elizabeth Sumartini Gunawan1

1Poltekkes Kemenkes Kupang, Kupang, Indonesia
2Poltekkes Kemenkes Malang, Malang, Indonesia

**Article Info**

**Abstract**

*Introduction:* Information on risk factors related to stunting is required as basic information in providing appropriate interventions in reducing the incidence of stunting. This study aimed to determine the relative risk factors for stunting.

*Methods:* The sample of 75 infants was selected by proportional cluster random sampling. The study design was a descriptive correlation by analyzing primary data through observation and interviews using questionnaires and secondary data through Mother and Children Handbook (MCH) observation. Data analysis uses logistic regression.

*Results:* Maternal education (p=0.005; OR=0.241), Maternal Occupation (p=0.005; OR=4.926), Father Occupation (p=0.000; OR=0.137), Maternal age at pregnancy (p=0.084; OR=1.775), Maternal Hemoglobin level at pregnancy (p=0.114; OR=2.917), Maternal arm circumference at pregnancy (p=0.000; OR=7.313), Ante Natal Care frequency (p=0.802; OR=0.889), Parenting (p=0.000; OR=0.323), Weight at birth (p=0.001; OR=6.424), Length of breastfeeding (p=0.005; OR=4.219), Age when starting to get complementary foods (p=0.000; OR=7.313), Dietary habit of children (p=0.090; OR=0.404), Infection history at children (p=0.001; OR=0.353).

*Conclusion:* The risk factors for stunting are maternal education, maternal occupation, father occupation, maternal arm circumference at pregnancy, parenting, weight at birth, length of breastfeeding, age when starting to get complementary foods, and infection history in children. It is expected that stunting prevention efforts are carried out by controlling the causative factors.

**Keywords:** risk factor, stunting, toddler

*e-mail: agustineuly@gmail.com*

This work is licensed under a Creative Commons Attribution 4.0 International License.
INTRODUCTION

Toddler is a golden period in the growth because it will affect and determine the child’s development [1]. One of the major nutritional problems in toddlers is stunting, which impacts their physical and mental and even increases the risk of death and morbidity [2].

The prevalence of stunting worldwide declined from 33.1% in 2000 to 22% in 2020. In Southeast Asia, it declined from 38% in 2000 to 27.4% in 2020 [3]. Indonesia is the third country with the highest prevalence in Southeast Asia or Southeast Asia Region (SEAR). Stunting in children aged 12-59 months in Indonesia in 2013 was 37.2%, and in 2018 was 30.8% [4], [5]. Stunting in children between 12 and 24 months (40% to 54%), continues to rise until 36 months of age (58%), and then remains relatively stable until 5 years of age (50%) [6].

According to the Central Statistics Agency report in 2020, East Nusa Tenggara Province is the top five prevalence of stunting in Indonesia in 2018, 26.7% are in the short toddler category, and 16% are very short toddler category [7]. The prevalence of stunting in West Sumba Regency in 2018 in toddlers for the short category was 26.77%, and in the very short category was 20.99% [8].

A comprehensive effort is necessary at the high prevalence and impacts of stunting. One of the efforts is controlling the causative factors [9]. There are three relative factors such as distal, intermediary, and proximal factors. Distal factors include the maternal education, ethnicity, economic status, location, and type of settlement. Intermediary factors include environmental and maternal factors. Proximal factors include the child’s birth order, health status, and early breastfeeding initiation [10]. Previous study on the causes of stunting includes low parental education and income, never suffering from the infection, not getting exclusive breastfeeding, poor parenting, and eating patterns [11]. Similarly, a study by [12] showed that the factors affecting the incidence of malnutrition were the maternal education, child’s birth weight, birth spacing, and history of chronic infection.

There are many factors of stunting in Indonesia, so researchers are interested in exploring the risk factors for stunting in toddlers aged 24-59 months in West Sumba, East Nusa Tenggara Province.

METHODS

The study design was a descriptive correlation to determine the relative risk factors of stunting. This study took place in West Sumba Regency, East Nusa Tenggara Province, with a population of 641 infants, and the sample of 75 infants was selected by proportional cluster random sampling. The sample selection based on the selected sub-districts, such as Lamboya, Tana Righu, Waikabubak City, West Lamboya, Loli, and Wanokaka. Inclusion criteria were toddler aged 24 – 59 months, stunted as a case, had a Mother and Child Handbook (MCH), and mothers were willing to be interviewed. The data collected for three months, from June to August 2021.

This study identified variables through primary and secondary data. The primary
data identified variables such as Maternal education, Maternal Occupation, Father Occupation, Parenting, Length of breastfeeding, Age when starting to get complementary foods, Dietary habits of children, Infection history in children, and data collection through observation and interviews using questionnaires. Meanwhile, secondary data was obtained through MCH observations containing the history of pregnancy, childbirth, the development of the toddler up to 59 months, Maternal arm circumference and Maternal Hemoglobin level at pregnancy, Weight at birth, and Ante Natal care frequency. Analysis of data used logistic regression with computer. The study has received ethical approval from the Ethics Committee of STIKes Bahrul Ulum Jombang, dated May 20, 2021. Number 57/EC/KEPK-BU/V/2021.

RESULTS

Table 1 shows the results of factor analysis related to the incidence of stunting in toddlers aged 24-59 months in West Sumba, including maternal education (p=0.005; OR=0.241), maternal occupation (p=0.005; OR=4.926), father occupation (p=0.000; OR=0.137), maternal age at pregnancy (p=0.084; OR=1.775), maternal hemoglobin level at pregnancy (p=0.114; OR=2.917), maternal arm circumference at pregnancy (p=0.000; OR=7.313), Ante Natal Care frequency (p=0.802; OR=0.889), Parenting (p=0.000; OR=0.323), weight at birth (p=0.001; OR=6.424), length of breastfeeding (p=0.005; OR=4.219), age when starting to get complementary foods (p=0.000; OR=7.313), dietary habit of children (p=0.090; OR=0.404), and infection history at children (p=0.001; OR=0.353).
## DISCUSSION

### Maternal Education

The results show a significant value of 0.005, which indicates a relationship between maternal education and the incidence of stunting in children. Mothers with basic education levels (elementary and junior school) showed the results of 0.241. This condition is in line with the results of systematic reviews and study that parents with low levels of education tend to have

### Table 1

Cross-tabulation between children under five years status with factors of mother and children

<table>
<thead>
<tr>
<th>Factors of mother and children</th>
<th>Category</th>
<th>Children under five years status</th>
<th>OR and 95% CI value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Stunting f (%)</td>
<td>Not stunting f (%)</td>
</tr>
<tr>
<td><strong>Mother education</strong></td>
<td>Elementary &amp; junior school</td>
<td>8 (10.7%)</td>
<td>26 (34.7%)</td>
</tr>
<tr>
<td></td>
<td>Senior school &amp; higher</td>
<td>23 (30.7%)</td>
<td>18 (24.0%)</td>
</tr>
<tr>
<td><strong>Mother employment</strong></td>
<td>Does not work</td>
<td>19 (25.3%)</td>
<td>39 (52.0%)</td>
</tr>
<tr>
<td></td>
<td>Working</td>
<td>12 (16.0%)</td>
<td>5 (6.7%)</td>
</tr>
<tr>
<td><strong>Father employment</strong></td>
<td>Does not work</td>
<td>15 (20.0%)</td>
<td>5 (6.7%)</td>
</tr>
<tr>
<td></td>
<td>Working</td>
<td>16 (21.3%)</td>
<td>39 (52.0%)</td>
</tr>
<tr>
<td><strong>Mother years old (yo) at pregnancy</strong></td>
<td>&lt; 20 yo and &gt; 35 yo</td>
<td>0 (0.0%)</td>
<td>4 (5.3%)</td>
</tr>
<tr>
<td></td>
<td>20 – 35 yo</td>
<td>31 (41.3%)</td>
<td>40 (53.3%)</td>
</tr>
<tr>
<td><strong>Mother Hb level at pregnancy</strong></td>
<td>&lt; 10 g%</td>
<td>7 (9.3%)</td>
<td>4 (5.3%)</td>
</tr>
<tr>
<td></td>
<td>&gt; 10 g%</td>
<td>32 (32.0%)</td>
<td>64 (85.3%)</td>
</tr>
<tr>
<td><strong>Mother arm circumference at pregnancy</strong></td>
<td>&lt; 23.5 cm</td>
<td>15 (20.0%)</td>
<td>5 (6.7%)</td>
</tr>
<tr>
<td></td>
<td>≥ 23.5 cm</td>
<td>16 (21.3%)</td>
<td>39 (52.0%)</td>
</tr>
<tr>
<td><strong>Ante Natal Care frequency</strong></td>
<td>4 times (not sequentially)</td>
<td>16 (21.3%)</td>
<td>24 (32.0%)</td>
</tr>
<tr>
<td></td>
<td>4 times (sequentially)</td>
<td>15 (20.0%)</td>
<td>20 (26.7%)</td>
</tr>
<tr>
<td><strong>Parenting</strong></td>
<td>Less</td>
<td>10 (13.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>21 (28.0%)</td>
<td>44 (58.7%)</td>
</tr>
<tr>
<td><strong>Weight at birth</strong></td>
<td>&lt; 2400 g</td>
<td>14 (18.7%)</td>
<td>5 (6.7%)</td>
</tr>
<tr>
<td></td>
<td>≥ 2400 g</td>
<td>17 (22.7%)</td>
<td>39 (52.0%)</td>
</tr>
<tr>
<td><strong>Length of breastfeeding</strong></td>
<td>&lt; 6 months</td>
<td>15 (20.0%)</td>
<td>8 (10.7%)</td>
</tr>
<tr>
<td></td>
<td>≥ 6 months</td>
<td>16 (21.3%)</td>
<td>36 (48.0%)</td>
</tr>
<tr>
<td><strong>Age when start getting comple-mentary foods</strong></td>
<td>&lt; 6 months</td>
<td>15 (20.0%)</td>
<td>5 (6.7%)</td>
</tr>
<tr>
<td></td>
<td>≥ 6 months</td>
<td>16 (21.3%)</td>
<td>39 (52.0%)</td>
</tr>
<tr>
<td><strong>Dietary habit of children</strong></td>
<td>Not good</td>
<td>11 (14.7%)</td>
<td>8 (10.7%)</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>20 (26.7%)</td>
<td>36 (48.0%)</td>
</tr>
<tr>
<td><strong>Infection history at children</strong></td>
<td>Rarely</td>
<td>24 (32.0%)</td>
<td>44 (58.7%)</td>
</tr>
<tr>
<td></td>
<td>Often</td>
<td>7 (9.3%)</td>
<td>0 (0.0%)</td>
</tr>
</tbody>
</table>
stunting toddlers [13] because the level of education can affect the way of thinking and the ability to analyze a problem. Education has an indirect effect on a healthy lifestyle and family income. One of the efforts to improve the education level of parents in Indonesia is to set the minimum age for marriage for men and women to be 19 years. The determining purpose of the minimum age for marriage is to support a woman who will become a mother having a minimum education level of senior high school.

**Maternal Occupation**

The results show a significant value of 0.005, which indicates a relationship between a maternal occupation and the incidence of stunting in children. The parents’ occupation (father and mother) is a risk factor for stunting in toddlers. The contribution of the risk factor for the mother who does not work in the incidence of stunting is almost five times, and the risk factor for the father who does not work is smaller about 0.371 times. However, study in Klaten found that working mothers contributed to the incidence of stunting [14]. This condition is different between the districts of West Sumba and Klaten. Differences can be due to geographic and economic conditions. Geographically, West Sumba Regency is a mountainous area, so the income depends on the sale of agricultural products. This condition illustrates the importance of occupation for mothers because it will be an additional source of income for the family to fulfill basic needs.

**Father occupation**

The results show a significant value of 0.000, which indicates a relationship between the father’s occupation and the incidence of stunting in children. Geographically, Klaten Regency is a metropolitan and modern city. The father is the head of the family and has a decent income according to government regulations. So, if the mother works, the toddler needs will not be fulfilled because the mother tends to work in the non-formal sector [14].

**Maternal Age**

The results show a significant value of 0.084, which indicates no relationship between maternal age and the incidence of stunting in children. However, usually, the nutritional status of children can also be affected by maternal age. When a young mother gives birth (<20 years), it will increase the risk of preterm delivery, intrauterine growth retardation, infant and maternal mortality, and malnutrition [15]. Younger mothers generally have a lower nutritional status than older mothers. It indicates a low pre-pregnancy weight (under 50 kg) or weight gain during pregnancy of less than 10 kg [16]. The nutritional status of mothers who are less than ideal can increase the risk of having children with low birth weight, so they are at risk of stunting [17]. On the other hand, older maternal age has some risk for pregnancy, such as fetal death, premature birth, intrauterine growth disorders, and chromosomal abnormalities [15]. This study was supported by [18] found a significant relationship between the incidence of
stunting and high-risk maternal age (<20 years or >35 years). For this reason, it is also necessary to pay attention to maternal age during pregnancy to avoid the risk of stunting.

**Maternal Hemoglobin level at pregnancy**

The results showed a significant value of 0.114, which indicates no relationship between maternal hemoglobin levels during pregnancy and the incidence of stunting. Maternal hemoglobin values are associated with anemia to maternal nutritional status during pregnancy. Meanwhile, mothers with anemia tend to give birth to babies with low body weight and subsequently have the potential for stunting [19]. A nutritional boost is necessary for pregnant women even before fertilization occurs to ensure optimal growth of the fetus in the uterus [20]. Giving blood supplements (iron / folic acid) can increase hemoglobin levels in pregnant women [21]. Study on the use of iron/folic acid supplementation or multiple micronutrient supplementation during pregnancy can increase fetal growth, birth length, and postnatal growth [22].

**Maternal arm circumference at pregnancy**

A study on the use of iron/folic acid supplementation or multiple micronutrient supplementation during pregnancy can increase fetal growth, birth length, and postnatal growth [23]. Maternal malnutrition, as seen from the MUAC indicator (MUAC cutoff <21-23 cm), is a risk of giving birth to a newborn with low birth weight [24]. Maternal malnutrition can affect fetal growth, including malnutrition in the intrauterine, which causes lower birth weight, and genetic formation disorder during pregnancy. The reduced nutrient stores in the mother can affect the quality of the nutrient provided during breastfeeding [25]. As a solution, by providing additional ready-to-use food for pregnant women. A study in Guinea Bissau showed that supplementary feeding for three months has significantly increased MUAC by an average of 0.6 cm [26].

**Ante Natal Care frequency**

The results show a significant value of 0.802, which indicates no relationship between the frequency of ANC and the incidence of stunting. ANC is a preventive service to monitor maternal health and complications for the mother and fetus [27]. Sufficient ANC visits will increase their knowledge about proper feeding for their babies after delivery, including breastfeeding and complementary feeding [28]. In addition, mothers have a chance to receive information about childhood diseases, infections, and how to prevent them. It is related to mothers' attitudes about adequate postnatal care, leading to optimal and welfare child growth [29].

**Parenting**

The results show a significant value of 0.000, which indicates a relationship between parenting and the incidence of stunting. The results support previous studies that negative parenting causes stunting in children [30]. Toddlers with less history of parenting have
14.5 times the chance of experiencing stunting than toddlers with a good one [31]. Maternal parenting is a child's need to grow and develop, including how to interact, cultivate attitudes, and instill values and morals. Good attitude patterns and family are related to stunting [32]. Parenting patterns in this study were focused on parenting and health care because poor parenting causes poor children's nutritional status [31]. Mothers who do not maintain the cleanliness and safety of children's food cause various diseases, so it is necessary for mothers to have a positive parenting pattern to avoid various health problems [33].

**Weight at birth**

The results show a significant value of 0.001, which indicates a relationship between birth weight and the incidence of stunting. Previous study stated that a history of low birth weight increased the risk of stunting more than 12 times compared to those with normal birth weight [2]. A study in Zimbabwe also found that infants with a history of low birth weight (41.4%) were more likely to experience stunting [34]. In particular, a prospective study in Cebu showed that LBW infants are at higher risk of stunting during the first two years of life compared to normal weight at births [35]. History of low birth weight led to growth retardation in the womb, either acutely or chronically. Therefore, these children are susceptible to infections such as diarrhea and lower respiratory tract infections, as well as increased chances of jaundice, anemia, chronic lung problems, fatigue, and loss of appetite compared to children of normal birth weight. 70% of infants in the case group had a history of normal birth weight, possibly because inadequate nutrition led to growth retardation [36].

Our study found that low birth weight and length had a significant relationship with stunting. A study in Indonesia by [12] showed the relationship between low birth weight and the incidence of stunting. Birth weight determined a child's body size in the further growth and development phase. Children with low birth weight (below 2,500 grams) led to a higher risk of malnutrition, infections, and degenerative diseases. And it causes growth and development and increase childhood morbidity [18].

**Length of breastfeeding**

The results show a significant value of 0.005, which indicates a relationship between the length of breastfeeding and the incidence of stunting. Breast milk is the most important food for babies during the first six months of life. The World Health Organization recommends that all infants be exclusively breastfed [37]. The benefits of breast milk for infants are essential to the growth and development of, reducing the long-term risk of NEC and sepsis, optimizing cognitive function, and reducing the risk of several diseases related to the immune system [38]. Several studies have identified that non-exclusive breastfeeding is associated with child stunting [2]. WHO recommends four specific strategic points in providing baby food to achieve optimal growth and development. Such as early initiation of
breastfeeding in the first 30 minutes of life, exclusive breastfeeding for the first six months of life, complementary feeding of breast milk at the age of 6-24 months, and continued breastfeeding for two years [2]. Breast milk contains many immunological substances than formula milk, such as immunoglobulins to prevent disease, secretory substances to neutralize pathogenic E. coli and various gastrointestinal viruses, lactoferrin for binding iron from the digestive tract, and has bactericidal properties. The results showed that exclusively breastfed infants were more resistant to infection and prevented stunting because stunting is one of the effects of repeated infections in children [39].

Age when starting to get complementary foods

The results show a significant value of 0.000, which indicates a relationship between the age when starting to get complementary foods and the incidence of stunting. Previous studies have also confirmed that one of the factors in the incidence of stunting is the first-time giving complementary feeding [40]. Children who get their first food before reaching the age of six months are at risk of experiencing stunting twice compared to children who consume complementary foods at six months old. For babies, breast milk provides the best source of nutrition and boosts the development of the immune system [41]. Early weaning of breastfeeding led to the immunological control of hypersensitivity reactions and autoimmune diseases [42]. When infants are given breastmilk substitutes before six months, they are sensitive of bacterial contamination [40]. Improper feeding of substitutes such as non-sterile bottles, non-boiling water, unclean cooking and eating utensils, and lack of precise food storage. Giving complementary foods before six months increases the risk of infectious diseases such as fever and diarrhea [43]. Physiological conditions associated with infection can interfere with growth by inhibiting nutrient absorption, increasing nutrient loss, reducing appetite, and depriving a child of nutrients for growth, thereby limiting the child from reaching his growth potential [1].

Dietary habit of children

The results show a significant value of 0.090, which indicates no relationship between the Dietary habit and the incidence of stunting. This finding is different from the study [44] which showed the relationship between food diversity to the incidence of stunting in children. Therefore, interventions are necessary to promote food groups in the diets of mothers and children, including those rich in growth-promoting nutrients such as dairy and meat/poultry. Other findings by [45] found that a higher intake of dairy products and eggs could reduce the risk of stunting. However, the consumption of other food groups such as meat, fruits, and vegetables was not significantly related to stunting. Eggs and milk contain protein that affects plasma levels of insulin-like growth factor 1, a growth hormone mediator, bone matrix proteins, and growth factors, which play an essential role in bone formation [41] [46]. Dietary habits may
have direct consequences on health and disease via epigenetic processes. Previous studies have shown that lower intakes of energy, protein, and carbohydrates are significantly associated with increased global DNA methylation in children [47].

**History of infection**

The results showed a significant value of 0.001, which indicates a relationship between Infection history in children and the incidence of stunting. Based on the WHO framework, infections include enteric (diarrheal disease, environmental enteropathy, and helminthiasis), respiratory tract infections, malaria, and inflammation. The literature notes that respiratory and intestinal infections are predictors of stunted child [48]. Infectious diseases are one of the predictors of stunting in toddlers. Infectious diseases are caused by several things, such as poor environment and sanitation. More than one-fifth of the world’s population is in conditions of a lack of clean water that allows high rates of enteric diseases, such as diarrhea. Enteric infections will interfere with the absorption function of nutrients in the intestine, causing up to 43% of growth inhibition [5].

Two studies found a relationship between a history of infectious disease and the incidence of stunting [5] and [49]. It is supported by [50] that children with a history of infection had a nine times greater risk of stunting than the healthy children. Other findings by [51] in Lubuk Begalung found a significant relationship between a history of infectious diseases and the incidence of stunting, with the OR value was 3.868. It means 3.868 times greater risk of experiencing stunting than children without a history of infectious diseases. Exposure to infectious diseases has a more severe effect than growth disorders in normal children. Prevention of infection is avoiding the triggers and proper treatment when it occurs.

**IMPLICATION AND LIMITATIONS**

Information about relative risk factors to stunting can be used as basic information in providing appropriate management to reduce stunting by controlling preventable risk factors such as maternal education, maternal occupation, father occupation, maternal arm circumference at pregnancy, parenting, length of breastfeeding, age when starting to get complementary foods, controlling infectious diseases in children by implementing clean and healthy living behavior. The limitation from this study used only 75 samples with the study design descriptive correlation and analyze statistics with logistic regression. For further study this design is considered for a longer time, and one variable should involve around 50 samples.

**CONCLUSION**

It was concluded that the risk factors for stunting were maternal education, maternal occupation, father occupation, maternal arm circumference at pregnancy, parenting, weight at birth, length of breastfeeding, age when starting to get complementary foods, infection history at children. It is hoped that this research can be used as a reference in efforts to prevent stunting through a control approach from the causative factors.
ACKNOWLEDGMENTS

The researcher thanks to Poltekkes Kemenkes Kupang, the West Sumba Health Office, and the respondents who helped carry out this research.

CONFLICT OF INTEREST

All authors have no conflict of interest.

REFERENCES


[38] C. L. Granger, N. D. Embleton, J. M. Palmer, C. A. Lamb, J. E. Berrington, and


[49] N. Y. Triana and S. Haniyah, "Relationship Between Characteristics of Children, Status of Infectious Disease, and
