



ORIGINAL PAPER

Spatial analysis and factors related to stunting prevalence in Lampung Province in 2024 (INSS Data in 2024)

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Abstract

Background: Stunting is a growth and developmental disorder caused by chronic malnutrition and recurrent infections and is defined as a Height-for-Age Z-score (HAZ) below -2 standard deviations. Despite ongoing interventions, stunting remains a major public health problem in Indonesia. Geographic Information Systems (GIS) can be used to identify the spatial distribution of stunting; however, spatial studies on stunting in Indonesia remain limited.

Objective: This study aimed to analyze spatial patterns and factors associated with stunting prevalence in Lampung Province in 2024.

Methods: A cross-sectional study was conducted using secondary data from the 2024 Indonesian Nutrition Status Survey (INSS). The study population consisted of 8,964 children under five years of age, with 2,778 children included after data cleaning. Data were analyzed using univariate, bivariate, and spatial analyses.

Results: The prevalence of stunting was 15.3%, while 84.7% of children were not stunted. Exclusive breastfeeding, birth weight, and maternal age were significantly associated with stunting prevalence ($p < 0.05$). Spatial analysis showed significant associations of exclusive breastfeeding in several districts/cities, birth weight in West Coast, West Lampung, and East Lampung, and maternal age in Central Lampung.

Conclusion: Exclusive breastfeeding, birth weight, and maternal age were associated with stunting prevalence in Lampung Province in 2024.

Keywords: birth weight, exclusive breastfeeding, maternal age, spatial analysis, stunting

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Introduction

Stunting remains a major public health and nutritional problem among children worldwide.¹ According to the World Health Organization (WHO), stunting is defined as impaired growth and development resulting from chronic malnutrition and recurrent infections,²⁻⁴ which are characterized by a z-score value of less than -2SD/standard deviation (stunted).⁵ Stunting can adversely affect children's growth and development and may reduce their productivity in adulthood.⁶

On a global scale, in 2024 it is estimated that around 150 million children or 23.2% of children under five will experience stunting.^{7,8} The results of the 2024 Indonesian Nutrition Status Survey (INSS) reported that the national stunting prevalence dropped to 19.8%⁹. However, this figure is still far from the long-term target and shows the need for focused and contextual interventions.¹⁰ According to INSS, the percentage of stunting in Lampung Province has decreased from 15.2% in 2022 to 14.9% in 2023. However, the prevalence of stunting has increased slightly to 15.9% in 2024.¹¹

The prevalence of stunting is influenced by various risk factors, factors that are often associated with the prevalence of stunting include the condition of the baby at birth and the condition of the mother.^{12,13} Children's health practices such as exclusive breastfeeding play a role in ensuring nutritional adequacy¹⁴ and preventing infectious diseases that can hinder children's growth.^{15,16} Exclusive breastfeeding refers to feeding infants only breast milk during the first six months of life, without providing any additional food or liquids, including water.¹⁷⁻¹⁹ Birth weight is an important indicator of fetal growth and development during pregnancy. Infants born with low birth weight are at greater risk of experiencing growth problems, including stunting during childhood,^{20,21} Birth weight refers to the baby's body mass at birth, which is measured in grams.²² Birth weight is generally categorized into low birth weight (LBW) and normal birth weight (NBW).^{22, 23}

Low birth weight (LBW) is defined as a birth weight of less than 2.500 grams, whereas NBW is defined as a birth weight of 2.500 grams or more.^{24,25} Maternal age reflects the biological readiness of a woman for pregnancy,²⁶ Maternal age at childbirth is defined as the mother's age at the time of delivery. Maternal age was categorized into two groups: risk age (<20 years or >35 years) and non-risk age (20–34 years). This categorization was based on reproductive health recommendations indicating that pregnancies occurring before the age of 20 years or after 35 years are associated with increased maternal and child health risks.^{27,28} Based on research conducted by,²⁹ which was carried out on children under five aged 24-59 months, namely factors related to the prevalence of stunting include history of LBW, intake energy, carbohydrate, fat, history of diarrhea diseases, exclusive breastfeeding, complementary food, maternal nutritional status, history of anemia, and maternal age.

In this study, the use of Geographic Information System (GIS) is carried out which is a computing-based system designed to understand and manage geographic information.^{30,31} Research based on spatial analysis related to stunting in Indonesia, both at the national and regional levels, is still rare. Thus, this study was conducted to analyze the spatial distribution pattern of stunting prevalence and factors related to stunting in Lampung Province in 2024 using INSS data and GIS approach as a basis for developing more targeted policy recommendations and interventions.³² This study aims to analyze the spatial patterns of stunting prevalence and its association with exclusive breastfeeding, birth weight, and maternal age.



Methods

This study is quantitative research with a cross-sectional design. This study uses data from the 2024 INSS, which is a national survey organized by the Ministry of Health of the Republic of Indonesia. The survey was carried out in stages from January to December 2024. The follow-up analysis conducted by the researcher was carried out from March to April 2026. The population in this study is all children under five in Lampung Province and is recorded in INSS 2024, which is 8,964 children under five. Data cleaning was performed to identify records with missing or incomplete information on the study variables. The inclusion criteria were children under five years of age recorded in the INSS with complete data on stunting status, exclusive breastfeeding, birth weight, and maternal age. The exclusion criteria were records with missing, incomplete, or inconsistent data on one or more study variables. Records meeting the exclusion criteria were removed during the data cleaning process. As a result, 2,778 children met the inclusion criteria and were included in the final analysis.

Data were obtained from the INSS database, and then the process of cleaning, coding, and analysis is carried out. Data analysis was carried out in stages including univariate, bivariate, and spatial analysis. Univariate analysis was used to describe the distribution of respondent characteristics and research variables.³³ Bivariate analysis was performed using the chi-square test at a 5% significance level ($\alpha = 0.05$)³⁴ to assess the association between the independent variables and stunting prevalence. Spatial analysis was carried out to identify the distribution pattern of stunting prevalence geographically in Lampung Province using Quantum GIS software. This research received ethical approval from the Health Research Ethics Committee, Malahayati University (Approval No: 5190/EC/KEP UNMAL/II/2026).

Results

Respondent characteristics

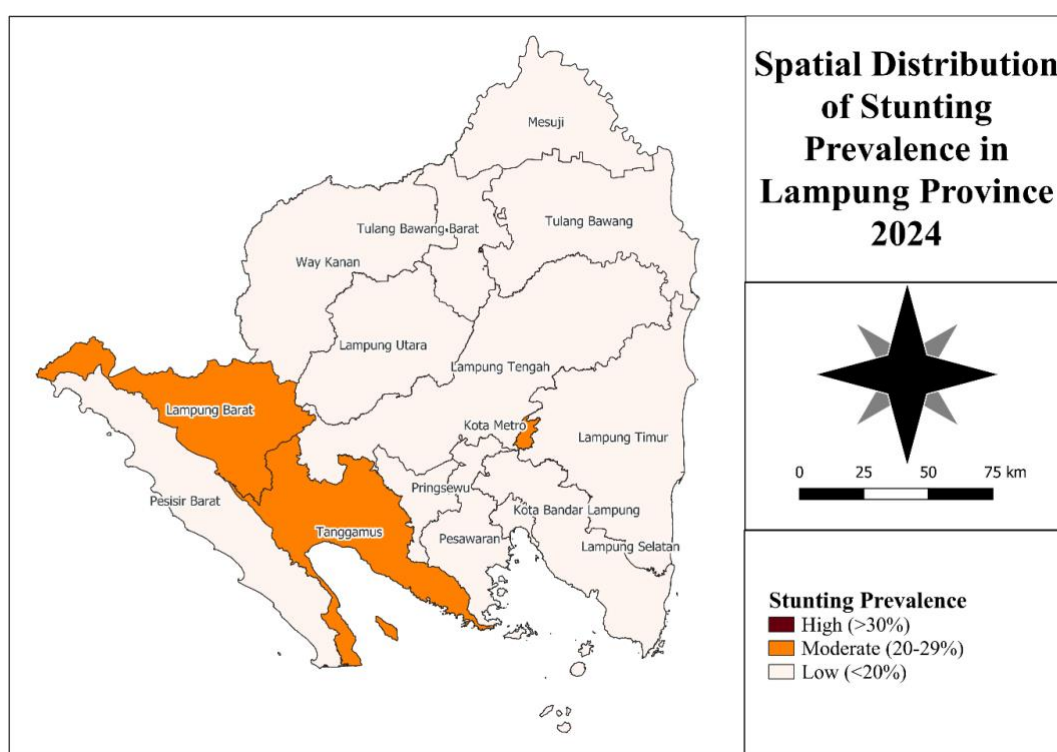
Table 1 presents the characteristics of the 2,778 children under five included in this study. The proportion of children under five who were stunting at 15.3% and those who were not stunting at 84.7%. The majority of children under five received exclusive breastfeeding (92.6%), while a small percentage did not receive exclusive breastfeeding (7.4%). Based on birth weight, most children under five have a NBW (94.6%), while 5.4% are classified as LBW. In addition, the majority of mothers were in the non-risk age (68.4%), while 31.6% were in the risk age.

**Table 1.** Characteristics of respondents

Variable	Result
Stunting	
Not Stunting	2,354 (84.7%)
Stunting	424 (15.3%)
Exclusive Breastfeeding	
Exclusive Breastfeeding	2,573 (92.6%)
Not Exclusive Breastfeeding	205 (7.4%)
Birth Weight	
Normal Birth Weight	2,629 (94.6%)
Low Birth Weight	149 (5.4%)
Mother's Age	
Non Risk Age	1,899 (68.4%)
Risk Age	879 (31.6%)

Spatial distribution of stunting prevalence in Lampung province, 2024

Figure 1 presents the spatial distribution of stunting prevalence in Lampung Province in 2024. The classification of stunting prevalence was based on height-for-age anthropometric measurements according to the standards established by the Ministry of Health and the WHO. Based on the results of the analysis, it shows that the areas that experience the most stunting prevalence are in Metro City and the least are in Mesuji Regency.

**Figure 1.** Spatial distribution of stunting prevalence in Lampung province 2024



The prevalence of stunting in districts/cities in Lampung Province, there are no areas that are included in the high category. Based on the classification of stunting prevalence according to the WHO, there are three areas that are included in the medium category (20-29%), namely Metro City with a stunting prevalence of 20.8%, Tanggamus Regency of 21.9% and West Lampung Regency of 22.2%. Most of the other districts/cities are in the low category (<20%). The results show spatial variation in stunting prevalence in Lampung Province. Metro City recorded the highest stunting prevalence (20.8%), while Mesuji Regency had the lowest prevalence. Based on the WHO classification, no regency/city was categorized as having a high prevalence of stunting. Three areas were classified as having a moderate prevalence (20–29%), namely West Lampung Regency (22.2%), Tanggamus Regency (21.9%), and Metro City (20.8%). The remaining regencies/cities were classified as having a low prevalence of stunting (<20%).

Spatial pattern of the relationship between exclusive breastfeeding and stunting prevalence in Lampung province in 2024

In **Figure 2**, the map shows that the areas of Bandar Lampung City, West Lampung Regency, East Lampung Regency, Mesuji Regency, Pesawaran Regency, West Tulang Bawang Regency, Way Kanan Regency, Central Lampung Regency, Pringsewu Regency, Tulang Bawang Regency, South Lampung and Metro City have a $P < 0.05$, which means that the region has a relationship between the exclusive breastfeeding variable and stunting prevalence.

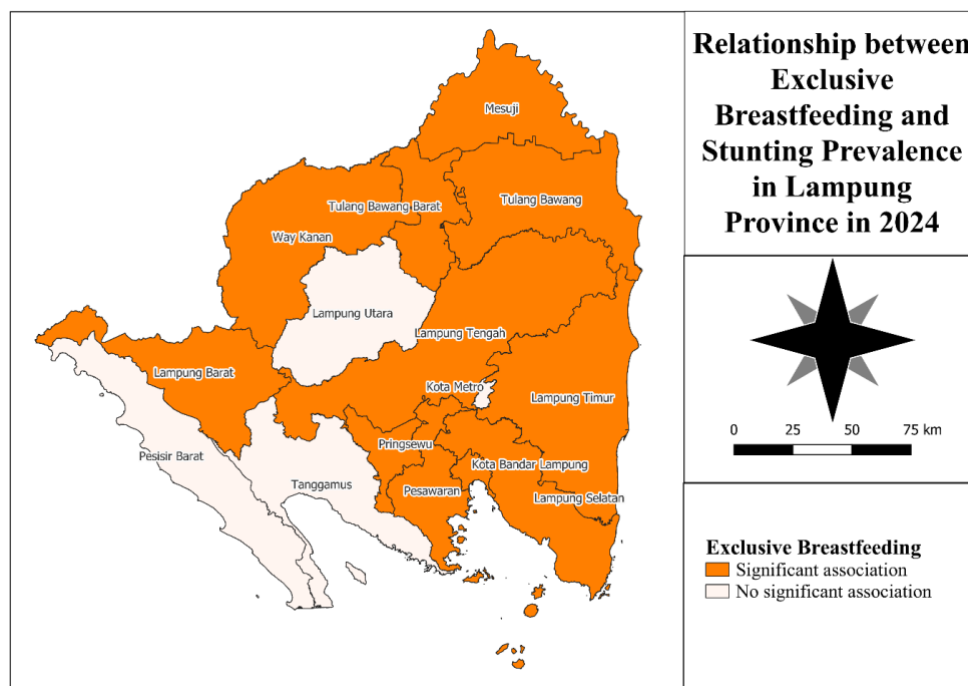


Figure 2. Spatial pattern of the relationship between exclusive breastfeeding and stunting prevalence in Lampung province in 2024



Spatial pattern of the relationship between birth weight and stunting prevalence in Lampung province in 2024

Figure 3 shows that the areas of West Coast Regency, West Lampung Regency, and East Lampung Regency have a $P < 0.05$, which means that the area has a relationship between the birth weight variable and the prevalence of stunting.

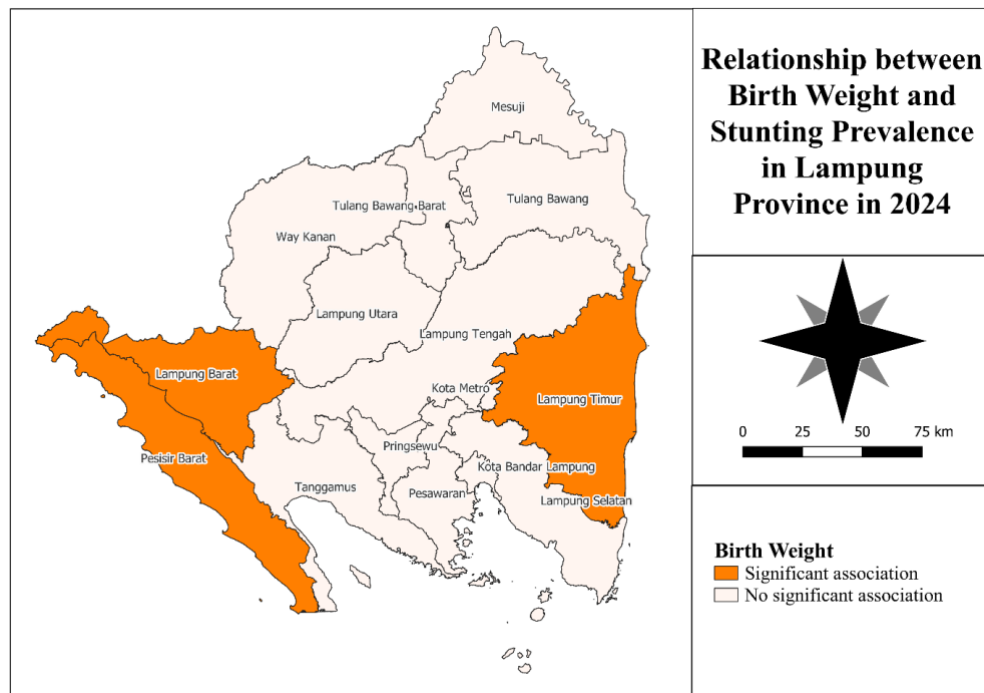


Figure 3. Spatial pattern of the relationship between birth weight and stunting prevalence in Lampung province in 2024

Spatial patterns of the relationship between maternal age and stunting prevalence in Lampung province in 2024

The map shows that the Central Lampung Regency area has a $P < 0.05$, which means that the region has a relationship between the maternal age variable and the prevalence of stunting.

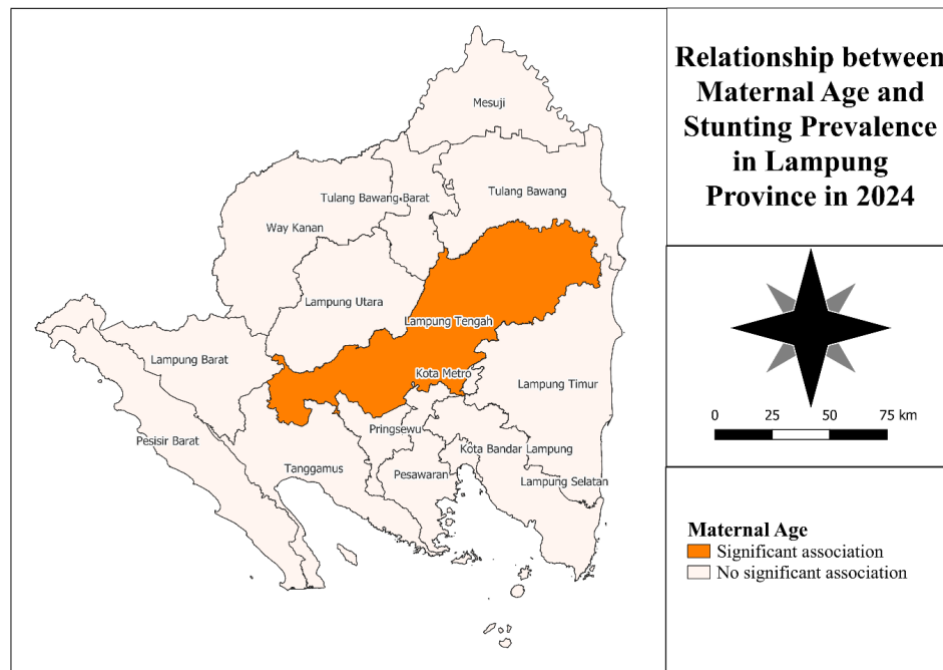


Figure 4. Spatial patterns of the relationship between maternal age and stunting prevalence in Lampung province in 2024

Discussion

This study shows that of the total 2,778 children under five studied, the majority are not stunted, namely 2354 children under five (84.7%). Meanwhile, there are 424 children under five (15.3%) who are stunted. Based on the stunting prevalence classification, there are three areas that are included in the medium category, namely Metro City with a stunting prevalence of 20.8%, Tanggamus Regency at 21.9% and West Lampung Regency at 22.2%. Most of the other districts/cities fall into the low category. The results of this study show that although most of the children under five are not stunted, although most children under five were not stunted, the stunting prevalence of 15.3% remains a public health concern because stunting can have long-term effects on human capital.³⁵ Children who experience stunting not only experience physical growth inhibitions, but are also at risk of cognitive development disorders, decreased learning ability, and lower productivity in adulthood.³⁶

In this study, most children under five had received exclusive breastfeeding. Areas that have a significant relationship between exclusive breastfeeding and stunting prevalence are Bandar Lampung City, West Lampung Regency, East Lampung Regency, Mesuji Regency, Pesawaran Regency, West Tulang Bawang Regency, Way Kanan Regency, Central Lampung Regency, Pringsewu Regency, Tulang Bawang Regency, South Lampung and Metro City. Children under five who do not receive exclusive breastfeeding are more likely to experience inadequate nutrient intake during the critical first six months of life, a period characterized by rapid growth and development.³⁷ Breast milk provides essential nutrients, including high-quality proteins, fats, carbohydrates, vitamins, and minerals that support optimal physical growth.³⁸ Exclusive breastfeeding for the first six months is recommended because breast milk alone is sufficient to meet an infant's nutritional and physiological needs during this period. Frequent infections and inadequate nutrient intake during early life may impair linear growth and increase the risk of growth



faltering. Consequently, children who do not receive exclusive breastfeeding may be more susceptible to chronic undernutrition, which can contribute to the development of stunting.³⁹ The results of this study are in accordance with research conducted by Fesliria which shows that there is a significant relationship between exclusive breastfeeding and the occurrence of stunting.⁴⁰ Children under five who do not receive exclusive breastfeeding have a 2.28 times higher risk of experiencing stunting compared to children under five who receive exclusive breastfeeding.

In the birth weight variable, it was found that most of the children under five had normal birth weight. Areas that have a significant relationship between the birth weight and the prevalence of stunting are West Coast Regency, West Lampung Regency, and East Lampung Regency. Children born with LBW are at greater risk of developing stunting because LBW reflects suboptimal fetal growth and inadequate nutritional conditions during pregnancy.⁴¹ Although stunting is assessed after birth and is influenced by postnatal factors, growth restriction that occurs during the intrauterine period may have long-term consequences for a child's growth trajectory. Infants with LBW often have reduced nutrient reserves, impaired organ development, and a lower capacity for catch-up growth compared with infants born at normal weight.⁴² If adequate nutrition and health care are not provided during infancy and early childhood, these initial growth deficits may persist and contribute to impaired linear growth. Therefore, low birth weight can be considered an early indicator of vulnerability to stunting, linking adverse intrauterine conditions with subsequent growth failure during childhood. The results of this study are in accordance with research conducted by Kinaya Pranindita dan Hary Cahyati, which showed that a history of low birth weight has a significant relationship with the prevalence of stunting.²⁹

Mothers who become pregnant during adolescence (<20 years) are still undergoing their own physical growth and development, resulting in competition for nutrients between the mother and the fetus. This condition may increase the risk of inadequate fetal growth, low birth weight, and poor nutritional status at birth, which are recognized risk factors for stunting. Conversely, pregnancies at advanced maternal age (>35 years) are associated with a higher risk of pregnancy complications, such as hypertension and placental insufficiency, which may impair fetal growth and development.⁴³ Therefore, maternal age can affect child nutritional outcomes through its influence on fetal growth, birth outcomes, and the quality of postnatal care, ultimately increasing the risk of stunting.⁴⁴ The area that has a significant association between maternal age and stunting prevalence is Central Lampung Regency. The results of this study are in accordance with research conducted by Nuridah Hasrun⁴⁵ which shows that there is a significant relationship between maternal age and the emergence of stunting in children under five. The study showed that 35-year-old mothers were more likely to have children who were stunted than mothers between the ages of 20 and 35, as evidenced by a P 0.015. Click or tap here to enter text.

One limitation of this study was the substantial amount of missing data, which reduced the final sample size after data cleaning and may have introduced selection bias. Furthermore, although the INSS dataset contains numerous variables that may be associated with stunting prevalence, this study focused on exclusive breastfeeding, birth weight, and maternal age because these variables had relatively complete data and were considered relevant to the study objectives.



Conclusion

This study shows that most of the children under five in Lampung Province do not experience stunting, with the highest prevalence in Metro City and the lowest in Mesuji Regency. Most of the children under five have received exclusive breastfeeding, and there is a significant relationship between exclusive breastfeeding and stunting prevalence, with a significant regional distribution in several districts/cities in Lampung Province. In addition, the majority of children under five have normal birth weight, and the weight birth is significantly related to the prevalence of stunting, especially in West Coast Regency, West Lampung, and East Lampung. Maternal age also shows a significant relationship with stunting prevalence, with significant areas in Central Lampung Regency. Overall, exclusive breastfeeding factors, birth weight, and maternal age play a role in stunting prevalence in Lampung Province in 2024.

Conflict of interest

The authors declared no conflict of interest regarding this article.

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Author Contributions

FES: Conceptualization, data acquisition, formal analysis, interpretation of results, drafting the manuscript, and final approval of the version to be published; RY: Supervision, critical revision of the manuscript, interpretation of data, and final approval of the version to be published; AMS: Conception and design of the study, critical revision of the manuscript for important intellectual content, and final approval of the version to be published.

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