Overview of the Distribution Pattern of Stunting Toddlers in Pesawaran Regency, Lampung Province

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Abstract: Stunting is a chronic malnutrition condition accompanied by disease complications that are still a serious health problem in Indonesia. Based on the 2022 National Nutrition Status Survey (SSGI), the prevalence of stunting in Indonesia reached 21.6%, down from 24.4% in the previous year, but still far from the 2024 target of 14%. Pesawaran Regency in Lampung Province has the highest prevalence (25.1%), while Central Lampung Regency has the lowest prevalence (8.7%). Stunting is detrimental in the short and long term and starts from the nutritional status of the mother during pregnancy to the age of the child under 2 years old. Nutritional counseling for pregnant women and maternal and child health services is very important in preventing stunting. The distribution of stunting cases is not arbitrary and tends to form groups in certain areas. In Pesawaran Regency, stunting cases are spread across 11 sub-districts with different performance coverage results, influenced by the location of the region. Nearest Neighbor Analysis is used to understand this distribution pattern. The results of the analysis show a highly grouped distribution pattern with statistically significant values, indicating the specific factors that led to this grouping. Factors that contribute to stunting grouping include socio-economic, environmental, health and nutrition, educational, and cultural factors. These factors include limited access to resources, poor housing and sanitation conditions, lack of nutritional intake, limited access to health services, maternal knowledge of nutrition, and traditional practices or local beliefs. Understanding these factors is important for designing appropriate and effective interventions to reduce stunting rates in the region..

1 INTRODUCTION

Stunting is a chronic malnutrition condition accompanied by complications of infectious diseases and is still a serious health problem faced by Indonesia [1]. Based on data from the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in Indonesia is 21.6%, this figure decreased compared to the previous year (24.4%). However, this figure is still high, considering the stunting prevalence target in 2024 of 14%. According to SSGI 2022, Pesawaran Regency is the district with the highest prevalence (25.1%) in Lampung Province [2], [3], [4].

Stunting has a bad impact, both short-term and long-term [5]. The stages of a child becoming stunted start from the nutritional status of the mother during pregnancy to the nutritional status of a 2-year-old child [6], [7], [8]. Nutritional counseling services for mothers play an important role during pregnancy for the fetus and the child being born [9], [10]. Maternal and child health services are an effective program to prevent stunting [11]. The services provided are in the form of energy and nutrition intake as well as treatment of infectious diseases in pregnant women and children under 2 years old, the distance between the toddler's home and health service facilities is also an important factor for prevention efforts [12][13]

Factors that affect the incidence of stunting can be influenced by regional, geographical, and even demographic factors of an area and are not scattered randomly [14]. However, stunting cases tend to form groups in certain locations. Cases of stunting of toddlers in Pesawaran Regency in 2022 are spread across 11 sub-districts in 15 health centers [3]. Each region has different performance coverage results; Several factors are also influenced by the location of the region [15], [16]. Health problems are the same health events that occur in the same area and time, so they contain important significance in a health data analysis [17].

Nearest neighbor analysis is a spatial statistical method used in various contexts of health problems to identify relationships or patterns in data that have a certain distance factor or physical similarity in

common. This method is often used in a variety of disciplines, including health sciences and others. In this analysis, there are several important parameters, such as the observed mean distance, the expected average distance, the ratio of the nearest neighbors, and the z-score and p-value, to measure the statistical significance of the results obtained. By understanding these parameters, we can assess distribution patterns more accurately and provide more precise recommendations based on the findings of the analysis. From the description above, it is necessary to analyze the distribution pattern of stunting cases using the analysis of the nearest neighbors in Pesawaran Regency. How is the distribution pattern of stunting areas and health service indicators using the analysis of the nearest neighbors for stunting prevention in Pesawaran Regency[18]. The purpose of this study is to find out and explain the distribution pattern of stunting cases for stunting prevention by the Pesawaran local government.

2 METHOD

The research location is in all government work areas of Pesawaran Regency, Lampung Province. The type of research uses a qualitative analysis approach to analyze the distribution pattern of stunting areas using the ArcGIS application.

The subjects of this study were all stunted toddlers, with the source of coordinate points measured by trained surveyors using GPS tools and additional information from interviews with parents of toddlers. To complete other information, interviews with the community, community leaders, village leaders, health workers and health cadres. The number of samples from all stunted toddlers. Data collection was carried out by a team of local health worker enumerators who had been trained by the research team to fill out questionnaires and GPS sets.

3 DISCUSSION

Pesawaran Regency is part of Lampung Province. Astronomically, it is located between 104.92° — 105.34° East Longitude (E) and 5.12° — 5.84° South Latitude (LS), with an area of about 4,077.47km². Pesawaran Regency has a tropical climate with an average rainfall of 23-312 mm, air temperature ranging from 26.05-27.47 °C, and air humidity between 80.37-87.51%. This regency consists of 11 sub-districts and 148 villages and has three islands, namely Legundi Island, Pahawang Island, and Kelagian Island. In addition, there are several mountains in the region, with Mount Pesawaran in Padang Cermin District being the highest, reaching a height of 1,604 m. The longest river is Way Semah, with a length of 54 km and a watershed of 135.0 km². The contours of the Pesawaran Regency area vary, ranging from coastal areas to hills. A total of four sub-districts are located in the coastal area, namely Punduh Pidada District, Marga Pundun District, Padang Cermin District, and Teluk Pandan District. Punduh Pidada District has the highest number of islands, reaching 29 islands [19].

Health facilities are places used to provide health services, in the form of hospitals, maternity homes, health centers with inpatient care, health centers without hospitalization, additional health centers, polyclinics/treatment centers, doctor's practice places, maternity homes, midwifery practices, village health posts (poskesdes), village maternity homes (polindes), pharmacies, and posyandu. The number of health centers in Pesawaran Regency until the end of 2024 is 15 health centers. Puskesmas are spread across 11 sub-districts with a total of 9 inpatient health centers and 6 non-inpatient health centers [20].

Figure 1 below is a map of the distribution of stunting by population in Pesawaran Regency, Lampung Province in 2024. This map uses the Universal Transverse Mercator (UTM) projection system zone 48S with the 1984 datum. Provincial, county, and sub-district boundaries are marked on a map, along with rivers, provincial roads, and the sea. Several symbols are used to mark stunting points in various sub-districts. The sub-districts included in the map include Tegineneng, Negerikaton, Gedong Tataan, Way Lima, Way Khilau, Kedondong, Way Ratai, Padang Cermin, Teluk Pandan, Marga Punduh, Marga Punduh, and Punduh Pidada. The insert map in the lower right corner shows the location of Pesawaran Regency in the context of Lampung Province.

Figure 1 explains the analysis of the relationship between population density and the distribution of stunted toddlers in Pesawaran Regency in 2024 in the Dense Zone (Red) of sub-districts with high population density, such as Gedong Tataan, Way Lima, Kedondong, Negeri Katon, and Tegineneng

which shows the number of stunted toddlers. In the Medium (Yellow) zone, Padang Cermin, Punduh Marga, and Punduh Pidada Districts have a moderate population density and also show several stunting spots for toddlers. Areas with low population density, such as in the southern part of Pesawaran Regency, have fewer stunting points.

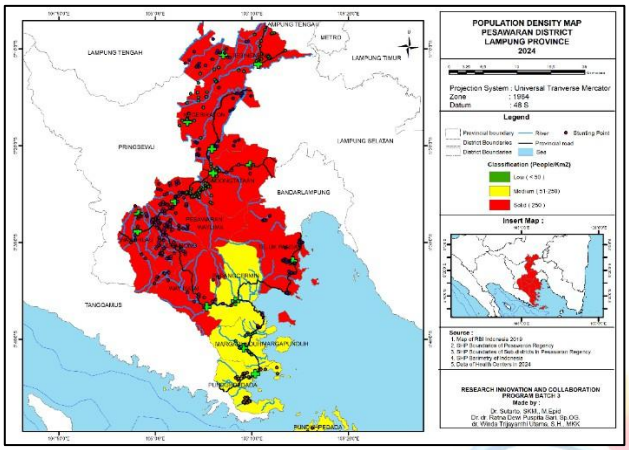

Fig. 1 Distribution Map of Stunting Toddlers Based on Population Density

Furthermore, figure 2 explains the relationship between the distribution of stunted toddlers and the height of the place. The highlands (>700 MDPL) are highland areas with high population density, not showing stunted toddlers. In the moderate plains (400-700 MDPL), some parts of the area show the presence of stunted toddlers, especially in high-density areas. Lowlands (<400 MDPL) are low-lying areas on the coast and south with low population densities that have more stunted toddlers.

Areas with low population density tend to have a higher number of stunted children under five years old. This may be due to limited resources and access to health services in densely populated areas. Areas with moderate population density also show stunting points in toddlers, which indicates that nutritional problems occur not only in very dense areas but also in areas with medium density [21], [22].

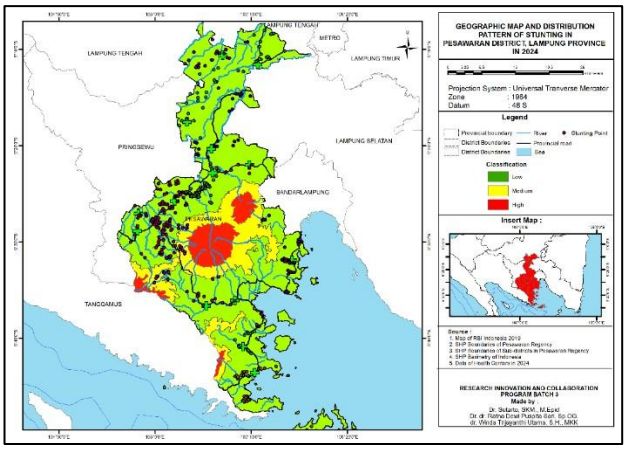

Fig. 2 Distribution Map of Stunting Toddlers Based on the Location Height of Pesawaran Regency in 2024

Areas with low population density show fewer stunting points for toddlers, which can indicate that these areas have better access to resources or do not face the same population pressures as denser areas. Factors that affect the distribution of stunting include limited uneven access to health services in densely populated areas, which can exacerbate the stunting problem. Socio-economic factors also play an important role in the spread of stunting. Areas with high poverty rates may face greater challenges in providing adequate nutrition for children [23], [24].

The availability of infrastructure such as clean water, sanitation, and health facilities can affect the distribution of stunted toddlers. Underdeveloped areas may face more problems related to malnutrition. The map above shows that there is a significant relationship between population density and the distribution of stunted toddlers in Pesawaran Regency. Areas with high population density tend to have more stunting cases, which may be caused by various factors such as access to health services, socioeconomic conditions, and infrastructure. This analysis can be used to formulate more effective policies and interventions to address nutrition problems in the region [25], [26], [27].

The spatial distribution of points within an area can provide important insights into the patterns that exist within them. The results of the analysis of the nearest neighbor are obtained in Figure 3. By looking at Figure 3 to understand the distribution of stunting balta points forming cluster groups. In this context, the data collection of distribution points for stunted toddlers in locations in the Pesawaran Regency area.

Figure 3 is the result of a spatial analysis that measures the distribution pattern of points in Pesawaran Regency using the Nearest Neighbor Analysis method. This analysis compares the observed mean distance between the points in the dataset to the expected average distance in a random distribution.

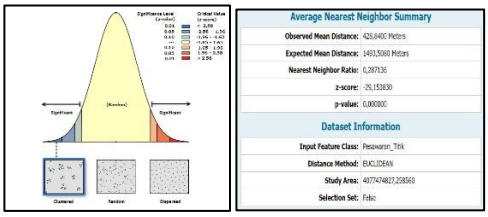

Fig. 3 Results of Analysis of Nearest Neighbors at the Pesawaran Regency Level in 2024

Figure 3, explains that the average distance observed is 428.84 meters, which is the actual average distance between each stunting toddler point in the data set. The expected average distance is 1493.5080 meters. This is the expected average distance at the points of stunted toddlers randomly scattered within the study area. The nearest neighbor ratio is 0.287136, this data provides information that the ratio of comparison between the observed distance and the expected distance. A value of less than 1 indicates a distribution pattern that tends to be very grouped, while a value of more than 1 indicates a scattered distribution pattern. The z-score value is -29.153830. Measuring the distance between the coordinate points of stunted toddlers and the data observed to deviate from normal distribution and have a very large and negative value indicates that the distribution of coordinate points of stunted toddlers is in groups. The p-value of 0.0001 is the statistical significance value of the analysis results. A very small p-value (less than 0.05) indicates that the observed outcome is highly unlikely to occur by chance, resulting in a very clustered and very statistically significant distribution [28].

The research area is about 4,077.47 km2, based on the analysis of stunting incidence points in Pesawaran Regency, showing a very grouped distribution pattern with the average distance observed much smaller than expected than random distribution. These results are statistically significant, suggesting that the distribution of these clusters is not a coincidence. This can indicate the existence of certain factors that cause the grouping of points in the region. This data is not a coincidence and can be indicated by certain factors that cause the grouping of points in the region. Some factors that can contribute to the grouping of stunting events are socio-economic factors, including limited access to resources in areas with high poverty rates may have limited access to essential resources such as nutritious food, health services, and education. This limitation can lead to an increase in stunting incidence in the region. Low-income families may not be able to provide nutritious food and adequate health services for their children, contributing to high stunting rates [23], [24].

Environmental factors, such as poor access to clean water and sanitation, can lead to diseases that interfere with nutrient absorption in toddlers, ultimately leading to stunting. Poor housing conditions, including high population density, can also contribute to the spread of diseases that impact children's health. Health and Nutrition Factors: children who do not get adequate nutritional intake during their critical growth period are at higher risk of stunting. Areas with limited access to health services tend to have higher rates of stunting because children do not get the care they need for healthy growth [27].

Educational factors, low-educated mothers may have limited knowledge about child nutrition and health, which affects their ability to provide adequate nutrition and health services for their children. The level of public awareness about the importance of nutrition and child health can affect the parenting and diet of children in the region. Cultural factors, some traditional practices, or local beliefs can influence children's diets and health care, which can contribute to stunting [29], [30], [31], [32].

The distribution of stunting incidence groups in Pesawaran Regency shows that certain factors affect this pattern significantly. Socio-economic, environmental, health, educational, and cultural factors play an important role in determining the distribution pattern of stunting. Understanding these factors is important for designing appropriate and effective interventions to reduce stunting rates in the region.

4 CONCLUSIONS

Pesawaran Regency in Lampung Province faces serious challenges related to the spread of stunting in toddlers, which can be seen from the distribution pattern that is very grouped in various sub-districts.

Data shows that areas with high population density, such as Gedong Tataan and Way Lima, have a higher number of stunted children under five, especially in lowland and moderate areas. The main factors affecting the distribution of stunting include unequal access to health services, socio-economic conditions, limited infrastructure, and public education and awareness about the importance of nutrition.

Analysis of the nearest neighbors showed that the stunting points clustered significantly, not coincidentally, with the observed mean distance much smaller than expected on the random distribution. Environmental factors, such as access to clean water, sanitation, and housing conditions, also play a role in the increase in stunting rates in this region. In addition, the low education of mothers and cultural factors also affect the distribution pattern of stunting. Therefore, effective interventions need to consider socio-economic, health, environmental, and educational factors to reduce the prevalence of stunting in Pesawaran Regency.

REFERENCES

H. Khoeroh, O. W. K. Handayani, and D. R. Indriyanti, "Evaluasi Penatalaksanaan Gizi Balita Stunting di Wilayah Kerja Puskesmas Sirampog," Unnes Journal of Public Health, vol. 6, no. 3, 2017, doi: 10.15294/ujph.v6i3.11723.

Kementerian Kesehatan Republik Indonesia, "Buku Saku Hasil Studi Status Gizi Indonesia (SSGI) tingkat Nasional tahun 2021," Jakarta, 2021.

Kementerian Kesehatan Republik Indonesia, "Pedoman Nasional Pelayanan Kedokteran Tata Laksana Stunting," Indoensia, pp. 1–52, 2022.

Kementerian Kesehatan RI, Hasil Survei Status Gizi Indonesia (SSGI) 2022. Jakarta, 2023.

S. Sutarto, A. D. N. Yadika, and R. Indriyani, "Analisa Riwayat Pemberian ASI Eksklusif dengan Stunting pada Balita Usia 24-59 Bulan di Wilayah Kerja Puskesmas Way Urang Kabupaten Lampung Selatan," Jurnal Kesehatan Masyarakat Indonesia, vol. 16, no. 3, 2021, doi: 10.26714/jkmi.16.3.2021.148-153.

W. Widiantini and Z. Tafal, "Aktivitas Fisik, Stres, dan Obesitas pada Pegawai Negeri Sipil," Kesmas: National Public Health Journal, no. 4, p. 325, 2014, doi: 10.21109/kesmas.v0i0.374.

K. M. Harper, M. Mutasa, A. J. Prendergast, J. Humphrey, and A. R. Manges, "Environmental enteric dysfunction pathways and child stunting: A systematic review," PLoS Negl Trop Dis, vol. 12, no. 1, pp. 1–23, 2018, doi: 10.1371/journal.pntd.0006205.

C. A. Safitri and T. S. Nindya, "Hubungan ketahanan pangan dan penyakit diare dengan stunting pada balita 13-48 bulan di Kelurahan Manyar Sabrangan, Surabaya," Jurnal Amerta Nutrition, vol. 1, no. 2, pp. 52–61, 2017, doi: 10.20473/amnt.v1i2.2017.52-61.

B. L. Horta and C. G. Victora, "Short-term effects of breastfeeding: a systematic review on the benefits of breastfeeding on diarrhoea and pneumonia mortality," World Health Organization, pp. 1–54, 2013.

World Health Organization, Scalling up nutrition. 2013.

S. C. Vir, "Improving women's nutrition imperative for rapid reduction of childhood stunting in South Asia: Coupling of nutrition specific interventions with nutrition sensitive measures essential," Matern Child Nutr, vol. 12, no. Suppl. 1, pp. 72–90, 2016, doi: 10.1111/mcn.12255.

E. M. Sari, M. Juffrie, N. Nurani, and M. N. Sitaresmi, "Asupan protein, kalsium dan fosfor pada anak stunting dan tidak stunting usia 24-59 bulan," Jurnal Gizi Klinik Indonesia, vol. 12, no. 4, pp. 152–159, 2016, doi: 10.22146/ijcn.23111.

I. Purnamasari, F. Widiyati, and M. Sahli, "Analisis Faktor Risiko Yang Mempengaruhi Kejadian Stunting Pada Balita Info Artikel Abstrak," Jurnal Penelitian dan Pengabdian Kepada Masyarakat UNSIQ, vol. 9, no. 1, pp. 48–56, 2022.

P. A. B. Putra and N. L. P. Suariyani, "Pemetaan Distribusi Kejadian Dan Faktor Risiko Stunting Di Kabupaten Bangli Tahun 2019 Dengan Menggunakan Sistem Informasi Geografis," Archive of Community Health, vol. 8, no. 1, p. 72, 2021, doi: 10.24843/ach.2021.v08.i01.p06.

N. K. Aryastami and R. Mubasyiroh, "Peran Budaya dalam Pemanfaatan Layanan Kesehatan Ibu Hamil," no. November, pp. 1–7, 2019.

D. Izwardy, "Studi Status Gizi Balita," 2020.

T. D. Harjanto, A. Vatresia, and R. Faurina, "Analisis Penetapan Skala Prioritas Penanganan Balita Stunting Menggunakan Metode DBSCAN Clustering (Studi Kasus Data Dinas Kesehatan Kabupaten Lebong)," Rekursif: Jurnal Informatika, vol. 9, no. 1, pp. 30–42, 2021, doi: 10.33369/rekursif.v9i1.14982.

M. Kulldorff, SaTScan User Guide 8.0, no. July. 2021.

Sugiarto, Kabupaten Pesawaran Dalam Angka 2024, 1st ed., vol. 1. GedongTataan: BadanStatisyikPesawaran, 2024.

Media Apriliana, Profil Kesehatan Pesawaran 2023, 1st ed., vol. 1. GedongTataan: Dinas Kesehatan Pesawaran, 2024.

M. Anismuslim, H. Pramoedyo, S. Andarini, and . Sudarto, "Modeling of Risk Factors of Childhood Stunting Cases in Malang Regency using Geographically Weighted Regression (GWR)," Open Public Health J, vol. 16, no. 1, 2023, doi: 10.2174/18749445-v16-e230420-2022-165.

Jusni, Arfiani, and Mudyawati Kamaruddin, "Geospatial Analysis On Stunting Prevalence And Strategies," Comprehensive Health Care, vol. 7, no. 1, 2023, doi: 10.37362/jch.v7i1.963.

K. A. Atalell, M. A. Techane, B. Terefe, and T. T. Tamir, "Mapping stunted children in Ethiopia using two decades of data between 2000 and 2019. A geospatial analysis through the Bayesian approach," J Health Popul Nutr, vol. 42, no. 1, 2023, doi: 10.1186/s41043-023-00412-3.

"The spatial econometrics of stunting toddlers in Nusa Tenggara Timur Province 2019," Communications in Mathematical Biology and Neuroscience, 2021, doi: 10.28919/cmbn/6584.

H. Fithra and D. Siska, "The correlation between environmental sanitation and stunting case in Pidie District," Int J Adv Sci Eng Inf Technol, vol. 10, no. 3, 2020, doi: 10.18517/ijaseit.10.3.11445.

N. Nizaruddin and M. I. Ilham, "The Effect of Sanitation on Stunting Prevalence in Indonesia," Populasi, vol. 30, no. 2, 2022, doi: 10.22146/jp.80186.

T. A. E. Permatasari, Y. Chadirin, Ernirita, F. Elvira, and B. A. Putri, "The association of sociodemographic, nutrition, and sanitation on stunting in children under five in rural area of West Java Province in Indonesia," J Public Health Res, vol. 12, no. 3, 2023, doi: 10.1177/22799036231197169.

Mutammimul Ula, Ananda Faridhatul Ulva, Ilham Saputra, Mauliza Mauliza, and Ivan Maulana, "Implementation of Machine Learning Using The K-Nearest Neighbor Classification Model in Diagnosing Malnutrition in Children," Multica Science And Technology (MST) Journal, vol. 2, no. 1, 2022, doi: 10.47002/mst.v2i1.326.

Kasmita, N. Tasrif, and T. D. Santi, "Stunting in Toddlers (6-60 Months): Parenting, Mother's Education, Infectious Diseases, and Breastfeeding," Kemas, vol. 18, no. 4, 2023, doi: 10.15294/kemas.v18i4.41433.

A. A. Rahmah, D. I. Yani, T. Eriyani, and L. Rahayuwati, "Correlation Mother's Eduaction and Received Stunting Information with Mother's Stunting Knowledge," Journal of Nursing Care, vol. 6, no. 1, 2023, doi: 10.24198/jnc.v6i1.44395.

A. A. Rahmah, D. I. Yani, T. Eriyani, and L. Rahayuwati, "Hubungan Pendidikan Ibu Dan

Keterpaparan Informasi Stunting Dengan Pengetahuan Ibu Tentang Stunting," Journal of Nursing Care, vol. 6, no. 1, 2023.

B. R. Pratiwi and A. Muhlisin, "Pendidikan Kesehatan terhadap Tingkat Pengetahuan dan Sikap Ibu Hamil tentang Upaya Pencegahan Stunting," Jurnal Keperawatan Silampari, vol. 6, no. 2, 2023, doi: 10.31539/jks.v6i2.5778.