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The Effect of Sanitation Performance and Parental Livelihood on Stunting Severity: Study at 3 Ecological Zones at South Lampung Regency, Indonesia

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Abstract Severity of stunting is frequently associated as a result of the effects of environmental factors, such as ecological differences, poor quality sanitation, and potential effects on parental livelihood. Knowledge about the effect of sanitation and parental livelihood at three ecological zones on stunting severity at South Lampung Regency is unknown. The aim of this study is to determine the effect of ecological zones, sanitation performance, and parental livelihood on stunting severity in toddlers aged 0-59 months at South Lampung Regency, Indonesia. The cross-sectional study was conducted in a sample of 182 households that were spread over the hilly zone, 82 lowland zones, and 49 coastal zones at South Lampung Regency, Indonesia. Data were collected using a structured questionnaire that captured the sanitation performance and parental livelihood. Toddler's heights were measured using a standard procedure and categorized manually according to national references. The ordinal logistic regression model was used to claim the effect. The higher probability of toddlers to be stunting was found significant on lowland zone, coastal zone, and clean water from drilled wells source, while lower probability significant on gallon drinking water, standard latrines, wastewater sewerage construction materials from cement and pipes, managed solid waste, ventilation not all rooms, bright lighting in rooms, and father's livelihood as a civil servant and entrepreneur. Stunting severity at South Lampung Regency is affected by ecological zones, sanitation performance, and father's livelihood. The results of our study are expected to assist the government in developing appropriate stunting reduction policy programs, especially comprehensive intervention by adjusting the ecological zone.

Keywords Stunting Severity, Ecological Zone, Sanitation, Parental Livelihood, Toddler

1. Introduction

Stunting is a condition of diminished body growth which is classified as Length/Height for-age-Z-Score<-2 standard deviation (SD) for the "stunted" category and <-3 SD for the "severely stunted" category from the median length/height of national reference population [1]. Stunting as a benchmark for the human development index is common in various regions in developing countries [2], such as South Lampung Regency, Indonesia, and its vulnerability in toddlers, or early life ages [3]. Some of the factors that can cause stunting include poor nutrition, recurrent chronic infections, poor childcare and environmental health [4]. Stunting conditions also increase the risk of degenrative disease such as obesity and cardiometabolic disease, as well as cognitive impairment, low productivity and the quality of a country's competitiveness [5], [6]. Recent studies have shown that regional differences are important drivers of human body growth [7], as such differences can give different results to ecological zones, sanitation, and livelihoods [8], [9].

Macro-grouping of regions can be a public policy action to overcome stunting if the interzones are significantly different in affecting the incidence of stunting. Most studies examine the incidence of stunting in lowland and highland zones [10], [11]. Thus, no conclusions can be drawn yet and limited data on stunting in toddlers from three differences in ecological zones (i.e., toddlers living in the hilly, lowland, and coastal). In addition, ecological zoning will provide diversity and an overview of sanitation and livelihood patterns in a large area, so that the samples obtained can present the representation of research results to predict stunting in toddlers in South Lampung Regency.

Collectively, the sanitation-stunting relationship is a cause-and-effect relationship from pathogen infection through poor sanitation pathways so that toddlers are affected by nutrient deficiencies and their growth is hampered [12]. According to the 2022 WHO report, nearly half of ten people use inadequate sanitation services, and it estimated that 45% of household water is disposed of without safe sewerage [13]. Several literature studies based in Indonesia found that successive sanitation plays a role in affecting the growth of toddlers [14], [15]. In addition, sanitation research for the characteristics of wastewater sewerage construction materials, ventilation windows, and house lighting on stunting is rarely considered beforehand. Furthermore, parental livelihood can play an important role in affecting the family's economic needs, including infrastructure and the nutritional needs of toddlers. WHO shows that as many as 149.2 million (22%) toddlers are stunted, and 54% live in Asia. However, this data does not take into consideration the impact of the COVID-19 pandemic, which led to a sharp increase in the number of children with malnutrition due to decrease in the purchasing power of families toward nutritious food [16]. Stunting at South Lampung Regency has not reached 0% until 2021, with a total of 1,386 stunted cases and 354 severely stunted toddlers [17]. Stunting prevention is one of the programs in Indonesia as stipulated in Presidential Regulation 72 of 2021 concerning the Acceleration of Stunting Reduction.

In this study, we aim to determine the effect of ecological zones, sanitation performance, and parental livelihood on the severity of stunting in toddlers aged 0-59 months, with the hope of helping optimize the implementation of various programs that have been built by the government in an effort to encourage the handling of stunting cases and reduce stunting rates in South Lampung Regency. We hypothesize that ecological zones, sanitation performance, and parental livelihood have a significant effect on stunting incidence at South Lampung Regency.

2. Materials and Methods

2.1. Research Design, Sampling, and Settings

This research is a cross-sectional household survey conducted from July 2022 to August 2022 at South Lampung Regency (Figure 1). The subjects selected were 182 toddlers using a stratified random sampling technique while suited the eligibility criteria. South Lampung Regency can be divided into three strata within its ecological zone, namely hilly, lowlands, and coastal, due to topography, geography, and ecosystems (topographical and geographical division by the Government of the Republic of Indonesia [18], [19]. Because the hill zone is determined by three districts that have an altitude of +100 above sea level (masl), the other zones follow the number of districts in the zone, which is three districts each. Because the population varies greatly across the three zones, 51 (28%) toddlers were selected from the hilly zone (spread in Katibung, Merbau, Mataram, and Way Sulan districts), 82 (45%) from the lowland zone (spread in Natar, Penengahan, and Palas districts), and 49 (27%) from the coastal zone (spread in Bakauheni, Kalianda, and Rajabasa districts).

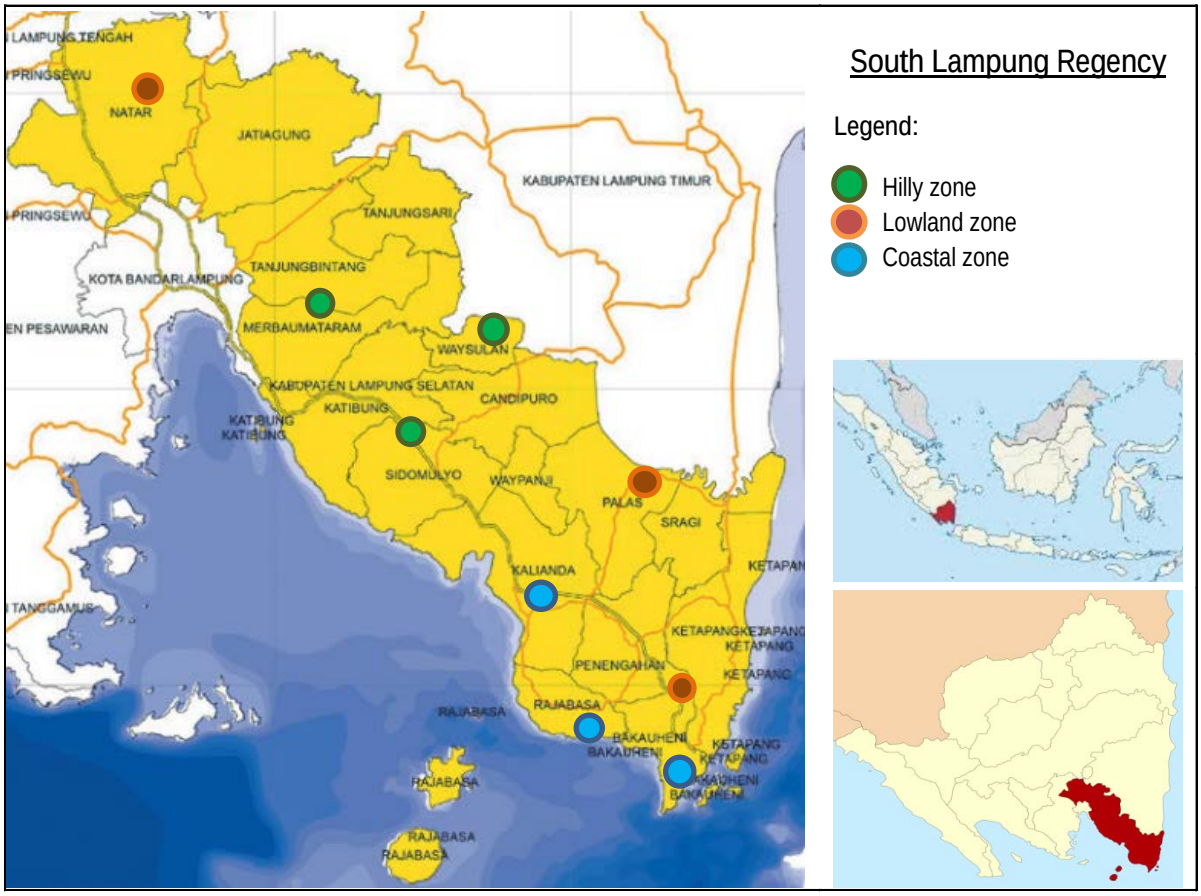

Figure 1. Research location (Source: Modified from Fitrah et al, 2020 [20]).

2.2. Respondents Eligibility Criteria

Toddlers aged 0-59 months with complete main family (father and mother) were included in this study. All mothers and toddlers with congenital abnormalities, illness, and/or toddlers whose families refused to participate were excluded from the study. The purpose, benefits, and flow of the research were explained to all respondents, and informed consent was obtained before the study.

2.3. Data Collection Method

A structured questionnaire was used to interview mothers of toddlers aged 0-59 months about their (mother and father) livelihoods and the mother's handwashing habit with soap before hand feeding their toddlers, also including documenting observations of household sanitation performance, the ecological zone, and the value of anthropometric measurements. Some situations during the collecting data are depicted in Figure 2.

Anthropometry of toddlers aged 0-59 months was measured manually using a SECA measuring instrument (210 measuring mat for length and 213 stadiometer for height) and classified using the length/height-for-age indicator based on the reference to the Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2020 about Child Anthropometry Standards, with four scales, which are severely stunted (<-3 SD), stunted (<-2 SD), normal (+3 SD), and tall (>+3 SD) based on the average length/height of the reference population [1]. Shoes are removed during length/height measurement. A toddler who could not stand alone was measured lying on his back on a flat base, while a toddler who was able to stand was measured while standing on a stadiometer. Measurements were recorded to the nearest 0.1 cm and carried out by the research team and assisted by village midwives or carried out by the research team and assisted by village midwives or other health workers.

Figure 2. (a) Interview, (b) Observation (c) Health Care Center (d) Antropometric measureament

2.4. Statistical Analysis

All data entry and analysis were performed using Minitab Version 16.2 (Minitab Inc., Sydney NSW, Australia, 2013). Ordinal logistic regression analysis was used to assess the potential factors of stunting with response variables using four scales, namely severely stunted, stunted, normal, and tall. Given a score of 0 if a sample is severely stunted, a score of 1 for stunted, a score of 2 if the sample is normal, and 3 if the sample is tall. The four possibilities were theorized as a result of each predictor variable of ecological zones, sanitation performance, and parental livelihood. The postulated model applied can be seen as follows:

$$\text{Ln}\frac{[P(Stunting)=1]}{1-[P(Stunting)=1]}_i = \beta_0 + \beta_1[\text{D1\_LOWLAND}]i + \beta_2[\text{D1\_COAST}]i + \beta_3[\text{D2\_DRILL\_WELL}]i + \beta_4[\text{D2\_MOUNT}]i + \beta_5[\text{D3\_DRINK\_WTR\_GLLN}]i + \beta_6[\text{D3\_DRINK\_WTR\_MOUNT}]i + \beta_7[\text{LATRINE}]i + \beta_8[\text{D4\_SWR\_BRICK}]i + \beta_9[\text{D4\_SWR\_CMNT}]i + \beta_{10}[\text{D4\_SWR\_PVC}]i + \beta_{11}[\text{D5\_FIRE}]i + \beta_{12}[\text{D5\_MNGED}]i + \beta_{13}[\text{D6\_CMNT}]i + \beta_{14}[\text{D6\_CRAMIC}]i + \beta_{15}[\text{D7\_NOT\_ARM}]i + \beta_{16}[\text{D7\_ARM}]i + \beta_{17}[\text{D8\_DIM}]i + \beta_{18}[\text{D8\_BRIGHT}]i + \beta_{19}[\text{WSH\_HND}]i + \beta_{20}[\text{D9\_FTH\_FARM}]i_i + \beta_{21}[\text{D9\_FTH\_LABOR}]i + \beta_{22}(\text{D9\_FTH\_CVIL\_SRVNT}]i + \beta_{23}[\text{D9\_FTH\_ENTRPRNR}]i + \beta_{24}[\text{D10\_MM\_FARM}]i_i + \beta_{25}[\text{D10\_MM\_LABOR}]i + \beta_{26}[\text{D10\_MM\_CVIL\_SRVNT}]i + \beta_{27}[\text{D10\_MM\_ ENTRPRNR}]i + \xi_i$$

In more detail, all the predictor variables in this analysis, with symbols in the model, measuring scale, methods of data collection and also their assessment are presented in Table 1. The results with p-value of <0.05 are considered to play a valid role in affecting stunting in toddlers aged 0-59 months.

Table 1. Predictor variables, symbol, measurement scale, collection method and as well as their scoring

Predictor Variables	Symbol	Measurement Scale	Data Collection Method	Data Scoring
1. Ecological Zones (Hills=0)		Nominal	Government data and information by health workers	
Dummy lowland	[D_1_LOWLAND]			=1 if lowland, =0 if other
Dummy coastal	[D_1_COAST]			=1 if coastal,=0 if other
2. Sanitation Performance				
Clean water source (*dug well=0*)		Nominal	Observation	
Dummy drilled well	[D_2_DRILL_WELL]			=1 if drilled well, =0 if other
Dummy mountain spring water	[D_2_MOUNT]			=1 if mountain spring water, =0 if other
Drinking water consumption (*well=0*)		Nominal	Observation	
Dummy gallon	[D_3_DRINK_WTR_GLLN]			=1 if gallon, =0 if other
Dummy mountain spring water	[D_3_DRINK_WTR_MOUNT]			=1 if mountain spring water, =0 if other
Family latrine (*non standard=0*)	[LATRINE]	Ordinal	Observation	=1 if standard latrine, =0 if other
Wastewater sewarage construction materials (*soil=0*)		Ordinal	Observation	
Dummy brick	[D_4_SWR_BRICK]			=1 if brick, =0 if other
Dummy cement	[D_4_SWR_CMNT]			=1 if cement, =0 if other
Dummy pipe	[D_4_SWR_PVC]			=1 if pipe, =0 if other
Solid waste treatment (*none=0*)		Ordinal	Observation	
Dummy collected and burned	[D_5_FIRE]			=1 if fire, =0 if other
Dummy collected and managed	[D_5_MNGED]			=1 if managed, =0 if other
House floor (*soil (none)=0*)		Ordinal	Observation	
Dummy cement	[D_6_CMNT]			=1 if cement, =0 if other
Dummy ceramic	[D_6_CRAMIC]			=1 if ceramic, =0 if other
House ventilation (window) (*none=0*)		Ordinal	Observation	
Dummy not all room	[D_7_NOT_ARM]			=1 if not all room, =0 if other
Dummy all room	[D_7_ ARM]			=1 if all room, =0 if other
House lighting during the day (*dark/can't read without lamp's lighting=0*)		Ordinal	Observation	
Dummy dim lighting	[D8_DIM]			=1 if dim lighting, =0 if other
Dummy bright lighting	[D8_BRIGHT]			=1 if bright lighting,=0 if other
Mother's handwashing habit with soap before hand feeding (*not always=0*)	[WSH_HAND]	Ordinal	Interview	=1 if always, =0 if other

Table 1. Continued

3. Parental Livelihood				
Father's livelihood (*none=0*)		Ordinal	Interview	
Dummy farmer	[D_9_FTH_FARM]			=1 if farmer, =0 if other
Dummy laborer	[D_9_FTH_LABOR]			=1 if laborer =0 if other
Dummy civil servant	[D_9_FTH_CVIL_SRVNT]			=1 if civil servant, =0 if other
Dummy entrepreneur	[D_9_FTH_ENTRPRNR]			=1 if entreprenuer, =0 if other
Mother's livelihood (*housewife=0*)		Ordinal	Interview	
Dummy farmer	[D_{10}_MM_FARM]			=1 if farmer, =0 if other
Dummy laborer	[D_{10}_MM_LABOR]			=1 if laborer =0 if other
Dummy civil servant	[D_{10}_MM_CVIL_SRVNT]			=1 if civil servant, =0 if other
Dummy entrepreneur	[D_{10}_MM_ENTRPRNR]			=1 if entreprenuer, =0 if other

2.5. Ethical and Participant Consent

Research ethics approval was approved by The Health Research Ethics Committee (reference letter no: 1995/UN.26.18/PP.05.02.00/2022) Faculty of Medicine, University of Lampung, starting July 2022. An informed written consent was obtained with the mother's signature of toddlers aged 0-59 months who participated in this study. The research permit has been received from the regency health office.

3. Results

3.1. Participants' Data Description

Data characteristics of the research variables were available for 182 household surveys with stunted and non-stunted toddlers aged 0-59 months spread over hilly, 82 lowland, and 49 coastal zones. Most of the nutritional status of toddlers based on LAZ/HAZ was normal (56%), followed by stunted (25.3%), severely stunted (17.6%), and the remaining 1.1% were toddlers in the tall category (Figure 3).

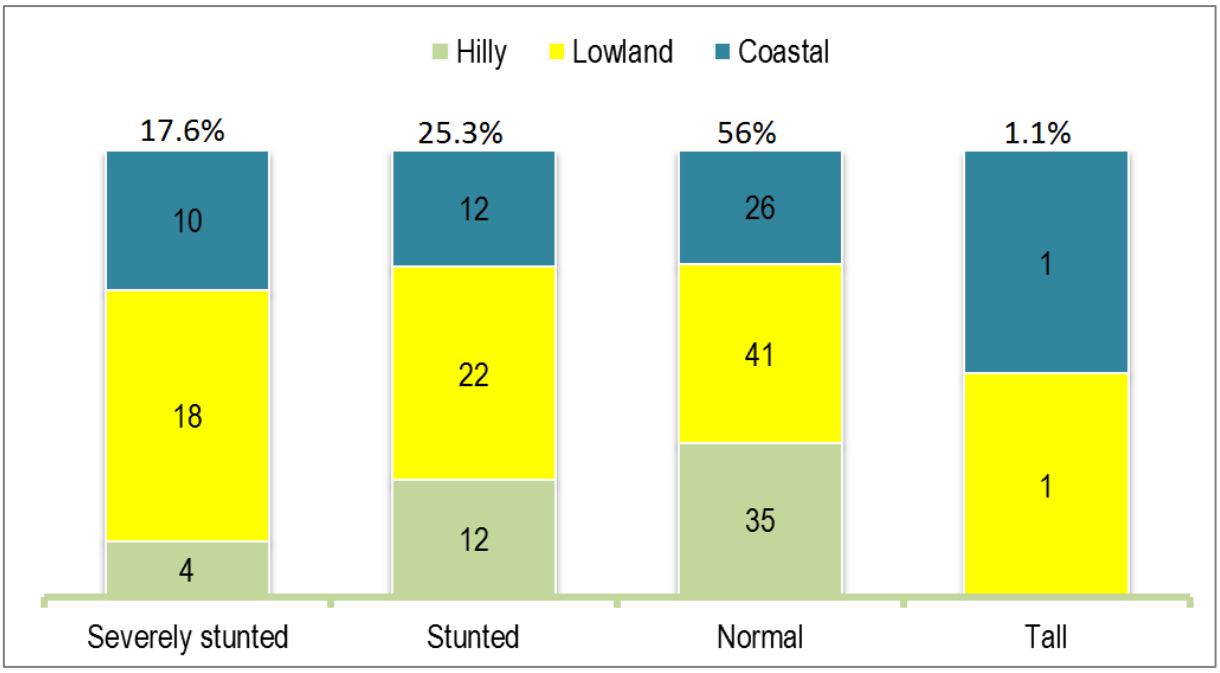

Figure 3. The frequency distribution of nutritional status in toddlers aged 0-59 months (LAZ/HAZ)

Based on Figure 3, it can be seen that the number of stunted toddlers overall in the sample was 78, with a prevalence of 42.9%. Of this prevalence rate, as many as 17.6% are in the severe stunted category and the other 25.3% are in the stunted category. The predictor variables characteristics are summarized in Figure 4.

As shown in Figure 4, the majority of households in hilly, lowland, and coastal zones have clean water from dug wells with a total percentage of 78.6%, and 60.4% have gallon water consumption for drinking water. Most of the population from each zone already has a family latrine that meets the criteria for healthy latrines with a total of nearly 60% of households. More than half of households have wastewater sewerage construction materials from cement (51.2%), solid waste treatment by collecting and burning (56.6%), and house floors from cement tiles (53.3%). Only a few households do not have ventilation in their houses (3.3%) compared to those that already have ventilation (about 80% of households). About 63.7% of households have a bright in-room where they can read a book during the day without having to turn on the lamp, of which 45.1% of the houses are in the hilly zone, 72% of the houses are in the lowland zone, and 69.4% of the houses are in the coastal zone. Most mothers (67%), whether in the hilly zone (60.8%), lowland (73.2%), or coastal (63.3%) do not have the habit of washing their hands with soap before hand feeding their toddlers.

Furthermore, 40.1% of fathers' livelihoods were laborers, followed by 30.2% entrepreneur, 23.6% farmers, 4.4% as civil servants, and the remaining 1.6% or as many as 3 fathers in the sample were found to be out of work. Meanwhile, as many as 133 (73%) mothers work as housewives, and as many as 10 (5.5%), 7 (3.8%), 9 (5%) and 23 (12.6%) other mothers have livelihoods as farmers, laborers, civil servants, and entrepreneurs.

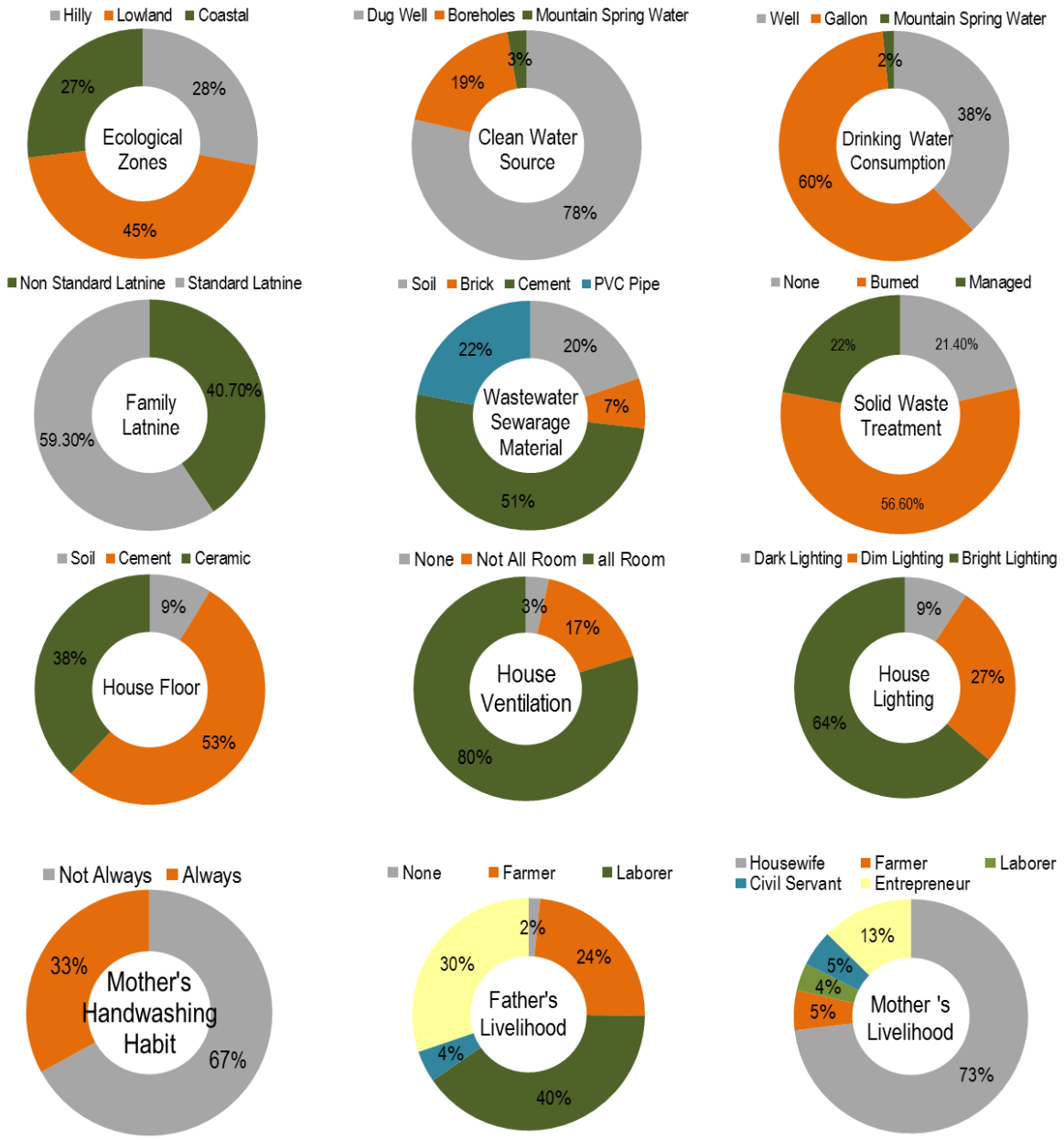

Figure 4. The frequency distribution of characteristic predictor variables

3.2. Determinants Stunting

If other variables remain, then the variable groups of ecological zones, clean water from drilled wells source, gallon water consumption for drinking water, standard latrines, wastewater sewerage construction materials were cement and pipe, managed solid waste, ventilation available but not all rooms, bright lighting in rooms (can read a book without lamp's light during daytime), and the father's livelihood as a civil servant and entrepreneur gives a real meaning to stunting in toddlers aged 0-59 months in South Lampung Regency because it has a p value which is less than 0.05 (Table 2).

Table 2. Result of optimizing the effect of ecological zone, sanitation performance, and parental livelihood variables on the stunting severity

Variable Group / Variable	Symbol	Coefficient	Std. Error Coefficient	Z Statistic	P	Odds Ratio	95% Confident Interval	
							Lower	Upper
Constant (1)	-	**5.48823**	**2.20524**	**2.49**	**0.013**	-	-	-
Constant (2)	-	**7.94375**	**2.26612**	**3.51**	**0.000**	-	-	-
Constant (3)	-	**15.4895**	**2.58017**	**6.00**	**0.000**	-	-	-
Ecological Zones (Hills=0)								
Lowland	[D_1_LOWLAND]	2.00677	0.570306	3.52	0.000	7.44	2.43	22.75
Coastal	[D_1_COAST]	2.50260	0.664155	3.77	0.000	12.21	3.32	44.89
Sanitation								
Clean water source (*dug well=0*)								
Drilled	[D_2_DRILL_WELL]	1.62245	0.582479	2.79	0.005	5.07	1.62	15.86
Mountain spring water	[D_2_MOUNT]	-0.885355	1.27023	-0.70	0.486	0.41	0.03	4.97
Drinking water consumption *(well=0)*								
Gallon	[D_3_DRINK_WTR_GLLN]	-0.869931	0.389896	-2.23	0.026	0.42	0.20	0.90
Mountain spring water	[D_3_DRINK_WTR_MOUNT]	-2.30280	2.16338	-1.06	0.287	0.10	0.00	6.94
Family latrine *(non standard=0)*	[LATRINE]	-1.16615	0.448013	-2.60	0.009	0.31	0.13	0.75
Wastewater sewerage construction materials *(soil=0)*								
Brick	[D_4_SWR_BRICK]	-1.34133	0.823815	-1.63	0.103	0.26	0.05	1.31
Cement	[D_4_SWR_CMNT]	-1.28419	0.561461	-2.29	0.022	0.28	0.09	0.83
Pipe	[D_4_SWR_PVC]	-1.47465	0.640420	-2.30	0.021	0.23	0.07	0.80
Solid waste treatment *(none=0)*								
Collected, and burnt	[D_5_FIRE]	-0.0313022	0.469920	-0.07	0.947	0.97	0.39	2.43
Collected, and managed	[D_5_MNGED]	-1.79104	0.725610	-2.47	0.014	0.17	0.04	0.69
House floor *(soil (none)=0)*								
Cement	[D_6_CMNT]	-0.190215	0.715915	-0.27	0.790	0.83	0.20	3.36
Ceramic	[D_6_CRAMIC]	-0.807855	0.837428	-0.96	0.335	0.45	0.09	2.30
House ventilation (window) (*none=0*)								
Not all room	[D_7_ NOT_ARM]	-2.88218	1.18782	-2.43	0.015	0.06	0.01	0.57
All room	[D_7_ARM]	-1.50038	1.13223	-1.33	0.185	0.22	0.02	2.05
House lighting during the day (*dark/can't read without lamp's lighting=0*)								
Dim lighting	[D_8_DIM]	-0.921661	0.716724	-1.29	0.198	0.40	0.10	1.62
Bright lighting	[D_8_BRIGHT]	-2.16022	0.765575	-2.82	0.005	0.12	0.03	0.52

Table 2 Continued

Mother's handwashing habit with soap before hand feeding *(not always=0)*	[WSH_HAND]	-0.453737	0.533815	-0.85	0.395	0.64	0.22	1.81
Parental Livelihood								
Father's livelihood (*none=0*)								
Farmer	[D_9_FTH_FARM]	-2.63094	1.79122	-1.47	0.142	0.07	0.00	2.41
Laborer	[D_9_FTH_LABOR]	-2.81661	1.77899	-1.58	0.113	0.06	0.00	1.95
Civil servant	[D_9_FTH_CVIL_SRVNT]	-5.33034	2.34703	-2.27	0.023	0.00	0.00	0.48
Entrepreneur	[D_9_FTH_ENTRPRNR]	-5.39690	1.86597	-2.89	0.004	0.00	0.00	0.18
Mother's livelihood (*housewife=0*)								
Farmer	[D_{10}_MM_FARM]	-0.997328	0.878899	-1.13	0.256	0.37	0.07	2.07
Laborer	[D_{10}_MM_LABOR]	-0.939249	1.00267	-0.94	0.349	0.39	0.05	2.79
Civil servant	[D_{10}_MM_CVIL_SRVNT]	-0.960602	1.14661	-0.84	0.402	0.38	0.04	3.62
Entrepreneur	[D_{10}_MM_ENTRPRNR]	-0.179942	0.825515	-0.22	0.827	0.84	0.17	4.21
Log-Likelihood = -115.991	Test that all slopes are zero: G = 141.967, DF = 27, P_{Value} = 0.000							
	Note: G=Gald Statistic, DF= Degree of Freedom							

Based on Table 2, it can be seen that toddlers aged 0-59 months who live in lowland and coastal zones are at a higher risk of stunting than toddlers in hilly zones, which are 7.44 and 12.21 times higher compared to hill zones, respectively. The risk of stunting is also higher in toddlers aged 0-59 months with clean water at home from drilled wells source (OR 5.07 95% CI: 1.62-15.86) than clean water from dug wells. In addition, under-five stunting susceptibility was lower in homes with gallon water consumption for drinking water (OR 0.42 95% CI: 0.20-0.90) and standard latrine facilities (OR 0.31 95% CI: 0.13-0.75) than drinking water from wells water and in non standard latrines. There are two variables from the variable group of wastewater sewerage construction materials that have a significant chance of reducing stunting in toddlers, namely in wastewater sewerage construction materials from cement (OR 0.28 95% CI: 0.09-0.83) and pipes (OR 0.23 95% CI: 0.07-0.80). Families that have solid waste treatment in a managed way (OR 0.17 95% CI: 0.04-0.69), the chances of their toddler experiencing stunting are lower than unmanaged solid waste (random disposal of solid waste). Toddlers aged 0-59 months who had houses with ventilation but not all rooms (OR 0.06 95% CI: 0.01-0.57) and bright lighting in rooms (OR 0.012 95% CI: 0.03-0.52) were less likely to be stunting compared to houses that have no ventilation and dark in rooms. Furthermore, toddlers with their father's livelihood as civil servants (OR 0.00 95% CI: 0.00-0.48) and entrepreneur (OR 0.00 95% CI: 0.00-0.18) have a lower stunting vulnerability than non-working fathers.

4. Discussion

Our findings confirm our hypothesis that ecological zones, sanitation performance, and parental livelihood play an essential and even very essential role in affecting the severity of stunting in toddlers because they have p-values <0.05 and even <0.01. This can be explained by the impact of natural resources (local food availability), disease spread, economics, social structures, culture, and law in society. Furthermore, if sanitation is inadequate, recurring illnesses and medicine consumption will make toddlers lose their appetites or have impaired nutrient absorption. Therefore, if the root cause of toddler malnutrition is not identified by this research, then any additional food intake interventions will not be consistently delivered to toddlers.

4.1. The Effect of Ecological Zones on Stunting Severity

Lowland and then coastal zone have a higher prevalence of stunting than hilly zones. Food consumption patterns and family sanitation facilities are generally a reflection of the surrounding environment. As observed in this study, the hilly zones tend to have a cleaner environment, especially with the source of water direct from mountain spring water and minimum air pollution, so that probably the chances of their toddlers getting stunting-causing

malnutrition diseases are lower. Supporting these findings, research in other countries also reported that high-temperature areas such as lowlands and coastal zones have a high potential for stunting because they affect their food security and livelihood opportunities [21], [22]. In addition, the high prevalence of stunting observed can be explained by poor coastal zones that can result in poor fish quality, for example finding a large amount of unmanaged solid waste resulting in seawater pollution. As shown in the data, the behavior of disposing of solid waste carelessly is also still commonly found in the lowland zone (23.2%). The presence of piles of garbage can also invite many vectors of the disease [23].

We highlight that different ecological zones will give each other control in promoting toddlers growth. In terms of the environment and natural resources, it is indicated by the availability of a cleaner environment, also a lot of vegetables and legumes as a protector for toddlers against stunting in the hilly zone. Such positive conditions can also arise from good sanitation behavior and the assistance of village midwives or officers with authorities through consistent interactions with monitoring toddlers nutrition and their household sanitation. These various processes can be expressed as an explanation of the way ecological zones affecting stunting in toddlers aged 0-59 months.

4.2. The Effect of Sanitation Performance on Stunting Severity

We found that the source of clean water from drilled wells had a significant effect on linear growth failure in toddlers aged 0-59 months. The observed vulnerabilities may be related to the condition of family latrines of which approximately 40% were found to be non standard for health requirements, where more than half did not meet the standard distance of septictank to clean water sources (≥10 m) [24], with a risk of stunting one by 0.31 times higher than standard family latrines at a significance of 95%. In relation to this findings, the variable drinking water consumption may present other interesting evidence of the importance of clean water sources. As shown by p=0.02, gallon drinking water has a significant effect with a chance of reducing stunting by 0.026 times compared to drinking water from wells. Sanitation, which refers to the water used for bathing, washing, toileting, and drinking, is frequently identified as a route of transmission of disease-causing organisms (pathogens), including feces [25]. Non standard latrines, such as dirty, open roofs, and inadequate water access as in our study, will cause the spread of disease vectors for users and the surrounding environment [26], [27]. However, additional checks are needed before drawing definite conclusions about the relationship between these variables with each other. Our finding also corroborates previous findings by showing that safe access to clean water sources [28], [29], drinking water [30], [31], and latrines [32], [33] reduces toddler growth failure. For example, a study in India found that inadequate access to water significantly increased the likelihood of a child's risk of stunting by 30% [34].

Some households were also found to have clean water source and drinking water consumption from mountain spring water. The mountain spring water has an effect of reducing stunting but does not have a statistically significant effect. A possible explanation for this lack of association is that the mountainous environment does not reflect the reliability and quantity of supply which could be effected by other hygiene-related behaviors, including water storage and overall hygiene practices [30].

Our data detected a significant effect of wastewater sewerage construction materials from cement and pipes in reducing stunting in toddlers aged 0-59 months. Pipe material wastewater sewerage qualifies as the best because they can resist all possible contamination that occurs in the home environment [24], meanwhile, the construction material for sewerage in the form of soil can be a breeding ground for vectors where transmission causes infectious diseases, and contaminant water infiltration can be carried to wells and rivers so that water is polluted [26], [35]. According to our observations in the field, some households drained wastewater directly to the ground near the well. In addition, the statistical results of wastewater sewerage from brick that are not strongly associated can be explained by the fact that wastewater that flows through brick sewers can still seep out into the ground, and its characteristics that are open can cause odors and vector nests. This evidence is corroborated by a logistic regression study in Indonesia which showed that there was a strong association between wastewater sewerage construction materials and infectious diseases (diarrhea) [35]. A significant relationship between wastewater sewerage and stunting has also been demonstrated by other researcher [26].

In this study, solid waste managed by collecting and then routinely transported by local cleaners was found to have a significant effect on reducing stunting in toddlers aged 0-59 months. This finding is in line with research in Indonesia which shows a significant effect between the appropriate solid waste disposal on the prevalence of stunting ($p<0.05$) [31]. Other studies have also proven that toddlers with families whose solid waste disposal, in addition to being managed properly, are significantly associated with stunting (OR 1,17, 95% CI, 1,05-1,29) [36]. The current findings cannot show that the solid waste treatment variables collected and then burned have a significant effect on stunting in toddlers. Solid waste treatment is carried out to prevent the accumulation of pathogens, contamination of the soil surface, water sources, and air pollution [37]. Treatment by burning can cause air pollution, and some pollutants resulting from the combustion have become a major public health problem [38]. Furthermore, studies in Nigeria show evidence of poor solid waste treatment is at risk of recurrent infectious diseases and the spread of infectious diseases [23].

Our findings do not show a statistically significant effect

of the variable group characteristic of house floors on stunting severity in toddlers aged 0-59 months. These findings differ from the findings of other researcher [39], this consistency may be shown by the research of Gaston at al[40]. It is important to note that the observed characteristics are limited to floor material only, as for example, frequency of dust and dirt or floor cleaning routines were not considered in our study. Dirty floors can facilitate contamination of hands, food, and other objects as a potential risk of infectious disease [41].

Variable ventilation is available although not all rooms have a significant effect on reducing the prevalence of stunting in toddlers aged 0-59 months compared with rooms without ventilation. Balietti and Datta[42] put forward a valid statement that the child's health condition will be disturbed by the absence of ventilation in the indoor area, because ventilation is a function of tidal volume, whereas tidal volume in children is also a function of growth [43]. Unlike the ventilation available but not in all rooms, the variable windows available in all rooms do not have a significant effect on toddlers stunting severity. The lack of observed associations can be explained because the presence of windows as ventilation does not reflect the optimal functioning of the ventilation. Such as windows that are not routinely opened or the window is blocked by an object as in this study.

Our study found a significant effect of bright lighting in rooms for reading books during the day on a reduction in the prevalence of stunting in toddlers aged 0-59 months. In accordance with the requirements of a healthy house, the important requirement of high sanitation level is including lighting [44]. In addition, our findings did not find a significant effect of variables of dimly rooms for reading books during the day on stunting of toddlers. The lack of association in our analysis may be explained by the weak relationship between low light coverage from natural sources and stunting in toddlers, while natural light through windows helps the role of sanitation in infection control and prevention of the spread of diseases in rooms [45].

The mother's handwashing habit with soap before hand feeding their toddler did not show a statistically significant effect on stunting. Although it has different findings [33], [46], [47], but it is currently consistent with a study by Saaka et al[48] in 2021 which showed an opposite relationship between stunting and handwashing with soap. Many behaviors of handwashing mothers were reported in open water storage instead in flowing water. This poor handwashing will lower their-defense mechanisms against infectious bacteria [28], [49].

High quality sanitation plays an important role in controlling various diseases related to the environment [50]. Our findings help identify the sanitation component that has important implications in reducing stunting prevalence. This shows that carrying out sanitation inspections on variables that have a significant effect, as in this study, can be a turning point to reduce the impact of stunting in toddlers aged 0-59 months.

4.3. The Effect of Parental Livelihood on Stunting Severity

There are two variables from the group of father's livelihood variables that have a significant effect in reducing the prevalence of stunting, namely the father's livelihood as a civil servants and an entrepreneur. This finding is consistent with a study in Jakarta, Indonesia, where toddlers aged 0-59 months were found to have a higher risk of stunting in fathers who did not work [51]. Father's livelihood can be used as a benchmark for the human development index because of its significant contribution to the occurrence of stunting in children [52]. In contrast, the father's livelihood as a farmer and laborer was not found to be significant in this study. In this study, stunting children were still mostly found in fathers who had a livelihood as farmers and laborers. This shows that it is not directly related to stunting under five. The absence of this relationship is also consistent by other researcher [53].

Studies in two regions (Peru and Musi Rawas) successively did not show a significant effect on stunting with mother’s livelihood [54], [55] as in our study. The weak associations in our analysis can probably be explained by the fact that about 54% of non-working mothers are found in non-stunted toddlers. A study shows that mothers who do not work more have time to take care of their child at home [56], children's growth and development are monitored more [57], while other researcher reported working mothers can help to meet the child's daily needs [58]. However, the study was limited because it did not consider how the mother's livelihood relates to time at home and the potential compensatory effects of the mother's work [57].

This study has limitations in the form of not measuring meters above sea level (masl) for the every location of the toddler's house but we measured masl of the area in general, which means that the selected masl house for toddlers represents the hilly zone, can be the same as the lowland zone. So the research needs to be expanded to include detailed data from three ecological zones at South Lampung Regency.

5. Conclusions

We report the significant effect of ecological zones, sanitation performance, and parental livelihood on the severity of stunting among toddlers aged 0-59 months in the South Regency. Toddlers' risk of stunting is significantly higher in lowland and coastal zones, as well as in areas with clean water from drilled wells.. While the lower was significantly effected by: gallon water consumption for drinking water, standard latrine, wastewater sewerage construction materials from cement and pipes, managed solid waste, ventilation available but not all rooms, bright lighting in rooms, and the father's livelihood as a civil servant and entrepreneur. The Ministry

of Health and the Ministry of Public Works and Public Housing need to establish a stunting reduction policy program that targets undernourished toddlers aged 0-59 months by considering the optimization of programs related to environmental sanitation, human resource development and monitoring the ecological zones in which toddlers live.

Abbreviations

CI: Confidence Interval; COVID-19: Coronavirus Disease 2019; HAZ: Height-for-Age Z score; LAZ: Length-for-Age Z score; SD: Standard Deviation; OR: Odds ratio; UNICEF: the United Nations International Children's Emergency Fund; WHO: World Health Organization.

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Conflict of Interest

We don not have any conflict of interest upon this research results.

REFERENCES

[1] Ministry of Heath Republic Indonesia, "Regulation of Ministry of Health Republic Indonesia No.2/MENKES/2020 about Child Anthropometry Standards." JDIH BPK RI, https://peraturan.bpk.go.id/Home/Details/152505/permenkes-no-2-tahun-2020 (accessed Sep. 1, 2022).

[2] Argaw A., Hanley-Cook G., De Cock N., Kolsteren P., Huybregts L., C. Lachat, "Drivers of Under-Five Stunting Trend in 14 Low- and Middle-Income Countries since the Turn of the Millennium: A Multilevel Pooled Analysis of 50 Demographic and Health Surveys," Nutrients, vol. 11, no. 10, p. 2485, 2019. DOI: 10.3390/nu11102485.

[3] Tadele T.T., Gebremedhin C.C., Markos M.U., E.L. Fitsum, "Stunting and Associated Factors Among 6–23 Month Old Children in Drought Vulnerable Kebeles of Demba Gofa District, Southern Ethiopia," BMC Nutrition, vol. 8, p. 9, 2022. DOI: 10.1186/s40795-022-00501-2.

[4] Li Z., Kim R., Vollmer S., S.V. Subramanian, "Factors Associated With Child Stunting, Wasting, and Underweight in 35 Low- and Middle-Income Countries," JAMA Network Open, vol. 3, no. 4, 2020. DOI: 10.1001/jamanetworkopen.2020.3386.

[5] De Sanctis V., Soliman A., Alaaraj N., Ahmed S., Alyafei F., N. Hamed, "Early and Long-term Consequences of Nutritional Stunting: From Childhood to Adulthood," Acta Biomedica, vol. 92, no. 1, p. e2021168, 2021. DOI: 10.23750/abm.v92i1.11346.

[6] Rolfe E.D.L., de Franca G.V.A., Vianna C.A., Gigante D.P., Miranda J.J., Yudkin J.S., Horta B.L., K.K. Ong, "Associations of Stunting in Early Childhood With Cardiometabolic Risk Factors in Adulthood," PLoS One, vol. 13, no. 4, p. e0192196, 2018. DOI: 10.1371/journal.pone.0192196.

[7] Qaisar R., Karim A., "A Comparison of International and National References to Measure The Prevalence of Stunting in Pakistani School-Age Girls," Scientific Reports, vol. 12, p. 5501, 2022. DOI: 10.1038/s41598-022-09511-3.

[8] Nafi J.D., "The Effect of Residential Ecosystem Zone With Stunting Event in Kupang," Berita Kedokteran Masyarakat, vol. 34, no. 5, 2018. DOI: 10.22146/bkm.37598.

[9] Adams H., Adger W.N., R.J. Nicholls, "Ecosystem Services Linked to Livelihoods and Well-Being in the Ganges-Brahmaputra-Meghna Delta," in (eds) Ecosystem Services for Well-Being in Deltas, Palgrave Macmillan, Cham, 2018, pp. 29-47.

[10] Mrema J.D., Elisaria E., Mwanri A.W., C.M. Nyaruhucha, "Prevalence and Determinants of Undernutrition among 6- to 59-Months-Old Children in Lowland and Highland Areas in Kilosa District, Tanzania: A Cross-Sectional Study," Journal of Nutrition and Metabolism, vol. 2021, p. 9, 2021. DOI: 10.1155/2021/6627557.

[11] Mohammed S.H., Habtewold T.D., Abdi D.D., Alizadeh S., Larijani B., A. Esmaillzadeh, "The Relationship Between Residential Altitude and Stunting: Evidence From >26 000 Children Living in Highlands and Lowlands Of Ethiopia," British Journal of Nutrition, vol. 123, no. 8, pp. 934–941, 2020. DOI: 10.1017/S0007114519003453.

[12] Budge S., Parker A.H., Hutchings P.T., C. Garbutt, "Environmental Enteric Dysfunction and Child Stunting," Nutrition Reviews, vol. 77, no. 4, pp. 240–253, 2019, DOI: 10.1093/nutrit/nuy068.

[13] World Health Organization, "Sanitation," WHO, https://www.who.int/news-room/fact-sheets/detail/sanitation (accessed Sep. 1, 2022).

[14] Huriah T., E. Fitriami, "Determinants of Stunting in Indonesia: A Literature Review," Joint Meeting on International Conference on Pediatrics, Nursing and Healthcare & 8th Pediatric Ophthalmology and Optometry Conference, Abu Dhabi, UAE, 11-12 April., 2019, vol. 9, p. 30. DOI: 10.4172/2161-0665-C2-087.

[15] Halimatunnisa M., Indarwati R., Ubudiyah M., Trihartuty, Sari N.K.P.M., S. Suhardin, "Family Determinants of Stunting in Indonesia: A Systematic Review," International Journal *of* Psychosocial Rehabilitation, vol. 24, no. 9, pp. 815–822, 2020. DOI: 10.37200/IJPR/V24I9/PR290099.

[16] World Health Organization, "The UNICEF/WHO/WB Joint Child Malnutrition Estimates (JME) group released new data for 2021," WHO, https://www.who.int/news/item/06-05-2021-the-unicef-who-wb-joint-child-malnutrition-estimates-group-released-new-data-for-2021 (accessed Sep. 2, 2022).

[17] South Lampung Regency Health Office, "Health Profile of

South Lampung Regency (2022)," South Lampung Regency Health Office. 2022.

[18] South Lampung Regency Government, "South Lampung Regency Regional Regulation Number 15 of 2012 about the South Lampung Regency Spatial Plan 2011-2031." JDIH BPK RI, https://peraturan.bpk.go.id/Home/Details/99997/perda-kab-lampung-selatan-no-15-tahun-2012 (accessed Sep. 1, 2022).

[19] Central Bureau Statistics of South Lampung Regency, "South Lampung Regency in Number 2022." Badan Pusat Statistik (BPS), https://lampungselatankab.bps.go.id/publication/2022/02/25/f632d36ce14cd17032812ae6/kabupaten-lampung-selatan-dalam-angka-2022.html#:~:text=Publikasi%20Kabupaten%20Lampung%20Selatan%20dalam%20%20Numbers%20%28LSDA%29%202022%2C,%20various%20sources%20so%20that%20can%20used%20by%20communit (accessed Sep. 1, 2022).

[20] Fitrah A, Suroso D.S.A., Asb A.M, "Kesesuaian Rencana Pola Ruang Kabupaten Lampung Selatan Terhadap Tingkat Risiko Tsunami," Jurnal Dialog Penanggulangan Bencana 2020, vol. 11, no. 2, 167–177.

[21] Ahmed K.Y., Agho K.E., Page A., Arora A., F.A. Ogbo, "Mapping Geographical Differences and Examining the Determinants of Childhood Stunting in Ethiopia: A Bayesian Geostatistical Analysis," Nutrients, vol. 13, no. 6, p. 2104, 2021. DOI: 10.3390/nu13062104.

[22] Priestley R.K., Heine Z., T.L. Milfont, "Public Understanding of Climate Change-Related Sea-Level Rise," PLoS One, vol. 16, no. 7, p. e0254348, 2021, DOI: 10.1371/journal.pone.0254348.

[23] Omang D.I., John, G.E., Inah S.A., J.O. Bisong, "Public Health Implication of Solid Waste Generated by Households in Bekwarra Local Government area," African Health Sciences, vol. 21, no. 3, pp. 1467–1473, 2021. DOI: 10.4314/ahs.v21i3.58.

[24] Ministry of Health Republic Indonesia, "Regulation of Ministry of Health Republic Indonesia No.3/MENKES/2014 about Community Based Total Sanitation." JDIH BPK RI, https://peraturan.bpk.go.id/Home/Details/116706/permenkes-no-3-tahun- (accessed Sep. 2, 2022).

[25] Pandey P. K., Kass P. H., Soupir M. L., Biswas S., V.P. Singh, "Contamination of water resources by pathogenic bacteria," AMB Express, vol. 4, p. 51, 2014. DOI: 10.1186/s13568-014-0051-x.

[26] Purba I.G., Sunarsih E., Trisnaini I., R.J. Sitorus, "Environmental Sanitation and Incidence of Stunting in Children Aged 12-59 Months in Ogan Ilir Regency," Jurnal Kesehatan Lingkungan, vol. 12, no. 3, 2020. DOI: 10.20473/jkl.v12i3.2020.189-199.

[27] Wiyono S., Burhani A., Harjatmo T.P., Astuti T., Zulfianto N.A., Tugiman., M.S Putri, "The Role Sanitation to Stunting Children Age 6-35 Months, Purwojati subdistrict, Banyumas district, Central Java, Indonesia," The International Journal of Community Medicine and Public Health, vol. 6, no. 1, 2019, DOI: 10.18203/2394-6040.ijcmph20185231.

[28] Kwami C.S., Godfrey S., Gavilan H., Lakhanpaul M., P. Parikh, "Water, Sanitation, and Hygiene: Linkages with Stunting in Rural Ethiopia,"International Journal of Environmental Research and Public Health., vol. 16, no. 20, p. 3793, 2019. DOI: 10.3390/ijerph16203793.

[29] Daiva A.D., Nurhayati E., Y. Fadillah, "Relationship of Access to Clean Water with Prevalence of Stunting in Puskesmas Cicalengka in 2020," RSF Conference Proceeding Series: Medical and Health Science, Bandung, 2021, vol. 1, no. 1, pp. 85–90. DOI: 10.31098/cpmhs.v1i1.271.

[30] Bekele T., Rahman B., P. Rawstorne, "The Effect of Access to Water, Sanitation and Handwashing Facilities on Child Growth Indicators: Evidence From The Ethiopia Demographic and Health Survey 2016," PLoS One, vol. 15, no. 9, p. e0239313, 2020. DOI: 10.1371/journal.pone.0239313.

[31] S. Irianti, P. Prasetyoputra, I. Dharmayanti, K. Azhar, and P. S. Hidayangsih, "The Role of Drinking Water Source, Sanitation, and Solid Waste Management in Reducing Childhood Stunting in Indonesia," The 5th International Conference on Water Resource and Environment (WRE 2019), Macao, China, 16-19 July, 2019. DOI: 10.1088/1755-1315/344/1/012009.

[32] Dearden K.A., Schott W., Crookston B.T., Humphries D.L., Penny M.E., Behrman J.R., Young Lives Determinants and Consequences of Child Growth Project Team, "Children With Access to Improved Sanitation but Not Improved Water are at Lower Risk of Stunting Compared to Children Without Access: A Cohort Study in Ethiopia, India, Peru, and Vietnam," BMC Public Health, vol. 17, no. 1, p. 110, 2017. DOI: 10.1186/s12889-017-4033-1.

[33] Ahmadi, S. Lilis, R. Azizah, H. Oktarizal, "Association Between Toilet Availability and Handwashing Habits and the Incidence of Stunting in Young Children in Tanjung Pinang City, Indonesia," Malaysian Journal of Medicine and Health Science, vol. 16, no. 2, pp. 215–218, 2020.

[34] Choudhary N., Schuster R.C., Brewis A., A. Wutich, "Household Water Insecurity Affects Child Nutrition Through Alternative Pathways to WASH: Evidence From India," Food and Nutrition Bulletin, vol. 42, no. 2, pp. 170–187, 2021. DOI: 10.1177/0379572121998122.

[35] Sriyani A., Berawi K. N., Bakri S., H. Kaskoyo, "Development of Prediction Model for Childhood Diarrhea Based on Maternal Care Variables, Characteristics of Children, Demography and Sanitation in Study Environment Tulang Bawang Barat Regency," International Journal of Progressive Sciences and Technologies, vol. 23, no. 2, 2020. DOI: 10.52155/ijpsat.v23.2.2366.

[36] Badriyah L., Syafiq A., "The Association Between Sanitation, Hygiene, and Stunting in Children Under Two-Years (An Analysis of Indonesia's Basic Health Research, 2013)," Makara Journal of Health Research, vol. 21, no. 2, pp. 35–41, 2017. DOI: 10.7454/msk.v21i2.6002.

[37] Hidayangsih P. S., Tjandrarini D. H., Kristanto A.Y., N.E.W. Sukoco, "Disposal of Household Burned Garbage and Risk of Low Birth Weight in Central Sulawesi Province, Indonesia," Health Science Journal of Indonesia, vol. 5, no. 2, pp. 89–93, 2014. DOI: 10.22435/hsji.v5i2Dec.3596.89-93.

[38] Morsi R.Z., Safa R., Baroud S.F., Fawaz C.N., Farha J.I., El-Jardali F., M. Chaaya, "The Protracted Waste Crisis and

Physical Health of Workers in Beirut: A Comparative Cross-Sectional Study," Environmental Health., vol. 16, no. 39, 2017. DOI: 10.1186/s12940-017-0240-6.

[39] Cruz L.M.G., Azpeitia G.G., Súarez D.R., Rodríguez A.S., Ferrer J.F.L., L. Serra-Majem, "Factors Associated with Stunting among Children Aged 0 to 59 Months from the Central Region of Mozambique," Nutrients, vol. 9, no. 5, p. 491, 2017. DOI: 10.3390/nu9050491.

[40] Gaston R.T., Habyarimana F., S. Ramroop, "Joint Modelling of Anaemia and Stunting in Children Less Than Five Years of Age in Lesotho: A Cross-Sectional Case Study," BMC Public Health, vol. 22, p. 285, 2022. DOI: 10.1186/s12889-022-12690-3.

[41] Sartorius B., Legge H., R. Pullan, "Does Suboptimal Household Flooring Increase The Risk Of Diarrhoea and Intestinal Parasite Infection in Low and Middle Income Endemic Settings? A Systematic Review and Meta-Analysis Protocol," Systematic Reviews, vol. 9, p. 133, 2020. DOI: 10.1186/s13643-020-01384-9.

[42] Balietti A., Datta S., "The Impact of Indoor Solid Fuel Use on The Stunting of Indian Children," Economics, Environmental Science, 2017.

[43] Moschovis P.P., Addo-Yobo E.O.D., Banajeh S., Chisaka N., Christiani D.C., Hayden D., Jeena P., MacLeod W.B., Mino G., Patel A., Qazi S., Santosham M., Thea D.M., P.L. Hibberd, "Stunting is Associated with Poor Outcomes in Childhood Pneumonia," Tropical Medicine & International Health., vol. 20, no. 10, pp. 1320–8, 2015. DOI: 10.1111/tmi.12557.

[44] Osibona O., Solomon B.D., D. Fecht, "Lighting in the Home and Health: A Systematic Review," International Journal of Environmental Research and Public Health, vol. 18, no. 2, p. 609, 2021. DOI: 10.3390/ijerph18020609.

[45] Hobday R.A., Dancer S.J., "Roles of Sunlight and Natural Ventilation for Controlling Infection: Historical and Current Perspectives," Journal of Hospital Infection, vol. 84, no. 4, pp. 271–82, 2013. DOI: 10.1016/j.jhin.2013.04.011.

[46] Shrestha S.K., Vicendese D., B. Erbas, "Water, Sanitation and Hygiene Practices Associated with Improved Height-For-Age, Weight-For-Height and Weight-For-Age Z-Scores Among Under-Five Children in Nepal," BMC Pediatrics, vol. 20, p. 134, 2020. DOI: 10.1186/s12887-020-2010-9.

[47] Sewenet T., W/Selassie M., Zenebe Y., Yimam W., L. Woretaw, "Undernutrition and Associated Factors Among Children Aged 6-23 Months in Dessie Town, Northeastern Ethiopia, 2021: A Community Based Cross-Sectional Study," Frontiers in Pediatrics, vol. 10, p. 916726, 2022. DOI: 10.3389/fped.2022.916726.

[48] Saaka M., Saapiire F.N., R.N. Dogoli, "Independent and Joint Contribution of Inappropriate Complementary Feeding and Poor Water, Sanitation and Hygiene (WASH) Practices to Stunted Child Growth," Journal of Nutrition Science, vol. 10, 2021. DOI: 10.1017/jns.2021.103.

[49] Wolf J., Johnston R., Freeman M.C., Ram P.K., Slaymaker T., Laurenz., A. Prüss-Ustün, "Handwashing with Soap After Potential Faecal Contact: Global, Regional and Country Estimates," International Journal of Epidemiology, vol. 48, no. 4, pp. 1204–1218, 2019. DOI: 10.1093/ije/dyy253.

[50] Rah J.H., Sukotjo S., Badgaiyan N., Cronin A.A., H. Torlesse, "Improved Sanitation is Associated with Reduced Child Stunting Amongst Indonesian Children Under 3 Years of Age," Maternal & Child Nutrition, vol. 16, no. Suppl 2, p. e12741, 2020. DOI: 10.1111/mcn.12741.

[51] Utami R.A., Setiawan A., P. Fitriyani, "Identifying Causal Risk Factors For Stunting in Children Under Five Years of Age in South Jakarta, Indonesia," Enfermería Clínica, vol. 29, no. Suppl 2, pp. 606–611, 2019. DOI: 10.1016/j.enfcli.2019.04.093.

[52] Suciyanti D., Wangge G., Iskandar E., Fahmida U., T. Supali, "Social Determinants and Access to Water-Sanitation-Hygiene as Dominant Risk Factors of Stunting among Under-five Children in Rural Area of East Indonesia," Preprints, 2021. DOI: 10.20944/preprints202107.0279.v1.

[53] Rohmawati N., "Risk Factors Stunting Incidence in Children Aged 6-36 Months in Jember Regency," Proceeding of 3rd International Nursing Conference, East Java-Indonesia, 4-5 November 2017, pp. 128–136.

[54] Chávez-Zárate A., Maguiña J.L., Quichiz-Lara A.D., Zapata-Fajardo P.E., P. Mayta-Tristán, "Relationship Between Stunting in Children 6 To 36 Months of Age and Maternal Employment Status in Peru: A Sub-Analysis of the Peruvian Demographic and Health Survey," PLoS One, vol. 14, no. 6, p. e0217252, 2019. DOI: 10.1371/journal.pone.0217252.

[55] Adla R., Siregar S.M.F., A. Husna, "The Relationship Of Mother's Education And Occupation To Stunting Events In Toddlers," Mutlidiciplinary Output Research For Actual and International Issue, vol. 2, no. 1, 89-94, 2022. DOI: 10.54443/morfai.v2i1.203.

[56] Davis K D., Lawson K.M., Almeida D.M., Kelly E.L., King R.B., Hammer L., Casper L.M., Okechukwu C.A., Hanson G., S.M. McHale, "Parents' daily time with their children: a workplace intervention," Pediatrics, vol. 135, no. 5, pp. 875–82, 2015. DOI: 10.1542/peds.2014-2057.

[57] Manzione L.C., Kriser H., Gamboa E.G., Hanson C.M., Mulokozi G., Mwaipape O., Hoj T.H., Linehan M., Torres S., Hall P.C., West J.H., B.T. Crookston, "Maternal Employment Status and Minimum Meal Frequency in Children 6-23 Months in Tanzania," International Journal of Environmental Research and Public Health., vol. 16, no. 7, p. 1137, 2019. DOI: 10.3390/ijerph16071137.

[58] Lubis D.A., Zulkarnain M., Flora R., R. Tanjung, "The Relation between the Characteristics of Parents and the Incidence of Stunting in Elementary School Children in the Working Area of the Air Beliti Health Center," Budapest International Research and Critics Institute-Journal, vol. 4, no. 3, pp. 4391–4397, 2021. DOI: 10.33258/birci.v4i3.2215.

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