Prediction Models Comparison of Stunting in Districts/Cities of Stunting Locus with Different Geographical Characteristics in Jambi Province

Analysis of the 2018 Indonesia Basic Health Survey

Ummi Kalsum[1(✉)], Islakhiyah Islakhiyah[2], and Hendra Dhermawan Sitanggang[1]

[1] Public Health Study Program, Medicine and Health Sciences Faculty, Universitas Jambi, Jambi, Indonesia
ummi_kalsum@unja.ac.id

[2] National Population and Family Planning Agency, Jakarta, Indonesia

Abstract. Stunting is still a nutritional problem in Indonesia and also in Jambi Province. The causes of stunting are multifactorial. The purpose of this study was to analyze predictive models of stunting in under five children in districts of focus on stunting with different geographical characteristics. This study was secondary research using part of the 2018 Basic Health Research (Riskesdas) data with a cross sectional design. Samples were under five children (24–59 months) total 859 peoples. The independent variables were household characteristics, father, mother and child factors. The dependent variable was Stunting (Height to Age if Z score < -2 Standard Deviation). Data analysis using Chi-square and Multiple Logistics Regression. The incidence of stunting in Jambi Province was 26.4%, varying from 16.9–35.3% in several districts at the locus of Stunting. The prediction model in the districts with the locus of stunting varies but it made pattern on one root cause, namely the socio-economic level. Prediction models in highland geography was the mother's occupation after being controlled by infectious diseases, smoking, monitoring of child growth and development, access to health care facilities, place of delivery, personal hygiene and father's height. Stunting prediction model in the lowlands was the mother's occupation after being controlled by access to health care facilities, mother's education, place of delivery, socioeconomic, parity and pregnancy complication. The prediction model in watersheds area was the socioeconomic after being controlled by infectious diseases, smoking, pregnancy status, mother's education [1], monitoring growth of under five children, place of delivery and parity. While the prediction model in urban areas was maternal height after being controlled by environmental health, place of delivery, parity and socio-economics. It is recommended that the districts governments strengthen multi-sectoral synergy in the handling and prevention of stunting and improve the socio-economic level of the community.

Keywords: prediction · stunting · underfive children · secondary analysis

I. Ifdil (Ed.): PSSHERS 2021, ASSEHR 690, pp. 345–363, 2023.
https://doi.org/10.2991/978-2-494069-33-6_41

1 Introduction

Nutrition is one of the important elements in the development of quality human resources. Adequate nutrition is needed by every individual, from fetuses, infants, children, adolescents, adults to the elderly, where mothers or adolences are a vulnerable group. Indonesia is currently facing a triple burden of nutritional problems, namely undernutrition, overnutrition and micronutrient deficiency. The problem that is currently getting a high priority in Indonesia and also the world is the problem of malnutrition which focuses on stunting in children, especially toddlers [1]. Stunting is still a public health problem in Jambi Province.

Indonesia is the third country with the highest stunting prevalence rate in Asia in 2017, namely 36.4% [1]. The prevalence of stunting in under five in Indonesia in 2018 was 30.8%, although it decreased compared to 2013, but it still has not reached a prevalence of less than 20% [2–4]. The results of National Basic Health Research (Riskesdas) in 2018, the prevalence of stunting in under five children in Jambi Province reached 30.12%. There were seven districts/cities with stunting rates > 30%. The three highest regencies were Tanjung Jabung Barat (44%), Tanjung Jabung Timur (40.9%) and Kabupaten Kerinci (42.4%) [3].

The impact of stunting is a brain development disorder that reduces intelligence, impaired physical growth and metabolic disorders. The long-term impact is decreased cognitive abilities of the brain, learning difficulties, low immunity to easily get sick and a high risk of developing metabolic diseases. When they grow up, they will be short in stature, have low levels of productivity and have no competitiveness in the world of work. Stunting is a major threat in realizing quality Indonesian human resources [5]. Stunting can indirectly remove 11% of GDP and diminish adult employees' earnings by up to 20%. It can also result in intergenerational poverty by reducing 10% of total lifetime income. Stunting as a toddler can raise the likelihood of developing degenerative illnesses as an adult, contributing to an increase in the risk of mortality in children [2, 6].

The multifactorial determinants of stunting both directly and indirectly include household characteristics, father, mother and child factors including lack of nutritional intake starting during pregnancy, lack of exclusive breastfeeding (ASI), poor parenting practices, maternal nutrition during pregnancy. Pregnancy and pre-pregnancy nutrition, infant morbidity, lack of nutritional intake for infants, limited health services, lack of access to nutritious food, socio-economic conditions, as well as other factors such as low access to sanitation and poor environmental hygiene make children contaminated with bacteria so that they become diseased [2, 7–16]. Likewise, the difference in the area of residence (village/city).

Many programs and prevention efforts have been implemented by the Government, but so far have not been able to reduce the incidence of stunting according to the set targets. This study aims to analyze stunting prediction models for under five children (24–59 months) according to the different characteristics of the districts/cities that are the focus of stunting handling in Jambi Province, including highlands (Kerinci Regency and Sungai Penuh City), lowlands (Tanjung Jabung Regency). West and East Tanjung Jabung), watersheds (Merangin and Tebo regencies) and urban areas (Jambi City).

2 Method

This study employs a quantitative technique with a cross-sectional design, as well as secondary data from the Indonesian Basic Health Research in 2018. The Health Research and Development Agency of the Ministry of Health of the Republic of Indonesia carried out Basic Health Research (Riskesdas) in 2018, which was carried out nationally in all provinces in Indonesia. This study is limited to Jambi Province and covers all districts/cities that are the focus of integrated stunting management, namely six districts/cities with varying geographical features.

Riskesdas 2018 was a community based research to assess the success of implementing medium-term development. Also as a means to evaluate the development of the health status of the Indonesian people at the national, provincial and district/city levels. This includes specific health problems in each district/city, the development of factors that can affect the health status of the community at each level of the government area, and the development of health development efforts at the national, provincial and district/city levels in the last six years. The targets of Riskesdas 2018 were selected Households (RT) and Household Members (ART). Data collection by interview using a structured questionnaire and measurements carried out by enumerators with minimum qualifications of Diploma 3 health graduates. Each team consists of 5 people who have been trained and supervised by the District/City Technical Responsible Person, and the Provincial Technical Responsible Person. The sampling method used was PPS (probability proportionate to size) [3].

The population in this study were under five children (24–59 months) in all districts/cities of Jambi Province in 2018. The sample in this study were some children aged 24–59 months who lived in Jambi Province in 2018 especially in six districts/cities (Kerinci District, West Tanjung Jabung, East Tanjung Jabung, Merangin, Tebo and Jambi City). The inclusion criteria used were toddlers aged 24–59 months, single-born, had complete parents (data for both father and mother were available), while the exclusion criteria were toddlers who had congenital abnormalities or suffered from chronic diseases/congenital disabilities or incomplete data. The number of under-fives analyzed was 859 under-fives with the weighting based on the total population of each district/city.

The variables studied in this study were divided into household characteristics (family size, socio-economic level, access to health service facilities and environmental health conditions), father factors (education, occupation, height and smoking behavior), maternal factors (education, occupation, age during pregnancy, parity, birth spacing, height, pregnancy status, hygiene behavior, pregnancy disorders, Antenatal care (ANC) and consumption of blood-added tablets during pregnancy) and child factors (birth weight, length at birth, premature birth, age of gestation at birth, early initiation of breastfeeding, exclusive breastfeeding, infectious diseases, non-infectious diseases, place of delivery, birth attendant, neonatal visit, newborn care, basic immunization status, growth monitoring and possession of MCH Handbook). Dependent variable was stunting with indicator height/age. It is said to be stunted if the Z value $<= -2$ standard deviation.

Data analysis using chi-square test with alternative Exact Fisher test and multivariate analysis using Multiple Logistics Regression at 95% confidence level. The research ethics was submitted to the Health Research Ethics Commission of the Jambi Health Polytechnic Ministry of Health and has received approval.

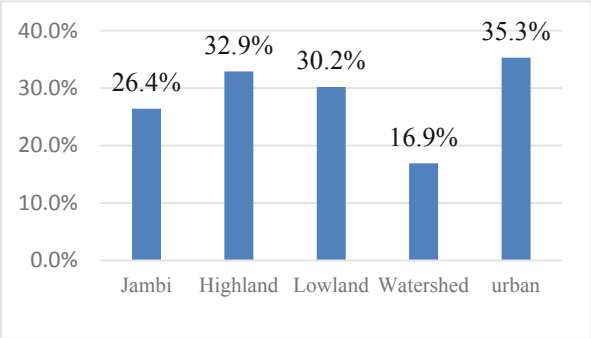

Fig. 1. Stunting Prevalence in under five children (24–59 months) in district/city with different geographical characteristic area

3 Results

The results of this study found that the prevalence of stunting among toddlers (24–59 months) in Jambi Province was 26.4%, varying between 16.9–35.3% in the districts/cities where the focus of stunting was handled. The highest proportion of stunting was in urban areas (Jambi City) at 35.3% and the lowest in lowland/coastal areas at 16.9% (Fig. 1).

Table 1 shows the factors related to the incidence of stunting in under five children in Jambi Province, namely body length at birth (OR = 1.995; 95% CI: 0.997–3.988), non-infectious diseases (OR = 11.689; 95% CI: 1.030). -132.707), and monitoring the growth of under five children (OR = 1.578; 95% CI: 1.052–2.368). Factors related to the incidence of stunting in highland areas were infectious diseases (OR = 4,379; 95%CI:1,049–18,276) and growth monitoring of children (OR = 2,181;95%CI:0.925–5,143). Factors related to the incidence of stunting in the plains/river areas were the mother's education (2.127; 95% CI: 0.983–4.600), the mother's height (OR = 3.989; 95%CI: 0.919–17.319), place of delivery (OR = 2.013; 95%CI:1.054–3.843), and access to health facilities was difficult (OR = 3.557; 95%CI:1.463–8.646) and moderate (OR = 3.246; 95%CI:1,031–10,222). Factors related to the incidence of stunting in lowland areas were the place of delivery (OR = 2.420; 95%CI: 0.986–5.938). Statistically, there are no factors related to the incidence of stunting in urban areas.

The results of multivariate analysis (Table 2) showed that the dominant factor causing stunting in Jambi Province was infectious disease, where children with infectious diseases had a 5.73 times greater risk of stunting compared to children who did not experience infectious diseases after controlling for smoking behavior, parity, length of birth, ownership of MCH book, socioeconomic level, access to health facilities, mother's occupation, gestational age and place of delivery. The dominant factor in the incidence of stunting in highland area was mother's occupation, where mothers who do not work have a 5.443 times greater risk of having stunting children compared to mothers who work formally and mothers who work informally have a risk of 6.115 times greater risk of having stunting children compared to mothers who work formally after controlling

Table 1. Relationship of risk factors with stunting incidence in under five children based on differences in geographical characteristics of regions

Variables		Highland		Watershed		Lowland /Coastal		Urban		Jambi Province	
		OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	*p*
Father's education	Low	1.03 (0.30–3.55)	0.957	1.42 (0.72–2.78)	0.306	0.72 (0.27–1.88)	0.492	0.52 (0.16–1.73)	0.278	1.00 (0.70–1.43)	0.999
	High										
Father's Job	Job Less	NA	0.489	NA	NA	NA	NA	NA	0.266	2.34 (0.24–23.07)	0.450
	Work										
Father's height	Short	0.17 (0.02–1.89)	0.105	0.89 (0.25–3.18)	0.855	0.72 (0.12–4.19)	0.710	0.41 (0.63–2.70)	0.336	0.97(0.49–1.93)	0.933
	Normal										
Smoking behavior	Active	2.27 (0.60–8,60)	0.218	1.77 (0.86–3.61)	0.116	1.37 (0.40–4.75)	0.614	0.62 (0.17–2.28)	0.461	1.32(0.87–2.00)	0.194
	Not smoke										
Mother's education	Low	0.95 (0.33–2.69)	0.916	2.13 (0.98–4.60)	0.052	2.14 (0.75–6.06)	0.145	0.46 (0.11–1.86)	0.262	0.95(0.67–1.35)	0.780
	High										
Mother's job	Not work	2.81 (0.82–9.60)	0.097	1.15 (0.37–3.53)	0.807	7.42 (0.75–73.17)	0.085	2.23 (0.46–10.94)	0.311	1.40 (0.79–2.49)	0.244
	Informal	1.92 (0.46–7.98)	0.366	1.60 (0.49–5.17)	0.431	3.99 (0.37–47.36)	0.269	NA	0.000	1.39 (0.73–2.64)	0.310
	Formal										

(*continued*)

Table 1. (*continued*)

Variables		Highland		Watershed		Lowland /Coastal		Urban		Jambi Province	
		OR (95% CI)	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	***p***
Parity	Primipara	0.34 (0.05–2.11)	0.240	0.48 (0.15–1.53)	0.213	1.53 (0.39–6.01)	0.539	0.62 (0.15–2.57)	0.503	0,686 (0,409–1,149)	0.152
	Multipara	0.37 (0.08–1.70)	0.197	1.52 (0.63–3.65)	0.348	2.45 (0.62–9.69)	0.199	0.36 (0.11–1.18)	0.090	1,000 (0,645–1,553)	0.998
	Never pregnant										
Pregnancy Status	Unwanted	0.88 (0.28–2.75)	0.543	1.34 (0.62–2.89)	0.446	NA	0.209	3.88 (0.28–54.20)	0.273	1.49 (0.65–3.39)	0.343
	Desirable										
Mother's height	Short	NA	0.826	3.99 (0.92–17.32)	0.049	1.43 (0.49–4.18)	0.503	2.46 (0.52–11.71)	0.243	1.25 (0.86–1814)	0.244
	Normal to high										
Personal Hygiene of mother	Poor	0.28 (0.08–1.00)	0.044	2.21 (0.85–5.77)	0.099	1.57 (0.66–3.76)	0.301	1.52 (0.35–6.56)	0.564	0.87 (0.59–1.29)	0.492
	Good										
Pregnancy disorders	Yes	1.58 (0.48–5.24)	0.448	0.74 (0.19–2.99)	0.672	0.39 (0.09–1.72)	0.194	1.38 (0.26–7.34)	0.696	0.83 (0.48–1.43)	0.495
	No										

(*continued*)

Table 1. (*continued*)

Variables		Highland		Watershed		Lowland /Coastal		Urban		Jambi Province	
		OR (95% CI)	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	***p***
Antenatal Care	Poor	1.35 (0.50–3.62)	0.552	0.90 (0.45–1.82)	0.775	1.12 (0.43–2.94)	0.810	1.16 (0.39–3.44)	0.784	0.90 (0.63–1.28)	0.563
	Good										
Consumption of blood boost tablets	Poor	1.70 (0.60–4.85)	0.312	0.73 (0.35–1.53)	0.399	0.87 (0.40–1.90)	0.728	1.51 (0.51–4.45)	0.448	0.96 (0.69–1.34)	0.808
	Good										
Baby birth weight	Low	1.06 (0.09–12.01)	0.961	NA	0.080	2.31 (0.23–23.22)	0.461	NA	NA	1.38 (0.33–5.87)	0.66
	Normal										
Baby birth height	Short	3.24 (0.39–27.25)	0.262	1.63 (0.63–4.17)	0.305	0.94 (0.08–11.61)	0.961	NA	0.220	1.99 (0.10–3.99)	0.048
	Normal										
Head circumference at birth	Abnormal	0.75 (0.03–17.60)	0.858	0.62 (0.20–1.92)	0.399	NA	NA	NA	0.000	0.66 (0.29–1.52)	0.329
	Normal										
Congenital defect	Yes	NA	0.508	N/A	0.511	2.45 (0.18–32.56)	0.480	NA	NA	0.74 (0.11–5.28)	0.765
	No										

(*continued*)

Table 1. (*continued*)

Variables		Highland		Watershed		Lowland /Coastal		Urban		Jambi Province	
		OR (95% CI)	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	***p***
Gestational age	Preterm	0.79 (0.31–2.03)	0.614	1.46 (0.66–3.22)	0.350	2.10 (0.74–5.95)	0.160	0.61 (0.17–2.25)	0.448	0.95 (0.63–1.43)	0.803
	Posterm	NA	0.000	-	-	NA	0.000		NA	7.63 (0.47–123.45)	0.152
	Aterm										
Infectious disease	Yes	4.38 (1.05–18.28)	0.030	3.67 (0.71–19.01)	0.099	1.49 (0.35–6.40)	0.587	0.81 (0.11–6.00)	0.835	1.72 (0.85–3.51)	0.129
	No										
Non infectious disease	Yes	NA	0.499	NA	NA	NA	NA	NA	NA	11.69 (1.03–132.71)	0.012
	No										
Place of delivery	Not a health service facility	0.46 (0.17–1.79)	0.122	2.01 (1.05–3.84)	0.033	2.42 (0.99–5.94)	0.049	2.06 (0.63–6.73)	0.221	1.27 (0.89–1.80)	0.188
	Health service facility										

(*continued*)

Table 1. (*continued*)

Variables		Highland		Watershed		Lowland /Coastal		Urban		Jambi Province	
		OR (95% CI)	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	***p***
Birth attendant	Not a Health Worker	1.70 (0.44–6.51)	0.431	1.02 (0.40–2.60)	0.972	0.84 (0.29–2.41)	0.737	1.36 (0.27–6.84)	0.700	0.95 (0.60–1.53)	0.843
	Health Worker										
Growth monitoring	No	2.18 (0.93–5.14)	0.050	2.00 (0.96–4.16)	0.061	1.63 (0.59–4.51)	0.343	1.16 (0.26–5.18)	0.841	1.58 (1.05–2.37)	0.027
	Yes										
Ownership of KIA Books	No	0.92 (0.37–2.27)	0.850	1.23 (0.61–2.46)	0.557	1.71 (0.64–4.59)	0.28	0.92 (0.27–3.18)	0.896	1.32 (0.93–1.87)	0.120
	Yes										
Family size	>4	0.84 (0.32–2.19)	0.710	0.87 (0.42–1.81)	0.705	0.99 (0.39–2.51)	0.983	0.97 (0.33–2.90)	0.960	1.02 (0.73–1.43)	0.905
	<=4										
Socio-economic level	Low	0.93 (0.27–3.19)	0.912	NA	NA	1.92 (0.59–6.30)	0.277	0.38 (0.09–1.56)	0.175	1.50 (1.02–2.20)	0.126
	Moderate	0.28 (0.09–0.89)	0.031	NA	NA	2.52 (0.73–8.71)	0.141	0.54 (0.11–2.67)	0.437	1.36 (0.87–2.13)	0.034
	High										

(*continued*)

Table 1. (*continued*)

Variables		Highland		Watershed		Lowland /Coastal		Urban		Jambi Province	
		OR (95% CI)	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	***p***
Sanitation	Poor	0.83 (0.31–2.18)	0.694	1.28 (0.60–2.70)	0.519	1.13 (0.40–3.13)	0.820	2.79 (0.74–10.59)	0.120	1.36 (0.95–1.95)	0.097
	Good										
Access to Health Facilities	Difficult	0.74 (0.22–2.50)	0.625	3.56 (1.46–8.65)	0.006	2.93 (0.81–10.62)	0.099	NA	0.000	1.49 (0.89–2.48)	0.041
	Moderate	0.56 (0,102–3.08)	0.501	3.25 (1.03–10.22)	0.044	3.48 (0.60–20.18)	0.161	1.66 (0.51–5.15)	0.398	1.82 (1.10–3.18)	0.182
	Easy										

Table 2. Different models of determinants of stunting incidence on various geographical characteristics in districts/cities stunting focus handling in Jambi Province

Variables	Highland		Watershed		Lowland/Coastal		Urban		Province	
	POR (95%CI)	**p**	**POR (95%CI)**	**p**	**POR (95%CI)**	**p**	**POR (95%CI)**	**p**	**POR (95%CI)**	**p**
Smoking	4.23 (0.82–21.69)	0.083	2.24 (0.76–6.62)	0.144					3.59 (1.72–7.49)	0.001
Parity (1) Parity (2)			0.22 (0.07–0.73)	0.014	0.53 (0.17–1.63)	0.262	0.40 (0.11–1.54) 0.19 (0.05–0.75)	0.177 0.019	0.35 (0.12–1.03) 2.33 (1.06–5.11)	0.055 0.035
Birth height									2.81 (1.29–6.13)	0.010
Infectious disease	2.40 (0.54–10.67)	0.246	2.37 (0.22–25.81)	0.475					**5.74 (1.46–22.56)**	**0.013**
KIA book ownership									2.23 (1.16–4.27)	0.016
Socio-economic (1) Socio-economic (2)			**5.70 (1.15–21.76)** **4.84 (1.13–20.70)**	**0.012** **0.034**	1.35 (0.35–5.22) 2.31 (0.55–9.79)	0.655 0.252	0.25 (0.06–0.96) 0.34 (0.05–2.14)	0.040 0.240	2.99 (1.39–6.42) 1.29 (0.59–2.84)	0.005 0.521
Health facility access (1) Health facility access (2)	0.27 (0.04–1.76) 0.17 (0.03–0.86)	0.166 0.033			4.40 (0.95–20.43) 6.99 (0.62–79.41)	0.058 0.115			4.18 (1.45–12.02) 4.70 (1.46–15.19)	0.008 0.010
Mother's education			1.60 (0.49–5.31)	0.440	5.91 (0.48–7.08)	0.367				
Mother's job (1) Mother's job (2)	**5.44 (1.14–25.93)** **6.12 (1.31–28.58)**	**0.034** **0.022**			**7.34(0.29–185.66)** **3.63(0.12–106.32)**	**0.222** **0.448**			1.01 (0.38–2.63) 1.05 (0.34–3.27)	0.999 0.932
Gestational age (1)									1.90 (0.72–4.96)	0.192
Place of birth	0.41 (0.11–1.47)	0.166	0.64 (0.22–1.90)	0.417	2.37 (0.87–6.46)	0.092	1.87 (0.49–7.11)	0.352	0.53 (0.24–1.17)	0.115
Mother's height							**6.00 (0.84–42.81)**	**0.073**		
Father's height	0.12 (0.01–1.29)	0.079								
Sanitation							4.77 (1.12–20.38)	0.036		
Personal Hygiene	0.34 (0.07–1.61)	0.169								
Growth monitoring	2.37 (0.63–8.93)	0.198	1.82 (0.67–4.95)	0.240						
Pregnancy status			1.74 (0.30–10.09)	0.529						
Pregnancy disorder					0.37 (0.07–2.08)	0.254				

for smoking behavior, infectious diseases, access to health facilities, place of delivery, father's height, personal hygiene, and growth monitoring.

The dominant factor in the incidence of stunting in watershed area was socioeconomic level, where a low socioeconomic level has a 5.69 times greater risk of becoming stunted compared to a high socioeconomic level after controlling for parity, pregnancy status, place of delivery, infectious diseases, education of mothers, growth monitoring of children, smoking behavior. The dominant factor for stunting in lowland area was the mother's occupation, with an OR value of 7.34, where mothers who do not work have a 7.34 times greater risk of stunting compared to mothers who work formally after controlling by socioeconomic level, parity, mother's education, pregnancy disorders, access to health facilities, and place of delivery. Whereas in urban areas the dominant factor causing stunting in toddlers was maternal height, where mothers who have short height have a 5.99 times greater risk of having stunting children compared to mothers who have normal height after being controlled by the location. Delivery, parity, socioeconomic level and environmental health.

4 Discussion

This study found the prevalence of stunting among toddlers (24–59 months) in Jambi Province was still > 20% (medium category). The results of this study indicate that there were differences in the incidence of stunting based on geographical conditions, where the highest prevalence of stunting in urban areas and the lowest prevalence was in low/coastal areas.

The results of this study were in line with the research of Cahyono, et al. (2016) which showed that in the lowland ecosystem zone, energy intake was found that affected the incidence of stunting with an OR = 0.059 (P-value = 0.002; 95% CI: 0.010 to 0.359). Energy intake in lowland ecosystem zones, children's energy intake has a protective effect (lower risk) against stunting by 0.059 compared to highlands [17]. The results of the research by Satriani and Yuniastuti (2020) also show that there were differences in the risk factors for stunting between the lowlands and the highlands [18].

The prevalence of stunting that varies according to the characteristics of this geographical area proves that there are possible differences in the causes of stunting according to the place of residence of children under five. The results of Riskesdas itself divide the results of the analysis according to the classification of the area of residence based on Village/City. Where the results of the analysis show that very short toddlers are more common in urban areas, but stunted toddlers are more common in rural areas. When combined between stunting and very short status, the proportion of stunting (short and very short) in toddlers (0–59 months) was slightly more common in urban areas, which was 30.2%, while in rural areas it was 30.08%. This is in line with the results found in this study, namely the highest proportion of stunting based on differences in the geographical area where children live actually occurs in urban areas compared to other districts/cities.

Geography comes from the Greek "geo" which means earth and "graphy" means writing. Geography teaches humans to study the earth where they live and the conditions on it. Earth has different geographical characteristics in each region. There is a north pole and a south pole which is covered with ice all year round, there are desert areas,

there are mountainous areas, there are oceans, there are rainforests and other landscapes and geography. Geographical characteristics of a region can affect the socio-cultural life. This is able to shape the social life of the community (Kompas.com, 2021). Physical systems and environmental characteristics do not by themselves determine patterns of human activity, but influence and limit the choices people make. These differences in geographical characteristics consist of differences in day and night, differences in climate, topography, availability of water and availability of food sources (Kompas.com, 2021). This will affect socio-cultural conditions that have an impact on differences in health status, including differences in the incidence of stunting in children. This is in line with the UNICEF theory which states that socioeconomic level is the root cause of malnutrition, including stunting [2, 7, 19].

The results of this study found that all prediction models were compared according to differences in the geographical characteristics of the Regency/City area which became the focus of stunting handling, although there were differences, all the prediction models obtained strengthened the evidence that socioeconomic levels were indeed the root of the problem of stunting that must be handled carefully. Multi-sectoral interventions known as sensitive nutrition interventions, in addition to specific nutrition interventions carried out by the health sector [20].

This study found that the dominant cause of stunting in highland areas was the mother's occupation after controlling for smoking behavior, infectious diseases, access to health facilities, place of delivery, father's height, personal hygiene, and growth monitoring. This result was also found in lowland/coastal areas, where the dominant factor causing stunting was the mother's occupation after controlling for socioeconomic level, parity, maternal education, pregnancy disorders, access to health facilities, and place of delivery. The analysis showed that the distribution of under five children based on the employment status of mothers in the highlands mostly worked as farmers (29.6%) and did not work (24.9%), while in East Tanjung Jabung and West (lowland areas) most of them did not. working (72.7%).

Mothers who work in the formal sector tend to receive more information, including those related to meeting the nutritional needs of children, than mothers who do not work and mothers who work in the informal sector. This can cause mothers who do not work and mothers who work in the informal sector have a greater likelihood of nutritional problems in their children, including the incidence of stunting. Although mothers who work in the formal sector tend to have regular working hours every working day, conditions in Kerinci Regency, Sungai Penuh City, East Tanjung Jabung and West Tanjung Jabung allow mothers to return home during breaks so that attention is paid to the food that will be served. Consumed by families including children is still possible to be considered.

The results of this study are in line with the results of research by Kolbrek (2011) which shows that mothers who work in the formal sector have a protective effect against stunting in children compared to mothers who do not work. Mothers who work in the formal sector have a lower risk of their child experiencing stunting [11]. Research in Surabaya also found that the type of mother's work (formal or informal) was related to the nutritional status of her child, mothers who work in the formal sector have better nutritional status than children whose mothers work in the informal sector [21].

Mother's occupation, whether working in the formal, informal sector, or not working is a consideration in the preparation of stunting prevention interventions for under five children.

In addition, the risk factors for stunting in highland area were father's smoking behavior, infectious diseases and growth monitoring of under five children. In order to reduce the incidence of stunting, strategic efforts are needed to reduce the impact of exposure to cigarette smoke on children, for example by promoting smoking behavior outside the home. This study found that the behavior of fathers who smoked actively was 74.3%, and 37.7% of them had stunting children. The proportion of stunting is higher than in fathers who do not smoke, which is 21.1%.

The risk factors for stunting in East and West Tanjung Jabung Districts were socioeconomic level, mother's education, and place of delivery. Socio-economic status can be related to the mother's occupation, which is the dominant factor in the incidence of stunting in East and West Tanjung Jabung Districts, where most of the mother's employment status is not working. The proportion of families with low socioeconomic status in mothers who do not work is 31.58% and there are those who work in the informal sector of 36.9%. This proportion is higher when compared to mothers who work in the formal sector, which is only 7.5%. This problem can be overcome by providing or monitoring social protection programs that are already running.

Access to health facilities is also a risk factor for stunting in East and West Tanjung Jabung Districts. This is possible because some of these areas are coastal areas. This study shows that there are 58.3% of children in the difficult category in terms of access to health care facilities. Access to health care facilities is fundamental in improving health status, including reducing the incidence of stunting. Innovative efforts need to be made in providing easy access to health care facilities for the community, in addition to improving existing facilities and infrastructure.

The place of delivery is also a risk factor for stunting in under five children in East and West Tanjung Jabung Districts. Based on the data obtained, 19.8% of deliveries were not carried out in health care facilities. This is not in line with Permenkes no. 97 of 2014 article 14 paragraph 1 which states that childbirth must be carried out in health care facilities. Mother's education is also a risk factor for stunting that needs attention. The results showed that most of the mother's education was in the low category. Low education tends to be related to knowledge [22, 23]. Therefore, it is necessary to improve Communication, Information and Education (IEC) related to health and nutrition in children.

The risk factors for stunting in watersheds area regency were parity, socioeconomic level, pregnancy status, place of delivery, infectious diseases, maternal education, monitoring growth of under five children and smoking behavior. The dominant factor that causes stunting was the socioeconomic level after being controlled by parity, pregnancy status, place of delivery, infectious diseases, mother's education, monitoring the growth of children, smoking behavior.

Research by Al-Anshori & Nuryanto found that low socioeconomic status families have an 11.8 times risk of stunting in children compared to high socioeconomic status [24]. Torlesse et al.'s research also found that socioeconomic status was a risk factor for

stunting. In this study, it was found that the lower the level of welfare or socioeconomic status, the higher the risk of stunting [14].

The socioeconomic status of the family is closely related to the fulfillment of family needs, including the fulfillment of children's nutritional needs. Families with high economic status tend to be able to meet their family's food and nutritional needs better and varied, so that there is less risk of their children experiencing stunting or other nutritional problems, and vice versa. One of the socio-economic problems can be overcome by providing a support system, namely a social protection system, in addition to other supporting systems: health, sanitation, and education facilities [7]. Therefore, the handling of stunting cannot only be carried out by the health sector, but multi-stakeholder and cross-programme.

Risk factors for stunting in Merangin and Tebo regencies were father's smoking behavior, history of infectious disease, mother's education, growth monitoring of under five children and pregnancy disorders. The results showed that most of the smoking behavior of fathers in the category of active smoking, which was 62.7%, and the proportion of stunting in fathers who smoked actively was 35.9%. The proportion who have a history of infectious diseases is 3.9%, but the proportion of stunting in children who have a history of infectious diseases is quite high, which is 60%. Infectious disease is a direct factor causing stunting [7, 25]. In watershed area also found that most of the mothers had low education. Therefore, communication, information and education (IEC) efforts related to health and nutrition in children need to be improved, especially for mothers with low levels of education. This is because education and knowledge can be interrelated [8, 22].

The results of this study also found that most mothers did not monitor the growth of their children. This is also in line with the low ownership of MCH books (including those who cannot show it) and access to service facilities is difficult. In addition, the factor of pregnancy disorders also needs to be a concern as a determinant of stunting in children in watershed area, it is known that there are 15.6% who experience pregnancy disorders, and 35.4% of them are stunted. Efforts to monitor the pregnancy process can be done through adequate and quality antenatal care services. However, the proportion of examination visits and antenatal care visits in poor categories is still quite high. Therefore, efforts to increase visits and examinations in antenatal care services are also important things to do in order to reduce the incidence of stunting in watershed Regencies.

The results of research in urban areas found that the dominant cause of stunting was maternal height after controlling for the variables of place of delivery, parity, socioeconomic level and environmental health. This is consistent with research conducted in Larantuka City, East Flores Regency, which found a significant relationship between maternal height and the incidence of stunting, with mothers with short bodies (155 cm) having a three times higher risk of stunting in children than mothers with taller bodies (155 cm) [13]. In Laos, research found that taller women had a lower risk of stunting in their children (OR = 0.78, P = 0.006), but short moms have a higher risk of stunting in their children (OR = 0.78, P = 0.006) [21].

The height of the parents, including the height of the mother, is an important factor in determining the child's growth pattern. Research conducted by WHO found that the height of parents (mid-parental height) correlated with height of children after the age

of two years. This study also found that interventions can be carried out at least until the age of two years by meeting the nutritional needs of children according to international recommendations [26].

The dominant factor for stunting in Jambi Province is infectious disease after controlling for smoking behavior, parity, birth height, ownership of MCH books, socioeconomic level, access to health facilities, mother's occupation, gestational age, and place of delivery. This is in line with the conceptual framework of the determinants of child undernutrition which states that disease is a direct cause of nutritional problems in children [7, 25]. Research in Padang City in 2018 showed that children whose disease duration frequency was more than 3 days per sick episode had a 7 times higher risk than children whose disease duration frequency was 3 days per sick episode of stunting [27].

Of all the comparisons of prediction models that are compared based on geographical characteristics, although there are differences in dominant factors and several variables, all of the prediction models for stunting lead to one equation, namely the socioeconomic level of the family, and this is in accordance with the UNICEF concept.

UNICEF states that malnutrition, including stunting, can be caused by direct causes, namely food and disease. Malnutrition is caused not just by a lack of food, but also by sickness. Children who receive adequate nourishment but are frequently unwell may develop malnutrition. Similarly, youngsters who do not eat enough will have a weakened immune system and will be more prone to sickness. Inadequate family food security, child care patterns, basic health services, and environmental cleanliness are also indirect contributors. These three criteria are connected to the amount of education, knowledge, and skills in the family. The higher the level of education, knowledge, and skills, the greater the degree of family food security, the better the parenting pattern, and the more the use of health services, the more families will utilize health services [25].

Based on this study results, it is necessary to comprehensively prevent and control stunting in children by implementing sensitive nutrition interventions as well as specific nutrition interventions. The problem of stunting can not only be solved by the health sector alone, because in reality the specific nutrition intervention only contributes 30%, while for the prevention and control of nutritional problems the largest is 70%. Multi-sectoral and multi-program coordination and synergy is a must in accelerating the handling of stunting events [20, 28].

The results of the study support what has been implemented in the flagship program of the National Population and Family Planning Agency (BKKBN), namely Family Development, Population and Family Planning (called "Bangga Kencana"). The Bangga Kencana program aims to create quality families who live in a healthy environment through various community activity groups, including finding solutions to deal with stunting cases in the future, in order to create a superior, competitive and quality Indonesian generation. There are several program groups in the Bangga Kencana program, namely to overcome the socio-economic problems of the community through the UPPKS (Efforts to Increase Prosperous Family Income) which is an effort to empower the family economy which is developed through micro-economic businesses with family targets, especially pre-prosperous families and prosperous families [29].

In the Bangga Kencana program, efforts have been made to develop the Under five Children Family (BKB) to overcome the problems of children, both infectious diseases

and monitoring the growth and development of children. This BKB aims to improve the knowledge and skills of families with children in fostering child development through proper parenting based on age groups, including in handling smoking behavior at home and ownership of MCH books as a place for monitoring the growth and development of toddlers [29, 30].

The results of this study recommend that the prevention and control of stunting in under five children were adapted to the characteristics of specific geographic and local areas, interventions should be directed at sensitive nutrition interventions involving multi-sectoral and cross-programme, especially in terms of socio-economic improvement of the family, should also be carried out in an integrated manner with specific nutritional interventions. Supplementary feeding (PMT) efforts for families with stunting children need to be monitored, but improving the socioeconomic level remains a point of concern and monitoring and evaluation of the social protection system that has been running in the district/city area needs to be monitored. Increased efforts to prevent and control infectious diseases, especially in children as an effort to prevent stunting where this is closely related to the improvement of basic sanitation and also the promotion of personal hygiene. Revitalizing the Posyandu for children and upgrading the Posyandu into a Holistic-integrative Posyandu, so that the role of monitoring growth and development, education and poverty alleviation programs can be carried out together.

Acknowledgments. The authors expresses appreciation and thanks to the Jambi Provincial Representative Office of BKKBN which has provided funds for the implementation of this research activity and all parties who have facilitated the implementation of this activity.

Authors' Contributions. UK was the principal investigator in charge of this research activity, preparing proposals and supervision of analyze and the compilation of draft articles. HDS was also a research member that assisted in preparing the research proposal, analyzing data, and helping to draft the article. IS also a research member and assisted in preparing research proposal and administration arrangement.

References

1. Kemenkes RI. Situasi Balita Stunting di Indonesia. Jakarta: Kemenkes RI; 2018.
2. UNICEF, WHO, World Bank. Levels and trends in child malnutrition. Switzerland: UNICEF, WHO and the World Bank Group Joint Child Malnutrition; 2020.
3. Kemenkes RI. Laporan Nasional Riskesdas 2018. Badan Penelitian dan Pengembangan Kesehatan. Jakarta, Indonesia; 2019.
4. Kemenkes RI. Laporan riskesdas 2013. Jakarta Puslitbangkes Kemenkes RI. 2014;
5. Kementerian PPN/Bappenas. Kajian Sektor Kesehatan Pembangunan Gizi di Indonesia. Kementerian PPN/Bappenas. 2019. 1–78 p.
6. WHO. Reducing Stunting in Children: Equity Considerations for Achieving Global Nutrition Target 2025. 2018.
7. UNICEF. The State of the World's Children 2019. Growing Well in a Changing World. Children. Food Nutr (Roma). 2019;
8. Alifariki LO, Rangki L, Haryati H, Rahmawati R, Sukurni S, Salma WO. Risk Factors of Stunting in Children Age 24-59 Months Old. Media Keperawatan Indones. 2020 Feb 29; 3(1): 10.

9. Haris A, Fitri A, Kalsum U, Studi P, Masyarakat K, Jambi U. Determinants of Stunting and Underweight of underfive children of Suku Anak Dalam in Nyogan Village Muaro Jambi, 2019. J Kesehat Masy Jambi. 2019; 3(1): 41–53.
10. Kalsum U, Julita K, Pertiwi DR. Inbreeding marriage related to stunting in children aged 24–59 months. … Kesehat Ibu dan … [Internet]. 2019; 13(1): 10–8. Available from: https://www.e-journal.poltekkesjogja.ac.id/index.php/kia/article/view/383
11. Kolbrek M. Malnutrition and associated risk factors in children aged 6–59 months in urban Indones: A quantitative study. 2011.
12. Ramli, Agho KE, Inder KJ, Bowe SJ, Jacobs J, Dibley MJ. Prevalence and risk factors for stunting and severe stunting among under-fives in North Maluku province of Indonesia. BMC Pediatr. 2009 Sep 6; 9: 64.
13. Wahdah S, Juffrie M, Dietetik EH-JG dan, 2016 undefined. Faktor risiko kejadian stunting pada anak umur 6–36 bulan di wilayah pedalaman kecamatan silat hulu, Kapuas hulu, Kalimantan barat. ejournal.almaata.ac.id.
14. Torlesse H, Cronin AA, Sebayang SK, Nandy R. Determinants of stunting in Indonesian children: Evidence from a cross-sectional survey indicate a prominent role for the water, sanitation and hygiene sector in stunting reduction. BMC Public Health. 2016 Jul; 16(1).
15. Larasati DA, Susila Nindya T, Arief YS. Hubungan antara Kehamilan Remaja dan Riwayat Pemberian ASI Dengan Kejadian Stunting pada Balita di Wilayah Kerja Puskesmas Pujon Kabupaten Malang The Correlation Between Adolescent Pregnancy, Breastfeeding Practice and Stunted Children at Puskesmas Pujon Kabupaten Malang. 2018; 1–12.
16. Rahmawati VE, Pamungkasari EP, Murti B. Determinants of Stunting and Child Development in Jombang District. J Matern Child Heal. 2018; 03(01): 68–80.
17. Cahyono F, Manongga SP, Picauly I. Faktor Penentu Stunting Anak Balita Pada Berbagai Zona Ekosistem di Kabupaten Kupang. J Gizi Pangan. 2016; 11(1): 9–18.
18. Satriani dan Yuniastuti A. Risk Factor of Stunting in Toddlers (Study of Differences Between Low and Highlands). J world Nutr. 2020; 3(1): 32–41.
19. WHO. Childhood Stunting: Context, Causes and Consequences. WHO. 2013.
20. Reinhardt K, Fanzo J. Addressing Chronic Malnutrition through Multi-Sectoral, Sustainable Approaches: A Review of the Causes and Consequences. Front Nutr. 2014; 1(August): 1–11.
21. Kamiya Y, Nomura M, Ogino H, Yoshikawa K, Siengsounthone L, Xangsayarath P. Mothers' autonomy and childhood stunting: evidence from semi-urban communities in Lao PDR. BMC Womens Health. 2018; 18(1): 1–9.
22. Rahmawati A, Nurmawati T, Sari LP. Faktor yang Berhubungan dengan Pengetahuan Orang Tua tentang Stunting pada Balita. J Ners dan Kebidanan (Journal Ners Midwifery). 2019; 6(3): 389–95.
23. Perkasa DD, Dzul Akmal SKM. Faktor Yang Berhubungan Dengan Pengetahuan Ibu tentang Makanan Pendamping Air Susu Ibu pada Baduta Usia 6–24 Bulan di Wilayah Kerja Puskesmas Colomadu I Kabupaten Karanganyar. Universitas Muhammadiyah Surakarta; 2019.
24. Al-Anshori H, Nuryanto N. Faktor risiko kejadian stunting pada anak usia 12–24 bulan (Studi di Kecamatan Semarang Timur). Diponegoro University; 2013.
25. Unicef. Improving child nutrition: the achievable imperative for global progress. New York UNICEF. 2013; 1–14.
26. Garza C, Borghi E, Onyango AW, de Onis M, Group WHOMGRS. Parental height and child growth from birth to 2 years in the WHO M ulticentre Growth Reference Study. Matern Child Nutr. 2013; 9: 58–68.
27. Setiawan E, Machmud R. Faktor-Faktor yang Berhubungan dengan Kejadian Stunting pada Anak Usia 24–59 Bulan di Wilayah Kerja Puskesmas Andalas Kecamatan Padang Timur Kota Padang Tahun 2018 [Internet]. Vol. 7, Jurnal Kesehatan Andalas. 2018. Available from: http://jurnal.fk.unand.ac.id

28. Scaling Up Nutrition Movement. Annual Progress Report 2014. Geneva: SUN Movement Secretariat; 2014.
29. Kencana B. “ Bangga Kencana ” Profile of. 2019.
30. Aji N, Kusuma R, Zulfiani D. Pelaksanaan Program Pembangunan Keluarga Kependudukan dan Keluarga Berencana (Bangga Kencana) Kota Samarinda. 2021; 9(1).