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Stunting risk assessment: Its relationship with the life habits of West Sumatra brides-to-be

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Abstract

This study aims to analyze the relationship between several risk factors and the incidence of stunting in young women who are brides-to-be in West Sumatra Province. The study used a quantitative method with a survey approach to examine variables related to stunting risk, which were measured through Body Mass Index (BMI) and Upper Arm Circumference (LiLA). The independent variables analyzed included exposure to cigarette smoke (X1), the role of government assistance (X2), consumption of healthy foods and supplements (X3), and education through digital media campaigns (X4). The population in this study consisted of all adolescent girls in each district/city in West Sumatra, with the sample purposively selected, namely adolescent girls aged 10–24 years who are in the preparation stage for marriage. Data collection was carried out using survey techniques with questionnaires, followed by descriptive statistical analysis (mean, median, standard deviation). The analysis of the relationship between variables was conducted using the Pearson Product-Moment correlation technique. The results showed that all independent variables had a significant relationship with stunting risk, with very strong correlation values and significance levels below 0.05. These findings confirm that interventions on these factors, especially those related to education, government policies, and nutritional consumption, are essential in reducing the risk of stunting among brides-to-be in 19 districts and cities in West Sumatra, Indonesia. This study provides recommendations for strengthening promotive and preventive strategies based on local culture and digital approaches.

Keywords: Bride-to-be, Digital Campaigns, Life habits, Stunting.

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1. Introduction

Stunting is one of the public health problems that remains a serious concern in Indonesia. It is a condition in which a child's height is significantly shorter than that of peers due to prolonged malnutrition, affecting growth and development from pregnancy to the age of two, leading to long-term health problems [1]. Stunting is a condition characterized by stunted body growth in toddlers caused by chronic malnutrition that is not properly treated [2]. This condition significantly affects the growth, development, and health of children, which has long-term consequences if not managed effectively [3]. Stunting is a condition in which the height of toddlers is more than -2 standard deviations below the median of WHO child growth criteria, indicating chronic nutritional problems that can stunt growth and development, leading to long-term educational challenges [4]. Data from the 2022 Indonesian Nutrition Status Study (SSGI) shows that the national stunting prevalence reached 21.6%, while West Sumatra recorded a figure of 23.3%, still above the 14% threshold set by the WHO as a low category [5]. Stunting not only impacts children's physical growth but also affects cognitive development, long-term productivity, and vulnerability to non-communicable diseases in adulthood [6]. Stunting risk factors are known to be related not only to infancy and toddlerhood but also to the preconception condition of mothers, especially brides-to-be. The nutritional status of adolescents in the study revealed that 40% of rural students were underweight, while 26% of urban students were underweight [7]. Determinants of nutritional status in adolescents include dietary intake (carbohydrates, proteins, fats), with no significant association found with stress levels or physical activity [8]. The nutritional status of adolescents aged 12-18 years in Indonesia shows that 19.1% are Overnourished and 31% are obese. In Banten Province, these figures are 20.9% and 30%, respectively, indicating a significant prevalence of malnutrition among adolescents [9]. The nutritional status of adolescents in the study revealed that 71.7% had a calorie deficit, with 72.3% having a normal BMI, while 15.2% were thin and 11.5% were very thin, indicating persistent malnutrition that requires focused intervention [10]. The premarital period is an important time to ensure that the mother-to-be is in good nutritional status because the nutritional status before pregnancy greatly influences the outcome of pregnancy and the growth and development of the child to be born.

In this context, the measurement of Body Mass Index (BMI) and Upper Arm Circumference (LILA) becomes a simple and practical indicator that can be used to identify the risk of chronic nutrition and energy deficiency in women of childbearing age. The study did not find a significant association between the nutritional status of breastfeeding mothers and the incidence of stunting in infants, with a p-value of 0.307. However, stunting is more common in toddlers whose mothers have poor nutritional status [11]. The study found a significant association between the nutritional status of pregnant women (measured by LILA) and stunting in infants, with 34.0% of pregnant women experiencing chronic energy deficiencies, contributing to 47.4% of babies experiencing stunting [12]. Previous research has shown that maternal nutritional status, especially chronic energy malnutrition during pregnancy, is significantly associated with stunting in children aged 6-23 months. Improving women's nutritional status is essential to prevent stunting and improve child growth and development outcomes [13]. The nutritional status of the mother during pregnancy has a significant impact on stunting in toddlers. Poor nutritional conditions in mothers lead to an inadequate supply of nutrients, increasing the risk of stunting by as much as 13 times compared to those with good nutritional status, as studies have shown [14]. Women with unbalanced eating habits and low physical activity are more at risk of malnutrition.

In West Sumatra, the culture of early marriage and the lack of premarital health checks have also worsened the situation. Many brides-to-be are not aware of the importance of physical and nutritional readiness before pregnancy, which can impact the nutritional status of the child. Government policies through the "Bride-to-be Assistance" program by BKKBN and the Ministry of Religion have not fully integrated aspects of stunting risk assessment comprehensively, especially based on anthropometric data and lifestyle habits [15]. Studies have shown a link between preconception nutritional status and stunting risk, but there is still limited research linking simultaneous BMI and LILA measurements to the lifestyle of brides-to-be, especially in local cultural contexts such as West Sumatra [16]. Therefore, an in-depth study is needed that integrates anthropometric approaches and lifestyle habits as an effort to early predict the risk of stunting from the premarital period. This research is important because it raises the issue of stunting from the perspective of preconception, which has received less attention in stunting prevention strategies. By measuring BMI and LILA and assessing the lifestyle habits of brides-to-be, the results of this study are expected to serve as a scientific basis for more comprehensive and contextual premarital interventions. In addition, this study answers the need for local data that has not been systematically available in West Sumatra. This research is important because it raises the issue of stunting from the perspective of preconception, which has received less attention in stunting prevention strategies. By measuring BMI and LILA and assessing the lifestyle habits of brides-to-be, the results of this study are expected to serve as a scientific basis for more comprehensive and contextual premarital interventions. In addition, this study answers the need for local data that has not been systematically available in West Sumatra.

2. Research Methods

This research was conducted using a quantitative research method with a survey approach to collect data related to stunting risk assessment based on the sample Body Length and Arm Circumference Index as a dependent variable (Y). Data collection using survey techniques was also carried out for the variables of Cigarette Exposure (X1), Role of Government Assistance (X2), Healthy Food Consumption (X3), and Health Campaigns through social media (X4). The study population comprises all adolescent girls grouped in each district and city in West Sumatra Province. The sample was selected randomly using purposive sampling, focusing on adolescents aged 10–24 years old who are prospective brides, i.e., those who intend to marry. The statistical analysis includes data description with basic data disclosure: median, *standard deviation*, maximum, minimum, followed by narrative explanations of data interpretation. Data analysis was performed using the partial Product-Moment Correlation formula to examine the relationships between variables X1-Y, X2-Y, X3-Y, and X4-Y. If the

significance value is <0.05, then a decision is made to accept the formulated hypothesis that or independent variables have a significant effect on the dependent variable. The research hypothesis can be described as follows:

H_1: There is a positive and significant association between cigarette exposure and the risk of stunting in adolescent brides-to-be in West Sumatra

H_2: There is a positive and significant relationship between government assistance and the risk of stunting for adolescent brides-to-be in West Sumatra

H_3: There is a positive and significant relationship between healthy food consumption and the risk of stunting in adolescent brides-to-be in West Sumatra.

H_4: There is a positive and significant relationship between Education Through Social Media and the risk of stunting in adolescent brides-to-be in West Sumatra

3. Research Results

3.1. Data Description

*3.1.1. Stunting Risk (*Y)

The following are the results of the survey and analysis data on the Stunting Risk sample based on the Body Mass Index and Chronic Energy Deficiency (SEZ):

Table 1.
Stunting Risk Data Based on BMI and SEZs.

No.	Regency/City	N	Low BMI		CAKE	
			f	%	f	%
1	Pesisir Selatan	2152	242	11	372	17
2	Solok	3098	265	9	603	19
3	Sijunjung	1268	192	15	261	21
4	Tanah Datar	3404	370	11	591	17
5	Padang Pariaman	3576	338	9	429	12
6	Agam	3283	303	9	466	14
7	Lima Puluh Kota	2530	302	12	479	19
8	Pasaman	1682	191	11	326	19
9	Kepulauan Mentawai	103	25	24	22	21
10	Dharmasraya	1225	146	12	207	17
11	Solok Selatan	1590	158	10	235	15
12	Pasaman Barat	2323	230	10	508	22
13	Kota Padang	6130	388	6	690	11
14	Kota Solok	348	30	9	29	8
15	Kota Sawahlunto	416	40	10	44	11
16	Kota Padang Panjang	318	11	3	47	15
17	Kota Bukittinggi	375	44	12	33	9
18	Kota Payakumbuh	858	103	12	120	14
19	Kota Pariaman	951	78	8	139	15
	Average	35630	3456	11	5601	16

Stunting risk variables are measured by body mass index, which is a heuristic proxy for human body fat based on a person's weight and height. BMI doesn't measure body fat percentage. Assignment: Chronic Energy Deficiency (CED), which is one of the states of malnutrition. What is the condition of a woman who suffers from chronic food deficiency that results in the occurrence of health problems in the mother, relative, or absolute of one or more nutrients? [10]. A person is considered at risk of SEZ if the LiLA (Upper Arm Circumference) is less than 23.5 cm. The survey results indicate that each district or city in West Sumatra has a young woman who is a bride-to-be with a low BMI, averaging 11%, and there are SEZ cases with an average of 16%. The survey also shows that on average, 11% of bride-to-be adolescent girls in West Sumatra have a low Body Mass Index (BMI), and 16% of them experience Chronic Energy Deficiency (SEZ). This is an important finding in the context of stunting prevention during the preconception period. Low BMI in adolescent girls reflects poor nutritional status and can potentially disrupt reproductive processes and future fetal growth. BMI is a simple yet useful indicator for assessing nutritional status based on the ratio of body weight (kg) to squared height (m^2). Although it does not directly measure body fat percentage, BMI is widely used as a proxy in public health surveys [17]. The existence of young women with a LiLA of < 23.5 cm as an indicator of SEZs further strengthens the assumption that many brides-to-be are in suboptimal nutritional conditions. SEZs in adolescent girls show long-term energy and nutrient deficiencies, which significantly contribute to the risk of giving birth to babies with low birth weight (BBLR), which is one of the main risk factors for stunting in children [18]. This underscores the importance of nutritional interventions during adolescence, especially in groups that are about to enter the marriage and pregnancy phases [19]. This inequality in nutritional status can be caused by various factors, including lack of access to nutritional information, unbalanced diets, social pressures related to ideal body shape, and lack of adolescent health services [20]. Therefore, stunting prevention programs cannot only focus on pregnant women and toddlers but must be expanded to include adolescents as a strategic group. Interventions such as nutrition education, supplementation, and the

promotion of a healthy lifestyle need to be implemented in an integrated manner through a cross-sectoral approach. Given the trend of low prevalence of STIs and SEZs among adolescent girls in West Sumatra, it is important to develop local data-driven prevention strategies and contextual interventions. This step will be very beneficial in breaking the chain of the intergenerational malnutrition cycle and sustainably reducing the stunting rate.

3.1.2. Cigarette Smoke Display (X1)

The following are the results of the survey and analysis data on the conditions of exposure to cigarette smoke in the research sample:

Table 2.
Exposure to Cigarette Smoke.

No.	Regency/City	N	Exposed	
			f	%
1	Pesisir Selatan	2152	618	29
2	Solok	3098	1552	50
3	Sijunjung	1268	537	42
4	Tanah Datar	3404	924	27
5	Padang Pariaman	3576	804	22
6	Agam	3283	1183	36
7	Lima Puluh Kota	2530	992	39
8	Pasaman	1682	478	28
9	Kepulauan Mentawai	103	67	65
10	Dharmasraya	1225	325	27
11	Solok Selatan	1590	230	14
12	Pasaman Barat	2323	958	41
13	Kota Padang	6130	594	10
14	Kota Solok	348	88	25
15	Kota Sawahlunto	416	177	43
16	Kota Padang Panjang	318	89	28
17	Kota Bukittinggi	375	79	21
18	Kota Payakumbuh	858	221	26
19	Kota Pariaman	951	181	19
	Average	35630	10097	31

One of the factors that increases the risk of stunting is exposure to cigarette smoke. Based on the study results, it is known that 31% of young women who are prospective brides in the West Sumatra region are exposed to cigarette smoke**.** The study also showed that 31% of prospective brides and grooms in the West Sumatra region are exposed to cigarette smoke in their neighborhood. This high exposure rate is a serious concern because cigarette smoke contains more than 7,000 harmful chemicals, including carcinogenic substances that can affect reproductive health and fetal growth in the future [21]. Smoking, both during pregnancy and postnatally, is negatively associated with children's stature. The study found that parental smoking remained associated with stunting, even after adjusting for socioeconomic factors, highlighting its significant impact on growth in children under five years of age [22]. Parental smoking behavior is significantly correlated with the incidence of stunting in toddlers, as evidenced by a p-value of 0.00 and a correlation coefficient of 0.378. Smoking affects the absorption of nutrients and financial resources, inhibiting the growth and development of children [23].

3.1.3. The Role of Government Assistance (X2)

The following are the results of the survey and data analysis on the role of government assistance in the research sample:

Table 3.
The Role of Government Assistance.

No.	Regency/City	N	Exposed	
			f	%
1	Pesisir Selatan	2152	469	22
2	Solok	3098	1387	45
3	Sijunjung	1268	361	28
4	Tanah Datar	3404	697	20
5	Padang Pariaman	3576	1041	29
6	Agam	3283	1070	33
7	Lima Puluh Kota	2530	671	27
8	Pasaman	1682	334	20
9	Kepulauan Mentawai	103	21	20
10	Dharmasraya	1225	296	24
11	Solok Selatan	1590	580	36
12	Pasaman Barat	2323	678	29
13	Kota Padang	6130	1229	20
14	Kota Solok	348	41	12
15	Kota Sawahlunto	416	110	26
16	Kota Padang Panjang	318	34	11
17	Kota Bukittinggi	375	93	25
18	Kota Payakumbuh	858	200	23
19	Kota Pariaman	951	177	19
	Average	35630	9489	25

The results of the study show that as many as 25% of prospective young women in the West Sumatra region have not received counseling and assistance related to stunting. This condition is an indicator of weak access to reproductive health information and education, which should be a basic right of adolescents, especially those who will enter the marriage and pregnancy phase. The lack of assistance from the government and related institutions leads to a low understanding of risk factors and stunting prevention, including the importance of nutritional status, maternal health, and child care. According to the Ministry of Health of the Republic of Indonesia [24], nutrition and reproductive health education since adolescence is a crucial step in breaking the chain of stunting between generations. This is in line with the opinion of UNICEF [25], which emphasizes that effective interventions must begin before pregnancy through a community-based approach and cross-sectoral support. The absence of counseling can result in low readiness of adolescents to undergo a healthy and quality pregnancy.

Table 4.
Consumption of healthy foods and dietary supplements.

No.	City Districts	N	Exposed	
			f	%
1	Pesisir Selatan	2152	718	33
2	Solok	3098	1552	50
3	Sijunjung	1268	517	41
4	Tanah Datar	3404	1736	51
5	Padang Pariaman	3576	1554	43
6	Agam	3283	1488	45
7	Lima Puluh Kota	2530	1069	42
8	Pasaman	1682	723	43
9	Kepulauan Mentawai	103	3	3
10	Dharmasraya	1225	473	39
11	Solok Selatan	1590	1138	72
12	Pasaman Barat	2323	703	30
13	Kota Padang	6130	2227	36
14	Kota Solok	348	97	28
15	Kota Sawahlunto	416	190	46
16	Kota Padang Panjang	318	101	32
17	Kota Bukittinggi	375	148	39
18	Kota Payakumbuh	858	478	56
19	Kota Pariaman	951	297	31
	Average	35630	15212	40

3.1.4. Consumption of Healthy Food and Dietary Supplements (X3)

The following are the survey results and analysis data on the consumption of healthy foods and dietary supplements in the research sample:

The results of the study show that as many as 40% of young women brides-to-be in the West Sumatra region do not receive dietary supplements as part of a healthy diet. This fact indicates that there is a gap in meeting basic nutritional needs that are very important for reproductive health and pregnancy preparation [26]. Adolescence is a crucial period during which the need for energy and nutrients increases rapidly to support the growth and development of reproductive organs [27]. Insufficient intake of micronutrients such as iron, folic acid, zinc, and vitamin A can cause anemia, chronic fatigue, immune disorders, and decreased body readiness to face the pregnancy and childbirth processes [12]. A study in Indonesia found that children with adequate energy, protein, fat, carbohydrates, and zinc intake had a lower risk of stunting. The study also found that zinc consumption was the most dominant factor influencing stunting, with a significant correlation between zinc intake and a reduced risk of stunting [28]. Maternal nutrition, dietary diversity, and specific nutrient intake all play an important role in reducing the risk of stunting [29]. Community-based interventions and the handling of socio-economic factors can further increase efforts to prevent stunting [12]. By promoting healthy diets and providing nutrition education, communities can take significant steps to reduce the prevalence of stunting and improve children's health and well-being [8]. The lack of access to dietary supplements, whether due to economic factors, lack of nutrition education, or the absence of intervention programs from authorities, risks worsening the nutritional status of adolescent girls [7]. This certainly has a direct impact on the risk of giving birth to children with low birth weight and stunting. Therefore, increasing community-based premarital nutrition interventions is a strategic step in preventing stunting from the upstream.

3.1.5. Education Through Digital Media Campaigns (x4)

The following are the results of the survey and analysis data on education from social media campaigns obtained by sampling about stunting:

Table 5.
Digital Media Campaign Data.

No.	Regency/City	N	Exposed	
			f	%
1	Pesisir Selatan	2152	2008	93
2	Solok	3098	2942	95
3	Sijunjung	1268	1247	98
4	Tanah Datar	3404	3249	95
5	Padang Pariaman	3576	3373	94
6	Agam	3283	2833	86
7	Lima Puluh Kota	2530	2362	93
8	Pasaman	1682	1613	96
9	Kepulauan Mentawai	103	103	100
10	Dharmasraya	1225	1169	95
11	Solok Selatan	1590	1515	95
12	Pasaman Barat	2323	2194	94
13	Kota Padang	6130	5678	93
14	Kota Solok	348	340	98
15	Kota Sawahlunto	416	371	89
16	Kota Padang Panjang	318	301	95
17	Kota Bukittinggi	375	325	87
18	Kota Payakumbuh	858	786	92
19	Kota Pariaman	951	847	89
	Average	35630	33256	94

The results of the study revealed that 94% of young brides-to-be women in the West Sumatra region have never participated in health campaigns through digital media. This finding is a serious concern, considering that digital campaigns are one of the strategic means to convey health information quickly, broadly, and relevantly, especially for the younger generation who are very familiar with technology [30]. The lack of exposure to digital campaigns indicates the low use of information technology as an educational tool and the increase in nutrition literacy and reproductive health in the general public [31]. Adequate knowledge about stunting and its prevention among adolescents plays an important role in preparing mothers-to-be who are physically and mentally healthy [26]. Social media-based digital campaigns can increase adolescents' awareness and understanding of the importance of balanced nutrition, pregnancy planning, and a healthy lifestyle [32]. Digital health interventions have great potential to reach vulnerable groups, especially adolescent girls, through informative and interactive content [33]. The lack of access to or involvement in digital campaigns leads to limited adolescents' knowledge of crucial issues such as stunting, anemia, and the importance of reproductive readiness. Therefore, it is necessary to design a digital campaign model that is more inclusive and adaptive to the characteristics of adolescents, to increase their involvement and understanding as part of an effective stunting prevention strategy from an early age.

3.2. Hypothesis Testing

The results of data acquisition based on filling out questionnaires conducted by the research sample can be explained by the description of the basic research data presented in Table 1:

Table 6.
Description of Research Basic Data.

Variable	N	Mean	Median	SD
Stunting Risk (Y)	19	329.58	323.00	232.346
Cigarette Smoke Display (X1)	19	531.42	478.00	434.225
The Role of Government Assistance (X2)	19	499.42	361.00	428.222
Consumption of Healthy Food and Dietary Supplements (X3)	19	800.63	703.00	653.511
Education Through Digital Media Campaigns (x4)	19	1750.32	1515.00	1427.588

The hypothesis test was conducted to verify the alleged cause of the problem of low entrepreneurial competence among students interested in entrepreneurship, and whether the entrepreneurship learning curriculum provided by universities was the cause. The analysis of the hypothesis test data can be seen in the following table;

Table 7.
Correlation Analysis.

Analysis Variables	N	Correlation Score	Sig.
X1 – Y	19	0.839	0.000
X2 – Y	19	0.862	0.000
X3 – Y	19	0.724	0.000
X4 – Y	19	0.687	0.000

Based on the results of Pearson's correlation analysis, this study showed that all independent variables had a very significant relationship with the risk of stunting in brides-to-be in 19 districts/cities in West Sumatra. Exposure to cigarette smoke (X1) showed a very strong correlation with the risk of stunting ($r = 0.839$; $p = 0.000$), which is in line with the findings [34]. This statement indicates that exposure to secondhand smoke harms women's reproductive health and fetal development. In West Sumatra, the social culture within extended families and the gadang house often unites many family members, making it difficult for women to avoid exposure to cigarette smoke in the domestic environment. The role of government assistance (X2) also demonstrated a very strong correlation ($r = 0.862$; $p = 0.000$). This finding is consistent with previous research [32]. This emphasizes that intensive assistance from health workers can reduce the risk of stunting by increasing understanding of premarital nutrition. However, this approach in West Sumatra needs to be adjusted to local wisdom, such as the *Nagari*, which is collectively based and has the potential to serve as a strong community education medium. Meanwhile, the consumption of healthy foods and supplements (X3) has a strong association with the risk of stunting ($r = 0.724$; $p = 0.000$). This aligns with the findings of [35]. This suggests that poor nutritional intake in adolescence contributes to the incidence of KEK. In the ethnographic context of West Sumatra, the consumption of traditional foods such as *Stuttgar*, *Fried fish*, and *Cassava Leaf Goulash* is actually rich in nutrients if managed correctly. However, the modernization of diets has led to a shift towards low-nutrient instant foods. Education through digital campaigns (X4) has a very strong correlation with stunting risk ($r = 0.862$; $p = 0.000$). This is reinforced by the findings [36]. This statement indicates that digital interventions can enhance adolescents' knowledge about reproductive health and nutrition. Unfortunately, low penetration and digital literacy in rural areas of West Sumatra pose significant obstacles, especially for young women in coastal and inland regions. Overall, the results of this study reinforce that stunting intervention approaches must be contextual, sensitive to Minangkabau traditional values that prioritize the role of women in the family, and utilize social structures such as *Bundo Kanduang* and institutions as counseling channels. Support from local governments and cross-sector collaboration are essential to synergize these efforts. Stunting prevention requires a holistic approach based on culture and local wisdom, supported by digital media, through the development and principles of technological disruption in human life [37].

4. Conclusion

The results of this study clearly show that the risk of stunting in brides-to-be in the West Sumatra region is greatly influenced by several determinant factors, namely exposure to cigarette smoke, lack of assistance from the government, low consumption of nutritious foods and supplements, and lack of access to education through digital campaigns. The findings showed that all independent variables had a significant and strong relationship with stunting risk, with the highest correlation value indicated by government assistance and digital education ($r = 0.862$), followed by exposure to cigarette smoke ($r = 0.839$), and consumption of nutritious food ($r = 0.724$), all at a significance level of 0.000. This condition reflects the need for a more comprehensive and local context-based intervention in preventing stunting from the pre-marital period. Amid Minangkabau culture that places women at the center of the social order, stunting prevention strategies can be strengthened with approaches that respect traditional values, such as the use of the role of *Bundo Kanduang* and *nagari* institutions as relevant educational channels. In addition, digital transformation needs to be directed to reach adolescent girls, especially in rural areas that are not optimal in accessing health information. Thus, stunting prevention efforts must prioritize synergy between medical, educational, social, and local cultural approaches, so that the solutions offered are truly rooted in the reality of the people of West Sumatra and can respond to challenges in a sustainable manner.

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