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Analyzing Factors Affecting Stunting, Wasting, and Underweight in Toddlers in Padang Pariaman Regency

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Abstract: Stunting, wasting and being underweight are some of the significant health issues observed in Indonesia. A program called Community-Based Nutrition Recording and Reporting (e-PPGBM) is used to identify the prevalence of child malnutrition. This study aimed to use the e-PPGBM tool to examine the variables that affect toddlers' stunting, wasting, and underweight due to malnutrition. This study used cross-sectional research and quantitative analysis as its methodology. Using total sampling, 574 respondents were chosen as the samples, with the appropriate details: 316 people had stunting, 191 had wasting, and 67 had underweight. The findings of this study revealed a correlation of the occurrence of stunting with the exposure to cigarettes (26.6%), basic immunization (86.1%), helminthiasis (61.1%), and clean water facilities (4.7%), as well as the occurrence of wasting with the exposure to cigarettes (79.1%), incomplete basic immunization (26.7%), helminthiasis (6.8 %), and a lack of clean water facilities (12.6%). However, there was no statistically significant factor linked to the occurrence of underweight. As a result, this study recommends using a multi-strategy approach to address the root causes and immediate problems of under-five malnutrition.

Keywords: stunting, wasting, underweight, nutrition, e-PPGBM.

巴东帕里亚曼摄政区幼儿发育迟缓、消瘦和体重不足的影响因素分析

摘要：发育迟缓、消瘦和体重不足是在印度尼西亚观察到的一些重大健康问题。一个称为基于社区的营养记录和报告(e-PPGBM)的程序用于确定儿童营养不良的患病率。本研究旨在使用 e-PPGBM 工具检查影响幼儿因营养不良而发育迟缓、消瘦和体重不足的变量。本研究采用横断面研究和定量分析作为方法论。使用总抽样，选择了 574 名受访者作为样本，并提供了适当的详细信息：316 人发育迟缓，191 人消瘦，67 人体重不足。这项研究的结果揭示了发育迟缓的发生与接触香烟(26.6%)、基本免疫(86.1%)、蠕虫病(61.1%)和清洁水设施(4.7%)以及发生 因接触香烟(79.1%)、基本免疫接种不充分(26.7%)、蠕虫病(6.8%)和缺乏清洁水设施(12.6%)而导致消瘦。然而，没有与体重不足的发生相关的统计显着因素。因此，本研究建议使用多策略方法来解决五岁以下儿童营养不良的根本原因和直接问题。

关键词：发育迟缓、消瘦、体重不足、营养、e-PPGBM.

1. Introduction

The importance of malnutrition regardless of its cause is due to its consequences, this is because undernutrition is one of the utmost significant universal health problems, and it affects many children in developing countries [1]. The social determinants of malnutrition play a significant role in dictating the course of malnutrition outcomes in any population. Malnutrition accounts for 69% of these under-five deaths in India [2]. The risk factors for malnutrition identified were classified as child-related, parental/household-related, and community or area-related [3].

The nutritional status of individuals becomes a factor that will have a significant impact on the quality of future human resources. The term "nutritional status" describes how well one is meeting their nutritional demands and how their body is feeling because of eating. It is also described as a balance between the nutrients consumed and those required by the body to conduct various biological processes, including physical development, growth, activity or productivity, maintenance of health, and others. When the quality and quantity are deficient in food consumed by the individual, he or she may suffer from malnutrition [4].

The WHO report reveals that most of the children suffering from malnutrition live in Africa and Asia. By 2020, two of five children will experience stunted growth in the African region, while twenty-seven percent of children will be wasted and twenty percent of children who are overweight will be statistically malnourished, which will impact children dying every year with malnutrition.

One age group that is particularly vulnerable to nutritional issues is that of toddlers. The International Children's Emergency Fund of the United Nations (UNICEF) has listed the factors that contribute to childhood malnutrition. The main causes are described as diet, infection, or a mix of the two. In addition, there are disparities between urban and rural areas, low parental education, poor feeding practices, economic position, site of residence, family size, living in a developing country, and the number of children under the age of five in a family. The leading factor in the 3.1 million child deaths worldwide is malnutrition, which poses a threat to global population health. Growth and development issues are brought on by malnutrition, which also raises the risk of both acute and chronic illnesses, impairs cognitive function and academic performance, and reduces productivity at work [5].

A study conducted in Senegal [6] revealed that monitoring nutritional status, improving hygiene conditions, and endorsing good dietary practices among children could assist in fighting malnutrition. The study further showed that the factors of diarrhea, non-consumption of vegetables, incomplete immunization status, and non-consumption of meat.

Because stunting is linked to an increased risk of sickness and death as well as less-than-optimal brain development, which causes delayed motor development and stunted mental growth, it has become a problem over the past 20 years. Numerous studies have demonstrated the dangers of stunting due to decreased academic performance, susceptibility to infectious diseases [7], as well as impaired cognitive development, impaired physical growth, and metabolic abnormalities in the body [8]. Stunting in school-age children also affects their immune systems, their productivity, their maturity, their brain development, their academic performance, and their bone density [9]. The two indicators of malnutrition that are most frequently used are stunting and wasting [10].

Previous studies confirmed that the family's knowledge and attitudes determine the nutritional status of stunted children with $p = 0.004$, $r = 0.249$ [11]. Unfortunately, the lack of e-PPBGM use in earlier research revealed an issue, necessitating an innovation to speed up data gathering for early identification of children's nutritional status. The International Children's Emergency Fund of the United Nations (UNICEF) has listed the factors that contribute to childhood malnutrition. According to the Nations

It is essential to pay attention to eating behavior and eating habits since they can affect children's nutrition, helping prevent or early detect variables that promote child malnutrition [12]. Children who are underweight and stunted suffer long-term effects such as calorie imbalance and a rise in obesity [13].

According to WHO data from 2021, the rate of malnutrition in developing and underdeveloped nations did not significantly decline. In 2020, stunting affected 149.2 million children under the age of 5, while wasting affected 45.4 million kids.

According to statistics from the Basic Health Research in 2018, there was no significant improvement in malnutrition and undernutrition rates in Indonesia. Therefore, an innovation was needed to speed up the data collection for the early diagnosis of the nutritional status of children under five because e-PPBGM had not been used in a prior study.

The Technical Implementation of Nutrition Surveillance Regulation of the Minister of Health No. 14 of 2019 specifies that the Nutrition Information System, an IT-based nutrition information system, should be used for the technical implementation of nutrition surveillance. The Community Based Nutrition Recording and Reporting (e-PPGBM) program was created by the Nutrition Information System to record

and report nutrition data electronically. As the foundation for the program to be implemented, this application tracks the nutritional status of people in specific areas. Thus, it was required to do research on the factors influencing the nutritional insufficiency to decide on the program offered to the community.

It was important to gather data using the e-PPGBM program to speed up early detection of the nutritional condition of children under five. This study aimed to examine the variables that affect toddlers' stunting, wasting, and being underweight due to malnutrition.

2. Materials and Methods

2.1. Design, Samples, and Setting of the Study

This study was quantitative research with *cross-sectional study*. The regional data obtained from the selected e-PPGBM application was Padang Pariaman Regency. Total sampling was the sampling strategy used in this study (N=571), resulting in samples of stunting for 316 individuals, wasting for 191 individuals, and underweight for 64 individuals.

2.2. Variables

The variables in this study are exposure to cigarette smoke, basic immunization, healthy latrines, helminthiasis, clean water facilities that correlated with stunting, wasting and being underweight.

2.3. Data Collection and Data Analysis

This research was awarded ethical feasibility by the ethics commission of Fort De Kock University Bukittinggi No: 479/KE/IX/2021. The participants were informed about the purpose of the study and they could refuse to participate at any point of the study. Anonymity and confidentiality were ensured at every stage of the research. This study used secondary data originating from the e-PPGBM application at the Public Health Center of the Health Department Office in Padang Pariaman Regency. After obtaining the data, a data processing application was used to determine the frequency of characteristics and research of toddlers as well as to assess the relationship between the independent variable and the dependent variable using the chi-square test.

3. Results

This study found that most of the respondents with malnutrition (stunting, wasting, and underweight) were exposed to cigarette smoke (45.5%). The table shows very significant results, that for the complete basic immunization variable, most of the respondents (n = 345) were not received complete basic immunization.

Table 1 The frequency distribution of respondents based on variables (N = 571)

Variables		N (%) Frequency
Exposure to Cigarette Smoke	Yes	260 (45.5%)
No		311 (54.4%)
Basic Immunization	Yes	345 (60.4%)
No		226 (39.6%)
Healthy latrines	Available	485 (84.9%)
Not available		86 (15%)
Helminthiasis	Yes	212 (37.1%)
No		359 (62.9%)
Clean water facilities	Available	530 (92.8%)
Not available		41 (7.2%)

The results displayed in Table 2 describe that there is a significant relationship between the occurrence of stunting and exposure to cigarette smoke (*p-value 0.001*), basic immunization (*p-value 0.011*), helminthiasis (*p-value 0.043*), and clean water facilities (*p-value 0.000*). However, there was no significant relationship between the incidence of stunting and healthy latrine.

Table 2 The correlation of *Stunting* (N = 316) and variables

Variables	Categories	Stunting Occurrence				Total		P Value	OR
		No		Yes					
		N	%	n	%	n	%		
Exposure to cigarette smoke	Yes	59	41.3	84	58.7	143	31	0.001	2.346
	No	86	27	232	73	318	69		
Basic immunization	Complete	10	18.5	44	81.5	154	11.7	0.011	0.557
	Incomplete	135	33.2	272	66.8	407	88.3		
Unhealthy latrine	Yes	36	48	39	52	75	16.3	0.277	0.732
	No	109	28.2	277	71.8	386	83.7		
Helminthiasis	Yes	107	35.7	193	64.3	300	65.1	0.043	2.184
	No	38	23.6	123	76.4	161	34.9		
Clean water facilities	Available	123	29	301	71	424	92	0.000	3.589
	Not available	22	59.5	15	40.5	37	8		

Table 3 shows that there is a significant relationship between the occurrence of wasting and exposure to cigarette smoke (*p-value 0.031*), basic immunization (*p-value 0.0003*), helminthiasis (*p-value 0.009*), and clean water facilities (*p-value 0.004*). However, there is no significant relationship between the occurrence of stunting with comorbidities and healthy latrines.

Table 3 The correlation of *wasting* (N = 191) and variables

Variables	Categories	Wasting Occurrence				Total		P Value	OR
		No		Yes					
		n	%	n	%	n	%		
Exposure to cigarette smoke	Yes	235	60.9	151	39.1	386	83.7	0.031	0.565
	No	35	46.7	40	53.3	75	16.3		
Basic immunization	Complete	160	53.3	140	46.7	300	65.1	0.0003	1.887
	Incomplete	110	68.3	51	31.7	161	34.9		
Unhealthy latrine	Yes	62	65.3	33	34.7	95	20.6	0.171	1.427
	No	200	56.8	158	43.2	366	79.4		
Helminthiasis	Yes	41	75.9	13	24.1	54	11.7	0.009	0.408
	No	292	56.3	178	43.7	407	88.3		
Clean water facilities	Available	257	60.6	167	39.4	424	92	0.004	0.352
	Not available	13	53.1	24	64.9	37	8		

Table 4 indicates show that there is no significant relationship between the occurrence of underweight and exposure to smoking cigarettes, basic immunization, unhealthy latrines, helminthiasis, and clean water facilities.

Table 4 The correlation of underweight (N = 64) and variables

Variables	Categories	Underweight Occurrence				Total		P Value	OR
		No		Yes					
		n	%	n	%	n	%		
Exposure to cigarette smoke	Yes	109	28.2	277	71.8	386	83.7	0.073	2.346
	No	36	48	39	52	75	16.3		
Basic immunization	Complete	258	86	42	14	300	65.1	0.921	1.029
	Incomplete	139	86.3	22	13.7	161	34.9		
Unhealthy latrine	Yes	81	85.3	14	14.7	95	20.6	0.917	0.915
	No	316	86.3	50	13.7	366	79.4		
Helminthiasis	Yes	48	18.5	6	11.1	154	11.7	0.676	0.075
	No	349	85.7	58	14.3	407	88.3		
Clean water facilities	Available	362	85.4	62	14.6	424	92	0.191	2.997
	Not available	35	94.6	2	54	37	8		

4. Discussion

Based on the e-PPGBM application, this study shows factors influencing stunting, wasting, and underweight in toddlers. The results of this study showed that there are still many cases of malnutrition in Kabupaten Padang Pariaman, including 316 cases of stunting, 191 cases of wasting, and 64 cases of underweight. According to the study's findings, exposure to cigarette smoke, routine immunization, helminthiasis, and access to clean water facilities all had a significant impact on the likelihood of stunting and wasting. However, there was no statistically significant factor linked to the incidence of underweight.

The results of this study specifically showed that the incidence of stunting and wasting was significantly correlated with cigarette smoke exposure. Similar findings were made in [14], which discovered that toddlers who were exposed to tobacco smoke for longer than three hours per day saw a 10,316-fold increase in the risk of stunting. This is due to nicotine potential to impair oxygen delivery by 30-40% and interfere with the absorption of calcium, minerals, and vitamin C, all of which are crucial for toddler growth [15]. Toddlers exposed to cigarette smoke experienced a decline in body defense as a result of altered ciliary function and bacterial colonization of the normal flora [16]. A decrease in body defense causes toddlers to experience repeated respiratory tract infections causing the inflammatory process and fever, and increasing the need for nutrients for metabolism and in the end, toddlers experience a decrease in appetite.

Basic immunization was the second factor linked to stunting and wasting in toddlers. This is confirmed by [17] that discovered a substantial correlation between the occurrence of stunting in children under the age of five and inadequate immunization status. To achieve 14 of the 17 Sustainable Development Goals (SDGs), one of which is limiting malnutrition, vaccination is a cost-effective public health strategy. Global Alliance for Vaccines and Immunization (GAVI) estimates one dollar spent on vaccines, while other 16 dollars are saved in healthcare expenses and lost productivity because of morbidity and mortality [18]. World Health Organization states that immunization currently prevents 3-4 million under-five deaths every year [19].

Helminthiasis was a further variable connected to the nutritional state of infants in his study. It was closely tied to sanitation and hygiene standards. According, poor hygiene and sanitation practices are significant and enduring contributors to stunting and wasting. Diarrhea was brought on by improper sanitation and hygiene procedures that allowed pathogenic bacteria to spread throughout the body. As a result, this had a negative impact on toddlers' nutritional wellness. Additionally, the child's appetite was decreased by frequent episodes of diarrhea and helminthiasis, which led to malnutrition [20]. Clean

water facilities, in addition to hygiene and sanitation standards, impacted the frequency of stunting and wasting in toddlers. As stated in [21], water, sanitation, and hygiene have a strong relationship with the occurrence of stunting and wasting in toddlers. They add that unclean water sources cause exposure to bacteria in the digestive tract and the disruption of the barrier layer of the digestive tract (Environmental Enteric Dysfunction/EED) by enterotoxins [21].

Based on the UNICEF conceptual framework for the nutrition of children under five years, factors found in this study were regarded as the direct, underlying, and primary causes of under-five malnutrition According to the conceptual framework developed by UNICEF, malnutrition in children under the age of five is the result of many direct causes (at the individual level), underlying causes (at the household or family level), and primary causes (at the community level), where factors at one level impact factors at other levels. When we talk about direct causes, we are talking about how diseases and insufficient dietary intake affect the individual. The underlying causes mostly center on poor feeding practices, unhealthy living conditions, and insufficient care and health services. Meanwhile, the primary causes are societal processes occurred in society, including the social, cultural, structural, economic, and political processes. These processes lead to financial and social insufficiencies that limit household access to both the number and quality of people.

These elements interact and have a synergistic effect on how well toddlers eat. Therefore, the Lancet Maternal and Child Nutrition Series' comprehensive Action Framework must be adopted by international organizations, governments, non-governmental organizations (NGOs), the private sector, academia, program managers, and the larger community to effectively address these factors To address the underlying causes of under-five malnutrition, such as household food insecurity, poor parenting practices for toddlers, and unhealthy living environments, this framework calls for specific nutritional interventions that specifically target inadequate food intake and poor health status, the two direct causes of under-five malnutrition. The findings of this study can also be used to enhance how e-PPGBM is applied and used, ensuring that the information supplied complies with current nutritional assessment requirements and that implementation is effective.

5. Conclusions

This study demonstrated a strong correlation between the frequency of stunting and wasting with the exposure to cigarette smoke, basic immunization, helminthiasis, and clean water facilities. However, there was no statistically significant factor linked to the prevalence of being underweight. Malnutrition is caused by a variety of interrelated and complex circumstances. Therefore, scientific novelty of this research is it is strongly advised to use a multi-strategy approach the limitation of this study that focuses on the root and urgent causes of under-five malnutrition. To meet the WHO's global nutrition targets by 2025, these methods are anticipated to produce long-lasting improvements in under-five nutrition, particularly in emerging nations.

6. Limitations

Much data was not available while searching for data for e-PPGBM applications. To overcome this, researchers conducted data searches directly on individuals whose data were not available.

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