**Institute for Advanced Science,
Social and Sustainable Future**

MORALITY BEFORE KNOWLEDGE

Analysis of stunting and malnutrition factors and implementation of community-based total sanitation

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ABSTRACT

Background: Stunting and malnutrition remain important public health issues in rural areas. The prevalence of these conditions is closely linked to inadequate nutrition, poor sanitation, and suboptimal health practices. This study aimed to determine the prevalence of stunting and malnutrition among children, analyse contributing factors, and assess the effectiveness of community-based sanitation initiatives. **Methods:** A cross-sectional study was conducted involving 58 mothers of children under five. Data were collected using door-to-door questionnaires and anthropometric measurements focusing on height-for-age (TB/U) to assess the prevalence of stunting. Additional data were collected on infant feeding practices, sanitation behaviours, and immunisation coverage. Descriptive statistics were used to analyse findings, and STBM (Community-Based Total Sanitation) implementation was evaluated through community engagement and observation. **Findings:** Of the 60 children assessed, 39 (65%) were at risk of stunting. Anthropometric results showed that 16.7% of children had very short stature, while 18.3% were categorised as short. The prevalence of infectious diseases among children was 23.3%, and 8.3% had a history of low birth weight. Among adolescent girls, 75% had received TT immunisation, and all had normal nutritional status based on upper arm circumference (LILA) measurements. However, implementation of STBM practices was found to be lacking, with most communities not adopting good hygiene and sanitation behaviours. **Conclusion:** This study highlighted stunting and malnutrition as major health issues, with most children at risk. Poor sanitation and hygiene practices exacerbate these problems, underscoring the need for comprehensive health education and improved sanitation infrastructure. Interventions focusing on maternal education, nutrition, and community-based sanitation programmes are essential to address these issues. **Novelty/Originality of this article:** This study provides valuable insights into the linkages between stunting, malnutrition and community sanitation practices in rural areas of Indonesia. It is one of the first studies to evaluate the role of STBM in addressing these health challenges, providing a foundation for targeted interventions to improve community health outcomes.

KEYWORDS: community-based sanitation; child nutrition; infectious diseases; public health intervention; stunting.

1. Introduction

Field Learning Experience (PBL) is an initiative organized by the Faculty of Public Health aimed at engaging 6th semester students in observing and collecting data on stunting, a significant nutritional issue worldwide. According to the World Health Organization (WHO) data from 2008, approximately 21% of children under five are affected by stunting, a condition that contributes to the deaths of about 2.2 million children globally each year. This malnutrition problem is particularly prevalent in developing countries, including Indonesia, where the challenges associated with stunting are acute. Stunting arises from prolonged growth failure, primarily resulting from chronic malnutrition that

begins during pregnancy and persists until the child reaches two years of age. Furthermore, a child's nutritional status has a direct correlation with their cognitive development; inadequate nutrition during early childhood can adversely affect their intelligence and overall health.

Insufficient nutrition is a leading cause of nutritional disorders among children under five, resulting in various health issues, including stunting. The implications of nutritional deficiencies during infancy and toddlerhood are profound, significantly impacting growth and development, especially during the critical first two years of life. Stunting often results from chronic undernutrition, which can be aggravated by infectious diseases and suboptimal environmental conditions. For instance, inadequate sanitation and poor living conditions can lead to health challenges that hinder a child's nutritional status. It is crucial to understand that stunting is multifaceted; while environmental factors play a role, infections and parenting practices are equally significant contributors.

Moreover, children who frequently experience infections are at a higher risk of impaired food intake, leading to hindered growth and increased susceptibility to stunting. Addressing stunting requires a holistic approach that considers both nutritional intake and the broader environmental context, including sanitation and healthcare access. Effective interventions must not only focus on improving dietary quality and access to nutritious foods but also enhance living conditions to reduce infection rates. By recognizing the interconnectedness of nutrition, health, and the environment, stakeholders can develop comprehensive strategies to combat stunting and improve child health outcomes. Ultimately, understanding the complexities of stunting can guide public health efforts aimed at creating healthier environments for children and fostering better nutritional practices within communities.

2. Methods

2.1 Data and data analysis to prioritise problems

Educational facilities in Sukarami Village remain inadequate, as most educational activities are concentrated. This centralization of education leads to challenges for local students who may face difficulties accessing quality educational resources. The lack of sufficient facilities, such as schools, libraries, and learning centers within Sukarami Village, can hinder the educational development of children in the area. In addition, the dependency of education services may exacerbate the gap in learning opportunities for those living in Sukarami Village. To gain a clearer understanding of the situation, details of the existing educational facilities in Sukarami Village can be referenced in Table 1, highlighting the pressing need for improvements and investments in local education infrastructure. Addressing these gaps is crucial for ensuring that all children in Sukarami Village have equitable access to education and the resources necessary for their academic success.

Table 1. Level of education facilities in Sukarami Village

No	Jenis Pendidikan	Quantity
1	PAUD (Early Childhood Education)	1
2	TK (Kindergarten)	0
3	SD (Elementary School)	1
4	MI (Madrasah Ibtidaiyah)	0
5	SMP (Primary Secondary School)	0
6	SMA (Senior High School)	0

(Secondary data Sukarami Village profile 2019)

Educational facilities in Sukarami Village are still relatively incomplete and inadequate, particularly at the kindergarten (TK), Madrasah Ibtidaiyah (MI), junior high school (SMP), and senior high school (SMA) levels. Currently, Sukarami Village lacks these essential educational institutions, compelling local residents to seek education in the neighboring

village of Pemantung Ulu. This reliance on external villages for schooling presents significant challenges, including longer travel times and increased costs for families. Additionally, the absence of educational facilities within Sukarami Village may contribute to lower educational attainment and limit opportunities for children in the area. To foster a more conducive learning environment and support the community's educational needs, it is crucial to prioritize the development and establishment of adequate educational facilities within Sukarami Village. Ensuring accessible education can significantly enhance the academic and social outcomes for the village's youth, promoting overall community growth and development.

2.2 Sukarami Village infrastructure data

Health infrastructure in Sukarami Village is notably limited, with only one community health post (Poskesdes) and two integrated health posts (Posyandu) available to serve the local population. This inadequacy forces residents to seek health services in neighboring villages, where more comprehensive healthcare options are accessible. The lack of sufficient health facilities can lead to delays in receiving necessary medical care, potentially exacerbating health issues within the community. Moreover, the limited health infrastructure can negatively impact overall health outcomes, particularly for vulnerable groups such as children and the elderly, who may require more frequent medical attention. To enhance the health and well-being of the villagers, it is essential to invest in expanding and improving health services within Sukarami Village, ensuring that all residents have timely access to quality healthcare. Developing local health facilities can not only alleviate the burden on neighboring villages but also empower the community to take charge of their health needs more effectively. The types of public health infrastructure in Sukarami Village can be seen in Table 2.

Table 2. Types of community health infrastructure in Sukarami Village

No	Type	Available /No	Quantity
1	Hospital	No	-
2	Puskesmas	No	-
3	Sub-Community Health Centre	None	-
4	Village Health Post	Available	1
5	Integrated Service Post	Available	2

(Secondary data Sukarami Village profile 2019)

2.3 Institutional and community data

Community institutions in Sukarami Village play a vital role in fostering social cohesion and organizing various activities that contribute to the village's overall development. These institutions are quite active, as evidenced by the diverse range of community activities that have been documented within the village. Such activities include educational programs, health initiatives, and cultural events that aim to engage residents and improve their quality of life. The presence of these institutions not only facilitates collaboration among community members but also helps to address local issues by pooling resources and knowledge. Detailed information about the specific types of community institutions operating in Sukarami Village is available in Table 3, showcasing the richness of community engagement and the importance of these organizations in enhancing social capital. Strengthening these institutions further can lead to even greater participation and empowerment of residents, ultimately fostering a more resilient and self-reliant community. The details of the types of community institutions in Sukarami Village can be seen in table 3.

Table 3. Sukarami Village institution and community data

No	Institutions	Available/No
1	BPD	Available
2	LEMBAGA ADAT	Available
3	LPM	Available
4	LINMAS	Available
5	PKK	Available
6	RT	Available
7	RW	Available
8	KARANG TARUNA	Available

(Secondary data Sukarami Village profile 2019)

Based on the Sukarami Village Profile, it is evident that the community institutions within the village are relatively well-established, reflecting a commendable level of active participation among residents in the village's development. The variety of institutions indicates that the community is engaged in collective efforts aimed at addressing local issues and enhancing the quality of life for its members. However, despite this encouraging picture, observations made during the village assessment reveal that the Karang Taruna, a youth organization crucial for fostering community spirit and involvement, exists but is not fully active. This lack of full engagement within the Karang Taruna could potentially limit the effectiveness of youth initiatives and diminish opportunities for young people to contribute to village activities. Strengthening the Karang Taruna's role and revitalizing its programs could enhance youth participation and, by extension, invigorate overall community engagement, ensuring that all sectors of the population are involved in the development process.

2.4 Univariate analysis

The characteristics of respondents in Sukarami Village, as illustrated in Graph 1, provide valuable insight into the demographic and social composition of the community in 2020. This information is critical to understanding the diverse backgrounds of villagers, including age, gender, education level and occupation, which can significantly influence community dynamics and development initiatives. For example, the distribution of age groups can reveal the potential for different programs aimed at youth engagement or elderly care, while education levels can inform strategies to improve literacy and vocational training. Overall, analyzing these characteristics not only helps in tailoring development programs to better suit community needs, but also encourages a more inclusive approach to addressing local challenges and promoting sustainable growth. Below is information on the characteristics of respondents in Sukarami Village in 2020 (Figure 1).
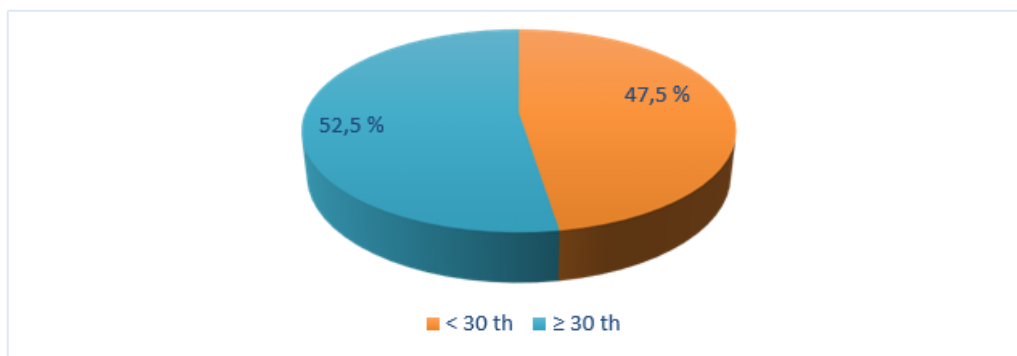

Fig 1. Age of respondents in Sukarami Village in 2020
(Primary data of PBL questionnaire FKM Unsri 2020)

The analysis of respondent age distribution in Sukarami Village, based on the graph, indicates a relatively balanced representation among the participants of the 2020 PBL FKM Unsri activities. Out of the 60 respondents who completed the questionnaire, 47.5% were

classified as being under 30 years old, while 52.5% were aged 30 years or older. This demographic trend suggests a slight predominance of older respondents, which could reflect the village's population dynamics and the engagement of different age groups in community activities. The significant presence of younger respondents may indicate a growing interest and involvement in local development initiatives, essential for fostering future leadership and innovation within the community. Understanding the age composition of the respondents is crucial for tailoring programs and interventions that resonate with their specific needs and preferences, ultimately contributing to more effective community development strategies. Furthermore, the education of respondents in Sukarami Village, in 2020 can be seen in Figure 2.
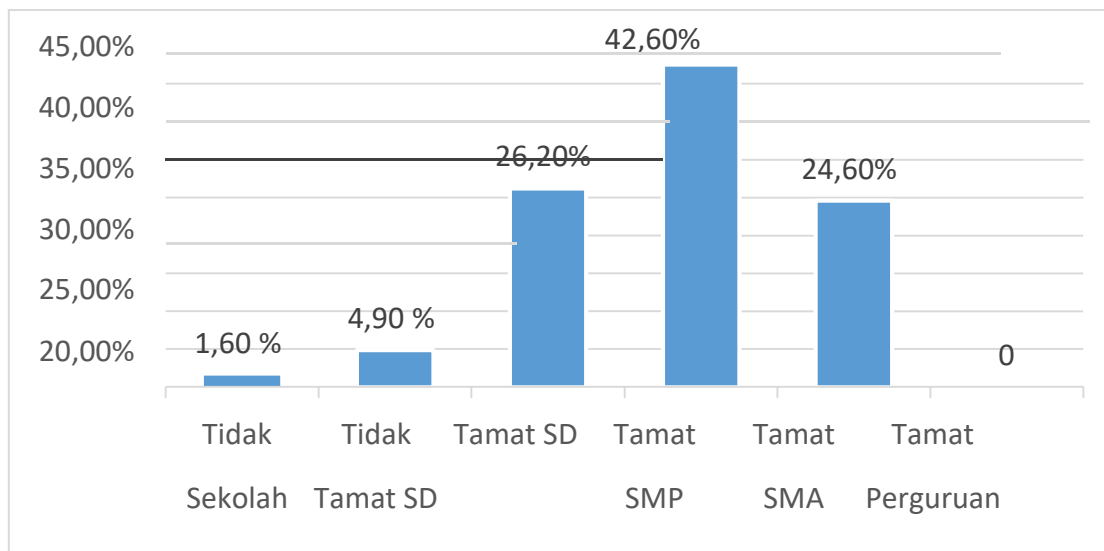

Fig 2. Last education of respondents in Sukarami Village in 2020
(Primary data of PBL questionnaire FKM Unsri 2020)

The educational attainment of respondents in Sukarami Village reveals a significant dominance of junior high school graduates, accounting for 42.6% of the population surveyed. Following this, elementary school graduates comprise 26.2%, while high school graduates make up 24.6% of the respondents. Notably, 4.9% of participants did not complete elementary school, and a small fraction, 1.6%, reported having no formal education at all. Despite the absence of respondents with tertiary education, the overall educational level in Sukarami Village can be categorized as sufficient for the community's needs. However, this educational landscape presents challenges, as the village is equipped with only one Early Childhood Education (PAUD) center and one elementary school, necessitating that junior and senior high school students travel to neighboring villages for their education. This limited access to educational facilities underscores the need for enhanced educational infrastructure within Sukarami Village to support the community's development and improve future opportunities for its residents. Furthermore, the type of work of respondents in Sukarami Village in 2020 can be seen in Figure 3.
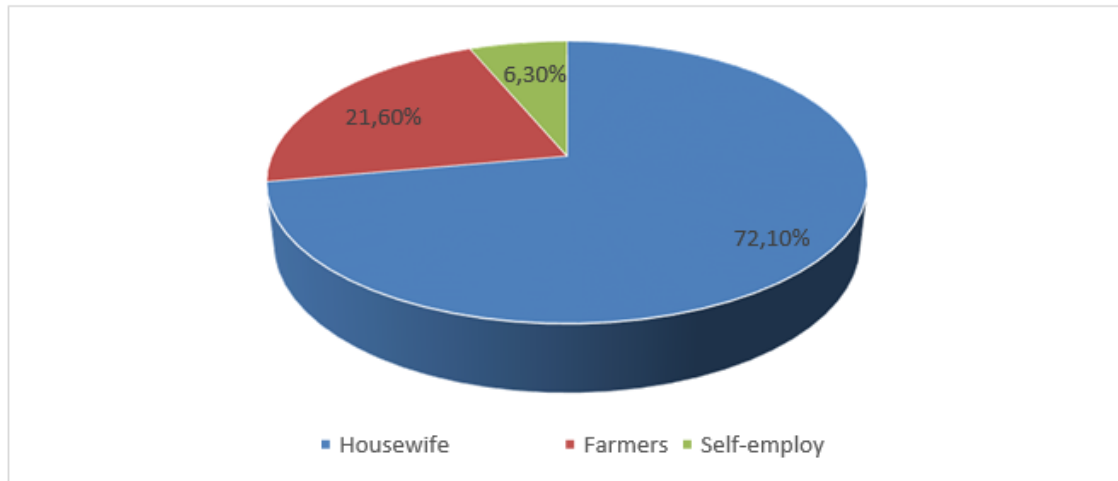
Fig 3. Type of work of respondents in Sukarami Village in 2020
(Primary data of PBL questionnaire FKM Unsri 2020)

The employment landscape in Sukarami Village is predominantly characterized by housewives, who constitute a significant 72.1% of the respondents. This high percentage reflects the traditional family structure and gender roles often observed in rural areas, where women typically manage household responsibilities while potentially assisting with family agricultural activities. Meanwhile, a smaller segment of the population, accounting for 21.6%, identifies as farmers, indicating that agriculture remains a vital source of livelihood in the village. Additionally, only 6.3% of respondents are engaged in entrepreneurship, which suggests limited economic diversification within the community. This distribution of occupations highlights the need for initiatives that could enhance entrepreneurial opportunities and provide support for farmers, ultimately fostering economic growth and resilience in Sukarami Village. By addressing these aspects, the village can better equip its residents to adapt to changing economic conditions and improve their overall quality of life. Furthermore, the total household income of respondents in Sukarami Village in 2020 can be seen in Figure 4.
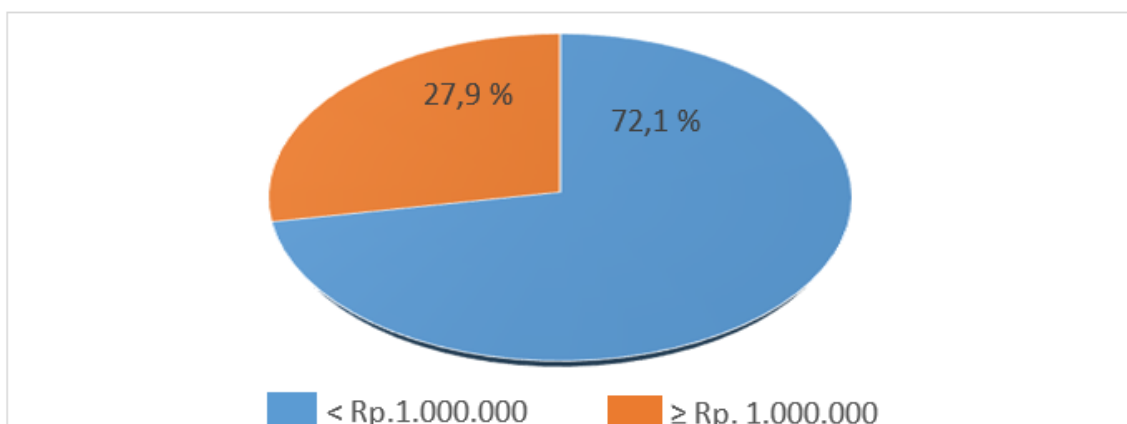

Fig. 4. Total household income of respondents in Sukarami Village in 2020
(Primary data of PBL questionnaire FKM Unsri 2020)

The income distribution among respondents in Sukarami Village reveals a significant disparity, with 72.1% of individuals earning less than Rp. 1,000,000. This figure indicates a prevalent economic struggle within the community, suggesting that a large portion of the

population is facing financial constraints that may impact their quality of life and access to essential services. In contrast, only 27.9% of respondents report earning Rp. 1,000,000 or more, highlighting the limited financial resources available to the majority of residents. This income disparity underscores the need for targeted economic development initiatives aimed at improving earning potential, such as skills training and access to credit facilities. By addressing the underlying causes of low income, Sukarami Village can work towards enhancing the economic well-being of its residents, ultimately fostering a more sustainable and prosperous community. Furthermore, the Number of respondent household members in Sukarami Village in 2020 can be seen in Table 4.

Table 4. Number of respondent household members in Sukarami Village in 2020

No	Number of households	Quantity	Percentage (%)
1	≥ 5 people	27	45,0
2	< 5 people	33	55,0
	Total	60	100%

(Primary data of PBL questionnaire FKM Unsri 2020)

The distribution of respondents based on household characteristics in Sukarami Village indicates a diverse range of family sizes. According to Table 4, 27 households, representing 45%, consist of five or more members, highlighting a significant segment of the population living in larger family units. In contrast, 33 households, or 55%, have fewer than five members, suggesting a notable presence of smaller families within the village. This variation in household size may reflect differing social dynamics and economic circumstances, influencing factors such as resource allocation and community support structures. Understanding these household characteristics is essential for tailoring community programs and services to meet the specific needs of both larger and smaller families, ultimately fostering a more inclusive and supportive environment in Sukarami Village. Furthermore, the JKN status of respondents in Sukarami Village, in 2020 can be seen in Table 5.

Table 5. JKN status of respondents in Sukarami Village in 2020

No	JKN status	Quantity	Percentage (%)
1	Have	27	45,0
2	Do not have	33	55,0
	Total	60	100%

(Primary data of PBL questionnaire FKM Unsri 2020)

The distribution of respondents in Sukarami Village concerning BPJS (Badan Penyelenggara Jaminan Sosial) ownership reveals significant insights into the community's access to health insurance. According to Table 5, 27 families, accounting for 45%, have registered for BPJS, which indicates a moderate level of participation in the national health insurance program. However, the data also shows that 33 families, or 55%, do not possess BPJS coverage, highlighting a considerable portion of the population that remains vulnerable to health risks without insurance protection. This disparity in BPJS ownership may reflect broader socio-economic factors, such as income levels, awareness of health insurance benefits, and barriers to enrollment. Addressing the gap in BPJS coverage is crucial for enhancing health security in Sukarami Village, as it can lead to improved access to healthcare services and contribute to the overall well-being of the community.

2.5 Problem identification

Based on the data obtained in the field, 5 health problems were found in Sukarami Village. (1) Of the 60 respondents, there were 21 (35%) infants with low Z-score after measurement using anthropometric indicators. (2) There was 1 stunted baby whose MCH

Book did not record a particular disease, but the baby had abnormalities such as not being able to walk even though he was more than 2 years old. This data was obtained when collecting questionnaire data by looking at the MCH Book of toddlers and Field Observation. (3) There are 3 stunted toddlers with an improper diet where 1 toddler has never been given EXCLUSIVE breast milk because if given breast milk then he vomits, so the toddler's mother gives formula milk, 1 toddler is not given MP-ASI after the age of more than 6 months and 1 toddler who does not want to drink breast milk and is only given foods such as snacks, if not given then the baby cries so the mother does not mind it. This data was obtained when collecting the questionnaire data and the respondent recounted the incident. (4) There are no garbage dumps in Sukarami Village, so people throw garbage into the forest and river. (5) Some respondents in Sukarami Village did not fulfil the requirements for healthy latrines, and this data was obtained during questionnaire data collection and field observations.

After identifying the problems, the next step is to prioritise the issues that need to be addressed. This prioritisation was done using the USG method, a method used to prioritise the issues that need to be resolved. This process is done by assessing the level of urgency, seriousness, and potential development of an issue, which is scored using a scale of 1-5 or 1-10. The issue with the highest total score is considered the top priority issue. The following is the calculation of determining the priority of problems in Sukarami Village in 2020 based on the USG method (table 6).

Table 6. Ultrasound on health problems in Sukarami Village

No	Problem	U	S	G	Total (U x S x G)
1	Stunting	5	5	5	125
2	Lack of knowledge of the importance of the MCH Book for babies	3	3	3	27
3	Improper Toddler Diet	3	5	3	45
4	Dumping rubbish into forests and rivers	3	4	4	48
5	Not fulfilling the requirements of a healthy latrine	3	4	3	36

Based on the problem identification conducted earlier, the next step is to prioritize the identified problems before starting the intervention. Prioritization is critical as it helps focus resources and efforts on the most pressing issues that have a significant impact on the community. By assessing the severity and urgency of each identified problem, stakeholders can determine which issues require immediate attention and which can be addressed later. This strategic approach ensures that interventions are not only effective but also efficient, maximizing the potential for positive outcomes. In addition, prioritization of problems allows for a structured framework in planning and implementing solutions, thus facilitating better coordination among community members and stakeholders involved in the intervention process. The results of the Prioritization of problems in Sukarami Village identification can be seen in Table 7.

Table 7. Prioritisation of problems in Sukarami Village

No	Problem	Prioritas
1	Stunting	I
2	Dumping Rubbish into Forests and Rivers	II
3	Improper Toddler Diet	III
4	Not fulfilling the requirements of a healthy latrine	IV
5	Lack of Maternal Knowledge on the Importance of MCH Book for Infants	V

3. Results and Discussion

3.1 Stunting data

Information regarding stunting among toddlers with detailed in Table 8. This table highlights the prevalence of stunting within the community, providing crucial insights into the nutritional status of young children. Stunting, a significant indicator of chronic malnutrition, can have long-lasting effects on a child's physical and cognitive development. Understanding the extent of stunting is essential for implementing targeted interventions aimed at improving the health and well-being of toddlers. By analyzing the data presented in Table 8, stakeholders can better assess the current situation and formulate strategies to combat stunting, thereby fostering a healthier future generation.

Table 8. Stunting data in 2020

Variables	Quantity	Percentage (%)
Risk of Stunting		
Not at risk	39	65
At Risk	21	35
Child Stunting Status		
Very Short	10	16,7
Short	11	18,3
Normal	38	63,3
Tall	1	1,7

(Primary data of PBL questionnaire FKM Unsri 2020)

Based on the table presented, of the 59 mothers who were respondents, 39 mothers (65%) were known to have children at risk of stunting. From the results of anthropometric measurements using the TB/U (height-for-age) parameter as an indicator of nutritional status in stunted children, it was found that 10 mothers (16.7%) had children with very short nutritional status, and 11 mothers (18.3%) had children with short nutritional status. According to WHO (2006), stunting is defined as a condition in which a child's TB/U value is equal to or less than minus two standard deviations (-2 SD) from the standard mean, which indicates that the child's height is lower than that of children of the same age. Stunting is an indicator of chronic malnutrition that reflects past nutritional conditions and is influenced by environmental factors and socioeconomic conditions.

3.2 Nutritional status data of adolescent girls

The nutritional status of adolescent girls with comprehensively presented in Table 9. This table provides essential data on the dietary habits and health metrics of adolescent females within the community. Adequate nutrition during adolescence is crucial, as this period significantly impacts physical growth, hormonal changes, and overall health. Analyzing the nutritional status of adolescent girls is vital for identifying potential health risks and developing effective nutritional interventions. By utilizing the information from Table 9, health officials and community leaders can work collaboratively to address any deficiencies and promote better dietary practices among adolescent girls, ultimately leading to improved health outcomes for future generations.

Table 9. Data on nutritional status of adolescent girls according to LILA in 2020

Variables	Quantity	Percentage (%)
Adolescent Daughter		
Good Nutrition	4	100
Under Nutrition	0	0
Poor Nutrition	0	0

(Primary data of PBL questionnaire FKM Unsri 2020)

The data presented in the table indicates that the nutritional status of adolescent girls, assessed through the LILA (Upper Arm Circumference) measurement tool, reveals that all participants (100%) exhibit good nutritional status. This is a significant finding, suggesting that the dietary practices and overall health conditions of adolescent girls in this community

are well within the acceptable range. Maintaining adequate nutrition during adolescence is crucial, as this period is essential for physical growth, development, and the prevention of future health complications. The positive results from the LILA measurements reflect the effectiveness of existing nutritional programs and community awareness regarding healthy eating practices. This achievement provides a foundation for further health initiatives, as it indicates a need to sustain and build upon these positive trends to ensure the continued well-being of young girls in the village.

3.3 Community-based total sanitation

Information on Community-Based Total Sanitation for under-five respondents, as illustrated in Table 10, highlights the importance of sanitation practices in improving children's health and well-being. This approach emphasizes the importance of community involvement in implementing sanitation measures that can effectively reduce health risks associated with poor hygiene. The data collected provides insight into the level of awareness and participation among families regarding sanitation practices, which are critical to preventing disease and improving overall community health. By fostering a clean environment and encouraging good sanitation behaviors, the village aims to protect under-fives from potential health hazards. The findings also form the basis for developing targeted interventions to improve sanitation infrastructure and education in the community, ultimately contributing to healthier living conditions for all residents.

Table 10. Community-based total sanitation among respondents of Toddlers in 2020

No.	STBM Pillar	Quantity	Percentage (%)
1	Stop defecation		
	Bad	8	13,6
	Good	51	86,4
2	Handwashing with Soap		
	Bad	17	28,8
	Good	42	71,2
3	Drinking Water and Food Management Household		
	Bad	2	3,4
	Good	57	96,6
4	Household Waste Management Household		
	Bad	41	69,5
	Good	18	30,5
5	Household Liquid Waste Safety		
	Bad	39	66,1
	Good	20	33,9

(Primary data of PBL questionnaire FKM Unsri 2020)

Based on the data obtained from the respondents, the implementation of Community-Based Total Sanitation (STBM) shows varying levels of success across its five pillars. For Pillar 1, 8 respondents (13.6%) reported poor implementation, while 51 respondents (86.4%) demonstrated proper practices. Pillar 2 exhibited similar results, with 17 respondents (28.8%) still struggling to meet the requirements, whereas 42 respondents (71.2%) adhered well. In terms of Pillar 3, only 2 respondents (3.4%) implemented it poorly, indicating a high compliance rate with 57 respondents (96.6%) implementing it well. However, the data reveals concerns for Pillar 4 and Pillar 5, with 41 respondents (69.5%) and 39 respondents (66.1%) respectively reporting poor implementation, highlighting areas that require further attention and improvement.

Community-Based Total Sanitation (STBM) aims to transform sanitation and hygiene behaviors within communities through empowerment and engagement strategies. This approach encourages communities to abandon open defecation, promote regular

handwashing with soap, and ensure the safe management of drinking water, food, and waste. The concept of total sanitation encompasses a holistic view of community health, recognizing that effective sanitation practices can significantly reduce disease transmission and improve overall well-being. By fostering a culture of hygiene and environmental stewardship, STBM can lead to sustainable improvements in health outcomes. The findings from this data not only underscore the successes in certain pillars but also serve as a critical reminder of the ongoing challenges in achieving comprehensive sanitation and hygiene standards within the community.

3.4 Personal hygiene

Information regarding personal hygiene among toddlers, was captured in Figure 5. This data illustrates the varying levels of personal hygiene practices among young children in the village. It is essential to emphasize that personal hygiene plays a crucial role in the overall health and well-being of toddlers, as it helps prevent the spread of infections and promotes healthy growth. The findings highlight the significance of educating caregivers about proper hygiene practices, such as regular handwashing, bathing, and oral care, which can significantly impact the health outcomes of children. Understanding the current state of personal hygiene in the community can guide future interventions aimed at improving health education and promoting better hygiene practices among families.
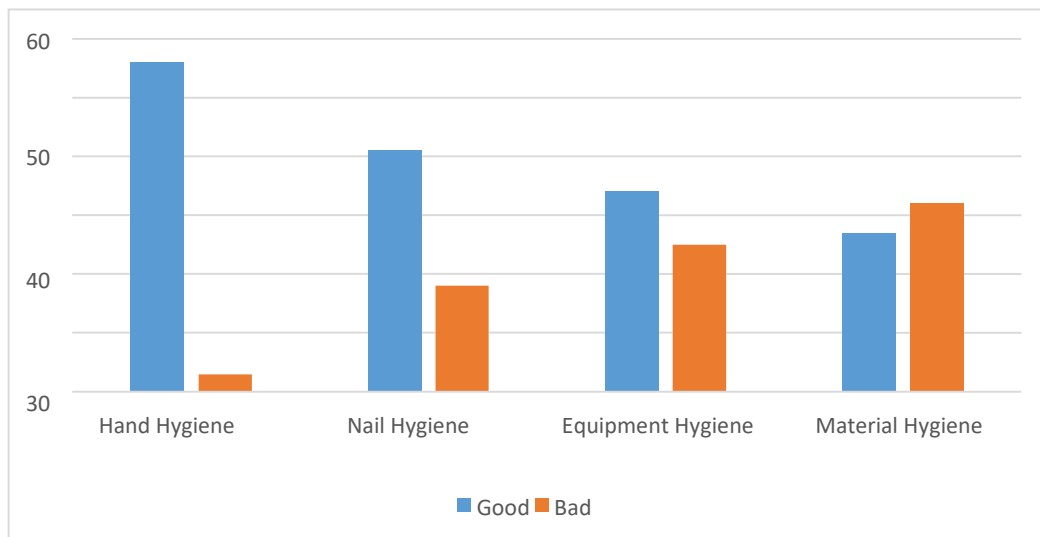

Fig 5. Personal Hygiene of Toddler Respondents in 2020
(Primary data of PBL questionnaire FKM Unsri 2020)

Based on the graph, the data reveals a significant trend in personal hygiene practices among respondents. A striking 94.9% of respondents are effectively practicing hand hygiene, while only 5.1% are not meeting this crucial standard. In terms of nail hygiene, 69.5% of participants reported maintaining their nails well, although 30.5% still fall short in this area. When it comes to food equipment hygiene, 57.6% of respondents perform this practice adequately, while 42.4% still need improvement. Additionally, food hygiene practices are also concerning, with only 45.8% of respondents maintaining good standards, leaving 54.2% at risk of poor hygiene practices that could affect health.

Personal hygiene encompasses the various practices individuals undertake to ensure their cleanliness and overall health, contributing significantly to physical and mental well-being. As highlighted by Poter and Perry (2005), personal hygiene includes actions that foster cleanliness, which is essential for preventing illness and promoting health. A lack of adequate self-care often leads to hygiene-related issues, which can compromise an individual's health and increase susceptibility to infections. Therefore, understanding the current state of personal hygiene practices is crucial for designing targeted health education

initiatives. By addressing the areas where respondents struggle, community programs can enhance awareness and promote better hygiene practices to improve overall public health outcomes.

3.5 Bivariate analysis

Bivariate analysis was conducted to explore the relationship between various independent variables and the incidence of stunting. The independent variables included open defecation-free habits, hand washing with soap, management of drinking water and food at home, household waste management, liquid waste management, as well as personal hygiene practices such as hand hygiene, nail hygiene, food utensil hygiene, and food hygiene. To determine the statistical significance of these associations, the Chi Square test was employed, which is a robust method for analyzing categorical data. The results, as presented in Table 11, highlight the correlation between the adherence to community-based total sanitation practices and the prevalence of stunting among children. Understanding these relationships is crucial, as it can inform targeted interventions aimed at improving hygiene and sanitation practices, ultimately contributing to the reduction of stunting in the community.

Moreover, the insights gained from this analysis could serve as a foundation for developing community health programs that focus on enhancing education and resources related to proper sanitation and hygiene. By addressing the key areas identified in the bivariate analysis, stakeholders can implement strategic actions to improve overall nutritional status and health outcomes for children. This proactive approach may not only mitigate the incidence of stunting but also promote healthier habits within the community, fostering a more sustainable environment for future generations. Thus, the findings of this study underscore the importance of integrating hygiene and sanitation practices into public health initiatives to combat malnutrition effectively.

Table 11. Results of bivariate analysis of STBM Pillars on the incidence of stunting in 2020

Independent Variable	Incidence of Stunting				p-value	OR (95%CI)
	Yes		No			
	N	%	N	%		
Stop Open Defecation						
Bad	5	62,5	3	37,5	0,119	3,646
Good	16	31,4	35	68,6		(0,775-17,156)
Handwashing with Soap						
Bad	6	35,3	11	64,7	1,000	0,982
Good	15	35,7	27	64,3		(0,302-3,189)
Household Water and Food Management						
Bad	1	50	1	50	1,000	1,850
Good	20	35,1	37	36,7		(0,110-31,183)
Household Waste Security						
Bad	18	43,9	23	56,1	0,04	3,913
Good	3	16,7	15	83,3		(0,980-15,625)
Household Liquid Waste Safety						
Bad	13	33,3	26	66,7	0,827	0,750
Good	8	40	12	60		(0,246-2,288)

Based on the analysis presented in the table, the relationship between open defecation behaviors and the incidence of stunting reveals important insights. The findings indicate that respondents with toddlers who are not stunted exhibit a higher percentage of good hygiene behaviors compared to those with poor hygiene practices. Statistical testing yielded a p-value of 0.119, suggesting that there is no significant difference in the proportions of stunting incidence between the two groups. This outcome implies that the correlation between open defecation behaviors and stunting is not statistically significant, thereby indicating that other factors may be at play. However, this finding warrants further

investigation, particularly in light of research by Torlesse et al. (2016), which highlighted significant associations between household sanitation facilities, water treatment practices, and stunting incidence.

In the context of this study, further analysis revealed that among the eight mothers exhibiting poor hygiene behavior, a concerning 62.5% of their toddlers were stunted. In contrast, only 31.4% of toddlers from the 51 mothers demonstrating good hygiene behaviors experienced stunting. These figures underscore a potentially critical relationship, suggesting that maternal behavior significantly influences child nutritional outcomes. The calculated odds ratio (OR) of 3.646 indicates that toddlers whose mothers engage in poor hygiene practices are 3.646 times more likely to be stunted than those whose mothers maintain good practices. This alarming statistic emphasizes the need for targeted interventions and educational programs that promote hygiene and sanitation, aiming to reduce stunting rates in vulnerable populations.

The analysis of the relationship between hand washing with soap (HWWS) and the incidence of stunting reveals noteworthy insights regarding hygiene practices among respondents. The findings indicate that respondents with toddlers who are not stunted demonstrate a higher percentage of good hand hygiene behavior compared to those with poor hygiene practices. However, the statistical test yielded a p-value of 1.000, suggesting that there is no significant difference in the incidence of stunting between respondents exhibiting good versus bad HWWS behaviors. This result implies that, in this specific context, HWWS behavior does not have a statistically significant relationship with the incidence of stunting. These findings highlight the complexity of factors influencing child health and nutrition, suggesting that other underlying issues may contribute to stunting beyond hand hygiene practices.

In contrast, existing literature presents differing perspectives on the significance of HWWS in preventing stunting. Research by Nasrul et al. (2015) identified a significant relationship between stunting in children aged 6-23 months and the habit of washing hands with soap, reporting a p-value of less than 0.05. Similarly, a study by Sinatrya (2019) corroborated these findings, revealing that mothers with poor hand washing habits have a 0.12 times higher risk of having stunted children under five. These contrasting results may suggest contextual variations or limitations in the current study's sample size and methodology. Consequently, further research is necessary to explore the impact of HWWS on child nutrition more comprehensively, considering various environmental and behavioral factors that could influence these outcomes.

The analysis examining the relationship between household drinking water and food management practices and the incidence of stunting yielded significant findings regarding respondents. The results indicated that respondents with toddlers who were not stunted demonstrated a higher percentage of good management behaviors compared to those exhibiting poor practices. However, the statistical test revealed a p-value of 1.000, leading to the conclusion that there is no significant difference in the proportion of stunting incidence between respondents with good and bad drinking water and food management behaviors. This suggests that, within the context of this study, the quality of drinking water and food management does not have a statistically significant relationship with the occurrence of stunting among toddlers. These findings underscore the complexity of child health determinants and highlight the need for further investigation into other factors that may contribute to stunting beyond household management practices.

The results of the analysis of the relationship between household waste safety and the incidence of stunting found that respondents with toddlers who were not stunted had a higher percentage of bad behaviour than respondents who behaved well. The statistical test results obtained a value of p = 0.04, it can be concluded that there is a difference in the proportion of incidence between respondents with toddlers who behave badly and well (there is a significant relationship between Household Waste Security and the incidence of stunting). Of the 41 mothers with poor behaviour, 43.9% of the toddler respondents were stunted. Meanwhile, of the 18 mothers with good behaviour, only 16.7% experienced stunting. The results of the analysis also obtained an OR value = 3.913, meaning that

mothers who behave badly have a 3.913 times greater chance for toddlers to be stunted than mothers who behave well.

The results of the statistical analysis showed that the risk factor of household waste management had a p value of 0.000 (0.000 < 0.05), indicating statistical significance. Thus, this study revealed a significant influence between household waste management and the incidence of stunting. The results of the analysis of the relationship between household liquid waste safety and the incidence of stunting found that respondents with toddlers who were not stunted had a higher percentage of poor behaviour than respondents with good behaviour. The statistical test results obtained a value of p = 0.827, it can be concluded that there is no difference in the proportion of incidence between respondents with toddlers who behave badly and well (there is no significant relationship between household liquid waste safety behaviour and the incidence of stunting).

3.6 Multivariate analysis

To comprehensively assess the factors influencing the incidence of stunting, a multivariate analysis was employed, focusing on several independent variables. These variables included the cessation of open defecation, hand washing with soap (HWWS), management of household food and drinking water, safety in household waste disposal, and liquid waste management practices. By utilizing multiple logistic regression as a predictive modeling technique, the analysis aimed to determine which of these factors had the most significant impact on the dependent variable, the incidence of stunting among toddlers. This method allows for a nuanced understanding of how these various elements interact and contribute to child health outcomes. The findings from this analysis, summarized in Table 12, provide valuable insights into the relationship between the pillars of community-based sanitation and the prevalence of stunting in the population under study, highlighting critical areas for intervention and policy development.

Table 12. Relationship between STBM Pillars and the Incidence of Stunting in 2020

Independent Variable	Crude OR		
	p-value	OR	95%CI
Stop Open Defecation	0,066	4,926	0,901-26,915
Handwashing with Soap	0,869	1,122	0,287-4,387
Household Food and Drinking Water Management	0,936	0,874	0,032-23,690
Safeguarding Household Waste	0,027	6,131	1,233-30,485
Safeguarding Household Liquid Waste	0,117	0,340	0,088-1,310

Based on the table above, the variables with p-value > 0.05 are Stop Open Defecation, Handwashing with Soap, Household Water and Food Management, and Household Liquid Waste Safety. The largest p-value is the Household Water and Food Management variable (p-value = 0.936) so that further modelling of the Household Water and Food Management variable is excluded from the model. After removing the Drinking Water and Household Food Management variables, there was no change in OR>10%, so the Drinking Water and Household Food Management variables were still excluded from multivariate modelling. Furthermore, variables with p-value > 0.05 were excluded, namely the Handwashing with Soap variable (p-value = 0.869) so that further modelling of the Handwashing with Soap variable was excluded from the model. After removing the Handwashing with Soap variable, there was no change in OR> 10%, so the Handwashing with Soap variable was also removed from the multivariate modelling just like the Household Water and Food Management variable. Furthermore, variables with p-value > 0.05 were excluded, namely the Household Liquid Waste Safety variable (p-value = 0.117) so that further modelling of the Household Liquid Waste Safety variable was excluded from the model. The OR changes that occurred can be seen in table 13.

Table 13. Relationship between Stop Open Defecation and Household Waste Safety to the Incidence of Stunting in 2020

Independent Variable	Crude OR	Adjusted OR	Perubahan OR	p-value
Stop Open Defecation	4,926	3,731	24,2%	0,112
Securing Household Waste	6,131	3,971	35,2%	0,057

After removing the Household Liquid Waste Security variable, there was a change in OR>10% in the Stop Open Defecation and Household Waste Security variables. So that the Household Liquid Waste Security variable is included in multivariate modeling and is a cofounding variable. Furthermore, variables with p-value > 0.05, namely the variable Stop Open Defecation (p-value = 0.066) so that further modeling of the variable Stop Open Defecation is removed from the model. After removing the Stop Open Defecation variable, there was a change in OR> 10% in the Household Waste Security and Household Liquid Waste Security variables. So that the variable stop open defecation is included in multivariate modeling and is a counfounding variable which can be seen in table 14.

Table 14. Relationship between Stop Open Defecation, Household Waste Safety and Household Liquid Waste Safety to the Incidence of Stunting in 2020.

Independent Variable	Crude OR		
	p-value	OR	95%CI
Stop Open Defecation	0,062	4,908	0,9241-26,059
Securing Household Waste	0,026	5,992	1,242-28,905
Securing Household Liquid Waste	0,117	0,343	0,090-1,306

The results of the analysis using the multiple logistic regression test of the prediction model above can be concluded that the variable that is significantly related to the incidence of stunting and the magnitude of its influence is the variable of securing household waste. while the variables of stopping open defecation and securing household liquid waste as confounding variables. the results of the analysis obtained the odds ratio (OR) of the household waste security variable is 5.992, meaning that mothers with poor household waste security behavior will have stunted toddlers 5.992 times higher than mothers with poor household waste security after controlling for the variables of stopping open defecation and securing household liquid waste.

Stop open defecation is one of the factors that can trigger stunting. This mechanism is related to the prevention of Tropical Enteropathy, diarrhea, and other infections that can interfere with the absorption of nutrients in the child's digestive system. Humphrey reports that subclinical conditions of environmental enteropathy can increase the permeability of the small intestine to pathogens, which in turn reduces nutrient absorption. As a result, this can lead to malnutrition and stunting, even in the absence of diarrhea symptoms. Research by Checkley et al. showed an association between the incidence of diarrhea in children and height. The results indicated that 25% of stunted children had also experienced diarrhea five or more times in the past two years.

Household Waste Management also has a significant impact on the incidence of stunting in. According to research by Nurkomala from the Diponegoro University Nutrition Science Study Program entitled "Practices of Providing Complementary Feeding for Mother's Milk (MPASI) in Stunted and Non-Stunted Children Aged 6-24 Months" (2017), waste management that does not meet health standards can create a dirty environment around the house, which contributes to stunting. An unclean and polluted environment increases the risk of disease, thus disrupting children's growth and development. Sri Harlinda in an article in Media Indonesia also stated that inadequate plastic waste management can increase the risk of stunting due to lack of nutritional intake in children. Plastic waste dumped into the ocean can contain microplastics, which if consumed by fish will reduce the nutritional value of the fish. If contaminated fish is consumed by humans, this can lead to stunting in children.

Household Liquid Waste Management is another factor that may contribute to stunting. Checkley et al. (2004) found that the lack of an adequate wastewater disposal system was associated with a 0.9 cm reduction in child height (95% CI = 0.2-1.7 cm) at 24 months of age. Poor sanitation can increase the incidence of stunting, as stated by Safitri (2017), who pointed out that stunting malnutrition in under-fives can be caused by direct factors, including food intake and infections such as diarrhea. Liquid waste comes from human excreta, dirty water from kitchens, bathrooms, toilets, and waste from companies. Inefficient sewage systems can be a source of disease. The absence of waste management facilities increases the risk of diarrhea in children under five in the family, as the spread of viruses, germs and bacteria will be higher.

4. Conclusions

Stunting and malnutrition have emerged as critical health issues, as highlighted by a problem prioritization exercise that identified these challenges alongside maternal and infant mortality rates (MMR and IMR) and pulmonary tuberculosis. In a study involving 58 mothers of toddlers, data were collected through questionnaires during door-to-door visits. The findings revealed that out of 60 mothers surveyed, 39 (65%) had children at risk of stunting. Anthropometric measurements using the height-for-age (TB/U) reference indicated that 10 mothers (16.7%) had children with very short nutritional status, while 11 mothers (18.3%) had children classified as having short nutritional status. Furthermore, the demographic profile of the toddlers showed that among the 60 children surveyed, 41 (68.3%) were male and 19 (31.7%) were female, indicating a predominantly male population in this sample.

Additionally, the data collected included health histories and immunization status, revealing that 14 toddlers (23.3%) had a history of infectious diseases, while 5 toddlers (8.3%) were identified as being at risk based on birth weight. Among adolescent girls in, 4 families participated in the study, with 75% of the adolescent girls having received tetanus toxoid (TT) immunizations, while 25% had not. Remarkably, the nutritional assessment of adolescent girls, based on the upper arm circumference (LILA) measurement, indicated that all respondents had good nutritional status. However, despite these positive indicators, the implementation of community-based total sanitation (STBM) remains insufficient, highlighting an urgent need for improvement. STBM aims to transform hygiene and sanitation behaviors through community empowerment, ensuring that the community refrains from open defecation, practices regular hand washing, and safely manages drinking water, food, and waste.

Author Contribution
The author contributed fully to the research.

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The authors declare no conflict of interest.

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