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Strategies to Accelerate The Reduction of Stunting Prevalence Through Mapping The Physical, Biological and Socio-Cultural Environment at Risk with The Trias Epidemiology Approach

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***Abstract*:** *Stunting is a serious problem that must be addressed because it has an impact on the quality of human resources that will be dated. The prevalence of stunting cases in Indonesia in 2022 has decreased compared to 2021, which was 21.6%. However, this figure is still above the government's expectations which determine a decrease of up to 14% in 2024. This determination requires comprehensive handling from various parties in reducing the incidence of stunting and preparing a better next generation. This study aims to determine environmental factors that are risk factors for stunting in Pekalongan City through the trias epidemiological approach. This study is a mixed methods study using an explanatory sequential design with a case control approach. The independent variables to be studied include host and environment variables. The data obtained will be analyzed bivariate and multivalent with data reduction and drawing conclusions from qualitative data. Furthermore, the results of the mix methods analysis will be included in the SWOT analysis to formulate a strategy to accelerate the reduction of stunting prevalence in Pekalongan City.*
Keywords : *Stunting; Prevalence ; Risk factors; Strategy; Decline*

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INTRODUCTION

Global Nutrition Report 2018 reported that there are around 150.8 million (22.2%) stunted children under five which is one of the factors hindering human development in the world (United Nation, 2018). The World Health Organization (WHO) has determined five subregions for stunting prevalence, including Indonesia, which is in the Southeast Asian region at 36.4% (WHO, 2020). Based on data from the 2021 Indonesian Toddler Nutrition Status Survey, the current prevalence of stunting is still at 24.4 percent or 5.33 million children under five (SSGBI, 2021). This prevalence has decreased from the previous year, but President Jokowi targets the stunting rate to drop to 14 percent in 2024 (Ministry of Health of the Republic of Indonesia, 2024).

Stunting is a condition that describes the undernutrition status that has a chronic nature during the growth and development of children from the beginning of life which is confirmed by a z-score of height according to age less than minus two standard deviations based on growth standards according to WHO

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(Ni'mah, 2019). Stunting is a marker of poor child development and can cause a lack of cognitive and physical abilities in children, besides that stunting can also cause a decrease in productive ability and can increase the risk of degenerative diseases in the future Factors that cause stunting consist of direct and indirect causative factors (Raj et al., 2022). Direct factors for stunting are the nutritional status of pregnant women, infectious diseases, and nutrition of toddlers, while indirect factors can occur from various aspects. One of the indirect factors that cause stunting is water, sanitation and hygiene (WASH), namely drinking water sources, physical quality of drinking water, toilet ownership and hygiene, namely hand washing habits (Uliyanti, et al, 2023).

In 2018, the Environment Agency conducted sampling and water quality tests of excavated wells at 15 points for 15 villages where each village took 2 samples to ensure pollution or not. The results found that in the northern part of Pekalongan City such as the Bandengan area, the water quality is no longer suitable for consumption where it is considered to be sanitary with high salt content which makes the water change color and taste salty. As for the southern part, the majority of which is adjacent to the batik industrial area, indicates high COD (Chemical Oxygen Demand) pollution and can cause various infectious diseases for humans. The status factor of toddler infectious diseases is also a factor that affects the incidence of stunting in toddlers. Most of the stunted toddler groups often suffer from pain, meaning that there is a meaningful relationship between the frequency of illness and the nutritional status of stunted toddlers (Subroto et al., 2021). Infectious diseases can also interfere with the growth and nutritional status of children under five, because infectious diseases can reduce food intake, nutrient absorption is disturbed and can cause the loss of nutrients directly (Erwin Saleh Pulungan et al., 2024). Another environmental risk factor that affects the incidence of stunting is about waste management (Novianti & Padmawati, 2020).

Pekalongan City has a quite serious stunting problem with a prevalence rate of 20.9%. In fact, we know that stunting is very related to productivity. The condition of lack of height in adulthood is the result of childhood stunting which is associated with a loss of productivity of 1.4%. Furthermore, stunting also reduces a person's intelligence level (IQ) from 5-11 points (Nutritional failure in Ecuador: Causes, consequences, and solutions', 2007). This condition will certainly affect the quality of human resources, so it is necessary to analyze the causative factors both in terms of health, socio-culture and environmental quality (Farah Okky Aridiyah, Ninna Rohmawati, 2015).

METHODOLOGY

The type of research used in this research is *mixed methods* using *explanatory sequential design* with *a case control approach.* According to Guttterman, the mixed method is a research approach that combines or combines qualitative and quantitative forms (Guetterman et al., 2015). The quantitative data in this study is to analyze the independent variables and bound variables, which are then complemented by qualitative data to formulate a strategy to accelerate stunting reduction in the city of Pekalongan.

RESULTS AND DISCUSSION

The incidence of stunting in children under five in the city of Pekalongan currently reaches 1187 cases with a prevalence of 7.43% spread across 27 villages. The highest number of cases was in Setono village (120 cases / prevalence of 20.24%), while the lowest number of cases was in Bandari village (0

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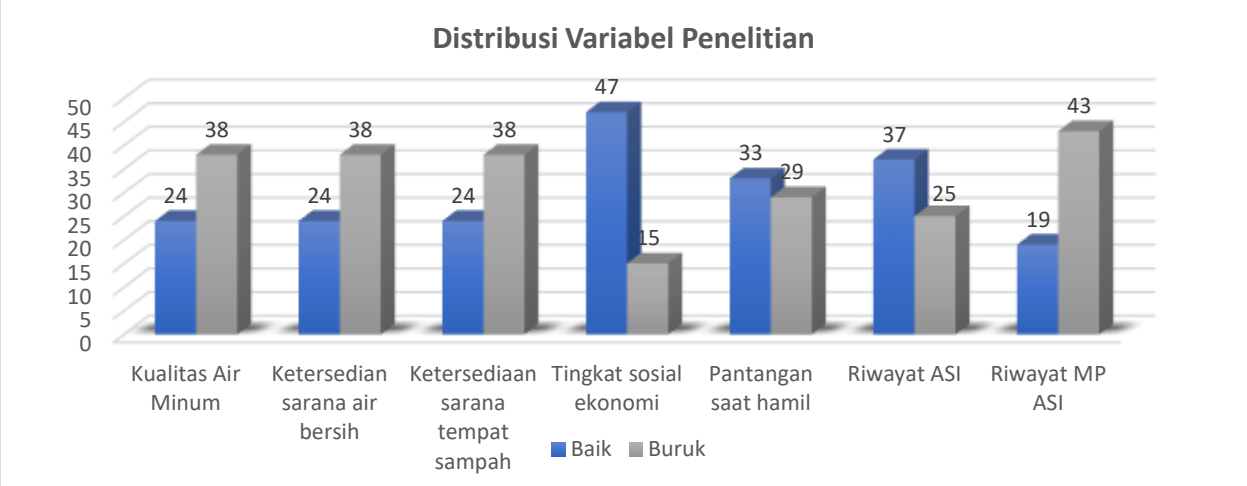
cases) which was included in the work area of the Dukuh Health Center. So based on the lemeshow formula, which is the sample size formula to hypothesize the difference of 2 proportions, so that this study was carried out on 31 cases and 31 controls with a total of 62 research samples.

Univariate analysis of research variables

Diagram 1. Results of the research variables



The variable data of this study was obtained from 62 samples divided into 31 cases and 31 controls. This data was obtained by conducting observations, interviews and laboratory tests. The results of the analysis of the above variables are as follows:

a. Drinking Water Quality, The sample tested is ready-to-drink water taken from the drinking water storage area owned by the respondent, which is taken using a bottle that has been sterilized and then analyzed for the presence of coliform bacteria in the sample. Based on laboratory results with the filter membrane method, the distribution of poor drinking water quality / not qualified was obtained as many as 38 people / 61.3%, while the quality of drinking water was good / qualified as many as 24 people / 38.7
b. The availability of clean water, the results of analysis with observation and interviews showed that the quality of clean water facilities was good for 24 people, while the facilities for poor clean water availability were 38 people.
c. Availability of Trash Cans, as a result there are still 38 people who are bad in providing trash cans and only 24 good ones.
d. Socio-economic level, based on the results of interviews, there are still 15 people with a low socioeconomic level.
e. Taboos during pregnancy, based on the results of observations and interviews of mothers who have bad habits, too many taboos during pregnancy amounted to 29 mothers.
f. The results of Breastfeeding are still 25 mothers who are not exclusively breastfeeding. B
g. Complementary food history, the results of observations and interviews showed that only 19 people did well with complementary feeding, while the other 43 people had a bad history of complementary feeding.

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Bivariate Analysis

1) The Relationship between Drinking Water Quality and the Incidence of Stunting

Table 1.1 The Relantionship between Drinking Water Quality and the Incidence of Stunting

Drinking Water Quality	Stunting Incidence				OR 95% CI	P value	desc
	Case		Control				
	N	%	N	%			
Bad	28	90,3	10	32,3	19,60	0,000	There is a
Good	3	9,7	21	67,7	(4,791 –		relationship
Total	**31**	**100**	**31**	**100**	80,185)		

Based on Table 1.1 above, it is known that there are 28 respondents (90.3%) of the case group has poor drinking water quality which is characterized by the discovery of coliform bacteria and only 3 respondents have good water quality. Meanwhile, in the control group, there were 10 (32.3%) respondents who had poor drinking water quality and 21 respondents (67.7%) who had good drinking water quality. The results of bivariate analysis of water quality and stunting incidence showed a relationship with *a p value* of 0.000 < α 0.05 which showed a statistically significant relationship between drinking water quality and stunting incidence.

Families who consume drinking water with poor quality, the babies they give birth to have a 19.6 times risk of stunting. The indicator used is if the drinking water contains coliform bacteria. Coliform bacteria include the normal flora of the human colon and warm-blooded animals, they are harmless, but there are several strains that are pathogenic to humans and animals so that they can cause diseases in humans, be it urinary tract infections, gastrointestinal tract infections to brain membrane infections (Amalina et al., 2023). Thus, individuals who consume water of poor quality are very likely to have a high risk of developing diseases caused by these EColi bacteria. Especially if the person who consumes water with poor quality is still a baby, it can very likely cause the baby to become sick and cause disruption in the growth and development of the baby.

2) The Relationship between the Availability of Clean Water Facilities and the Incidence of Stunting

Table 1.2 Relationship between the Availability of Clean Water Facilities and the Incidence of Stunting

Clean Water Facilities	Stunting Incidence				OR 95% CI	P value	Desc
	Case		Control				
	N	%	N	%			
Bad	21	67,7%	17	54,8	1,729	0,297	No
Good	10	32,7%	14	45,2	(0,615 –		relationship
Total	**31**	**100**	**31**	**100**	4,860)		

Based on Table 1.2, there are 21 respondents (67.7%) of the case group who have poor clean water facilities and 10 people (32.3%) who have good water sources, this is marked by the distance between the water source used in daily activities and the garbage can, the empty tank and

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assessed from the adequacy of clean water. Meanwhile, the control group that had good clean water was 14 (45.2%) and as many as 17 (54.8%) had poor clean water availability facilities. The results of the bivariate analysis of clean water availability and stunting incidence showed that there was no relationship with *a p value* of 0.297 > α 0.05 which showed that there was no significant relationship between the availability of clean water facilities and the incidence of stunting.

The results of the study showed that the availability of clean water facilities was not related to the incidence of *stunting*. This condition may be explained that the real condition is not necessarily in accordance with the theory, that there is a minimum distance required between the water source and the garbage disposal/*septic tank* to be safe from pollution. From the above incident, the water source used is close, it's just that it has not yet polluted. However, in this case, the researcher does not recommend not paying attention to the distance between clean water sources and garbage disposal. It is also possible that there is an influence from the pattern of people's habits that to meet their drinking water needs, they prefer to use mineral/bottled water, and well water is only used for toilet purposes.

3) The Relationship between the Availability of Trash Facilities and the Incidence of Stunting

Table 1.3 The Relationship between the Availability of Trash Facilities and the Incidence of Stunting

Trash Can Facilities	Stunting Incidence				OR 95% CI	P value	Desc
	Case		Control				
	N	%	N	%			
Buruk	25	80,6	13	41,9	5,769	0,002	There is a
Baik	6	19,4	18	58,1	(1,843 –		relationship
Total	**31**	**100**	**31**	**100**	18,064)		

Based on Table 1.3, it is known that there are 25 respondents (80.6%) of the case group having poor trash can facilities which are characterized by unclosed trash cans and the length of the waste disposal process and there are only 6 respondents (19.4%) of the case group who have good trash can facilities. Meanwhile, in the control group, there were 13 (41.9%) respondents who had poor trash can facilities and as many as 18 respondents (58.1%) had good trash can facilities. The results of bivariate analysis of the availability of garbage can facilities and stunting incidence showed a relationship with *a p value* of 0.002 < α 0.05 which showed a significant relationship between the availability of garbage cans and stunting events.

Waste is defined as the remnants of human daily activities or natural processes that are solid or semi-solid, in the form of organic or inorganic substances, and are degradable or indegradable, which are considered useless and disposed of in the environment (Indonesia, 2008). Based on its nature, waste is classified into organic waste, inorganic waste and Hazardous and Toxic Materials (B3) waste. All of them have the risk of polluting the environment. This is in line with the results of this study, namely there is a relationship between garbage can facilities and *stunting* incidence. The explanation for this is that the availability of adequate garbage can facilities will reduce the risk of contamination of family water sources. So that the water consumed by the

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family is still of good quality, which of course minimizes the risk of diseases that hinder the development of the baby/child in the family.

4) Socio-Economic Relationship with Stunting Incidence

Tabel 1.4 Socio – Economic Relationship with Stunting Incidence

Socio-Economic	Stunting Incidence				OR 95% CI	P value	Desc
	Case		Control				
	N	%	N	%			
Less	9	29,0%	6	19,4	1,705	0,374	No
Enough	22	71,0%	25	80,6	(0,523 –		relationship
Total	**31**	**100**	**31**	**100**	5,554)		

Based on Table 1.4, it is known that there are 25 respondents (80.6%) of case groups who are not good at providing complementary foods, both related to the 4* menu provided and the intensity and method of administration. Meanwhile, respondents in the case group who had provided complementary food well only reached 6 respondents (19.4%). The control group with insufficient complementary feeding as many as 18 (58.1%) and as many as 13 respondents (41.9%) had provided complementary food well. The results of the bivariate analysis between the provision of complementary foods and the incidence of stunting showed that there was no relationship with *a p value* of 0.05 = α 0.05 which showed that there was no significant relationship between the provision of complementary foods and the incidence of stunting.

This condition is contrary to the results of previous studies that state that there is a relationship between socio-economic and stunting incidence, such as research by (Ngaisyah, 2015) with the title "Socioeconomic relationship with stunting incidence in toddlers in Kanigoro village, Saptosari, Gunung Kidul" and research from (Ardha et al., 2023) with the title "Socio-Economic Relationship with Stunting Incidence in the Cipadung Health Center Area, Bandung City". Socioeconomic conditions can be related and not related to the incidence of stunting, because what is directly related to the occurrence of stunting is good nutritional intake from the mother during pregnancy and also good nutritional intake from the baby/child during the growth and development period. Even though the family is categorized as a low socio-economy, but has good knowledge about the importance of nutrition for the health of pregnant women and the growth and development of children, then they will allocate sufficient funds for it, creatively try to meet nutrition with cheap foodstuffs but still have good nutritional value.

5) The Relationship between Taboo Habits During Pregnancy and the Incidence of Stunting

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https://nawalaeducation.com/index.php/JHH

Tabel 1.5 Relationship between Taboo Habits during Pregnancy and the Incidence of Stunting

Taboo Habits During Pregnancy	Stunting Incidence				OR 95% CI	P value	Desc
	Case		Control				
	N	%	N	%			
Bad	19	61,3	10	32,3	3,325	0,022	No
Good	12	38,7	21	67,7	(1,171 –		Relationship
Total	**31**	**100**	**31**	**100**	9,442)		

Based on Table 1.5, it is known that there are 19 respondents (61.3%) of the case group who have taboo habits during pregnancy and as many as 12 respondents (38.7%) of the case group who do not follow the taboo habits during pregnancy. Meanwhile, in the control group, there were 10 (32.3%) respondents who followed taboo habits during pregnancy and as many as 21 respondents (67.7%) did not follow taboo habits during pregnancy. The results of the bivariate analysis of taboo habits during pregnancy and stunting incidence showed a relationship with *a p value* of 0.022 < α 0.05 which showed a significant relationship between taboo habits during pregnancy and stunting incidence.

Actually, taboos during pregnancy do not always connote as something negative. There are good taboos during pregnancy and should be done by pregnant women such as not being allowed to do strenuous physical activity because it risks causing injury to the abdomen and premature contractions, not being able to consume excess caffeine, because the placenta will easily absorb caffeine and risk inhibiting fetal growth and development, smoking should not be done because cigarettes contain a lot of risky nicotine, Eating raw foods, sea fish high in mercury and other foods that can be at risk to the womb. It is also important for pregnant women Anxiety will cause abnormal conditions during the delivery process (Selfiana et al., 2023). Meanwhile, taboos for pregnant women that have a negative connotation are because in our society there are still many taboos for pregnant women related to foods that are actually not medically harmful but can actually increase nutrition for pregnant women. When the mother experiences malnutrition during pregnancy, it will result in the growth and development of the baby/child being disturbed.

6) The Relationshio between Exclusive Breastfeeding and the Incidence of Stunting

Table 1.6 Exclusive Relationship between Breastfeeding and Stunting Incidence

Exclusive Breastfeeding	Stunting Incidence				OR 95% CI	P value	Desc
	Case		Control				
	N	%	N	%			
No	12	38,7%	13	41,9	0,874	0,796	No
Yes	19	61,3%	18	58,1	(0,317 –		Relationship
Total	**31**	**100**	**31**	**100**	2,414)		

Based on Table 1.6, it is known that there are 12 respondents (38.7%) of the case group who do not practice exclusive breastfeeding, while as many as 19 respondents (61.3%) have given exclusive breastfeeding to their children. The control group from areas with zero stunting cases had the practice of exclusive breastfeeding as many as 18 (58.1%) and as many as 13 respondents

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https://nawalaeducation.com/index.php/JHH

(41.9%) did not practice exclusive breastfeeding. The results of the bivariate analysis related to exclusive breastfeeding and stunting incidence showed no relationship with a p value of 0.796 > α 0.05 which showed no significant relationship between exclusive breastfeeding and stunting incidence.

There is a lot of scientific evidence that shows that breast milk given exclusively during the first 6 months of life can meet the nutritional needs of babies to grow and develop. Breast milk has advantages over formula milk, where lactose breast milk as a source of carbohydrates is absorbed better than that contained in formula milk. Thus, of course, breast milk is very good for the development and growth of babies. However, this does not mean that without exclusive breastfeeding babies cannot grow and develop properly. They can still grow and develop well by only consuming formula milk, although there may be less than babies who consume breast milk. If her nutritional needs are met with formula milk, she can still grow and develop properly or stunting does not occur.

7) The Relationship between MP-Breastfeeding and the Incidence of Stunting

Tabel 1.7 The Relationship between MP-Breastfeding and the Incidence of Stunting

Provision of complementary foods	Stunting Incidence				OR 95% CI	P value	Desc
	Case		Control				
	N	%	N	%			
Less	25	80,6%	18	58,1	3,009	0,054	No
Good	6	19,4%	13	41,9	(0,961 –		Relationship
Total	**31**	**100**	**31**	**100**	9,423)		

Based on Table 1.7, it is known that there are 25 respondents (80.6%) of case groups who are not good at providing complementary foods, both related to the 4* menu provided and the intensity and method of administration. Meanwhile, respondents in the case group who had provided complementary food well only reached 6 respondents (19.4%). The control group with insufficient complementary feeding as many as 18 (58.1%) and as many as 13 respondents (41.9%) had provided complementary food well. The results of the bivariate analysis between the provision of complementary foods and the incidence of stunting showed that there was no relationship with *a p value* of 0.05 = α 0.05 which showed that there was no significant relationship between the provision of complementary foods and the incidence of stunting.

The results of this study found that the provision of complementary foods was not related to the incidence of *stunting*. This is of course not in line with the theory (Maria, 2021) that the right MP-Breastfeeding pattern in babies not only achieves optimal growth but also prevents malnutrition. After 6 months, breast milk cannot meet the needs of minerals such as iron and zinc, so to meet these needs, MP ASI (complementary foods for breast milk) that is rich in iron must be given. But it is possible that poor Mp-Asi is not a factor related to stunting incidence. As we know, MP-ASI is measured based on the menu given, the intensity and the method of delivery. However, it is possible that the menu is able to provide the nutrition that the baby needs.

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SWOT MIX strategy of methods from quantitative and qualitative data in accelerating stunting control in the city of Pekalongan

Based on the results of the analysis of the SWOT strategy as a program to accelerate stunting control in the city of Pekalongan in general and in two research loci in particular, namely Bandari Village and Setono Village. So 4 strategies can be prepared, namely:

1. ***SO Strategy***
   SO is a strategy to strengthen the strength of stunting management programs by taking advantage of existing opportunities. Based on the SWOT analysis that has been prepared, it produces Strategy 1 (SO) as follows:
   - Synergizing the stunting control program between the health center and the village government by utilizing the village fund budget to provide posyandu infrastructure facilities to improve the nutritional status of toddlers.
   - Synergizing the ILP program and the stunting control program at the health center level.
2. ***WO Strategy***
   WO is a strategy to reduce the shortage of stunting programs by taking advantage of existing opportunities. Based on the SWOT analysis that has been prepared, it produces Strategy 2 (WO) as follows:
   - The program to control the physical environment of healthy houses at the village level to manage household waste.
   - Clean water triggering program based on village communities.
   - Cadre empowerment uses village funds in pregnant women's class activities to increase mothers' knowledge not to believe in the abstinence of protein foods during pregnancy.
3. ***ST Strategy***
   ST is a strategy to mobilize the strength of stunting handling programs to minimize the threat of the program. Based on the SWOT analysis that has been prepared, it produces Strategy 3 (ST) by increasing stunting risk factor surveillance activities in pregnant women.
4. ***WT Strategy***
   WT is a strategy to control the threat of the stunting handling program by paying attention to the weaknesses of the threat itself. Based on the SWOT analysis that has been prepared, it produces Strategy 4 (WT) by providing education to pregnant women and their families not to believe in the taboo of eating protein during pregnancy by involving the village government.

Journal of Public Health Indonesian
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SWOT ANALYSIS OF ACCELERATION OF STUNTING CONTROL WITH AN EPIDEMIOLOGICAL TRIANGLE APPROACH	**STRENGHT** 1. The existence of a stunting control program from the center 2. The existence of a stunting control program from the local government 3. The existence of the MDGs program to overcome hunger and poverty is one of the risk factors for stunting. 4. Routine surveillance program of the health center	**WEAKNESS** 1. Lack of knowledge in mothers 2. Unqualified drinking water quality 3. Posyandu facilities and infrastructure that are not yet adequate 4. Environmental sanitation facilities, water sources that have not met the requirements 5. Lack of community participation in posyandu activities 6. Lack of surveillance officers Lack of health workers for posyandu is outside
OPPORTUNITY 1. Existence of ILP (new primary service integration) program 2. There are cadres at the village level who synergize with the health center 3. Support from the village government for the optimization of posyandu 4. Support from the village government for household waste management	**SO Strategy** 1. Synergize the stunting control program between the health center and the village government by utilizing the village budget to provide posyandu infrastructure to improve the nutritional status of toddlers. 2. Synergizing the ILP program and the stunting control program at the health center level	**WO STRATEGY** 1. The program to control the physical environment of healthy houses at the village level to manage household waste. 2. Clean water triggering program based on village communities. 3. Empowerment of cadres to use village funds in pregnant women's class activities to increase mothers' knowledge not to believe in the abstinence of protein foods during pregnancy
THREATH The existence of socio-cultural habits of taboos during pregnancy, which are encouraged by family members, should not eat fish, shrimp and marine protein,	**ST Strategy** 1. Increasing stunting risk factor surveillance activities in pregnant women.	**WT Strategy** Provide education to pregnant women and pregnant women's families not to believe in abstinence from eating protein during pregnancy by involving the village government.

CONCLUSIONS

Based on the results of research on strategies to accelerate the reduction of stunting prevalence through mapping the physical, biological and socio-cultural environment at risk with a trias epidemiological approach, it can be concluded that from the many variables there are several variables related to the

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incidence of stunting, namely the quality of mimum water, the availability of waste disposal facilities, and also taboos during pregnancy. Furthermore, as an effort to accelerate the reduction of stunting prevalence, the SWOT mix strategy can be used from quantitative and qualitative data that has been compiled based on the results of the analysis of research variables.

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