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Association of Household Food Safety Practices with Stunting in Children Under Five: A Case-Control Study in A High-Prevalence Indonesian Village

Nur Ahmad Habibi[1*], Neza Viona Ariska[1], Ismanilda[1], Zulkifli[1], Marni Handayani[1], Citra Tristi Utami[2]

[1] Department of Nutrition, Health Ministry Polytechnic of Padang, Indonesia
[2] Department of Nutrition, Andalas University, Indonesia

Corresponding Author Email: nahindo2022@gmail.com

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ABSTRACT

One of the factor's causing stunting is infection related to poor household food safety practices. This study aims to analyze the correlation between household food safety practices and the incidence of stunting in Sibakur Village, Sijunjung District, Indonesia. The research used a case-control design with a sample size of 60 toddlers (30 cases and 30 controls) selected by simple random sampling. Data were collected through interviews using a questionnaire and analyzed by chi-square test, calculation of odds ratio (OR) with Confidence Interval (CI). The results showed a significant relationship between food safety practices and the incidence of stunting (p = 0.000; OR = 8.5; 95% CI =2.3-30.4), which means that toddlers from households with poor food safety practices have an 8.5 times higher risk of being stunting. Food safety factors closely related to stunting include sanitation, personal hygiene, raw materials, pest control, and cross-contamination. In conclusion, poor household food safety practices significantly increase the risk of stunting. Therefore, educative interventions of food safety need to be strengthened as a strategy to prevent stunting at the household level.

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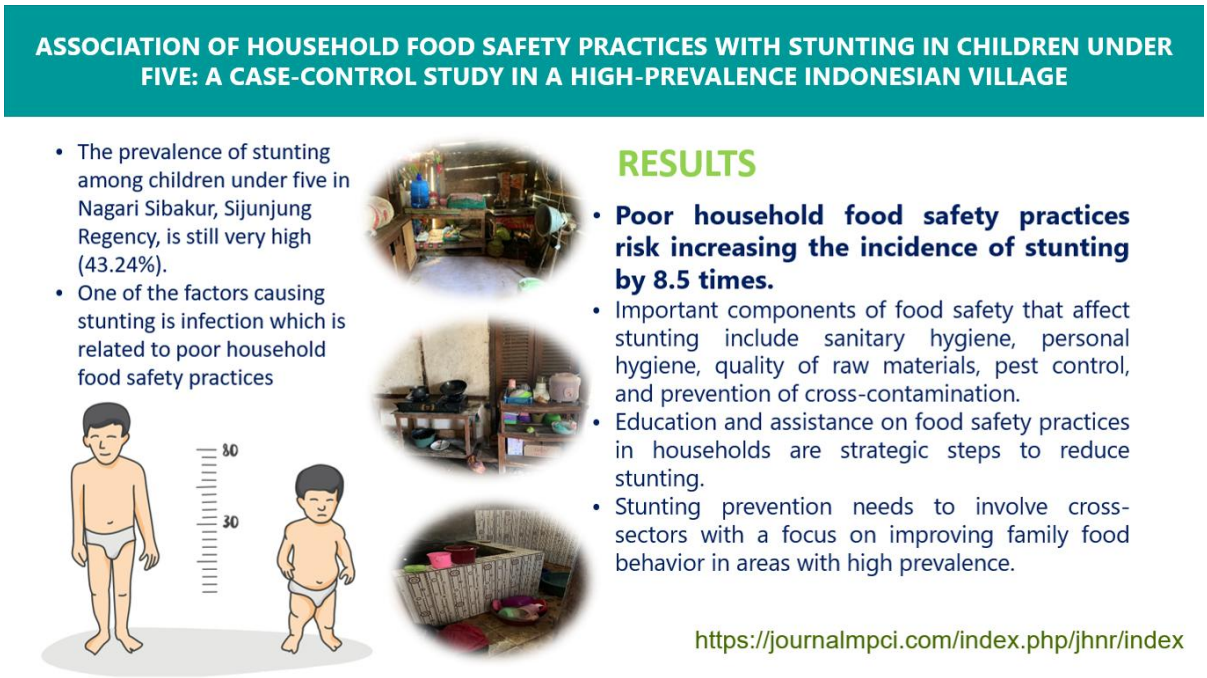
Key Messages:

- The prevalence of stunting among children under five in Nagari Sibakur, Sijunjung Regency, is still very high (43.24%).
- Poor household food safety practices risk increasing the incidence of stunting by 8.5 times.
- Important components of food safety that affect stunting include sanitary hygiene, personal hygiene, quality of raw materials, pest control, and prevention of cross-contamination.
- Education and assistance on food safety practices in households are strategic steps to reduce stunting.
- Stunting prevention needs to involve cross-sectors with a focus on improving family food behavior in areas with high prevalence.

GRAPHICAL ABSTRACT



INTRODUCTION

Stunting is a condition of impaired growth and development in children, characterized by a height that is shorter than the standard height for their age. This condition is measured using the height-for-age (H/A) indicator, where a child is categorized as stunted if their height is below minus two standard deviations (< -2 SD) from the median of the growth standard(1,2). Stunting has significant negative impacts, both in the short and long term. In the short term, stunting can hinder brain development, reduce intellectual capacity, disrupt physical growth, and negatively affect metabolic functions (3,4). In the long term, stunting can lead to decreased cognitive function and academic achievement, weaken the immune system, and increase the risk of non-communicable diseases such as diabetes, obesity, heart disease, hypertension, stroke, and various other health problems (5–7).

The prevalence of stunting in Indonesia remains high. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting among children under five was recorded at 21.6%. In West Sumatra Province, the prevalence rate is higher, reaching 25.2%, placing the province 14th out of 33 provinces nationally. One area with a particularly concerning stunting rate in West Sumatra is Sijunjung District, with a prevalence rate of 30%(8). According to data from the Sijunjung District Health Office, the area with the highest prevalence of stunted children is in the working area of Tanjung Gadang Community Health Center, specifically in Nagari Sibakur, with a case rate of 43.24%(9).

There are several factors that influence the incidence of stunting, both directly and indirectly. Direct factors include inadequate nutritional intake and a high incidence of infectious diseases in children. Indirect factors include food availability, socioeconomic conditions, educational level, maternal knowledge of nutrition, and the living environment (10,11). Infectious diseases are among the direct factors contributing to stunting. One infection with a high risk of causing stunting in children, especially during the first two years of life, is diarrhea and Acute Respiratory Infections (ARI)(10). According to the 2018 Basic Health Research (Riskesdas) data, obtained through diagnoses by health professionals, the prevalence of diarrhea in Indonesia was 6.8%, while in Sijunjung District, it was higher at 12.4%. Additionally, the prevalence of ARI in Indonesia was recorded at 9.3%, while in West Sumatra Province, it was slightly higher at 9.8%(12). Diarrhea in developing countries is often caused by contaminated food, posing a serious threat to young children.

Each year worldwide, unsafe food causes 600 million cases of foodborne diseases and 420 000 deaths. 30% of foodborne deaths occur among children under 5 years of age. WHO estimated that 33

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million years of healthy lives are lost due to eating unsafe food globally each year, and this number is likely an underestimation(13). Foodborne diseases or food poisoning occur due to contamination of food and drinks by microorganisms(14). Meanwhile, ARI is caused by infection with pathogens that can decrease appetite and interfere with nutrient absorption in the intestine. These conditions increase catabolism, resulting in insufficient nutritional reserves to support optimal tissue formation and child growth(15). Therefore, preventing infectious diseases through the implementation of proper food safety practices is a strategic step in reducing the prevalence of stunting.

Most existing studies on stunting in Indonesia have concentrated on nutritional intake, maternal education, sanitation, and economic conditions as key determinants(16). However, the influence of household food safety practices—such as hygienic food preparation, storage, and handling—remains underexplored, even though foodborne infections like diarrhea and ARI are proven contributors to stunting through impaired nutrient absorption and increased metabolic burden(17). Food safety practices aim to prevent contamination of food by pathogenic microorganisms, hazardous chemicals, or other foreign objects that may enter the food. Effective food safety practices include the handling, preparation, and storage of food ingredients to prevent the occurrence of foodborne diseases(18). Food safety is an effort to protect food from biological, chemical, and physical contamination that can disrupt, harm, or endanger human health. The kitchen is a crucial location that requires special attention in efforts to maintain food safety. As the site for preparing and processing food at home, the kitchen carries a high risk for the spread of infectious diseases if food handling is not performed correctly(19).

This study offers novelty by focusing its analysis on the relationship between household food safety practices and the incidence of stunting among children under five, a topic that has rarely been explored in depth in Indonesia. Most previous studies have focused on nutritional intake, environmental sanitation, and socioeconomic status, while the aspect of food safety—particularly related to handling, storage, and processing of food in household kitchens—has not been widely examined as a direct determinant of stunting. Yet, infections originating from contaminated food and water, such as diarrhea and ARI, have been proven to significantly increase the risk of stunting through mechanisms of nutrient malabsorption and metabolic disorders(20,21). Therefore, the aim of this study is to analyze the correlation between household food safety practices and the incidence of stunting in Sibakur Village, Sijunjung District, Indonesia.

METHODS

Research Design

The design of this study is an analytic observational study with a case-control approach. The research was conducted in Nagari Sibakur, Sijunjung Regency. The study period was from June 2024 to June 2025.

Subjects

The population in this study consisted of all children aged 6–59 months in Nagari Sibakur, Sijunjung Regency, in 2025, totaling 185 individuals. Sampling was conducted using a simple random sampling technique. The sample size was determined using the Neyman-Pearson formula, resulting in a requirement of 60 respondents, with 30 respondents each in the case and control groups. Inclusion criteria in this study were families with children under five years old with a z-score < -2SD for the case group, families with children under five years old with a z-score ≥ -2SD for the control group, and families who had lived in their house for approximately five years or at least as long as the child's age. Exclusion criteria were respondents do not present at the time of the study and those unwilling to participate as research respondents.

Variables

The dependent variable in this study was the nutritional status of children under five, consisting of two categories: 1 = stunted and 2 = normal. The independent variable was household food safety practices: 1. Good if the score is ≥ 80%, and 2. Poor if the score is < 80% as Bloom's cut off to evaluate knowledge and practices. Components of food safety practices included: sanitation, personal hygiene, equipment, water, raw materials, processing and storage, leftover food handling, pest control, and cross-contamination.

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Data Collection

Data were collected using a questionnaire through interviews. The data collected included respondent characteristics, parental characteristics, and household food safety practices. Respondent characteristics included sex, nutritional status, age, history of infection, source of clean water, source of drinking water, and consumption of cooked food. Parental characteristics included age, education level, occupation, marital status, and income. Data on household food safety practices were assessed using several indicators: sanitation, personal hygiene, equipment, water, raw materials, processing and storage, leftover food handling, pest control, and cross-contamination. Nutritional status data were obtained from secondary data available at Tanjung Gadang Health Center, Sijunjung Regency, and then validated by the researcher through direct height measurement by nutrition enumerators using a microtoise with an accuracy of 0.1 cm for children who could stand, and body length for those who could not yet stand.

Instrument Validity and Reliability

The questionnaire instrument used was tested for validity and reliability beforehand. Validity testing was conducted by experts and statistically using the Pearson correlation method. All questionnaire items met the standard validity criteria ($r > 0.3$) and showed adequate statistical significance at a 95% confidence level. Reliability testing of the 36 questionnaire items showed Cronbach's Alpha values ranging from 0.701 to 0.739, indicating that the research instrument is reliable for producing consistent and stable data in measuring the studied variables(22). Table 1 shows the questions on the food safety practice at home questionnaire.

Table 1. The questions on food safety practice at home questionnaire (n=36)

Aspect	No	Question
Hygiene and Sanitation	HS1	Does the mother clean the kitchen after each food preparation?
	HS2	Is the trash bin in the kitchen covered?
	HS3	Is the wastewater drain in the kitchen functioning properly and not clogged?
	HS4	Does the toilet door directly face the kitchen?
	HS5	Is the toilet far from the kitchen?
	HS6	Is the dishwashing area clean and separate from the toilet?
Personal Hygiene	PH1	Does the mother wash her hands before preparing food?
	PH2	Does the mother wash her hands using soap and running water?
	PH3	Does the mother remove jewelry (rings, bracelets) while cooking?
	PH4	Does the mother wear an apron while preparing food?
	PH5	Does the mother cover her mouth when sneezing/coughing during food preparation?
	PH6	Does the mother wash her hands with soap after using the toilet?
Utensils	UT1	Does the mother always wash cooking utensils with running water?
	UT2	Does the mother dry cooking utensils after washing?
	UT3	Does the mother use a clean and dry cloth to dry the utensils?
	UT4	Are kitchen utensils stored in a clean condition?
	UT5	Does the mother replace damaged or rusty utensils?
	UT6	Has the mother ever placed hot food directly into plastic containers?
	UT7	Are cooking utensils stored in a clean place, separated from trash or other contaminants?
	UT8	Is the refrigerator at home cleaned regularly?
Water	WA1	Does the mother use clear, odorless, and tasteless water for cooking?
	WA2	Does the mother clean the water storage tank regularly?
	WA3	Is the water treated before being used for cooking?
Raw Materials	RM1	Does the mother wash food ingredients before storing them?
	RM2	Are all food ingredients fresh and free from foreign contaminants?
	RM3	Does the mother separate raw and cooked ingredients during storage?
Food Processing	FP1	Does the mother cook at an adequate temperature (boiling)?
	FP2	Does the mother thaw frozen ingredients (meat, chicken, fish) before processing?
	FP3	Are raw ingredients stored at the correct temperature?

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Aspect	No	Question
	FP4	Is the food served no more than 4 hours at room temperature?
Leftover Food Handling	LH1	Are leftovers stored at the proper temperature?
	LH2	Are leftovers stored in closed containers?
Pest Control	PC1	Is the food protected from pest contamination?
	PC2	Is the kitchen free of signs of pests (rats, cockroaches, ants)?
Cross-Contamination	CC1	Does the mother use different knives or cutting boards for raw and cooked foods?
	CC2	Does the mother always wash the cutting board and knife with soap and hot water before using them for other food items?

Data Analysis

Data processing was performed statistically using SPSS software. Data analysis was conducted both univariately and bivariately. Univariate analysis was used to observe the frequency distribution of research variables, while bivariate analysis was used to determine the relationship between research variables using the Chi-Square test. Furthermore, the strength of the association was measured using the Odds Ratio (OR) and 95% Confidence Interval (CI) (23).

Code of Health Ethics

This study received ethical approval from the Ethics Committee of Perintis University, Indonesia with number 965/KEPK.F1/ETIK/2024 dated December 23, 2024.

RESULTS

Characteristics of Subjects

Table 2 shows the characteristics of the study subjects. Most respondents in both the case and control groups were male and fell within the 25–36 month age range. A history of infectious diseases was more frequently found in the case group, with 80% of children having experienced an infection, the highest proportion being Acute Respiratory Infections (ARI) at 76.7%. Regarding sources of clean water, most respondents in both groups used PDAM water (93.3%). For drinking water sources, the majority of children in the case group consumed bottled (gallon) water (93.3%), with only a small proportion using boiled clean water (6.7%). In contrast, in the control group, 33.3% consumed boiled clean water and 66.7% consumed bottled water. In terms of cooked food consumption, both the case and control groups tended to consume food stored for less than 24 hours more frequently than food that was always freshly cooked.

Table 2. Characteristics of Subjects

Variable	Nutrition Status		AOR	95% CI	p-value
	Case	Control			
	n (%)	n (%)			
Sex					
1. Male	19 (63.3)	20 (66.7)	0.7	0.28-1.75	0.45
2. Female	11 (36.7)	10 (33.3)			
Age (months)					
1. 6-24	5 (16.7)	4 (13.3)	1.5	0.33-6.81	0.59
2. 25-36	12 (40.0)	7 (23.3)			
3. 37-48	9 (30.0)	14 (46.7)			
4. 49-59	4 (13.3)	5 (16.7)			
Infectious disease history					
1. Yes	24 (80.0)	21 (70.0)	1.7	0.58-4.97	0.34
2. No	6 (20.0)	9 (30.0)			
Infectious disease type					
1. Diarrhea	1 (3.3)	3 (10.0)	0.16	0.01-2.00	0.15
2. Acute Respiratory Infections	23 (76.7)	18 (60.0)	0.88	0.27-2.89	0.83
3. No	6 (20.0)	9 (30.0)			
Use of Clean Water					

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1. Dug well	2 (6.7)	2 (6.7)	2.3	0.24-21.5	0.47
2. Bore well	0 (0.0)	0 (0.0)			
3. Regional Drinking Water Company	28 (93.3)	28 (93.3)			
Use of Drinking Water					
1. Boiled clean water	2 (6.7)	10 (33.3)	0.1	0.02-0.55	0.01
2. Bottled (gallon) water	28 (93.3)	20 (66.7)			
3. Packaged drinking water	0 (0.0)	0 (0.0)			
Cooked food consumption					
1. Food always freshly cooked	12 (40.0)	10 (33.3)	0.9	0.34-2.38	0.84
2. Food reheated	0 (0.0)	0 (0.0)			
3. Food stored for less than 24 hours	18 (60.0)	20 (66.7)			

The multivariate analysis revealed that among all variables assessed, the source of safe drinking water emerged as the most independent factor associated with children's nutritional status AOR 2.3. Children who consumed properly treated safe drinking water had a lower risk of stunting compared to those who consumed untreated or inadequately treated water. Although a history of infectious diseases appeared to be associated in the bivariate analysis, its effect diminished and lost statistical significance after adjustment for other variables, suggesting it may act as a confounding factor. Other variables, such as sex, age, type of infectious disease, and food consumption patterns, did not show independent associations with stunting.

Table 3 shows the characteristics of the parents of the study subjects. Most mothers in both the case and control groups were in the 20–35 year age range. In terms of education, 66.7% of mothers in the case group had a low level of education (no schooling, only completed elementary or junior high school), while in the control group, this proportion was lower at 46.7%. Regarding occupation, the majority of mothers in both groups were housewives, with 83.3% in the case group and 73.3% in the control group. However, mothers in the control group showed more diverse occupations, including formal employment such as civil servants/military/police at 6.7%. In terms of income, most mothers in the case group (86.7%) and the control group (83.3%) were classified as having low income.

Table 3. Characteristics of parents

Variable	Nutrition Status	
	Case	Control
	n (%)	n (%)
Age		
1. 20-35 Years	20 (66.7)	21 (70.0)
2. 36-50 Years	10 (33.3)	9 (30.0)
Education Level		
1. No schooling/ elementary school/ junior high school	20 (66.7)	14 (46.7)
	8 (26.7)	10 (33.3)
2. High school graduate	2 (6.7)	6 (20.0)
3. College		
Occupation		
1. Housewife	25 (83.3)	22 (73.3)
2. Farmer/Fisherman/Laborer	1 (3.3)	3 (10.0)
3. Entrepreneur	0 (0.0)	0 (0.0)
4. Civil Servant/Military/Police	0 (0.0)	2 (6.7)
5. Others	4 (13.3)	3 (10.0)
Marital Status		
1. Married	30 (100.0)	30 (100.0)
2. Single mother/widow	0 (0.0)	0 (0.0)
Income		
1. High	4 (13.3)	5 (16.7)
2. Low	26 (86.7)	25 (83.3)

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Household Food Safety Practices

Table 4 shows that several aspects of household food safety practices have a significant association with stunting incidence. The most prominent variables are sanitation, use of unsuitable raw materials, personal hygiene, and pest control. Among the case group, 96.7% came from food preparation environments with poor sanitation, compared to only 50% in the control group (p = 0.000). This indicates that poor environmental sanitation is closely linked to the likelihood of nutritional problems in children. Personal hygiene also shows a significant association (p = 0.003), with 83.3% of cases coming from individuals with poor personal hygiene practices.

Another statistically significant aspect is the use of unsuitable raw materials; 83.3% of the case group used poor-quality raw materials, while only 33.3% of the control group did so (p = 0.000). This finding reinforces the importance of food quality in determining children's nutritional status. In addition, pest control (p = 0.039) and cross-contamination (p = 0.010) also show meaningful associations, with the case group being more exposed to contamination risks than the control group. Notably, cross-contamination occurred in 100% of the case group, indicating a very high level of risk.

Conversely, other factors such as equipment condition (p = 0.190), water quality (p = 1.000), food processing and storage (p = 0.438), and leftover food handling (p = 0.602) did not show statistically significant associations. Although these three factors were not significantly related, they may still contribute to the occurrence of stunting.

Table 4. Household Food Safety Practices Data

Variabel	Nutrition Status		*p-value
	Case	Control	
	n (%)	n (%)	
Sanitation			
1. Poor	29 (96.7)	15 (50.0)	p<0.05
2. Good	1 (3.3)	15 (50.0)	
Personal Hygiene			
1. Poor	25 (83.3)	14 (46.7)	p<0.05
2. Good	5 (16.7)	16 (53.3)	
Utensil			
1. Poor	15 (50.0)	10 (33.3)	0.190
2. Good	15 (50.0)	20 (66.7)	
Water			
1. Poor	16 (53.3)	16 (53.3)	1.000
2. Good	14 (46.7)	14 (46.7)	
Raw Material			
1. Poor	25 (83.3)	10 (33.3)	0.000
2. Good	5 (16.7)	20 (66.7)	
Food Processing			
1. Poor	17 (56.7)	14 (46.7)	0.438
2. Good	13 (43.3)	16 (53.3)	
Leftover Food Handling			
1. Poor	14 (46.7)	12 (40.0)	0.602
2. Good	16 (53.3)	18 (60.0)	
Pest Control			
1. Poor	19 (63.3)	11 (36.7)	p<0.05
2. Good	11 (36.7)	19 (63.3)	
Cross Contamination			
1. Poor	30 (100.0)	24 (80.0)	p<0.05
2. Good	0 (0.0)	6 (20.0)	

Table 5 shows a significant association between food safety practices and the nutritional status of children under five. A total of 66.7% of children with poor nutritional status (cases) came from households with poor food safety practices, while only 33.3% of the control group (normal nutrition) were in the same condition. Conversely, in the group with good food safety practices, the majority (81%) belonged to the

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control group and only 19% were in the case group. Statistical analysis yielded a p-value of 0.000, indicating a highly significant relationship between food safety practices and nutritional status. The Odds Ratio (OR) value of 8.500 with a 95% Confidence Interval (CI) of 2.3–30.4 indicates that children exposed to poor food safety practices have an 8.5 times greater risk of experiencing poor nutrition compared to children living in households with good food safety practices.

Table 5. Correlation between Overall Household Food Safety Practices and Stunting Incidence

Overall Household Food Safety Practices	Nutrition Status		Total	*p-value*	OR	95% CI
	Case	Control				
	n (%)	n (%)	N (%)			
Poor	26 (66,7)	13 (33,3)	39 (65)	<0.05	8,500	2.3-30.4
Good	4 (19)	17 (81)	21 (35)			

DISCUSSION

Research conducted in Nagari Sibakur, Sijunjung Regency, examined the relationship between household food safety practices and the incidence of stunting. The study yielded a p-value < 0.05, indicating a significant association between these variables. The findings revealed that a majority of respondents in the case group exhibited poor food safety practices (66.7%), compared to 33.3% in the control group. Children from families with inadequate food safety practices were found to be 8.5 times more likely to experience stunting than those from families with good practices. These results confirm previous studies that have linked poor personal hygiene and food safety practices to nutritional issues (20,24). The study underscores the critical role of enhancing household food safety in preventing stunting. While this suggests a strong association, the case–control design does not establish a causal relationship. Several indicators were employed to assess household food safety practices, including environmental sanitation, maternal hygiene in food processing, equipment, raw materials, food processing, leftover food handling, pest control, and cross-contamination. Of these, four indicators—environmental sanitation, hygiene personnel, raw materials, and cross-contamination—were significantly associated with stunting incidence.

Poor environmental sanitation was common in households with stunted children. Families with stunted children often had kitchens that did not meet hygiene and sanitation standards. Observed conditions included toilets adjacent to and facing the kitchen, dishwashing conducted in the toilet area, and uncovered trash cans. These conditions potentially increase the risk of cross-contamination and the spread of pathogenic microorganisms(25), such as *Staphylococcus aureus, Salmonella typhi, Streptococcus, Escherichia coli, Pseudomonas aeruginosa, Proteus mirabilis, Citrobacter freundii*, and *Staphylococcus epidermidis*(26). Pathogenic bacteria pose a risk of infections that can impair growth, as infectious conditions can hinder optimal nutrient absorption in children(26). This finding confirms that stunted toddlers have experienced infections, including diarrhea and acute respiratory infections.

Maternal personal hygiene also showed a strong association with stunting. The study identified a significant correlation between the incidence of stunting in toddlers and inadequate maternal personal hygiene practices. The findings indicated that mothers in the case group frequently neglected to wash their hands with soap prior to food preparation, failed to remove jewelry while cooking, and did not utilize aprons for clothing protection during food preparation. These practices elevate the risk of cross-contamination and exposure to pathogenic microorganisms, which can lead to infectious diseases in children. Conversely, the control group exhibited superior personal hygiene practices, particularly in the routine of washing hands with soap before and after handling food. The study established that personal hygiene is a primary predictor of food contamination, with poor practices heightening the risk of *Escherichia coli*(27).

The handling and quality of raw materials emerged as another critical factor. The use of raw materials also emerged as a significant factor in the incidence of stunting. Many households with stunted toddlers did not adequately process ingredients. Common practices among parents of stunted toddlers included storing raw materials without prior washing and maintaining them at inappropriate temperatures; for instance, meat should be stored at freezer temperatures below -14°C but was often kept at chiller temperatures below 10°C(28). Additionally, raw materials were not stored in contamination-

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protected environments. Vegetables with roots frequently contained soil, dirt, and pesticide residues, which could contaminate other food ingredients if not properly washed(29). This study linked the quality of raw materials to the incidence of stunting in Kurma Village, Mapilli District(30).

The research revealed that most families with stunting cases had kitchens with suboptimal hygiene conditions that were susceptible to pest infestations. Indicators of pest presence, such as rats and cockroaches, were observed in the respondents' kitchens. These pests can transmit pathogens, including *Mycobacterium tuberculosis, Mycobacterium microti, Escherichia coli*, and agents of tularemia, tick-borne relapsing fever, *bartonellosis, listeriosis, and Lyme disease*(31). Effective pest control measures, such as sealing entry points and proper waste management, can mitigate the risk of contamination(32).

Cross-contamination is a significant concern related to stunting in Sibakur Village. Certain food processing practices, such as using the same cutting board for both raw and cooked foods, elevate the risk of cross-contamination, potentially growing pathogenic microorganisms into food and adversely affecting the health of children under five. Contamination during processing can be minimized by separating cutting boards used for cooked products from those used for raw ingredients. Washing after use is key to preventing cross-contamination(33).

Although leftover management is not directly linked to stunting, poor practices, such as storing food at room temperature without a lid, increase the risk of contamination from environmental hazards and microbial growth due to improper temperature control. Food should not be stored at room temperature for more than four hours, and temperatures between 40-60°C should be avoided to prevent microbial growth(34). Mothers' knowledge and skills on how to store food need to be improved through training. Motivating mothers to learn about good food safety practices at home is key to minimizing foodborne illnesses(35).

In Sibakur Village, the primary source of clean water is PDAM water, which is regularly monitored for quality and safety. Conversely, drinking and cooking water often come from refilled sources utilizing ultraviolet systems. Generally, PDAM water quality surpasses that of dug well water, which frequently contains *Coliform bacteria*, including *E. coli*(36). PDAM water contamination typically results from pipe leaks, pollution of raw water sources, or inadequate treatment processes, while dug well water contamination is often due to nearby septic tanks, polluted rivers, and household waste dumps(37). However, neither clean water nor drinking water is considered a significant factor contributing to stunting.

Additionally, kitchen equipment does not exhibit a notable correlation with stunting incidence. Utensils are typically washed under running tap water and air-dried without cloth wiping. The materials used, such as stainless steel or aluminum, are deemed safe. Nevertheless, environmental conditions remain a concern, as many mothers wash utensils in toilets, and kitchens are often situated near toilets. This situation necessitates improvement to prevent environmental contamination through kitchen equipment(38).

Food processing is an important factor in determining food safety at the household level. However, in this study, no significant relationship was found between food processing and stunting (*p-value <0.05*). This is due to the fact that almost all mothers process food at adequate temperatures. Food is processed at a minimum boiling temperature of 72°C, which is considered sufficient to kill pathogenic bacteria(39). Nevertheless, there are still errors in storage techniques, whether in cold storage, frozen storage, or at room temperature. Most parents of toddlers do not know the proper way to thaw ingredients.

The potential influence of confounding factors should also be acknowledged. Variables such as maternal education, dietary patterns, and family income could influence both household food safety practices and child nutritional status. For example, higher maternal education has been linked to better hygiene practices and improved child nutrition, while low income can limit access to safe food and proper storage facilities(40). Without controlling for these variables, the strength of the association reported here may be over- or underestimated. The findings should be interpreted with caution, as unmeasured confounding factors, such as maternal education, family income, and dietary habits may have influenced the results. Additionally, the possibility of recall bias in questionnaire responses (e.g., a tendency to report “good” practices to appear clean) could have affected data accuracy(41,42).

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This study had some limitations. We did not inspect the food conditions relate quality and safety in each household to validate the laboratory assessments of proper food safety practices. The study was centered on the village of Sibakur in Sijunjung, West Sumatra, Indonesia, and as such, its results cannot be generalized to all mothers and children. A notable limitation of this study is the high risk of bias in the infectious disease variable. Data on infectious disease history were obtained through caregiver recall during interviews, which is prone to substantial recall bias. Caregivers may have under-reported or over-reported episodes of diarrhea, respiratory infections, or other illnesses due to memory lapses, misunderstanding of medical diagnoses, or social desirability bias. This limitation may have led to misclassification and weakened the observed association between infectious diseases and stunting. Therefore, further studies with a larger sample size and wider geographical range are needed, which could potentially lead to different conclusions than those drawn in this study.

CONCLUSION

The present study concludes a statistically significant correlation between inadequate household food safety practices and the incidence of stunting among children under five in Nagari Sibakur, Sijunjung Regency. Children from households with poor food hygiene were found to be 8.5 times more likely to experience stunting ($p < 0.05$) compared to those from households with adequate practices. Key contributing factors included substandard environmental sanitation, insufficient maternal personal hygiene during food preparation, improper handling of raw materials, and a high risk of cross-contamination.

These findings suggest that suboptimal household food environments increase exposure to pathogenic microorganisms, leading to recurrent infections that may impair nutrient absorption and contribute to growth faltering. While no significant associations were identified between stunting and variables such as clean water sources or kitchen utensils, persistent food storage and thawing errors underscore the need for improved household food safety knowledge.

Given these results, strengthening household-level food safety and hygiene interventions particularly those targeting maternal practices should be considered an essential component of stunting prevention strategies. However, the study's limitations, including reliance on self-reported data and its localized setting, constrain the generalizability of the findings. Future research employing larger, more diverse samples and incorporating laboratory-based assessments of microbial contamination is warranted to validate and expand upon these findings.

From a policy perspective, these results underscore the need to integrate household food safety education into existing stunting reduction programs. Community-based platforms such as Posyandu should be utilized to provide regular education and behavior change communication focused on hygienic food handling, preparation, and storage, especially targeting mothers and caregivers. Incorporating food safety modules into national maternal and child health strategies could strengthen Indonesia’s efforts to reduce stunting by addressing not only nutritional intake but also the quality and safety of food consumed.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

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