



## Stunting Prevention Behavior for Children Under Five Years of Age Based on Integrated Nutrition Education with Local Culture MARTABE: A Quasi Experiment

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### KEYWORDS

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### ABSTRACT

**Introduction:** Stunting is a serious problem in public health, especially in children under five years old. The nutrition education program integrated with the local culture of MARTABE Batak Angkola Tribe can effectively prevent stunting in children under five years old. This study aims to assess the influence of nutrition education programs integrated with local culture on stunting prevention behavior.

**Methods:** The study was conducted with a quasi-experimental design. Sampling was carried out by purposive sampling. The sample was divided into two groups: the intervention group that will be given the MARTABE local cultural integrated nutrition education program and the control group that did not receive the intervention. The intervention group was given a MARTABE local cultural integrated nutrition education program as a module, while the control group only received ordinary education through a leaflet. The local culture-based nutrition education program was carried out for 6 weeks, which included counseling on balanced nutrition, the benefits of local food, and ways to prevent stunting. Data was collected through questionnaires and observations. Data analysis used statistical techniques such as paired t-test, chi-square, and hotelling test.

**Results:** The results showed that both the intervention and control groups had a significant influence on knowledge ( $p=0.002$ ), attitude ( $p=0.000$ ), action ( $p=0.001$ ), and behavior ( $p=0.000$ ) after being given nutrition education integrated with MARTABE's local culture. Hotelling's Trace values for overall behavior change showed significant results ( $F=5794,811$ ,  $p=0.000$ ). This shows a significant difference in the behavior of caregivers under five between before and after the intervention. In other words, local culture-based nutrition education programs effectively influence changes in the behavior of caregivers under five years old.

**Conclusion:** Nutritional education integrated with local culture improves knowledge, attitudes, actions, and behaviors concerning stunting prevention in children under five. Therefore, this approach can be used as an intervention model in stunting prevention in Indonesia.

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## INTRODUCTION

Stunting in children under five is a global nutritional problem and is a leading indicator of public health status. Based on data from the World Health Organization (WHO) in 2020, around 149 million children under the age of five worldwide are stunted, which reflects impaired physical growth due to chronic malnutrition (1). Stunting in children under five is an important concern in the field of public health in Indonesia, and based on data from the 2022 Indonesian Nutrition Status Survey, it is as much as 21.6% (2). Meanwhile, 2022, North Sumatra Province will have 21.1%, and the city of Padangsidempuan will have a stunting prevalence rate of 28.8% in 2023 (2). Data shows that the stunting rate in Padangsidempuan City is still quite high, indicating the need for appropriate interventions to prevent it. Stunting in children can cause health and developmental problems in childhood and long-term impacts in adulthood, such as the risk of developing non-communicable diseases and low economic productivity (3,4). This problem is particularly pronounced in rural areas and regions with limited access to adequate health and nutrition services. The leading causes of stunting in Indonesia include a lack of balanced nutritional intake, recurrent infections, and suboptimal parenting. People often do not understand the importance of a nutritious diet, and there are adverse effects of malnutrition in the long term, such as stunting. In addition, low socioeconomic factors, low parental education levels, and unhealthy eating habits also contribute to the high prevalence of stunting in Indonesia (5–7).

Therefore, finding an effective solution to this stunting problem is necessary. One of the approaches that is considered to have potential is nutrition education programs that are integrated with the local culture of the Batak Angkola Tribe, which can improve the understanding and behavior of parents and caregivers related to stunting prevention. In addition, many families do not understand the importance of providing nutritious food during their children's growth period, which impacts poor nutritional status. Local cultural factors also play an important role in influencing children's eating behavior and parenting styles, which often do not fully support stunting prevention efforts (5,8). Several studies have shown that nutrition education provided to parents or caregivers positively impacts changes in children's eating behavior and nutritional status (9–11). A study by Yenealem (2024) shows that nutrition education for mothers can increase their knowledge about providing healthy food and reduce the prevalence of stunting in children. However, most existing nutrition education programs focus on universal aspects and pay little attention to the local cultural context (12).

In addition, previous research has also highlighted the importance of a local culture-based approach in improving public understanding of healthy eating. Research by Chapman (2024) shows that integrating local cultural values in nutrition education programs can increase community engagement, as they feel more connected to the material presented (13). A local culture-based approach, which combines nutritional knowledge with existing eating habits in the community, is a very relevant alternative to tackle stunting in Indonesia. However, research on the effectiveness of nutrition education programs integrated with local culture, especially those based on a model of knowledge sharing between caregivers of toddlers, is still limited and requires further research (14–16).

To overcome the problem of stunting in children under five, the solution proposed in this study is a nutrition education program integrated with MARTABE local culture. This program aims to educate caregivers of toddlers, mothers, and other family members about the importance of providing balanced, nutritious food by utilizing local food that is easily accessible to the community (17,18). In addition, this program also prioritizes counseling on ways to prevent stunting that can be applied in daily life by considering local culture and customs. Through a local culture-based approach, the community is hoped to more easily understand and implement behavior changes that support stunting prevention (19–21). The MARTABE program is expected to improve toddler caregivers' knowledge, attitudes, actions, and behaviors in providing optimal nutritional intake to their children. Thus, it is hoped that this program can contribute to reducing the prevalence of stunting in Indonesia and creating a healthier and more productive generation (22).

This study aims to evaluate the effectiveness of local culture-based nutrition education programs in improving knowledge, attitudes, actions, and behaviors of stunting prevention in caregivers of children under five in Indonesia. The results of this study are expected to provide empirical evidence regarding the success of the nutrition education approach integrated with local culture in reducing the prevalence of stunting in children under five years old.

## **METHOD**

### **Research Design**

This study uses a quasi-experimental design with experimental and control groups. This design was chosen because it allows for the evaluation of differences between two groups that received different treatments: the experimental group that followed the intervention program and the control group that did not receive the intervention or received the standard intervention.

### **Population and Sample**

The population in this study is caregivers of toddlers who have children aged 24-59 months in several villages located in areas with a high prevalence of stunting. The research sample was selected non-randomly from several villages that had met the relevant geographical and socioeconomic criteria. Caregivers of toddlers willing to participate in the entire series of programs and children in this age range are selected to be participants. Sampling was carried out by purposive sampling with the following criteria: Inclusion Criteria: Caregivers of toddlers with children aged 24-59 months, willing to participate in local culture-based nutrition education programs, and giving written consent to participate in the research. Exclusion Criteria: Caregivers of toddlers who cannot attend the intervention session or have health problems that hinder participation in the program.

### **Research Procedure**

Pre-test: Before the program starts, all participants (experimental and control groups) will take a pre-test to measure their knowledge, attitudes, actions, and behaviors related to nutrition, stunting, and prevention. This pre-test is a questionnaire about understanding balanced nutrition, children's eating habits, and stunting prevention practices applied by caregivers.

Intervention of the Local Cultural Integrated Nutrition Education Program (MARTABE) The experimental group will participate in an intervention program that lasts for 6 weeks. This program includes counseling integrated with local culture on the importance of providing balanced, nutritious food, preventing stunting, and using local food ingredients rich in nutrients and easily accessible to the community. Each intervention session will be carried out for 90 minutes and is carried out twice a week. In addition, caregivers of toddlers will also be allowed to discuss and share experiences regarding healthy eating practices in the context of local culture and given modules. Conversely, the control group will be provided with basic information about nutrition but without integrating local cultural elements in the counseling and leaflets.

Post-test: After the intervention is complete, both the experimental group and the control group will take a post-test similar to the pre-test to measure the changes that occur in their knowledge, attitudes, actions, and behaviors. This post-test aims to assess whether there is a significant improvement in the variables measured after the intervention.

### **Research Instruments**

The instrument used in this study is a questionnaire designed to measure the variables of knowledge, attitudes, actions, and behaviors of caregivers under five regarding stunting prevention.

### **Data Analysis**

The data was obtained from the pre-test and post-test and analyzed using the appropriate statistical test. Comparisons between the experimental and control groups will be conducted using a paired t-test to measure changes in knowledge, attitudes, actions, and behaviors before and after the intervention. The chi-square test will also be used to analyze the difference in the frequency of stunting prevention behavior categories, and the Hotelling test will be used to see the strong influence of the intervention of the two groups. The significance of the change between the groups will be tested at  $p < 0.05$ .

**Research Ethics**

This research follows the applicable research ethics guidelines. All participants were given a full explanation of the research objectives and procedures and their right to withdraw at any time without consequences. The data obtained is kept confidential and is only used for this research.

**RESULTS**

Analysis of identity characteristics of caregivers under five in the intervention group and control group. This analysis includes various demographic factors such as age, education level, occupation, family economic status, number of children, social support, and nutritional information sources.

**Characteristics of Caregivers and Toddlers**

**Table 1.** Analysis of the Identity Characteristics of Caregivers

Characteristic	Intervention		Control		P Value
	n(25)	Percentage	n(25)	Percentage	
<b>Mother's Age (Years)</b>					
30 – 34	27	54,0	25	50,0	
35 – 39	18	36,0	20	40,0	
40 – 44	4	8,0	3	6,0	0,755
45 – 49	1	2,0	2	4,0	
<b>Education</b>					
No School	5	10,0	3	6,0	
Primary school	8	16,0	9	18,0	0,005
Junior High School	12	24,0	10	20,0	
High School	18	36,0	10	20,0	
College	7	14,0	18	36,0	
<b>Work</b>					
Housewives	15	30,0	12	24,0	
Laborer	7	14,0	5	10,0	
Farmer	8	16,0	7	14,0	0,455
Guru	10	20,0	12	24,0	
Civil Servants	8	16,0	8	16,0	
Employee	2	4,0	6	12,0	
<b>Family Economic Status</b>					
Small	12	24,0	10	20,0	
Intermediate	32	64,0	28	56,0	0,137
Above	6	12,0	12	24,0	

Source: Primary Data, 2024

Table 1 shows that most caregivers in both groups were in the 30-34 age group (54% in the intervention group and 50% in the control group). Furthermore, the age group of 35-39 years is also quite dominant, at 36% and 40%, respectively. There was a slight difference between the two groups at the age of 40-44 years, but statistical tests showed that this difference was insignificant (p=0.755), meaning that the two groups had a relatively balanced age distribution. Based on the level of education, the intervention and control groups showed significant variation (p=0.005). In the intervention group, more caregivers had a high school education (36%) than the control group (20%), while in the control group, more had a college education (36%) than in the intervention group (14%). This difference reflects a variation in education levels in both groups, which may affect the reception of information provided during the intervention.

Regarding work, most caregivers in both groups worked as housewives (IRTs), with a slightly higher proportion in the intervention group (30%) than in the control group (24%). Other occupations include laborers, farmers, teachers, civil servants, and employees, with slight differences between the two groups. Statistical tests showed that the difference in job distribution between the two groups was insignificant ( $p=0.455$ ), indicating uniformity in the work of caregivers in both groups. Regarding family economic status, most caregivers come from families with middle economic status, both in the intervention group (64%) and control (56%). The difference between the two groups in terms of economic status was insignificant ( $p=0.137$ ), suggesting that the two groups have almost the same distribution of economic status. Overall, the characteristics of caregivers in both groups were quite homogeneous, which allowed a fair evaluation of the interventions' effects.

**Table 2.** Analysis of Toddler Characteristics

Characteristic	Group				P value
	Intervention		Control		
	n	Percentage	n	Percentage	
<b>Gender</b>					
Man	20	40,0	15	30,0	0,123
Woman	30	60,0	35	70	
<b>Age (years)</b>					
0-2	5	10,0	10	20	0,000
2-3	10	20,0	23	46	
3-5	35	70,0	17	34	
<b>Weight (kg)</b>					
09-11	10	20,0	13	26	0,000
11-14	12	24,0	17	34	
14-16	17	34,0	20	40	
17-19	11	22,0	3	6	
<b>Height (cm)</b>					
82-97	10	20,0	12	24	0,677
87-107	27	54,0	24	48	
107-124	13	26,0	14	28	

\*Chi-Square Test

Source: Primary Data, 2024

Table 2 presents an analysis of the characteristics of toddlers in the control group and the intervention group by gender; most toddlers in both groups are female, with 60% in the control group and 70% in the intervention group. Meanwhile, the proportion of male toddlers was 40% in the control group and 30% in the intervention group. Statistical tests showed that the difference in sex distribution between the two groups was not significant ( $p=0.123$ ), which showed that gender did not affect the results of the study. The age distribution of toddlers showed significant differences between the control and intervention groups ( $p=0.000$ ). In the control group, most toddlers were 3-5 years old (70%), while in the intervention group, more were 2-3 years old (46%).

In contrast, in the intervention group, the proportion of toddlers aged 0-2 years was higher (20%) than in the control group (10%). This significant difference indicates a difference in age distribution between the two groups that need to be considered in further analysis. In terms of weight, toddlers in both groups showed different distributions. In the control group, most toddlers weighed between 14-16 kg (34%), while in the intervention group, the group weighing 14-16 kg also had the most (40%). However, there was a significant difference between the two groups for weight distribution ( $p=0.000$ ), which indicated that the weight of toddlers in both groups was not comparable. A small percentage of toddlers in the intervention group were taller (17-19 kg), found in only 6% of toddlers in the control group.

Regarding height, the height distribution of toddlers in both groups was relatively balanced. Most toddlers in the control group (54%) and the intervention group (48%) had a height in the range of 87-107 cm. Statistical tests

showed that the difference between the control group and the intervention in height distribution was insignificant ( $p=0.677$ ), which showed that height was not a significant differentiating factor between the two groups.

### **Changes in Knowledge Before and After the Intervention of the Local Cultural Integrated Nutrition Education Program**

**Table 3.** Changes in Stunting Knowledge Before and After the Intervention

<b>Stunting Knowledge</b>	<b>Pre (Mean – SD)</b>	<b>Post (Mean – SD)</b>	<b><i>p</i>*</b>
Intervention	1.013±9.23	0.650±9.62	0.002
Control	0.751±9.31	0.480±9.69	

\*Wilcoxon Test

Table 3 compares changes in knowledge about stunting in the intervention group and the control group, which were measured before (pre) and after (post) intervention. In the intervention group, the average value of knowledge before the intervention (pre-test) was **1.013 ± 9.23**, while after the intervention (post-test) was **0.650 ± 9.62**. These results indicate a decrease in the average value of knowledge after the intervention, which may reflect a change in how caregivers understand or remember the material delivered. However, the Wilcoxon statistical test showed a significant difference ( $p = 0.002$ ), which showed that this difference was a statistically significant result despite the decrease in the mean knowledge. This indicates that the nutrition education-based intervention influences the increase or change in knowledge about stunting in the experimental group. In the control group, the average value of knowledge before the intervention (pre-test) was **0.751 ± 9.31**, while after the intervention (post-test), it was **0.480 ± 9.69**. Although there was a decrease in knowledge in the control group, there was a difference between the pre-test and post-test in this group.

### **Changes in Attitudes Before and After the Intervention of the Local Cultural Integrated Nutrition Education Program**

**Table 4.** Changes in Stunting Attitudes Before and After the Intervention

<b>Attitude</b>	<b>Pre (Mean – SD)</b>	<b>Post (Mean – SD)</b>	<b><i>p</i>*</b>
Intervention	2.410±34.85	1.437±35.31	0.000
Control	1.761±36.54	1.032±36.69	

\*Wilcoxon Test

Table 4 presents that in the intervention group, the average value of attitude before the intervention (pre-test) was **2,410 ± 34.85**, while after the intervention (post-test) was **1,437 ± 35.31**. This change showed a significant decrease in attitude scores, which indicated an increase in understanding or a change in the attitude of caregivers of toddlers towards stunting prevention. The Wilcoxon test showed a very significant difference ( $p=0.000$ ), indicating that the intervention strongly impacted attitude change in the intervention group. In the control group, the average value of attitude before the intervention (pre-test) was **1,761 ± 36.54**, while after the intervention (post-test) was **1,032 ± 36.69**. However, there was a decrease in attitude scores in the control group. From the results of this table, it can be concluded that nutrition education-based interventions significantly impact toddler caregivers' attitudes toward stunting prevention.

### **Changes in Actions Before and After the Intervention of the Local Cultural Integrated Nutrition Education Program**

**Table 5.** Changes in Stunting Actions Before and After the Intervention

<b>Action</b>	<b>Pre (Mean – SD)</b>	<b>Post (Mean – SD)</b>	<b><i>p</i>*</b>
Intervention	1.613±20.46	1,888±22.31	0.001
Control	4.343±21.23	5,076±22.46	

\*Wilcoxon Test

Table 5 presents the analysis of the intervention group; the average value of the action before the intervention (pre-test) was **1,613 ± 20.46**, while after the intervention (post-test) was **1,888 ± 22.31**. Despite the increase in action scores, the difference between the pre-test and the post-test was significant ( $p = 0.001$ ), as the Wilcoxon test shows. This indicates that nutrition education class-based interventions have improved stunting prevention measures in caregivers of toddlers, such as improvements in providing nutritious food, healthy living practices, and other efforts to prevent stunting in children. In the control group, the average score of the pre-test was **4,343 ± 21.23**, while the post-test was **5,076 ± 22.46**. There was an increase in action scores in the control group. From the results presented in this table, it can be concluded that the intervention class-based nutrition education program has succeeded in producing significant changes in the actions of caregivers of toddlers related to stunting prevention, with a very significant p-value ( $p = 0.001$ ).

### Behavior Changes Before and After the Intervention of the Local Cultural Integrated Nutrition Education Program

**Table 6.** Changes in Stunting Behavior Before and After the Intervention

Behavior	Pre (Mean – SD)	Post (Mean – SD)	<i>p</i> *
Intervention	0.630±9.31	0.660±9.46	0.000
Control	0.689±9.15	0.506±9.38	

\*Wilcoxon Test

Table 6 presents the analysis of the intervention group; the average behavior value before the intervention (pre-test) was **0.630 ± 9.31**, and after the intervention (post-test) increased slightly to **0.660 ± 9.46**. Although there was a slight increase in the mean behavior value, the Wilcoxon test showed a very significant difference ( $p = 0.000$ ). This indicates that the intervention class has succeeded in influencing the change in the behavior of caregivers under five related to stunting prevention, although the increase is relatively small. This increase reflects a change in habits or better stunting prevention measures post-intervention. In the control group, the mean behavior value before the intervention (pre-test) was **0.689 ± 9.15**, while after the intervention (post-test), it dropped slightly to **0.506 ± 9.38**. This change showed a decrease in the mean value of behavior in the control group. The results in this table indicate that the intervention class provided successfully led to a significant change in stunting prevention behavior in caregivers of toddlers in the intervention group ( $p = 0.000$ ). Although the recorded behavior change was small, the increase was statistically significant. In contrast, the control group did not show significant changes.

### The Effect of Local Cultural Integrated Nutrition Education Program on Changing the Behavior of Toddler Caregivers

**Table 7.** Multivariate Results: Differences in the Influence of Local Cultural Integrated Nutrition Education Programs on Changes in the Behavior of Toddler Caregivers

Variable	Value	F	P
<i>Hotelling's Trace</i>	790.202	5794.811	0.000
Knowledge	2134.440	2760.052	0.000
Attitude	30765.160	7704.130	0.000
Action	11025.000	1075.610	0.000
Behavior	2134.440	2760.052	0.000

\*Hotelling Test

Table 7 presents **Hotelling's Trace** values showing significant results with **F = 5794.811** and **p = 0.000**. This shows that the local culturally integrated nutrition education program greatly influences the changes that occur in the variables analyzed (knowledge, attitudes, actions, and behaviors of caregivers of toddlers). This change is statistically significant, indicating that the program has succeeded in producing meaningful changes in caregivers of toddlers. The Hotelling's Trace test for the knowledge variable showed a value of **F = 2760,052** with **p = 0.000**, which indicates that the intervention program has a significant influence on the improvement of caregivers' knowledge about stunting

and its prevention. The program has succeeded in substantially increasing knowledge. In the attitude variable, the test results showed a value of  $F = 7704,130$  with  $p = 0.000$ , which means that the local culture-integrated nutrition education program caused a significant change in attitudes in caregivers of toddlers. Caregivers' attitudes towards stunting prevention have improved after participating in the intervention program. For the action variable, the Hotelling's Trace test showed a value of  $F = 1075,610$  with  $p = 0.000$ , which indicates that the nutrition education program successfully influenced the actions of caregivers under five in implementing stunting prevention measures. This change shows that toddler caregivers are likelier to adopt a healthier diet and follow stunting prevention behaviors after participating in the program. Finally, for behavioral variables, the value of  $F = 2760.052$  with  $p = 0.000$  indicates a significant influence of the intervention on changes in the behavior of caregivers under five years old. This shows that the local culture-integrated nutrition education program improves knowledge and attitudes and causes positive changes in the behavior of caregivers under five in stunting prevention. Based on the results of this multivariate test, it can be concluded that the local culturally integrated nutrition education program significantly influences changes in the knowledge, attitudes, actions, and behaviors of caregivers under five related to stunting prevention. All the analyzed variables showed significant changes with very low p-values ( $p = 0.000$ ). This shows that this program effectively changes the understanding, attitudes, actions, and behaviors of caregivers under five years old, which can positively impact stunting prevention efforts

## **DISCUSSION**

### **The Effect of MARTABE's Local Cultural Integrated Nutrition Education Program with Stunting Knowledge of Toddler Caregivers**

Stunting prevention is one of the most important programs in the world of health because if stunting occurs in children under five years old, it is inevitable that human resources will decrease significantly (23). The findings of this study are that this program has a significant impact on increasing the knowledge of toddler caregivers about stunting and its prevention efforts. The increase in knowledge in the intervention group can be interpreted as a direct effect of the educational approach. The MARTABE program, integrated with local culture, combines material on stunting with an approach relevant and readily accepted by the local community (8). This culture-based approach provides knowledge related to balanced nutrition and builds awareness about local cultural practices that can support stunting prevention efforts (24,25). This explains why the program is so effective in increasing the knowledge of caregivers of toddlers about nutrition issues and stunting prevention, which may be challenging to achieve through a more generic approach to nutrition education and not integrated with cultural values (26). In addition, caregivers of toddlers involved in local culture-based educational interventions tend to understand and remember the information provided because the material presented is more relevant to their daily lives. The program also encourages group discussions, sharing experiences between caregivers, and the use of local foods in the management of children's nutrition, which enriches their learning experiences and reinforces knowledge change (27).

This study's results are consistent with previous research findings, which showed that community-based or local culture-based education programs can improve nutritional knowledge in the community. Research by Nurjanah (2024), which examines the effectiveness of culture-based approaches in nutrition education, shows that combining nutritional knowledge with local habits or cultures is more effective in increasing people's understanding of healthy nutrition because the material taught is more straightforward to accept and apply in daily life (24). Similarly, a study by Kumar (2021) on peer-based nutrition education shows that education relevant to social and cultural contexts is more effective in influencing changes in knowledge and attitudes, especially in children and caregivers of toddlers (28). In addition, research by Zurhayati & Hidayah (2022) on nutrition education interventions in rural areas of Indonesia also noted that an approach that integrates local elements in nutrition counseling can accelerate nutritional behavior change and increase public knowledge about the importance of a balanced nutritious diet (29). In this context, integrating local cultures in the MARTABE program aligns with evidence from previous studies that emphasize the importance of cultural values in designing health and nutrition programs to ensure their effectiveness. Several studies show that nutrition education programs and local culture can help prevent stunting in children under five. However, while these results show a significant increase in knowledge, it is important to note that instantaneous behavioral changes do not always follow changes in knowledge. Several other studies, such as those conducted by Sucipto (2023), show that although increased knowledge can be achieved, implementing behavior change requires a

longer time and a more comprehensive approach. Therefore, although the program effectively increases knowledge, further steps are needed to ensure that the knowledge gained translates into real action in stunting prevention (14).

These findings provide several important implications for developing more effective nutrition education programs, especially in the context of stunting prevention in Indonesia. These results show that programs that integrate nutritional knowledge with local culture have great potential to increase public understanding of the importance of stunting prevention. Therefore, nutrition counseling at the community level should be designed to consider existing cultural values and habits so that information is easier for the community to understand and accept. These findings reinforce the importance of local cultural integration in public health education and provide empirical evidence that culture-based approaches can increase public understanding and awareness of critical health issues such as stunting.

### **The Influence of MARTABE's Local Cultural Integrated Nutrition Education Program on the Attitude of Toddler Caregivers**

The attitude or desire of each mother with a toddler grows, and then the mother will look for information about stunting directly and what factors cause stunting. The information obtained in the MARTABE Local Cultural Integrated Nutrition Education Program certainly adds to the insight of mothers in implementing stunting behavior and prevention measures. The analysis results showed a significant change in the attitude of caregivers under five after participating in the intervention program. The decrease in the mean value of attitudes in the intervention group indicates that caregivers of toddlers experienced significant changes in their attitudes toward the importance of stunting prevention. The MARTABE program, which integrates nutrition education with local culture, has proven effective in forming a positive attitude of caregivers under five regarding the importance of providing nutritious food and preventing stunting. The local culture-based approach helps caregivers understand and receive the material more efficiently, as the information is relevant to their cultural context and daily habits (25,30–33).

The recorded change in attitude can be explained through the interactive approach used in this program, where caregivers of toddlers receive information from extension workers and discuss and share experiences with fellow caregivers. This method plays an important role in reinforcing positive attitudes, as caregivers feel more involved in the learning process and more confident in implementing the changes they learn daily (34,35). This study's results align with previous studies' findings, which show that an educational approach integrated with local culture can significantly affect people's attitudes. Research by Huriah (2023) on peer group-based nutrition education programs in Indonesia shows that community-based education and local culture can change participants' attitudes toward healthy eating habits and nutritious lifestyles (36). In this case, the culture-based intervention used in the MARTABE program provides more contextual and easily acceptable material for toddler caregivers. In addition, a study by Faridah (2024) on community-based nutrition education shows that attitudes toward healthy eating and stunting prevention can change significantly after participants engage in programs that use local approaches relevant to their habits (37,38). This study reinforces the argument that local culture-based interventions are more effective in influencing attitudes than approaches that focus solely on medical or scientific information less relevant to people's daily cultures. In addition, research by Ginting (2023) on local culture-based nutrition education programs also shows that integrating cultural values in nutrition education increases knowledge and changes participants' attitudes towards healthy eating and prevention of nutritional problems, including stunting (39). The culture-based approach allows the material taught to be more easily internalized by participants, thus encouraging them to change attitudes and behaviors related to health.

Although similar programs have previously shown positive impacts, this study strengthens the evidence that the integration of local cultures in nutrition education has a significant influence on changing attitudes of caregivers under five years old. This shows that knowledge and people's attitudes can be improved by using a more sensitive approach to their social and cultural context. These findings provide several important implications for developing more effective nutrition education programs, especially in stunting prevention efforts. Programs that integrate local culture into nutrition education have proven effective in changing caregivers' attitudes under five years old. Therefore, stunting prevention policies should rely on science-based information and consider cultural aspects in nutrition counseling. This approach can be used in government programs such as posyandu, health education in schools, or counseling to families at the community level. This study shows that MARTABE's local culturally integrated nutrition

education program has a significant influence on changes in the attitude of toddler caregivers regarding stunting prevention. This program has succeeded in changing the attitude of caregivers of toddlers towards the importance of providing nutritious food and preventing stunting, which is reflected in the significant difference between pre-test and post-test scores. Local culture-based approaches have proven effective in increasing public awareness and positive attitudes towards health issues, which is relevant in reducing the prevalence of stunting in Indonesia (40–45).

### **The Influence of MARTABE's Local Cultural Integrated Nutrition Education Program on the Actions of Toddler Caregivers**

Providing treatment in the form of modules for the Martabe Local Culture Integrated Nutrition Education Program is very beneficial for mothers who have toddlers because, in addition to increasing knowledge, it also increases the mothers' insight into Batak culture, which has many customs. For the Batak tribe, children are a very valuable asset, so parents must provide their children with a high education. To achieve this goal, the child needs to be given prevention from stunting (8). The analysis results showed that the MARTABE intervention program produced significant changes in toddler caregivers' actions. This increase in action scores can be interpreted as a positive effect of the intervention given. The MARTABE program, which integrates nutrition education with local culture, provides theoretical knowledge about nutrition and stunting prevention and practical skills relevant to people's daily habits. One of the important aspects of the program is how caregivers of toddlers are encouraged to change their habits and behaviors by providing nutritious food and implementing healthy lifestyles that can prevent stunting in their children (46–49). This change in action indicates that the intervention has successfully influenced caregivers of toddlers to be more active in implementing the knowledge they have gained about stunting prevention. By involving elements of local culture, the program ensures that caregivers not only know about healthy nutrition but can also apply that knowledge in their daily lives, using the food around them and in accordance with local habits (50).

This study's results align with the findings of previous studies that show that a local culture-based approach can improve community actions in maintaining health and nutrition. For example, research by Soviyati (2023) on peer group-based nutrition education shows that caregivers involved in community-based programs are likelier to change their actions related to healthy eating (51). This research highlights the importance of direct involvement and discussion between community members in motivating sustainable action change (52). In addition, research by Wiliyanarti (2022) that evaluated local culture-based nutrition education programs also showed a significant increase in community actions, especially among caregivers of toddlers, after they were involved in nutrition education programs (17). This program has successfully facilitated caregivers in implementing a nutritious diet, using affordable local food, and taking practical stunting prevention measures in daily life. The results of this study are also consistent with research by Aramico (2020), which shows that community-based education that pays attention to local culture significantly impacts changes in community actions in family nutrition management (53). The study noted that caregivers of toddlers who received nutrition training with a local culture-based approach could implement positive changes in their nutritional behavior more than those who only received general knowledge-based education. However, it is important to note that although the improvement in the intervention group was significant, the study did not directly measure how the change in the action affected the child's nutritional status or stunting prevention in the long term. Further research is needed to examine the sustainability impact of changes in actions on nutritional status and stunting prevalence (54–57).

These findings are important for developing more effective nutrition education programs, especially in stunting prevention efforts. The MARTABE program that integrates local culture has proven to be effective in improving the actions of caregivers under five years old, which is the first step in stunting prevention. Therefore, governments and health organizations must develop and expand models of local culture-based interventions in public health programs. One of the important implications of these findings is the need to integrate a local culture-based approach in stunting prevention policies. Programs that combine nutrition education materials with local customs and culture are more effective in motivating caregivers of toddlers to take real action in their lives. Therefore, government policies that include local cultural elements in health education programs, such as stunting prevention, will have a more significant impact and are more acceptable to the community (26,58–60).

## **The Influence of MARTABE's Local Cultural Integrated Nutrition Education Program on the Behavior of Toddler Caregivers**

The importance of providing insight into stunting prevention through the MARTABE local cultural integrated nutrition education program can be seen from the calculations obtained in both the control and intervention classes. This study shows a significant change in the behavior of caregivers of toddlers participating in the MARTABE intervention program. This program not only improves the knowledge and attitudes of caregivers of toddlers but can also motivate them to change their behavior regarding children's diets and implement healthy living practices that can support optimal growth and prevent stunting (61–63). This behavior change can be explained through the culture-based approach used in the MARTABE program. This program delivers educational materials that are very relevant to the cultural context and habits of the local community, such as the use of nutritious local food, which makes information more manageable for caregivers to understand and receive. In addition, the program also engages caregivers of toddlers in group discussions and sharing experiences, reinforcing their commitment to implementing the behavior changes they have learned (64–66). This study's results align with previous studies' findings, which show that local culture-based education can significantly affect changes in people's behavior. Lawal's (2023) research on community-based nutrition education shows that a culture-based approach increases public awareness and changes their behavior toward healthy eating (66). In this case, culture-based interventions in the MARTABE program provide relevant and readily receptive material for toddler caregivers, contributing to more tangible behavior changes.

Similar research by Lusambili (2020) also shows that integrating local culture into nutrition education programs increases the community's acceptance and implementation of healthy behaviors (67). They noted that caregivers who engage in culture-based programs are likelier to change their behavior regarding nutritious feeding, food selection, and healthy lifestyles. This shows that caregivers of toddlers in the MARTABE program tend to be more able to change their behavior because the approach is very much in line with the habits and resources around them (68). However, while these findings indicate significant behavior changes, it is important to note that small changes in behavior scores may reflect that full implementation of behavior change is taking longer. Several other studies, such as by Mansur et al. (2021), show that while behavior change can be achieved in the short term after an intervention, more sustainable change requires a longer process and ongoing support (69). Therefore, although the MARTABE program results in positive changes in the behavior of toddler caregivers, further research needs to be conducted to measure whether such behavior changes are sustained in the long term.

These findings provide several important implications for the development and implementation of nutrition education programs in the context of stunting prevention in Indonesia. Programs that integrate local culture into nutrition education have proven effective in encouraging changes in people's behavior, especially caregivers of toddlers. Therefore, stunting prevention programs based on local culture should be expanded and made part of public health policies. The local culture-based approach makes the program more accepted by the community and easier to apply in their daily lives. The results of this study underscore the importance of involving caregivers of toddlers in group-based learning, where they can share experiences and learn from fellow caregivers. This approach improves knowledge and attitudes and accelerates more practical and applicable behavior change. Therefore, programs like MARTABE that use interactive and community-based methods can be a very effective model for stunting prevention. Integrating local culture in nutrition education also opens opportunities to empower the community by utilizing existing local resources and promoting the consumption of nutritious local food ingredients to support children's growth and prevent stunting. The program improves children's nutritional status and educates the public on how to utilize affordable and available food around them (70–74).

### **Research Limitations**

Although this study provides valuable insights into the influence of MARTABE's local culturally integrated nutrition education program on the behavior of caregivers under five in stunting prevention, there are limitations in measuring only changes in knowledge, attitudes, actions, and behaviors of caregivers under five in the short term, i.e., immediately after the intervention is carried out. Although there were significant changes in these variables, the study did not evaluate the long-term effects of the intervention on children's behavior and nutritional status.

### **Recommendations for Future Research**

Further research should evaluate the long-term impact of nutrition education programs on the behavior of caregivers of toddlers and the nutritional status of children. Follow-up a few months or years after the intervention will provide a clearer picture of the sustainability of behavioral change and its effects on stunting prevention in the long term.

### **CONCLUSION**

This study shows that MARTABE's local culturally integrated nutrition education program significantly influences the behavior of caregivers under five in stunting prevention. This program has succeeded in increasing the knowledge, attitudes, actions, and behaviors of caregivers under five related to the importance of healthy eating and stunting prevention, with a local culture-based approach that is more readily accepted by the community. Although the behavioral changes recorded were relatively small, statistically significant differences showed the effectiveness of the intervention in raising awareness and preventive measures among caregivers of toddlers.

### **AUTHOR'S CONTRIBUTION STATEMENT**

All authors made significant contributions to the research and preparation of the manuscript. Author 1 designed and conceptualized the study, supervised the implementation of the intervention, and led the data analysis. Author 2 contributed to the literature review, coordinated data collection, and participated in interpreting the results. Authors 3 and 4 provide directions related to statistical analysis and contribute to the preparation and revision of manuscripts. All authors read and approved the final manuscript.

### **CONFLICTS OF INTEREST**

The authors stated that no conflict of interest was associated with the study. No financial or personal relationship with any organization could affect the conduct or findings of this study.

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