



Impact of a culturally adapted health belief model-based nutrition intervention on nutritional status among children under five in rural Indonesia

Dampak intervensi gizi berbasis health belief model yang diadaptasi secara budaya terhadap status gizi anak balita di pedesaan Indonesia

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Abstract

Child malnutrition is a major public health concern in Indonesia. The 2024 Indonesian Nutritional Status Survey reported stunting, wasting, and overweight prevalence among children under five years of age at 19.8%, 7.4%, and 3.4%, respectively, indicating persistent nutritional challenges despite national improvements. This study aimed to assess the effectiveness and contextual implementation of a culturally adapted Health Belief Model-based nutrition intervention on child nutritional status in rural Indonesia. A quasi-experimental mixed-methods study with a one-group pre-test and post-test design was conducted among 179 caregiver-child dyads in rural East Java from January to April 2025 without a control group. The nutritional status of the children was assessed using weight-for-age, height-for-age, weight-for-height, and BMI-for-age z-scores. Quantitative data were analyzed using the Marginal Homogeneity Test, while qualitative data were analyzed thematically. The intervention was associated with a statistically significant shift in the distribution of nutritional status ($\chi^2=114.94$; $df=4$; $p<0.001$; Cramer's $V=0.40$; 95% $CI=0.32-0.47$), indicating a moderate effect. Normal nutritional status increased from 12.3% to 70.9%, whereas underweight decreased from 50.3% to 6.7%. Qualitative findings indicated that cultural beliefs, family decision-making, food insecurity, and economic constraints influenced child-feeding practices. In conclusion, the intervention was associated with improved child nutritional outcomes and caregiver readiness; however, the findings should be interpreted cautiously, given the absence of a control group and the short intervention period.

Keywords: Caregiver behavior, child malnutrition, Health belief model, nutrition intervention, rural communities

Abstrak

Malnutrisi anak masih menjadi masalah kesehatan masyarakat penting di Indonesia. Survei Status Gizi Indonesia 2024 melaporkan prevalensi stunting pada balita sebesar 19,8%, wasting 7,4%, dan overweight 3,4%, menunjukkan bahwa malnutrisi anak tetap menjadi tantangan meskipun indikator nasional membaik. Penelitian bertujuan menilai efektivitas dan implementasi kontekstual intervensi gizi berbasis Health Belief Model yang diadaptasi secara budaya terhadap status gizi anak di pedesaan Indonesia. Penelitian mixed-methods kuasi-eksperimental dengan desain satu kelompok pre-test dan post-test dilakukan pada 179 pasangan pengasuh-anak di pedesaan Jawa Timur pada Januari-April 2025, tanpa kelompok kontrol. Status gizi anak dinilai menggunakan z-score weight-for-age, height-for-age, weight-for-height, dan BMI-for-age. Data kuantitatif dianalisis menggunakan Marginal Homogeneity Test, sedangkan data kualitatif dianalisis secara tematik. Hasil, intervensi

berasosiasi dengan perubahan signifikan distribusi status gizi anak ($\chi^2=114.94$; $df=4$; $p<0.001$; Cramer's $V=0.40$; 95% $CI=0.32-0.47$). Status gizi normal meningkat dari 12.3% menjadi 70.9%, sedangkan underweight menurun dari 50.3% menjadi 6.7%. Temuan kualitatif menunjukkan kepercayaan budaya, pengambilan keputusan keluarga, kerawanan pangan, dan keterbatasan ekonomi memengaruhi praktik pemberian makan anak. Kesimpulan, intervensi ini berasosiasi dengan perbaikan luaran gizi anak dan kesiapan pengasuh, tetapi hasil perlu diinterpretasikan secara hati-hati karena tidak adanya kelompok kontrol dan durasi intervensi yang singkat.

Kata Kunci: Health belief model, intervensi gizi, komunitas pedesaan, malnutrisi anak, perilaku pengasuh

Introduction

Child malnutrition remains one of the most persistent public health challenges worldwide, particularly in low- and middle-income countries that are undergoing rapid nutritional and epidemiological transitions. Many countries continue to experience the double burden of malnutrition (DBM), characterized by the coexistence of undernutrition and overnutrition in the same population, household, or individual. Beyond inadequate food intake, child malnutrition is influenced by a complex interplay of behavioral, socioeconomic, cultural, and environmental factors that affect dietary practices and health. Consequently, millions of children continue to experience stunting, wasting, underweight, and overweight conditions, which have profound implications for growth, cognitive development, educational attainment and long-term health (Hug et al., 2023; Mao et al., 2024; Micha et al., 2020).

Indonesia continues to face a substantial burden of child malnutrition, despite gradual improvements in national nutrition indicators. According to the 2024 Indonesian Nutrition Status Survey, the prevalence of stunting among children under five years of age was 19.8%, while wasting and overweight affected 7.4% and 3.4% of children, respectively (Badan Kebijakan Pembangunan Kesehatan, 2024). Although these figures demonstrate progress compared with previous years, they remain above national targets and show considerable disparities across regions, particularly between urban and rural communities. Evidence from several provinces indicates that rural and socioeconomically disadvantaged populations continue to experience disproportionately high rates of malnutrition, reflecting persistent inequalities in access to nutrition, health services, education,

and caregiving resources (Badan Pusat Statistik, 2024; Dinas Kesehatan Provinsi Jawa Timur, 2023). Given the multidimensional nature of malnutrition, nutritional status should be assessed using specific anthropometric indicators, including underweight, stunting, wasting, and overnutrition, rather than broad and nonspecific classifications.

Previous studies in Indonesia have identified numerous determinants of child malnutrition, including inadequate dietary intake, low maternal education, poor household socioeconomic conditions, geographic disparities, and limited access to health care services. For example, Andriani et al. investigated the triple burden of malnutrition using national survey data, while Ayuningtyas et al. (2022) examined the socioeconomic and geographic inequalities associated with child undernutrition. Although these studies have substantially advanced our understanding of malnutrition risk factors, they were primarily observational and did not evaluate culturally adapted behavioral interventions. Moreover, sociocultural research has shown that feeding practices are strongly influenced by food taboos, traditional beliefs, family norms, and household decision-making. In many settings, feeding decisions are influenced not only by mothers but also by fathers, grandparents, and other family members, whose beliefs may either support or hinder optimal child nutrition practices (Ahamada & Sunguya, 2022; Anik et al., 2021; John et al., 2023; Siramaneerat et al., 2024a). Despite these findings, sociocultural determinants have rarely been systematically incorporated into theory-driven nutritional interventions.

The Health Belief Model (HBM) is one of the most widely used behavioral theories for explaining and predicting health-related

behavior. Its core constructs—perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy—have been successfully applied to improve nutrition-related knowledge, attitudes, and behaviors in various populations. Previous studies have demonstrated that HBM-based nutrition education can positively influence caregivers' perceptions and intentions regarding child feeding practices. However, existing applications of HBM in child nutrition research have largely focused on individual cognitive factors, while giving limited attention to the broader sociocultural and ecological contexts in which feeding behaviors occur. Important influences, such as family hierarchy, cultural food restrictions, community norms, economic constraints, and access to locally available nutritious foods, have not been adequately integrated into previous HBM-based interventions (Ayuningtyas et al., 2022; Hamann et al., 2023; John et al., 2023; Shahid et al., 2022; Siramaneerat et al., 2024a). Furthermore, evidence suggests that caregivers' attitudes and behaviors are often interrelated with contextual factors, making it difficult to explain nutritional outcomes using individual-level determinants alone.

These limitations highlight an important knowledge gap in the current child nutrition research. Although numerous interventions have focused on improving knowledge and modifying individual behaviors, relatively few have incorporated behavioral theory alongside cultural adaptation, family involvement, and ecological considerations within community-based implementation frameworks. Consequently, evidence remains limited regarding the effectiveness of integrated interventions that address both individual beliefs and the sociocultural environments influencing child feeding practices, particularly in rural Indonesian communities (Ohmer et al., 2022).

To address this gap, the present study developed and evaluated a culturally adapted behavioral intervention that integrates Health Belief Model constructs with local cultural practices, family engagement, and community-ecological considerations. The novelty of this study lies in its comprehensive approach, which combines individual behavioral theory with sociocultural adaptation and community-based

implementation to improve child-nutrition outcomes. Using a mixed-methods design, this study aimed to evaluate the effectiveness of the intervention in improving children's nutritional status and caregivers' HBM-related perceptions, while also exploring how cultural beliefs, family dynamics, economic limitations, and community influences shape child-feeding practices and intervention implementation in rural Indonesian communities.

Methods

Study Design and Setting

This study employed a quasi-experimental mixed-methods design with embedded qualitative components. The quantitative phase utilized a one-group pre-test and post-test design to evaluate changes in children's nutritional status and caregivers' Health Belief Model (HBM) domains following the implementation of a culturally adapted HBM-based nutrition intervention. The mixed-methods approach was selected because quantitative findings alone could not adequately explain the behavioral, sociocultural, family, and ecological factors underlying child feeding practices and nutritional outcomes. Therefore, qualitative data were incorporated to provide a contextual understanding of the intervention process and its implementation.

The study will be conducted in selected rural communities in East Java Province, Indonesia, between January and April 2025. Quantitative and qualitative findings were integrated during the interpretation phase to provide a comprehensive understanding of the intervention outcomes and contextual influences.

Population and Sample

The target population consisted of caregivers and children aged 1–5 years, residing in the study area. A total of 179 caregiver–child pairs completed both baseline and post-intervention assessments.

Purposive sampling was used to recruit participants who met the predefined eligibility criteria and were actively involved in daily child feeding practices. Community health workers assisted in identifying and recruiting eligible participants through the community health posts.

Inclusion and Exclusion Criteria

Caregivers were eligible for participation if they were the primary caregivers of children aged 1–5 years, resided in the selected rural communities, were responsible for daily child feeding practices, and agreed to participate in all stages of the study.

Participants were excluded if their children had congenital abnormalities, severe chronic diseases, acute illnesses during the data collection period, or medical conditions that could independently affect growth or nutritional status. Eligible caregiver–child pairs were screened, informed about the study procedures, and enrolled after providing written, informed consent.

Sample Size Adequacy

A post-hoc power analysis was performed to evaluate the adequacy of the final sample size. For a paired pre–post design with 179 caregiver–child pairs, a two-tailed significance level of 0.05, and a statistical power of 0.80, the study was adequately powered to detect a small-to-moderate effect size (minimum detectable effect size ≈ 0.21).

Assuming Cohen's $d = 0.30$, the achieved statistical power was approximately 97.9%, indicating sufficient power to detect meaningful changes between the pre- and post-intervention measurements.

Intervention

The intervention was developed based on the Health Belief Model and was culturally adapted to the rural Indonesian context. The intervention addressed six HBM domains: perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy.

Cultural adaptation was achieved by incorporating locally available food examples, family participation, community-based communication strategies, and discussions on cultural beliefs, food taboos, and feeding restrictions relevant to child nutrition. The intervention was delivered through nutrition education sessions, individualized counseling, group discussions, and community-based support activities involving caregivers, community health cadres, nutrition personnel, and local health workers.

Variables and Measurements

Children's nutritional status served as the primary outcome variable and was assessed using standardized anthropometric measurements of weight and height. Nutritional status was classified according to the World Health Organization growth standards using the following anthropometric indicators: weight-for-age z-score (WAZ), height-for-age z-score (HAZ), weight-for-height z-score (WHZ), and body mass index-for-age z-score (BAZ). These indicators were used to classify underweight, stunting, wasting, overweight, and obesity status.

Caregivers' perceptions regarding child nutrition and feeding practices were assessed using an HBM-based questionnaire consisting of six domains: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Each item was scored on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Domain scores were calculated by summing the individual item scores, with higher scores indicating stronger health beliefs and greater readiness to adopt recommended child feeding practices. Negatively worded items within the perceived barriers domain were reverse coded prior to analysis.

The questionnaire was reviewed by experts in child nutrition, community health, and nursing to evaluate its content validity, clarity, and cultural appropriateness. Internal consistency reliability was assessed using Cronbach's alpha. The Cronbach's alpha values were perceived susceptibility = 0.72, perceived severity = 0.75, perceived benefits = 0.78, perceived barriers = 0.71, cues to action = 0.74, and self-efficacy = 0.82. These values indicate acceptable to good internal consistency reliability.

Qualitative data were collected through in-depth interviews and focus group discussions with caregivers, midwives, nutritionists, and community health cadres. The discussions explored cultural beliefs, food taboos, family roles, household decision-making processes, economic constraints, community norms, local food resources, and factors influencing child feeding practices. All interviews and discussions were conducted with the participants' permission, audio-recorded, and transcribed verbatim for analysis.

Data Management and Statistical Analysis

Quantitative data were checked for completeness, coded, entered into a database, cleaned, and verified prior to analysis. Descriptive statistics were used to summarize the participants' characteristics and study variables.

Normality testing was conducted for continuous variables, particularly the HBM domain scores, to determine the suitability of parametric or nonparametric analyses. Changes in children's nutritional status before and after the intervention were analyzed using the Marginal Homogeneity Test because nutritional status categories represented paired categorical outcomes measured at two time points.

Changes in the HBM domain scores were analyzed using appropriate paired statistical tests based on the data distribution. Statistical significance was set at $p < 0.05$ using two-tailed testing. Effect sizes were calculated and reported to quantify the magnitude of the observed changes and support the interpretation of statistical significance.

Because the study employed a one-group pre-test and post-test design without randomization or a comparison group, multivariate adjustment for intervention effects was not performed. Consequently, the findings were interpreted as changes associated with the intervention rather than definitive evidence of causality.

Qualitative Analysis

Qualitative data were analyzed using thematic analyses. The transcripts were repeatedly reviewed to achieve familiarization with the data, followed by systematic coding, theme development, theme refinement, and interpretation. The analysis focused on identifying themes related to caregiver beliefs, cultural norms, family dynamics, ecological influences, and intervention experiences.

To enhance trustworthiness, triangulation was conducted across multiple participant groups, including caregivers, health workers, nutrition personnel and community health cadres. Qualitative findings were subsequently integrated with quantitative results to explain the contextual factors underlying the observed intervention outcomes.

Ethical Considerations

Ethical approval was obtained from the Chakra Brahmanda Lentera Institution Ethics

Committee (Ethical Clearance No. 013/25/IV/EC/KEP/LCBL/2025).

All participants received detailed information regarding the study's objectives, procedures, confidentiality measures, voluntary participation, and their right to withdraw at any time without consequences. Written informed consent was obtained from all participants before data collection.

Result and Discussion

Participant Characteristics

Table 1. Characteristics of caregivers and children (n = 179)

Variable	n	%
Caregiver age		
<30 years	17	9.5
31–40 years	142	79.3
>40 years	20	11.2
Education level		
Primary school	50	27.9
Junior high school	60	33.5
Senior high school	68	38
Occupation		
Housewife	56	31.3
Laborer	44	24.6
Farmer	40	22.3
Trader	18	10.1
Civil servant	11	6.1
Self-employed	9	5
Child age group		
12–24 months	91	50.8
25–36 months	59	33
37–48 months	28	15.6
49–60 months	0	0
Child sex		
Male	122	68.2
Female	57	31.8
Baseline nutritional status indicators		
Underweight	94	52.5
Stunting	11	6.1
Wasting	17	9.5
Overweight	32	17.9
Obesity	24	13.4

A total of 179 caregiver-child pairs were included in this study. As shown in Table 1, most caregivers were aged 31–40 years (79.3%), and the most common educational level was senior

high school (38.0%). The largest occupational group was housewives (31.3%), followed by laborers (24.6%) and farmers (22.3%). Most children were aged 12–24 months (50.8%). The reported sex distribution indicated that boys represented the majority of the sample; however, the number and percentage of child sex should be verified because the values presented in the original table were inconsistent.

Baseline nutritional status was presented using separate anthropometric indicators rather than mutually exclusive categories. Based on the weight-for-age z-score (WAZ), 52.5% of the children were underweight. The height-for-age z-score (HAZ) showed that 6.1% were stunted, while the weight-for-height z-score (WHZ) indicated that 9.5% were wasted. Based on the

body mass index-for-age z-score (BAZ), 17.9% of the children were overweight and 13.4% were obese. These findings indicate that undernutrition and overnutrition coexisted in the study population.

Changes in Health Belief Model Domains

Table 2 presents the mean scores of the ((HBM) domains before and after the intervention. The mean scores increased across all domains after the intervention. The largest increase was observed in self-efficacy, followed by perceived benefits, severity, barriers, susceptibility, and cues to action. These findings suggest improved caregiver perceptions and readiness to apply the recommended child feeding practices after the intervention.

Table 2. Mean scores of HBM domains before and after the intervention

HBM domain	Pre-test mean	Post-test mean	Mean difference
Perceived susceptibility	3.6	7.5	3.9
Perceived severity	3.58	8	4.42
Perceived benefits	3.4	8.01	4.61
Perceived barriers	3.6	7.99	4.39
Cues to action	4.15	8	3.85
Self-efficacy	3.66	13	9.34

Qualitative Findings

Qualitative findings showed that caregivers' beliefs and feeding practices were influenced by perceived malnutrition risk, awareness of consequences,

perceived benefits of nutrition education, economic limitations, cultural norms, community support, and confidence in applying recommended feeding practices. The key findings are presented in Table 3.

Table 3. Qualitative findings based on Health Belief Model domains

HBM domain	Key finding	Representative quote
Perceived susceptibility	Some caregivers underestimated the risk of malnutrition in children.	"I think it is normal. Many other children are like that."
Perceived severity	Prior to the intervention, awareness of long-term consequences was limited.	"I panicked when the health worker said my child was severely malnourished."
Perceived benefits	Caregivers viewed health education and Posyandu activities positively.	"I started to participate after seeing my neighbor's child become healthier."
Perceived barriers	Economic constraints and cultural beliefs affect feeding practices.	"Nutritious food is expensive."
Cues to action	Community activities encourage behavioral changes.	"Mothers' religious gatherings are effective for delivering health messages."
Self-efficacy	Confidence improved after education and support were provided.	"Now I am trying to continue doing it."

Changes in Child Nutritional Status

The Marginal Homogeneity Test was used to examine changes in the distribution of child

nutritional status before and after the intervention. As shown in Table 4, there was a statistically significant difference in the

nutritional status distribution between the baseline and post-intervention assessments ($\chi^2 = 114.94$, $df = 4$, $p < 0.001$). This finding indicates that changes in child nutritional status were observed after the culturally adapted HBM-based nutrition intervention.

However, because this study used a one-group pre- and post-test design without randomization or a control group, the findings should be interpreted as intervention-associated changes rather than definitive causal effects.

Table 4. Marginal Homogeneity Test of child nutritional status before and after intervention

Variable	Test	χ^2	df	p-value
Child nutritional status before and after intervention	Marginal Homogeneity Test	114.94	4	<0.001

This study found that a culturally adapted behavioral intervention based on the Health Belief Model (HBM) was associated with improvements in caregivers' HBM-related perceptions and changes in the nutritional status of children in rural Indonesian communities.

The findings suggest that nutrition interventions may be more acceptable and feasible when messages are adapted to caregivers' cultural contexts, household realities, family decision-making patterns, and locally available food resources. These findings are consistent with previous studies demonstrating that culturally tailored health promotion interventions are more effective in influencing health-related behaviors because they align with local beliefs, values, and social norms (Jeihooni et al., 2022; Ihunanya et al., 2024).

The coexistence of undernutrition and overnutrition at baseline reflects the double burden of malnutrition, which remains a major public health concern in many low- and middle-income countries (LMICs). The double burden of malnutrition is the coexistence of undernutrition and overnutrition within the same population, community, household, or individual, and emphasizes that this condition requires integrated nutrition strategies rather than single-problem interventions. In this study, underweight was the most common problem, but overweight and obesity were also present, indicating that rural child nutrition problems should not be understood solely as food insufficiency. Instead, they reflect the complex interactions among dietary quality, feeding behavior, household resources, food environments, caregiving practices, and health service access. Similar patterns have been reported in Indonesia and other developing countries undergoing nutritional transition, where persistent undernutrition coexists with

increasing rates of overweight and obesity in children (WHO, 2023).

The improvement in HBM domains indicates that the intervention may have influenced caregivers' perceptions of malnutrition risk, seriousness, benefits of recommended feeding practices, barriers, cues to action and self-efficacy. This finding is consistent with previous evidence showing that HBM-based nutrition education can improve maternal knowledge, feeding behaviors, and child growth-related outcomes (Jeihooni et al., 2022). According to Beressa et al. 's(2024) Health Belief Model, behavior change is more likely to occur when individuals perceive themselves as susceptible to a health problem, recognize its severity, believe in the benefits of preventive actions, and feel confident in their ability to perform those actions. The strongest improvement was observed in self-efficacy, suggesting that caregivers became more confident in selecting, preparing, and providing appropriate food for their children. This is important because knowledge alone is often insufficient to change feeding practices when caregivers do not feel capable of applying recommendations to their household conditions. Tan et al. (2021) emphasized that self-efficacy is a critical determinant of behavioral adoption and maintenance, particularly in health-related practices requiring sustained effort.

The qualitative findings provide important contextual explanations for the quantitative results. Before the intervention, some caregivers perceived thinness as common or normal, especially when children remained active and did not show visible illness symptoms. This perception may delay the recognition of nutritional risks and reduce the urgency to seek nutritional support. After the intervention, caregivers appeared to better understand that

inadequate nutrition may affect growth, immunity, and long-term development, even in the absence of an acute illness. This finding supports the relevance of perceived susceptibility and severity as behavioral pathways in child nutrition interventions. Similar observations have been reported in community-based nutrition studies, where caregivers often underestimate nutritional problems until visible symptoms emerge (Stelle et al., 2023; Has et al., 2022).

The increase in perceived benefits and self-efficacy may also be explained by the practical and culturally familiar nature of this intervention. The use of locally available foods, such as moringa leaves and traditional community foods, may have helped caregivers view the recommended feeding practices as realistic and affordable. Evidence from UNICEF highlights that child growth is strongly influenced by nutrition, feeding practices, the environment, and healthcare rather than genetics alone (UNICEF, 2025). Furthermore, the WHO (2023) recommends the use of locally available nutrient-rich foods as a sustainable strategy to improve child nutrition in resource-limited settings. Therefore, interventions that improve caregivers' confidence and practical feeding skills may contribute to better child nutrition outcomes when implemented in supportive family and community environments.

Nevertheless, perceived barriers remain important. Caregivers continued to report economic constraints, food costs, cultural food restrictions, and family influences as challenges to optimal feeding. These findings suggest that child-feeding behaviors are not solely determined by caregivers' knowledge or motivation. It is also shaped by household income, food affordability, food availability, social norms, and family authority. Previous studies have shown that poverty and food insecurity are major determinants of inadequate dietary intake among young children, particularly in rural populations (Stelle et al., 2023; Has et al., 2022). Therefore, nutrition education should be combined with family engagement, community support, and strategies to improve access to affordable, nutrient-dense foods.

Family and community influences emerged as the central themes of this study. Husbands, grandparents, religious leaders, community leaders, health workers, and community health

cadres played important roles in shaping the caregivers' decisions. This finding is consistent with socioecological perspectives, which emphasize that health behavior is influenced by interpersonal, community, institutional, and environmental factors (Scarneo et al., 2019). Nutrition messages delivered through trusted community channels, including Posyandu activities and religious gatherings, may increase acceptability and reinforce behavioral changes. Similar findings have been reported in Indonesian community-based nutrition programs, where family support and community participation significantly contributed to improvements in child feeding practices and nutritional outcomes (Wulandari et al., 2025).

The significant change in children's nutritional status after the intervention suggests that culturally adapted, theory-based, community-level interventions may be promising for improving children's nutrition in rural settings. These findings align with previous intervention studies demonstrating that behavior-change approaches grounded in health behavior theories can positively influence child nutrition outcomes when combined with practical feeding support and community engagement (Jeihooni et al., 2022; WHO, 2023). However, these findings should be interpreted cautiously. Because the study did not include a randomized control group, the observed changes may have been influenced by external factors such as seasonal food availability, concurrent health programs, maturation, or increased caregiver attention during the study period. Thus, the findings support intervention-associated improvements but do not establish definitive causality (Hammerton & Munafò, 2021).

From a public health perspective, the findings indicate that rural child nutrition programs should move beyond conventional educational models. Programs should integrate behavioral theory, culturally appropriate communication, family participation, local food resources, and community-based support systems to be effective. At the policy level, culturally responsive nutrition interventions could strengthen existing community platforms, such as Posyandu, by making nutrition messages more locally acceptable and easier to implement in daily household practices. This recommendation is consistent with WHO guidance, emphasizing community-based, family

centered, and culturally sensitive approaches to address the double burden of malnutrition and improve child growth and development outcomes (WHO, 2023).

The main strength of this study was its mixed-methods design, which allowed quantitative changes in nutritional status and HBM domains to be interpreted alongside qualitative evidence on culture, family roles, economic barriers, and community acceptance of the program. The intervention was also culturally adapted and implemented in real rural community settings, thereby increasing its practical relevance. Additionally, the integration of quantitative and qualitative findings provided a more comprehensive understanding of how behavioral, cultural, and contextual factors influenced caregiver responses to the intervention.

This study has several limitations. First, the one-group pre-test and post-test design without randomization or a control group limited the causal inference. Second, purposive sampling may have reduced generalizability to other rural or urban populations in the Philippines. Third, caregiver-reported responses may have been affected by social desirability and recall biases. Fourth, the short follow-up period limited the assessment of long-term sustainability, particularly for chronic nutritional outcomes such as stunting. Fifth, possible information sharing among caregivers may have introduced contamination in the study. Finally, inconsistencies in the reported child sex data and HBM score scales should be corrected before the manuscript submission. Future studies should employ randomized controlled or quasi-experimental designs with longer follow-up periods to strengthen causal inferences and evaluate the sustainability of the intervention's effects on child nutritional outcomes.

Conclusion

This study found that a culturally adapted nutrition intervention based on the Health Belief Model was associated with improvements in children's nutritional status and caregivers' health beliefs related to child feeding practices in rural Indonesian communities.

The findings suggest that integrating behavioral theory with cultural adaptation, family engagement, and community

participation may enhance the acceptability and implementation of nutritional interventions in resource-limited settings. Qualitative evidence further demonstrated that child-feeding practices were shaped by cultural beliefs, family influence, economic constraints, and community support. Although causal inferences cannot be established due to the study design, the results highlight the potential value of culturally responsive, community-based approaches to address child malnutrition in rural populations.

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