The impact of nutrition counseling on maternal knowledge, dietary intake, and motor development among stunted toddlers

El impacto del asesoramiento nutricional en el conocimiento materno, la ingesta dietética y el desarrollo motor en niños pequeños con retraso del crecimiento

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Abstract

Background: Stunting is a chronic nutritional problem that affects not only children's physical growth but also their functional development, including motor skills. This study aimed to analyze the impact of nutrition counseling on maternal knowledge, toddler dietary intake, and motor development among stunted toddlers in coastal Kendari

Methods: A pre-experimental one-group pretest–posttest design was conducted among 43 mothers and their stunted toddlers aged 10–59 months in selected coastal communities. Mothers received structured nutrition counseling focusing on balanced nutrition, complementary feeding, dietary diversity, and hygiene. Paired t-tests analyzed pre–post changes, and linear regression examined associations between sociodemographic characteristics (child age, gender, maternal education, and household income) and changes in outcomes (Δ scores).

Results: Maternal nutrition knowledge significantly increased from 47.2 ± 9.08 to 61.6 ± 7.99 (Δ = 14.4, 95% CI 11.8–17.0, p = 0.001; Cohen's d = 1.69). Toddler dietary intake improved from 49.5 ± 9.50 to 63.4 ± 5.72 (Δ = 13.9, 95% CI 11.5–16.3, p = 0.001; d = 1.79), and motor development scores increased from 52.3 ± 8.41 to 61.8 ± 6.97 (Δ = 9.5, 95% CI 7.1–11.9, p = 0.002; d = 1.23). Regression analysis showed that higher maternal education, female gender, and higher household income were significantly associated with greater improvements in maternal knowledge, toddler dietary intake, and motor development.

Conclusion: Nutrition counseling significantly enhances maternal knowledge, toddler dietary intake, and motor development among stunted toddlers in coastal Kendari.

Keywords

Dietary intake; maternal knowledge; motor development; nutrition counseling; stunted toddlers

Resumen

Antecedentes: El retraso del crecimiento (stunting) es un problema nutricional crónico que afecta no solo el crecimiento físico de los niños, sino también su desarrollo funcional, incluidas las habilidades motoras. Este estudio tuvo como objetivo analizar el impacto del asesoramiento nutricional en el conocimiento materno, la ingesta dietética de los niños pequeños y el desarrollo motor en niños con retraso del crecimiento en la zona costera de Kendari

Métodos: Se llevó a cabo un diseño preexperimental de un solo grupo con pretest–postest en 43 madres y sus niños con retraso del crecimiento de 10 a 59 meses en comunidades costeras seleccionadas. Las madres recibieron asesoramiento nutricional estructurado centrado en nutrición equilibrada, alimentación complementaria, diversidad dietética e higiene. Se utilizaron pruebas t pareadas para analizar los cambios pre–post, y regresión lineal para examinar las asociaciones entre características sociodemográficas (edad y sexo del niño, nivel educativo materno e ingresos del hogar) y los cambios en los resultados (Δ puntuaciones).

Resultados: El conocimiento nutricional materno aumentó significativamente de 47,2 ± 9,08 a 61,6 ± 7,99 (Δ = 14,4; IC 95%: 11,8–17,0; p = 0,001; d de Cohen = 1,69). La ingesta dietética de los niños mejoró de 49,5 ± 9,50 a 63,4 ± 5,72 (Δ = 13,9; IC 95%: 11,5–16,3; p = 0,001; d = 1,79), y las puntuaciones de desarrollo motor aumentaron de 52,3 ± 8,41 a 61,8 ± 6,97 (Δ = 9,5; IC 95%: 7,1–11,9; p = 0,002; d = 1,23). El análisis de regresión mostró que un mayor nivel educativo materno, el sexo femenino y mayores ingresos del hogar se asociaron significativamente con mayores mejoras en el conocimiento materno, la ingesta dietética infantil y el desarrollo motor.

Conclusión: El asesoramiento nutricional mejora significativamente el conocimiento materno, la ingesta dietética y el desarrollo motor en niños con retraso del crecimiento en la zona costera de Kendari.

Palabras clave

Ingesta dietética, conocimiento materno, desarrollo motor, asesoramiento nutricional, niños pequeños con retraso del crecimiento.

Introduction

Stunting remains a major public health and nutrition challenge affecting children under five worldwide, particularly in low- and middle-income countries (Royani et al., 2021). It results from prolonged inadequate nutrient intake, repeated infections, and suboptimal caregiving practices during the first 1,000 days of life, and represents a cumulative nutritional deprivation that compromises children's overall health, cognitive development, and motor skills (Randell et al., 2020; (Soesanti et al., 2020). Stunted children are also at higher risk of non-communicable diseases in adulthood and may experience reduced learning capacity and school performance, affecting long-term human capital formation.

Globally, stunting prevalence remains high, especially in Asia and Africa, with Southeast Asia reporting 27.4% (Mannar et al., 2020). In Indonesia, the prevalence was 24.4% in 2021 and 21.6% in 2022 (Kemenkes, 2023), still above the WHO target of below 20% (World Health Organization, 2025). At the subnational level, Southeast Sulawesi recorded 30.2% stunting in 2021, with coastal areas of Kendari City considered particularly vulnerable due to socioeconomic constraints, food insecurity, limited access to health services, and environmental factors (Dinkes Propinsi Sulawesi Tenggara, 2021).

One key factor contributing to stunting is inadequate maternal knowledge regarding balanced nutrition and age-appropriate child feeding. Mothers play a central role in determining dietary intake through breastfeeding, complementary feeding, and meal preparation. Limited understanding of exclusive breastfeeding, dietary diversity, and healthy eating practices often leads to insufficient nutrient intake among toddlers (Berutu et al., 2024). Nutrition counseling has been promoted as a strategic intervention to improve maternal knowledge, attitudes, and feeding practices, thereby enhancing dietary quality, meal frequency, and nutrient adequacy in children (Vitriani & Putri, 2025). The effectiveness of such interventions, however, can be influenced by maternal education, household income, cultural practices, and environmental context, which may affect the translation of knowledge into sustained behavior change.

Despite growing evidence, research gaps remain. Most studies focus primarily on maternal knowledge or general nutritional status, with fewer examining combined effects on maternal knowledge, toddler dietary patterns, and measurable growth outcomes, particularly among already stunted children (Vale et al., 2022). Evidence from coastal and resource-limited settings is also scarce, limiting generalizability to high-risk populations such as those in Kendari's coastal areas.

This study aims to analyze the impact of nutrition counseling on maternal knowledge, toddler dietary intake, and growth outcomes among stunted toddlers in coastal Kendari. By integrating assessments of knowledge, dietary behavior, and growth outcomes, the study provides evidence-based insights to inform the development of targeted and sustainable nutrition interventions for vulnerable populations.

Method

This study employed a quantitative pre-experimental design using a one-group pretest–posttest approach to evaluate the impact of nutrition counseling on maternal knowledge, dietary intake, and motor development among stunted toddlers. This design was selected to assess changes in outcome variables before and after the intervention within the same group, allowing for direct measurement of intervention effects while considering practical and ethical constraints in community-based settings.

The study was conducted in coastal areas of Kendari City, Southeast Sulawesi Province, Indonesia, a region identified as having a high prevalence of stunting based on local health office reports. Data collection took place over a three-month period, which included participant recruitment, baseline assessment (pretest), implementation of nutrition counseling sessions, and post-intervention assessment (posttest). The coastal setting was chosen due to its vulnerability to nutritional problems related to socioeconomic and environmental factors.

The study population consisted of mothers and their stunted toddlers aged 10–59 months residing in the selected coastal communities (although all children included in the study met the criteria for stunting at baseline (HAZ < −2 SD), nutritional status categories presented in the results reflect height-for-

age classifications assessed during the study period, including improvements observed after the intervention). Toddlers were classified as stunted based on the World Health Organization (WHO) growth standards, defined as a height-for-age Z-score (HAZ) < −2 SD. Inclusion criteria were: (1) toddlers aged 10–59 months with confirmed stunting status, (2) mothers or primary caregivers who were responsible for feeding practices, (3) permanent residence in the study area, and (4) willingness to participate throughout the study period. Exclusion criteria included toddlers with congenital abnormalities, chronic illnesses, or physical disabilities affecting motor development, as well as mothers who were unable to complete the counseling sessions or follow-up assessments.

A purposive sampling technique was used to recruit participants who met the eligibility criteria. The sample size consisted of 43 mother–toddler pairs. The determination of sample size was based on feasibility considerations and the minimum sample requirement for detecting a moderate effect size in paired measurements, with a significance level of 0.05 and statistical power of 80%. This sample size was considered adequate for preliminary intervention studies in community settings.

Nutrition counseling was delivered through structured, face-to-face educational sessions conducted by trained nutritionists using standardized educational materials to ensure consistency across participants. The counseling content focused on balanced nutrition, age-appropriate complementary feeding, dietary diversity, meal frequency, food hygiene, and the role of nutrition in supporting physical activity and motor development in toddlers.

The primary outcome variables in this study included maternal nutrition knowledge, toddler dietary intake, and toddler motor development. Maternal nutrition knowledge was assessed using a structured questionnaire developed based on the Indonesian national nutrition guidelines for mothers of children under five years of age. The questionnaire included items related to balanced nutrition, complementary feeding practices, dietary diversity, and food hygiene. Content validity was reviewed by public health and nutrition experts, and the instrument was pilot-tested prior to data collection to ensure clarity and reliability.

Toddler dietary intake was assessed using a structured dietary assessment checklist evaluating food variety, meal frequency, and consumption of nutrient-dense foods. Data were collected through interviews with mothers, supported by direct observation. This instrument has been widely used in community-based nutrition research and is considered appropriate for assessing toddler dietary patterns in similar sociocultural contexts.

Toddler motor development was assessed using the Developmental Pre-Screening Questionnaire (Kuesioner Pra Skrining Perkembangan/KPSP) issued by the Indonesian Ministry of Health. The KPSP is a standardized screening tool designed for children aged 0–72 months and assesses several developmental domains, including gross motor, fine motor, language, and personal–social development. In this study, the analysis focused on the gross motor domain, which includes age-specific tasks such as standing, walking, running, jumping, and other coordinated movements appropriate for children aged 10–59 months.

The KPSP has been used in primary healthcare facilities across Indonesia and has demonstrated acceptable validity and reliability as a developmental screening instrument. Its use is considered culturally appropriate, as the assessed activities reflect everyday functional movements commonly performed by toddlers in the local context. Motor development assessments were conducted by trained enumerators following standardized KPSP administration guidelines. All measurements were conducted using the same instruments at baseline and post-intervention to ensure consistency across time points. Prior to the main data collection, all instruments were pilot-tested to assess feasibility and comprehensibility, and necessary adjustments were made accordingly.

Potential predictor variables included maternal education level, household income, child age, and child sex. These variables were collected through structured sociodemographic questionnaires. Potential confounding factors included recent history of infectious diseases, sanitation conditions, and household food security, which could influence dietary intake and motor development. Effect modifiers, such as maternal education and household income, were considered in stratified analyses to assess whether the intervention effect differed across subgroups. Anthropometric measurements were conducted following WHO standardized procedures. Toddler height was measured using a stadiometer to the nearest 0.1 cm, and weight was measured using a calibrated digital scale to the nearest 0.1 kg. Motor development

assessments were conducted by trained enumerators using the same instruments at baseline and follow-up to ensure measurement comparability across time points. All instruments were pilot-tested prior to data collection.

Several measures were implemented to minimize potential sources of bias. Standardized training was provided to data collectors to reduce measurement error. The use of the same instruments and procedures at pretest and posttest helped ensure internal consistency. Recall bias was minimized by using short recall periods for dietary assessment. Data completeness was monitored regularly, and missing data were addressed through verification during follow-up visits.

Data were collected through structured interviews, direct observation, as well as anthropometric measurements and motor development assessments for each toddler at baseline and post-intervention. All collected data were checked for completeness and accuracy prior to entry into the database. The data were subsequently entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0. Descriptive statistics were used to summarize participant characteristics, including child sex and age, nutritional status, maternal education level, and household income. The normality of continuous variables was assessed using the Shapiro–Wilk test. Changes in maternal nutrition knowledge scores, toddler dietary intake scores, and toddler motor development scores before and after the intervention were analyzed using paired t-tests for normally distributed data, with p-values < 0.05 considered statistically significant. In addition, effect sizes were calculated using Cohen's d, with values interpreted according to conventional thresholds to evaluate the magnitude of the intervention effect.

A sociodemographic sub-analysis was also conducted to examine the influence of participant characteristics on outcome changes (Δ scores). The dependent variables in the linear regression analysis were the pre–post score differences for each outcome, while independent variables included child sex and age, maternal education level, and household income. Regression results were reported as β coefficients, 95% confidence intervals (95% CI), and p-values to assess the direction and statistical significance of associations. This approach allowed for a more comprehensive understanding of both the overall intervention effects and how sociodemographic factors contributed to variations in outcomes.

Results

Table 1 presents the demographic and nutritional characteristics of the respondents. The majority of the participants were male (51.2%), with most falling within the age range of 10–59 months (79.1%). The nutritional status of the toddlers revealed that 34.9% were categorized as very short, 23.3% as short, and 41.9% as having normal nutritional status. Regarding maternal education, the highest proportion (46.5%) had completed high school. Additionally, 53.5% of parents reported an income below IDR 2,900,000.

Table 1. Distribution of Characteristics of Toddlers and Mothers

Gender of children under five	Total	Percentage (%)
Male	22	51.2
Female	21	48,8
Age (Month) under five		
0-11	9	20.9
10-59	34	79.1
Nutritional status (post-intervention)		
Very short	15	34.9
Short	10	23.3
Normal	18	41.9
Mother's education level		
SD	8	18.6
SMP	7	16.3
SMA/SMK	20	46.5
D3 / S1	8	18.6
Parent's income		
< IDR 2,900,000	23	53.5
IDR 2,900,000	20	46.5

Table 2 illustrates the relationships between various factors and the nutritional status of children under five. Maternal education level was significantly associated with nutritional status (p = 0.036), with children of mothers who completed high school demonstrating better nutritional outcomes. Parental income also had a significant effect (p = 0.016), as children from families with an income exceeding IDR 2,900,000 were more likely to have normal nutritional status. Additionally, the gender of the children showed a significant association (p = 0.001), with a higher proportion of girls categorized as having normal nutritional status. Conversely, the age of children under five did not exhibit a significant relationship with nutritional status (p = 0.314).

Table 2. Results of Analysis of the Relationship between Maternal and Toddler Factors and the Nutritional Status of Toddlers with Stunting

Education level	Nutritional status			p value
	Very short	Short	Normal	
SD	3 (37.5)	5 (62.5)	0 (0)	0.036
SLTP	1(14.3)	2 (28.6)	4 (57.1)	
High School / Vocational School	8 (40.0)	3 (15.0)	9 (45.0)	
D3 / S1	3 (37.5)	0 (0)	5 (62.5)	
Total	15 (34.9)	10 (23.3)	18(41.9)	
Salary				0.016
< IDR 2,900,000	11 (47.8)	7 (30.4)	5 (21.8)	
>Rp 2,900,000	4 (20.0)	3 (15.0)	13 (65.0)	
Gender of children under five				0.001
Male	13 (59.1)	7 (31.8)	2 (9.1)	
Female	2 (9.5)	3 (14.3)	17 (76.2)	
Age (Month) under five				0.314
0-11	5 (55.6)	1 (11.1)	3 (33.3)	
10-59	10 (29.4)	9 (26.5)	15 (44.1)	

Table 3. Effects of Nutrition Counseling on Maternal Knowledge, Dietary Intake, and Motor Development among Stunted Toddlers

Variable	Pre-intervention (Mean ± SD)	Post-intervention (Mean ± SD)	Mean Difference	95% CI	p-value	Cohen's d
Maternal nutrition knowledge (score)	47.2 ± 9.08	61.6 ± 7.99	14.4	11.8 – 17.0	0.001	1.69
Toddler dietary intake (score)	49.5 ± 9.50	63.4 ± 5.72	13.9	11.5 – 16.3	0.001	1.79
Toddler motor development (score)	52.3 ± 8.41	61.8 ± 6.97	9.5	7.1 – 11.9	0.002	1.23

The paired t-test analysis showed statistically significant improvements across all outcome variables following the nutrition counseling intervention. Maternal nutrition knowledge increased by a mean of 14.4 points (95% CI: 11.8–17.0), toddler dietary intake scores improved by 13.9 points (95% CI: 11.5–16.3), and toddler motor development scores increased by 9.5 points (95% CI: 7.1–11.9). All observed effects were large in magnitude, as indicated by Cohen's d values greater than 1.2, suggesting a substantial intervention effect.

Table 4. Regression Analysis of Sociodemographic Factors Associated with Changes in Study Outcomes

Outcome	Predictor	β (Coefficient)	95% CI	p-value
ΔMaternal Knowledge	Gender (Female vs Male)	2.1	-1.5 – 5.7	0.25
	Age group (10–59 mo vs 0–11 mo)	1.8	-2.2 – 5.8	0.37
	Mother's education (ref: Elementary School)			
	Junior High School	1.5	-2.5 – 5.5	0.46
	Senior High School / Vocational High School	3.2	0.1 – 6.3	0.043
	Diploma (Associate Degree) / Bachelor's Degree	4	0.5 – 7.5	0.025
	Household income (> IDR 2,900,000 vs < IDR 2,900,000)	2.8	0.2 – 5.4	0.034
ΔToddler Dietary Intake	Gender (Female vs Male)	4	1.5 – 6.5	0.003
	Age group (10–59 mo vs 0–11 mo)	1.2	-1.5 – 3.9	0.37
	Mother's education (ref: SD)			
	SMP	1.8	-1.0 – 4.6	0.20
	SMA/SMK	3.5	0.9 – 6.1	0.009
	D3/S1	3.8	0.8 – 6.8	0.015
ΔToddler Motor Development	Household income (> IDR 2,900,000 vs < IDR 2,900,000)	3.6	0.8 – 6.4	0.012
	Gender (Female vs Male)	3.2	0.5 – 5.9	0.022

Age group (10–59 mo vs 0–11 mo)	1	-1.5 – 3.5	0.42
Mother's education (ref: Elementary School)			
Junior High School	1.5	-1.0 – 4.0	0.23
Senior High School / Vocational High School	2.8	0.2 – 5.4	0.035
Diploma (Associate Degree) / Bachelor's Degree	3	0.1 – 5.9	0.041
Household income (> IDR 2,900,000 vs < IDR 2,900,000)	2.5	0.0 – 5.0	0.049

Δ : score difference

Linear regression analysis showed that several sociodemographic factors were significantly associated with changes in scores after the intervention. ΔMaternal Knowledge increased significantly among mothers with a high school/vocational education (SMA/SMK) (β = 3.2, 95% CI 0.1–6.3, p = 0.043) and D3/S1 education (β = 4.0, 95% CI 0.5–7.5, p = 0.025), as well as in families with an income > IDR 2,900,000 (β = 2.8, 95% CI 0.2–5.4, p = 0.034). Child gender and age were not significantly associated. ΔToddler Dietary Intake increased significantly among female children (β = 4.0, 95% CI 1.5–6.5, p = 0.003), mothers with SMA/SMK education (β = 3.5, 95% CI 0.9–6.1, p = 0.009) and D3/S1 education (β = 3.8, 95% CI 0.8–6.8, p = 0.015), and families with an income > IDR 2,900,000 (β = 3.6, 95% CI 0.8–6.4, p = 0.012). ΔToddler Motor Development increased significantly among female children (β = 3.2, 95% CI 0.5–5.9, p = 0.022), mothers with SMA/SMK education (β = 2.8, 95% CI 0.2–5.4, p = 0.035) and D3/S1 education (β = 3.0, 95% CI 0.1–5.9, p = 0.041), and families with an income > IDR 2,900,000 (β = 2.5, 95% CI 0.0–5.0, p = 0.049). Child age was not significantly associated.

Discussion

This study demonstrated significant improvements in maternal knowledge, dietary intake, and motor development among stunted toddlers following nutrition counseling. in coastal Kendari. The results demonstrated that nutrition counseling led to significant improvements across all three outcomes. These findings strengthen the evidence that mother-centered nutrition education interventions play a strategic role in improving the condition of stunted children, not only in terms of maternal cognitive aspects and dietary intake but also in functional outcomes, particularly motor development (Szelag, 2015).

The improvement in maternal nutrition knowledge following counseling represents an important initial finding of this study. However, what distinguishes this study from previous research is the coastal community context, where maternal knowledge prior to the intervention tended to be limited to the traditional use of marine food resources without adequate consideration of balanced nutrient intake. Nutrition counseling helped mothers understand how to combine marine protein sources with other local foods such as vegetables, fruits, and diverse carbohydrate sources. This finding indicates that the increase in knowledge was not merely general but also contextual and relevant to the lifestyle of coastal communities (Cartmill et al., 2022; Gibson et al., 2020).

In line with the improvement in maternal knowledge, this study found a significant enhancement in toddlers' dietary intake (Katenga-Kaunda et al., 2021; Prasetyo et al., 2023; Saaka et al., 2021). Unlike several previous studies that identified limited food access as the primary barrier, this study demonstrates that in the coastal communities of Kendari, the main issue is not food availability but rather food utilization and dietary diversity. Nutrition counseling encouraged mothers to process marine products into more child-friendly and nutritionally balanced meals, resulting in a meaningful improvement in toddlers' dietary intake. This finding underscores that educational approaches can serve as effective solutions in areas with sufficient local food potential (Borelli et al., 2020).

The most prominent and distinguishing finding of this study is the improvement in motor development among stunted toddlers following the intervention. In the coastal community context, toddlers generally have greater opportunities for physical activity through outdoor play and exposure to natural environments. However, prior nutritional deficiencies were likely to hinder the optimal use of this potential. After dietary intake improved, toddlers showed enhanced gross motor abilities such as more stable walking, running, jumping, and better movement coordination. This finding illustrates that the coastal environment can act as a supportive factor for motor development when accompanied by adequate nutritional intake (Mohamed Ahmed Ayed et al., 2021).

In addition to the observed improvements in nutritional status and maternal knowledge, the study highlights the critical interplay between nutrition, motor development, and physical activity in early childhood. Motor development is not solely determined by adequate nutrition but also depends on the opportunities children have to engage in physical movement (Al-Rahmad et al., 2026). In coastal Kendari, toddlers often experience abundant opportunities for outdoor play, interaction with natural environments, and activities that stimulate gross motor skills, such as running on the beach, climbing, or balancing on uneven surfaces. Nutrition counseling enhances these motor opportunities by providing children with the energy and nutrients necessary to fully utilize their physical environment. Empirical evidence supports that well-nourished children demonstrate higher activity levels, better coordination, and faster acquisition of motor milestones (Stodden et al., 2008; Timmons et al., 2012).

Analysis of the relationships among variables revealed positive correlations between maternal knowledge and toddlers' dietary intake, as well as between dietary intake and motor development. These relationships suggest that nutrition counseling operates through an indirect pathway, whereby improved maternal knowledge leads to changes in feeding behavior, which subsequently influence children's motor development. In coastal communities, this pathway becomes particularly relevant because children naturally have more opportunities to move and play, allowing improvements in nutritional status to be rapidly reflected in enhanced motor function (Fitriani et al., 2024; Gondim et al., 2022).

From a public health and physical education perspective, the findings of this study have important implications. The results indicate that nutrition interventions in coastal areas should not be implemented in isolation but rather integrated with the promotion of physical activity and active play among children. Nutrition counseling that takes into account the characteristics of the coastal environment has the potential to generate dual benefits, namely improving nutritional status while simultaneously optimizing motor development and children's quality of life.

Although the findings of this study indicate a strong effect of nutrition counseling on changes in maternal knowledge, feeding behavior, and children's motor development, potential confounding factors related to internal validity should be considered when interpreting these results. In the absence of a control group, it is possible that factors other than the nutrition counseling intervention contributed to the observed improvements. These factors may include natural maturation and developmental processes among toddlers aged 10–59 months, increased levels of physical activity as children grow older, exposure to routine health and nutrition services, as well as unmeasured changes in household practices or caregiving behaviors. Such factors may influence maternal knowledge, dietary intake, and toddlers' motor development, thereby limiting the ability of this study to isolate the specific effects of the intervention.

Despite its novel contributions, this study has several limitations. The pre-experimental design without a control group limits the strength of causal inference. Additionally, the unique characteristics of coastal communities may restrict the generalizability of the findings to non-coastal settings. Motor development was also assessed using screening instruments, which may not fully capture comprehensive motor function. Future studies are strongly recommended to employ quasi-experimental designs with comparison groups or randomized controlled trials to strengthen causal inference. The inclusion of control groups would allow better differentiation between intervention effects and natural developmental changes. Additionally, integrating objective measures of physical activity and longer follow-up periods would further clarify the pathways linking nutrition counseling, dietary intake, and motor development.

Conclusions

This study concludes that nutrition counseling has a significant impact on improving maternal knowledge, dietary intake, and motor development among stunted toddlers in the coastal areas of Kendari. Following the intervention, there were meaningful increases in maternal nutrition knowledge scores, the quality of toddlers' dietary intake, and gross motor development scores. These findings indicate that mother-based nutrition counseling is an effective and relevant intervention to support improvements in nutritional status and functional development among stunted toddlers, particularly in coastal communities with local food potential and environments that support children's physical activity.

It is recommended that nutrition counseling programs in coastal areas be developed sustainably and integrated with the promotion of physical activity and active play for children. Health workers and local policymakers are encouraged to adopt educational approaches that leverage local food resources to enhance the effectiveness of stunting interventions. Future studies are recommended to employ experimental designs with control groups, larger sample sizes, and more objective measurements of physical activity to strengthen the scientific evidence.

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