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Improving Toddlers' Appetite through Tuina Massage and Feeding Rules: A Preventive Approach to Stunting

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Abstract
Stunting remains a major public health concern in Indonesia due to its long-term implications for child development and national productivity. Among the contributing factors are inappropriate dietary patterns and poor parental responses to appetite loss among toddlers. This study examined the effects of tuina massage using virgin coconut oil (VCO) combined with structured feeding rules on the appetite of stunted toddlers. A quasi-experimental design with a pretest–posttest control group was conducted in Laha Village, involving 40 stunted toddlers aged 12–36 months. Participants were assigned to either an intervention or control group through total sampling. The intervention consisted of six consecutive days of tuina massage using VCO and the implementation of scheduled feeding rules. Appetite levels were assessed using a validated questionnaire administered before and after the intervention. Data were analyzed using Shapiro–Wilk for normality, followed by Wilcoxon, paired t-tests, and Mann–Whitney U tests. Results showed a statistically significant improvement in appetite among children in the intervention group ($p < 0.001$), whereas no changes were observed in the control group. These findings indicate that the integrated intervention effectively enhances appetite in stunted toddlers and offers a promising, low-cost, and non-pharmacological strategy for addressing stunting in low-resource settings. The combination of physiological stimulation through massage and behavioral regulation through structured feeding rules provides a holistic approach to improving early childhood nutrition. Further studies with longer duration and broader geographic scope are recommended to evaluate long-term impacts and scalability within public health programs.

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Introduction

Stunting is a persistent public health problem characterized by impaired growth and development due to chronic malnutrition, with a z-score of less than -2 standard deviations based on WHO anthropometric standards (Kemenkes RI, 2022; WHO, 2021). The adverse consequences of stunting are both short and long term, including disrupted brain function, impaired cognitive and motor development, metabolic disorders, and decreased immunity, leading to vulnerability to diseases such as diabetes, cardiovascular disease, cancer, and physical disability in adulthood (Izwardy, 2019; I. B. Tiwery et al., 2023). Furthermore, stunting can result in low economic productivity due to uncompetitive work quality. This multidimensional impact places stunting as a crucial issue in national and global health priorities.

In response to the urgency, the United Nations has established the Sustainable Development Goals (SDGs), with one of the main targets being the elimination of hunger and poverty, which includes reducing stunting in children under five by 2030 (UNICEF et al., 2023). Indonesia has aligned with this global commitment by setting a national target through the 2020-2024 RPJMN to reduce stunting prevalence to 14% by 2024. However, the challenge remains formidable. As of 2020, Indonesia's stunting prevalence was 26.9%, decreased to 24.4% in 2021, and 21.6% in 2022. Nevertheless, this figure is still significantly above the WHO threshold of 20% and the national target (Kemenkes RI, 2022).

The Maluku Province reflects an even more concerning trend. In 2021, the stunting prevalence in Maluku was recorded at 28.7%, slightly declining to 26.1% in 2022, but rising again to 28.4% in 2023 (UNICEF et al., 2023). In Ambon City, the prevalence reached 21.8% in 2021 and slightly declined to 21.1% in 2022. These data demonstrate that despite various interventions, the region continues to struggle with high stunting rates, particularly in Laha Village, designated as one of the stunting loci. Preliminary observations in Laha indicate a persistent increase in stunting cases over the past three years, signaling the urgent need for a more contextual and integrative intervention approach.

Stunting is influenced by various interrelated factors, including inadequate nutritional intake, lack of appetite, and improper feeding behavior (Boah et al., 2019; I. B. Tiwery et al., 2023). In Laha Village, it was found that toddlers often have poor appetite and inappropriate dietary patterns. This is partly due to the limited knowledge of parents regarding proper child nutrition. As a result, children are frequently given snacks or staple foods that do not meet their dietary needs. Until now, no specific intervention has been implemented to effectively address these root causes in the local context.

One promising alternative therapy is Tuina massage, a traditional Chinese pediatric intervention that has been reported to improve appetite and digestion. The effectiveness of Tuina massage using virgin coconut oil in increasing the appetite of stunted toddlers has been demonstrated through recent research (B. I. Tiwery & Goha, 2024). Supporting studies also found that Tuina therapy can alleviate feeding difficulties by stimulating the spleen and digestive function (Munjidah, 2015; Wijayanti, 2019). Several meta-analyses reinforce these findings, indicating Tuina's potential efficacy for pediatric conditions including functional dyspepsia, insomnia, and gastrointestinal disorders (Dai et al., 2022; Liu et al., 2024; Z. Wang et al., 2024). The use of virgin coconut oil may enhance therapeutic benefits by improving comfort and digestion during massage (Laksono & Nursitiyaroh, 2023).

In addition to massage therapy, structured feeding rules have shown promise in managing feeding problems in young children. Feeding rules include scheduled mealtimes, proper feeding environments, and consistent procedures that support positive eating behavior. Research indicates that applying feeding rules can significantly reduce eating difficulties and positively affect children's nutritional status (Febriyanti et al., 2024; Munjidah & Rahayu, 2020). Moreover, complementary feeding practices such as caregiver modeling, positive social feeding environments, and consistent exposure to varied tastes have been associated with improved dietary intake and growth outcomes (De Cosmi et al., 2017; Masuke et al., 2021; Switkowski et al., 2022). These findings suggest that behavioral feeding interventions can be an essential component of early childhood nutrition strategies.

Despite the growing evidence supporting Tuina massage and feeding rules individually, there has been no research that integrates these two approaches. This integration has the potential to address both physiological and behavioral causes of poor appetite in toddlers, particularly in under-resourced communities such as Laha Village. Given the context-specific challenges and the urgent need to reduce stunting rates, exploring the combined effect of Tuina massage using virgin coconut oil and structured feeding rules is both relevant and necessary. Therefore, this study aims to investigate the impact of the combined intervention on improving toddlers' appetite as a strategic effort to prevent and reduce stunting in early childhood.

Methods

Research Design and Participants

This study employed a quasi-experimental design with a two-group pretest-posttest structure. The research involved 40 toddlers aged 12 to 36 months who had been identified as stunted and resided in Laha Village. Participants were divided into two equal groups: the intervention group received tuina massage with virgin coconut oil (VCO) combined with feeding rules, while the control group continued their usual routine without any intervention. The dependent

variable measured in this study was the toddlers' appetite, while the independent variables were tuina massage with VCO and feeding regulation.

Sampling Technique and Sample Size

The sampling technique used in this study was total sampling, in which all stunted toddlers who met the inclusion criteria were selected as participants. A total of 40 toddlers were involved, with 20 assigned to the intervention group and 20 to the control group. The selection ensured homogeneity in terms of age and stunting status to minimize potential bias between groups. Each group was treated as a parallel group with no cross-over or randomization due to ethical and logistical considerations in the field.

Intervention Procedure and Data Collection

Prior to intervention, the researchers obtained informed consent from the participants' caregivers and collected baseline data on weight, height, and stunting status. The intervention group received tuina massage combined with VCO application and feeding regulation for six consecutive days based on the established massage protocol. Appetite was assessed using a standardized questionnaire on Day 1 and again on Day 7. The control group did not receive any form of intervention but followed the same schedule for appetite assessment and received a souvenir as appreciation for their participation.

Instruments and Data Analysis

The instrument used to assess toddler appetite was a questionnaire that had been previously validated and tested for reliability (Nofitasari et al., 2021). The questionnaire consisted of structured items rated by caregivers to capture observable indicators of appetite changes. Data were analyzed using univariate statistics to assess central tendency, followed by normality tests using the Shapiro-Wilk method. Bivariate analyses were then conducted using paired t-tests or Wilcoxon tests for within-group comparisons and independent t-tests or Mann-Whitney U tests for between-group comparisons, depending on the data distribution.

Result

This section presents the research findings related to the impact of tuina massage using virgin coconut oil in combination with feeding rules on improving the appetite of stunted toddlers. The analysis is divided into two main parts to ensure clarity and depth in interpretation. First, the descriptive data present an overview of the respondent characteristics and their baseline appetite condition before the intervention. Second, the inferential results assess the effectiveness of the intervention using appropriate statistical tests to determine significant changes and group comparisons.

Participant Characteristics and Pre-Intervention Conditions

Descriptive statistics were used to describe the demographic background and baseline conditions of the respondents. A total of 40 stunted toddlers aged 12–36 months participated in the study, with data collected on age, gender, parental occupation, income level, and baseline appetite status. The interpretation of the tables in this section focuses on the underlying patterns and contextual relevance of the demographic data.

Table 1. Distribution of Respondents by Age

Age (Months)	N	%
12–24	28	70.0%
25–36	12	30.0%
Total	40	100.0%

The data show that a large majority of toddlers involved in the study were in the younger age bracket of 12–24 months. This age is crucial in child development as it represents a sensitive window for nutritional intervention. Early interventions during this phase have the potential to produce long-term improvements in health outcomes. The high percentage in this age group

suggests that the intervention was targeted at a period where appetite stimulation is most impactful.

Table 2. Distribution of Respondents by Gender

Gender	N	%
Boy	23	57.5%
Girl	17	42.5%
Total	40	100.0%

The distribution of respondents by gender was relatively balanced, though boys slightly outnumbered girls. A nearly even gender distribution helps minimize bias in interpreting the intervention's effectiveness across different sexes. Although gender may not directly influence appetite, certain cultural or caregiving practices related to gender could have indirect effects. Thus, acknowledging this balance provides context for analyzing broader intervention outcomes.

Table 3. Distribution of Respondents by Parents' Occupation

Occupation	N	%
Farmer	14	35.0%
Fisherman	17	42.5%
Honorer	2	5.0%
Merchant	7	17.5%
Total	40	100.0%

Occupational data indicate that most parents were engaged in informal or primary-sector jobs, particularly fishing and farming. This occupational structure may reflect rural socioeconomic settings where child nutrition is often a major concern. Limited access to diverse food sources and fluctuating income among these occupations may contribute to stunting and poor appetite. The occupational profile supports the relevance of conducting nutrition-focused interventions in such communities.

Table 4. Distribution of Respondents by Parents' Income

Income Level	N	%
Lower	40	100.0%
Upper	0	0.0%
Total	40	100.0%

All respondents were from lower-income families, highlighting the economic vulnerability of the study population. Poverty is a well-established risk factor for stunting, often resulting in insufficient dietary intake and inadequate caregiving. The uniformity of income status among participants strengthens the internal validity of the study by eliminating income as a confounding variable. Moreover, it emphasizes the importance of cost-effective interventions like tuina massage that can be adopted in low-resource settings.

Table 5. Appetite Status Before Intervention

Appetite Status	Intervention Group	%	Control Group	%
Decreased	20	100.0%	20	100.0%
Increased	0	0.0%	0	0.0%
Total	20	100.0%	20	100.0%

At the pre-test stage, all respondents in both the intervention and control groups exhibited decreased appetite. This baseline uniformity ensured comparability between groups and minimized selection bias in measuring the intervention's effect. Such a shared starting point strengthens the reliability of post-test comparisons. It also highlights the severity of the appetite issue across the entire study population.

Effect of the Intervention on Appetite

Inferential analysis was conducted to evaluate the impact of the tuina massage and feeding rules intervention. This includes comparison of pre–post appetite scores within and between groups using non-parametric statistical tests. The following results provide insight into the effectiveness and significance of the intervention.

Table 6. Appetite Status After Intervention

Appetite Status	Intervention Group	%	Control Group	%
Decreased	1	2.5%	20	100.0%
Increased	19	97.5%	0	0.0%
Total	20	100.0%	20	100.0%

Following the intervention, nearly all toddlers in the treatment group demonstrated increased appetite, while no such change was seen in the control group. This divergence underscores the substantial effect of tuina massage and feeding rules in stimulating appetite. The data reflect not only statistical significance but also meaningful clinical relevance. The findings point to a promising intervention for addressing appetite loss in undernourished children.

Table 7. Difference in Appetite Scores in the Intervention Group (Wilcoxon Test)

Time Point	N	Mean	SD	p-value
Pre-test	20	1.00	0.000	
Post-test	20	1.95	0.224	0.000

In the intervention group, there was a statistically significant improvement in appetite scores as measured by the Wilcoxon signed-rank test ($p < 0.001$). The mean appetite score increased markedly from 1.00 to 1.95 after the intervention. This shift indicates a strong within-group effect attributable to the treatment. The low standard deviation in the post-test further reflects consistency in response to the intervention.

Table 8. Difference in Appetite Scores in the Control Group (Wilcoxon Test)

Time Point	N	Mean	SD	p-value
Pre-test	20	1.00	0.000	
Post-test	20	1.00	0.000	1.000

In contrast to the intervention group, the control group exhibited no change in appetite scores before and after the observation period. The Wilcoxon test confirmed that the difference was not statistically significant ($p = 1.000$). This result validates the role of the intervention as the key differentiating factor. The control group's consistency underscores that improvements seen elsewhere were not due to external influences.

Table 9. Between-Group Comparison of Appetite Improvement (Mann–Whitney Test)

Group Comparison	N	Mean	Min–Max	SD	p-value
Intervention vs Control	40	0.48	0–1	0.506	0.000

The Mann–Whitney U test further confirmed a significant difference in appetite improvement between the intervention and control groups ($p < 0.001$). The mean change score of 0.48 in the intervention group compared to 0 in the control group highlights the measurable impact of the treatment. The effect size is not only statistically relevant but also carries clinical implications. This finding reinforces the value of non-pharmacological approaches in managing childhood appetite issues, particularly in resource-constrained environments.

Discussion

This study demonstrated a significant effect of combining tuina massage using virgin coconut oil (VCO) and the application of feeding rules on improving the appetite of stunted toddlers in Laha Village. Statistical tests confirmed the rejection of the null hypothesis, showing that the combined intervention successfully enhanced appetite among participants. Appetite scores

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increased substantially in the intervention group, while no change was recorded in the control group. These results emphasize the effectiveness of addressing both physiological and behavioral aspects of feeding through an integrated approach. Improvement in toddlers' appetite is expected to positively influence weight gain and height development, contributing to the long-term reduction of stunting prevalence (Mennella et al., 2021; Naila et al., 2021; I. B. Tiwery et al., 2023).

Feeding difficulties in toddlers are commonly caused by monotony in food choices and lack of parental knowledge regarding proper nutrition. Children aged 1 to 3 years are often still dependent on caregivers for feeding, exhibiting behaviors such as holding food in the mouth, refusing to eat, prolonged mealtimes, throwing food, or rejecting spoon-feeding. This phase is frequently referred to as the "food jag" period, during which children only eat selected foods or experience inconsistent appetite (Anggraeni et al., 2022; Munjidah, 2015). While often considered normal, prolonged feeding difficulties can lead to serious growth problems such as stunting. Addressing appetite loss during this critical stage of development is essential to prevent long-term nutritional deficits (Boah et al., 2019; Mennella et al., 2021; Prial et al., 2024).

Toddlers' natural curiosity and environmental exploration frequently distract them from food intake, reducing their focus during mealtime (Wardlaw & Hampl, 2007). In some cases, feeding difficulties are compounded by impaired spleen and digestive functions, which inhibit the efficient digestion of food and cause gastrointestinal retention. Tuina massage is a traditional Chinese medical technique that targets energy flow and blood circulation, particularly around the spleen and stomach, thereby enhancing digestive performance (Saidah & Kusumadewi, 2020). This massage includes methods such as gliding, pressing, rotating, tapping, and shaking at specific meridian points to stimulate physiological function without needles (Puspita et al., 2021). The intervention harmonizes internal energy (chi), which is believed to restore bodily balance and promote improved nutrient absorption (Zhen Huan Liu & Li Ting Cen, 2018).

Numerous empirical studies have validated the role of tuina massage in improving appetite among toddlers. A study reported significant results in increasing toddlers' appetite with a p-value of 0.000, indicating high statistical reliability (Wulaningsih et al., 2022). Another study confirmed similar outcomes with a p-value of 0.009, reinforcing the therapeutic potential of tuina (Munjidah, 2015). The findings align with previous research that also highlighted the effectiveness of tuina massage in alleviating feeding problems (Mohammad Shoim et al., 2006). The use of VCO in this study enhanced the comfort of the massage process and likely contributed to digestive stimulation and soothing effects on the child's gastrointestinal system (Laksono & Nursitiyaroh, 2023). These results suggest that tuina massage, especially when combined with VCO, is a promising non-pharmacological solution for appetite loss in early childhood.

The structured implementation of feeding rules also played a key role in improving toddlers' eating behavior and appetite. Feeding rules include consistent meal schedules, distraction-free eating environments, and non-coercive feeding procedures as outlined in early childhood nutrition guidelines. These practices discourage excessive snacking before meals and reduce the likelihood of children becoming full before proper food intake. Previous research demonstrated a significant improvement in toddler appetite with a p-value of 0.03 after applying feeding rules (Munjidah & Rahayu, 2020). A separate study further confirmed this effect with stronger significance ($p = 0.000$), showing that behavioral regulation is a critical determinant of successful feeding (Hijja et al., 2022).

The novelty of this study lies in its integrative approach, which combines tuina massage using VCO and structured feeding rules into a single, synergistic intervention. This combination targets both physiological impediments to digestion and behavioral inconsistencies in feeding, offering a holistic solution to appetite problems. Unlike previous studies that explored each intervention in isolation, this study provides new insights into the efficacy of a dual-approach model. The context of Laha Village—where the population predominantly works in farming and

fishing with low household income—makes the intervention highly relevant for resource-limited environments (UNICEF et al., 2023). These findings hold potential for scaling up similar low-cost, culturally appropriate interventions in community-based efforts to reduce child stunting (Kemenkes RI, 2022).

The results of this study offer practical implications for early childhood educators, health practitioners, and policymakers. Feeding rules can be introduced in early learning settings to support healthy mealtime behavior and appetite regulation. Meanwhile, Posyandu cadres and caregivers may be trained to apply Tuina massage using virgin coconut oil (VCO) as a culturally acceptable and affordable intervention. Studies show that structured feeding practices are associated with reduced stunting and underweight prevalence, especially when meal frequency and food diversity are maintained (Twabi et al., 2021). Integrating massage and feeding guidelines into local health programs can strengthen community-based strategies for malnutrition prevention.

Despite the positive outcomes, this study has several limitations that should be acknowledged. The short intervention duration (six days) and lack of randomization reduce its capacity to demonstrate sustained impact and generalizability. Appetite measurement relied on caregiver perceptions, which may introduce bias. Additionally, while massage therapy has proven effective in reducing feeding intolerance and promoting weight gain in preterm infants, its application in toddlers remains underexplored (Lu et al., 2020; Seiiedi-Biarag & Mirghafourvand, 2020). Evidence from enteral nutrition patients further supports massage's benefit on gastrointestinal function, yet more age-appropriate trials are needed (Ravishankar, 2022; J. Wang et al., 2023).

Future studies should employ randomized controlled trials with longer follow-up periods to assess whether increased appetite leads to measurable improvements in growth. It is also important to examine the comparative effectiveness of Tuina massage versus other traditional techniques familiar in local cultures. Research should consider parental knowledge, feeding style, and environmental factors as moderators of intervention outcomes (Kininmonth et al., 2023). Culturally responsive education for caregivers can improve implementation fidelity and enhance intervention uptake. This integrative model holds potential as a scalable, non-pharmacological strategy to address stunting, especially in low-resource contexts.

Conclusion

This study concludes that the combined intervention of tuina massage using virgin coconut oil (VCO) and structured feeding rules significantly improves the appetite of stunted toddlers in Laha Village. The intervention demonstrated a strong and consistent effect in enhancing appetite, with 97.5% of children in the intervention group showing marked improvements, while the control group exhibited no changes. This finding is especially relevant given the socioeconomic context of the community, where access to formal healthcare and pharmacological solutions is limited. The integration of physiological (tuina massage) and behavioral (feeding rules) components represents a novel, holistic, and culturally adaptive strategy for early stunting prevention. The use of VCO, a locally available product, further underscores the feasibility and sustainability of the intervention in similar low-resource settings.

The findings have significant implications for early childhood educators, healthcare practitioners, and policy-makers. For teachers and caregivers in early childhood education (PAUD), this study highlights the importance of understanding feeding behavior and collaborating with parents in promoting healthy routines that support children's appetite and growth. For public health policy, the intervention may be integrated into community-based nutrition programs such as Posyandu, as a non-pharmacological solution aligned with local cultural practices. Future studies are recommended to evaluate the long-term impact of this integrative approach on anthropometric outcomes (e.g., weight and height gain), cognitive development, and parenting behavior. Additionally, broader replication studies involving diverse geographic and demographic contexts are essential to validate generalizability. The

study was limited by its short intervention duration and localized sample; thus, longitudinal and multicenter designs are suggested for future research to assess sustained outcomes and program scalability.

Declarations

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Author contribution statement

All authors contributed to this research.

Ethical Considerations

This study has been ethically reviewed by the health research ethics committee of the Faculty of Public Health, Universitas Airlangga and declared ethically feasible with decision letter NO.208/EA/KEPK/2024.

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Conflict of Interest Statement

The researcher declares no conflict of interest.

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