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Effect of Citronella Aromatherapy on Appetite and Sleep Quality in Stunted Toddlers: A Community-Based Intervention Study

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Abstract

Stunting is a major global health issue linked to chronic malnutrition, digestive dysfunction, and inadequate sleep, all of which impair growth and nutrient absorption. Toddlers with poor sleep quality are twice as likely to experience stunting, highlighting the importance of behavioral and sensory interventions. Citronella Oil aromatherapy, containing active compounds such as citronellal and geraniol, has potential appetite-enhancing and relaxing effects through olfactory stimulation of ghrelin and the limbic system. This study aimed to evaluate the effect of Citronella Oil aromatherapy on appetite and sleep quality among stunted toddlers aged 2–3 years in the working area of UPTD Tepian Buah Health Center, Berau Regency. A pre-experimental one-group pretest–posttest design was applied, involving 55 participants selected through stratified random sampling. Appetite and sleep quality were measured using validated questionnaires, and data were analyzed using the Wilcoxon signed-rank test. Results showed a significant increase in mean appetite scores (from 37.40 to 44.76) and sleep quality scores (from 7.24 to 12.82) after seven days of Citronella Oil aromatherapy ($p < 0.05$). These findings indicate that Citronella Oil effectively improves both appetite and sleep quality in stunted toddlers through neuroendocrine and behavioral mechanisms. The intervention offers a safe, low-cost, and culturally appropriate complementary therapy that may strengthen early childhood growth and development programs. However, limitations include a small sample size, the absence of a control group, and a short intervention duration, which constrain generalizability. Future studies using randomized controlled and longitudinal designs are recommended to confirm these findings. Beyond its local implications, this research contributes to global efforts to identify sustainable, non-pharmacological strategies to reduce stunting and advance holistic child health in low- and middle-income countries.

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Introduction

Stunting, defined as impaired growth and development in children resulting from chronic malnutrition and repeated infections, characterized by a height or length below -2.00 standard deviations (z-score) of the World Health Organization (WHO) standards for their age and sex, presents a critical global health crisis. As a key indicator that jeopardizes the achievement of the Sustainable Development Goals (SDGs), stunting impacts over 148 million children under five globally and contributes to significant national economic losses due to diminished human capital potential. The chronic nutritional deficiency that leads to stunting can begin in utero and becomes visibly apparent by the age of two, resulting in long-term developmental, cognitive, and health consequences. Within this global landscape, Indonesia has long struggled with a high prevalence of stunting, placing the issue as a central priority in national health policy and community-level interventions.

The progression toward stunting is multifactorial and often begins before conception, primarily due to maternal conditions such as chronic energy deficiency, anemia, and inadequate nutrient intake during pregnancy, compounded by environmental factors like poor sanitation

and recurrent infections (Riskseddas, 2023). The manifestation of these conditions typically starts with weight faltering, which, if unaddressed, progresses to underweight, wasting, and ultimately stunting (Tarmizi, 2023). Despite extensive interventions focusing on nutrition and sanitation, these efforts have not fully addressed the behavioral and physiological dimensions of the problem. Among these, appetite and sleep quality play a crucial yet often overlooked role in sustaining the cycle of malnutrition and poor growth. Malnourished children commonly experience appetite dysregulation and sleep disruption, both of which impair growth hormone secretion and immune function, exacerbating stunting severity.

The magnitude of this crisis extends beyond global statistics. In Southeast Asia, Indonesia remains among the countries most affected, with a reported stunting prevalence of 30.8% in 2018 and a subsequent decline to 21.5% in 2023 following government-led interventions (Riskseddas, 2023). These achievements are commendable; however, the ambitious national target to reduce prevalence to 12.83% by 2024 remains challenging due to persistent regional disparities. Localized data reveal pockets of high prevalence that resist national trends, suggesting the need for context-sensitive strategies. In Berau Regency, for instance, the prevalence reached 23.0% in 2023, up from 21.66% in 2022, underscoring the need for innovative interventions beyond nutritional supplementation alone.

At the community level, health services in Segah District, particularly UPTD Puskesmas Tepian Buah, have documented 122 stunted children out of 690 measured in September 2024, revealing the persistence of the problem despite ongoing programs. The Local Supplementary Feeding Program (PMT Lokal), funded through the Special Allocation Fund (DAK) Non-Physical, aims to improve nutrition through locally sourced food and education on hygiene, breastfeeding, and sanitation (Kemenkes, 2023). Nevertheless, such initiatives may be less effective when behavioral barriers, such as poor appetite and irregular sleep, persist. Observations and informal interviews with ten mothers of stunted toddlers revealed that seven experienced severe feeding difficulties and disrupted sleep routines. At the same time, the remaining three, though reporting adequate food intake, still struggled with poor sleep environments. These findings highlight a complex behavioral dimension often missing from conventional nutritional interventions.

The long-term effects of stunting encompass weakened immunity, cognitive delays, and increased vulnerability to chronic diseases, while short-term consequences include impaired intelligence and brain development (Ambarwati & Hastono, 2020). Poor eating habits and diminished appetite directly reduce nutrient intake, worsening growth outcomes (Carolyn, 2023). Furthermore, chronic nutrient deficiency can damage the intestinal lining, leading to malabsorption and further nutrient loss. At the hormonal level, disruptions in ghrelin regulation have been identified as a critical mechanism behind appetite loss among stunted children (Trisnanda, 2024). Such physiological and neuroendocrine disruptions explain why even well-designed feeding programs may fail to achieve expected results, reinforcing the importance of behavioral and sensory-focused interventions.

Aromatherapy has emerged as a promising complementary approach to address the dual challenges of poor appetite and sleep disturbances. Citronella oil, derived from lemongrass, contains active compounds such as citronellal and geraniol that stimulate hunger and promote relaxation (Ariani, 2019; Handarini, 2021). These compounds act through both olfactory and systemic pathways, influencing the hypothalamus and limbic system to trigger appetite and relaxation responses (Simanungkalit, 2021). Compared to single-scent essential oils like lavender, citronella offers a complex blend of citrus, fruity, and woody notes that stimulate sensory engagement. Previous studies have shown its benefits in adults and limited pediatric contexts, but none have simultaneously assessed its effect on both appetite and sleep among stunted toddlers.

Sleep plays an essential role in growth regulation through the pulsatile secretion of Growth Hormone (GH) during deep Slow-Wave Sleep (SWS). Poor sleep patterns disrupt this secretion rhythm and significantly increase the risk of stunting (Dewi, 2019; Simanungkalit,

2021). The bidirectional relationship between nutrition and sleep underscores the need for holistic intervention strategies, as malnutrition can lead to sleep disturbances, while poor sleep further impairs growth. Therefore, improving sleep quality alongside appetite regulation may create a synergistic effect, enhancing growth recovery in stunted children. This insight underscores the importance of examining behavioral interventions that target both dimensions concurrently.

Grounded in this rationale, the present study proposes to evaluate the effect of Citronella Oil Aromatherapy on appetite and sleep quality among stunted toddlers in the working area of UPTD Puskesmas Tepian Buah. By integrating behavioral, physiological, and sensory mechanisms, this quasi-experimental study aims to provide empirical evidence for a low-cost, non-pharmacological intervention that complements existing nutritional programs. The study has the potential to strengthen the holistic stunting intervention framework and inform local health policy by offering a culturally relevant, safe, and sustainable complementary therapy to improve child growth and development.

Methods

Study Design and Setting

This study employed a quantitative quasi-experimental design (One-Group Pretest–Posttest Design). The design was selected based on practical and ethical considerations, as forming a homogeneous control group within the health center environment was not feasible. The intervention under study, Citronella Oil Aromatherapy, was expected to have potential health benefits, making it ethically inappropriate to withhold treatment from any participant. Moreover, establishing a control group would require additional logistical resources and could encounter resistance from caregivers whose children were not assigned to receive the intervention. Although the absence of a control group may limit internal validity due to possible confounding effects such as history, maturation, and testing bias, the design remains effective for detecting pre-to-post changes within the same group. These methodological constraints were accounted for in data interpretation and discussed further in the discussion section.

Table 1. Experimental Design Scheme (One-Group Pretest–Posttest Design)

Notation	Description
O_1	Measurement of appetite and sleep quality before intervention (Pre-test).
X	Intervention using <i>Citronella Oil</i> aromatherapy.
O_2	Measurement after intervention (<i>Post-test</i>) of appetite and sleep quality.
\rightarrow	Indicates the chronological order of the intervention and measurement process.

Design structure:

$$O_1 \rightarrow X \rightarrow O_2.$$

Sampling Technique and Sample Size

Sampling was conducted using stratified random sampling to ensure representation across age strata of toddlers: 12–24 months, 25–36 months, and 37–60 months. A total of 55 respondents participated in the study. The sample size was determined using a formula for two paired means (paired t-test or Wilcoxon test) with $\alpha = 0.05$ and $\beta = 0.20$ (power = 80%), referencing prior studies with comparable designs and interventions. The sampling process was adjusted to local population structures to ensure adequate representation of various age and developmental stages.

Table 2. Operational Definition of Variables

Variable	Operational Definition	Measurement Scale	Score Range	Instrument	Source
Citronella Oil Aromatherapy (X)	Administration of 3 drops of pure Citronella essential oil (<i>Cymbopogon nardus</i>) applied to the child's pillow or blanket every night before bedtime for 14 consecutive days, according to the established Standard Operating Procedure (SOP).	Nominal	Given (1) / Not Given (0)	SOP of Citronella Oil Aromatherapy	Researcher-developed
Appetite (Y₁)	Behavioral eating response of the child as reported by parents/ caregivers, measured before and after intervention, covering dimensions such as food responsiveness and satiety responsiveness.	Ordinal / Interval (total score)	18–90 (Likert 1–5 per item)	Child Eating Behavior Questionnaire (CEBQ), Short Version (18 items)	Adapted from Wardle et al., 2001
Sleep Quality (Y₂)	Total sleep duration, number of night wakings, and nap/night sleep duration within the last 24 hours, measured before and after intervention.	Ordinal	Categorized as Good / Poor based on cut-off points of total sleep time and night waking frequency	Brief Infant Sleep Questionnaire (BISQ)	Adapted from Sadeh, 1996

The CEBQ instrument (Short Version, 18 items) measured eight dimensions of eating behavior, such as food responsiveness and emotional undereating, while the BISQ (10 items) assessed sleep duration and nighttime awakenings. Both tools underwent forward and backward translation into Indonesian and were pilot-tested with 30 non-sample respondents to assess contextual relevance. The validity and reliability results yielded a CVI of 0.92, with Cronbach's Alpha coefficients of 0.85 (CEBQ) and 0.78 (BISQ), confirming internal consistency. Confounding variables controlled in the study included acute comorbidities, physical activity levels, and environmental stimulation, which were documented through exclusion criteria and a supplemental questionnaire.

Intervention Procedure and Data Collection

The intervention utilized pure, food-grade Citronella Oil Aromatherapy, administered by applying 3 drops nightly on the child's pillow or blanket for 14 consecutive days, approximately 15–30 minutes before bedtime. Parents or guardians implemented the intervention according to a standardized operating procedure (SOP) distributed by the researchers. An allergy test was conducted on each child's arm for the first three days to monitor potential skin or respiratory reactions, with no adverse effects recorded during the intervention.

Prior to implementation, ethical clearance and a research permit were secured from the ethics committee and the local Health Office. Informed consent was obtained after researchers explained the study objectives, potential benefits, and risks. The procedure consisted of three

stages: (1) pre-test (O_1), where parents completed the CEBQ and BISQ based on the previous seven days' observations; (2) intervention (X), involving Citronella Oil administration for 14 days; and (3) post-test (O_2), using the same instruments to capture changes in appetite and sleep. Enumerators, who were trained midwives and nurses from the community health center, collected data under direct supervision to ensure procedural uniformity and data integrity.

Data Analysis and Ethical Considerations

Data analysis was performed using SPSS version 20. Univariate analysis described respondent characteristics using frequencies, percentages, means, and standard deviations. Bivariate analysis began with normality testing using the Shapiro–Wilk test ($n < 50$) or Kolmogorov–Smirnov test ($n \geq 50$). When data followed a normal distribution, a paired t-test was applied; otherwise, the Wilcoxon Signed-Rank Test was used. The threshold for statistical significance was set at $\alpha = 0.05$, and differences were deemed significant when $p \leq 0.05$. The ethical principles of autonomy, beneficence, nonmaleficence, and confidentiality were maintained throughout the research process.

Result

Participant Characteristics

A total of 55 mothers of stunted toddlers aged 2–3 years participated in this study. All respondents were residents of the UPTD Puskesmas Tepian Buah working area, Segah District, Berau Regency, East Kalimantan. The participants represented a relatively homogeneous population in terms of cultural and socioeconomic backgrounds, reflecting the demographic characteristics of families served by local public health centers in the region. Most mothers acted as primary caregivers, overseeing the children's nutritional intake and sleep routines, which are essential behavioral aspects related to stunting. The study included only toddlers who met the inclusion criteria, specifically those with confirmed stunting and without acute comorbid conditions. Since no separate demographic table was provided, the descriptive summary is presented narratively to reflect participant distribution and context within the local community health framework.

Descriptive Analysis

The descriptive analysis focused on the two primary behavioral outcomes —appetite and sleep quality — before and after the administration of Citronella Oil Aromatherapy. Based on data from 55 respondents, the mean appetite score before the intervention was 37.40, and after 14 days of Citronella Oil Aromatherapy, it increased to 44.76. The median appetite score improved from 39.00 to 45.00, with a reduction in standard deviation from 5.148 to 3.717, indicating greater consistency in responses post-intervention. The minimum appetite score rose from 29 to 35, and the maximum from 47 to 49, showing that all participants experienced a positive shift. These findings suggest that Citronella Oil Aromatherapy effectively enhanced appetite, potentially through its active compounds, citronellal and geraniol, which influence hypothalamic ghrelin secretion.

Table 3. Frequency Distribution of Appetite Before and After the Administration of Citronella Oil Aromatherapy

Category	Mean	Mean	Median	SD	SE	Min	Max
Appetite Before and After the Administration of Citronella Oil Aromatherapy	Pre Test	37,40	39,00	5,148	0,694	29	47
	Post Test	44,76	45,00	45,00	0,501	35	49

The descriptive data on sleep quality showed a similar pattern of improvement following the intervention. The mean sleep quality score before the intervention was 7.24, increasing to 12.82 after 14 days of consistent exposure to Citronella Oil Aromatherapy. The median scores also improved from 8.00 to 13.00, with reduced standard deviations from 1.360 to 1.278, and the

score range narrowed from 5–9 to 10–14. This change indicates more uniform improvement across participants. The enhancement in sleep quality is attributed to the relaxation effect of Citronella Oil's aroma, which stimulates the limbic system and promotes the release of enkephalins, leading to better sleep onset and continuity. These findings reinforce the potential of aromatherapy as a non-pharmacological complementary therapy for improving behavioral aspects associated with stunting.

Table 4. Frequency Distribution of Sleep Quality Before and After the Administration of Citronella Oil Aromatherapy

Category	Mean	Median	SD	SE	Min	Max
Pre-test	37.40	39.00	5.148	0.694	29	47
Post-test	44.76	45.00	3.717	0.501	35	49

Normality Test and Statistical Assumption Check

Before performing inferential statistical analyses, data normality was tested to determine the appropriate analytical method. The Kolmogorov–Smirnov test was applied to assess the distribution of both appetite and sleep quality variables before and after the Citronella Oil Aromatherapy intervention. The results showed that the pre- and post-test data for both variables had p-values less than 0.05, indicating that the data were not normally distributed. Specifically, appetite before treatment had a p-value of 0.000, appetite after treatment had a p-value of 0.000, sleep quality before treatment had a p-value of 0.000, and sleep quality after treatment also had a p-value of 0.000. These findings confirm that the assumption of normality was violated, requiring the use of a non-parametric test for subsequent analyses.

Violating the normality assumption suggests that the data exhibit skewed distributions, which may reflect individual differences in response to the intervention. The presence of non-normal data is not uncommon in small-scale behavioral studies involving heterogeneous samples. In such conditions, non-parametric methods provide more robust results, as they do not rely on assumptions of normal distribution. Therefore, the Wilcoxon Signed-Rank Test was selected for inferential analysis to examine the effect of Citronella Oil Aromatherapy on both appetite and sleep quality. This adjustment ensures that the analytical approach remains valid and statistically sound, given the characteristics of the collected data.

Table 5. Normality Test Results (Kolmogorov–Smirnov)

	Statistic	df	Sig
Pre Appetite	0,186	55	0,000
Post Appetite	0,198	55	0,000
Pre Quality Sleep	0,222	55	0,000
Post Quality Sleep	0,259	55	0,000

Inferential Analysis

The inferential analysis employed the Wilcoxon Signed-Rank Test to evaluate the effect of Citronella Oil Aromatherapy on appetite and sleep quality among stunted toddlers aged 2–3 years. Given the non-normal distribution of data, this non-parametric test was chosen to ensure reliable interpretation of pre- and post-intervention differences. The results demonstrated a statistically significant improvement in appetite following the intervention. The test showed no negative ranks, indicating that none of the respondents experienced a decrease in appetite scores. All 55 participants exhibited positive changes, with a mean rank of 28.00 and a sum of ranks of 1540.00. The calculated Z-value was -6.457, with an asymptotic significance (2-tailed) of 0.000 ($p < 0.05$), indicating a strong and consistent increase in appetite scores following the administration of Citronella Oil Aromatherapy.

Table 6. Wilcoxon Test Results: Effect of Citronella Oil Aromatherapy on Appetite

		N	Mean Rank	Sum of ranks	P Value
Posttest-Pretest	Negative Ranks	0 ^a	0,00	0,00	
	Positive Ranks	55 ^b	28,00	1540,00	
	Ties	0 ^c			0,000
	Total	55			

A similar pattern was observed in the sleep quality variable. The Wilcoxon Signed-Rank Test indicated significant improvement in post-test scores compared to pre-test scores. As with the appetite data, there were no negative ranks, meaning that none of the respondents experienced a decline in sleep quality following the intervention. All 55 toddlers demonstrated positive changes, with a mean rank of 28.00 and a total rank sum of 1540.00. The Z-value of -6.531 and p-value of 0.000 ($p < 0.05$) confirmed a statistically significant effect of Citronella Oil Aromatherapy on improving sleep quality among stunted toddlers.

Table 7. Wilcoxon Test Results: Effect of Citronella Oil Aromatherapy on Sleep Quality

		N	Mean Rank	Sum of Ranks	P Value
Posttest-Pretest	Negative Ranks	0 ^a	0,00	0,00	
	Positive Ranks	55 ^b	28,00	1540,00	
	Ties	0 ^c			0,000
	Total	55			

Collectively, these findings highlight that Citronella Oil Aromatherapy significantly enhanced both appetite and sleep quality in stunted toddlers, suggesting its effectiveness as a complementary behavioral and sensory intervention. The absence of negative ranks across both outcomes indicates a uniformly positive response to aromatherapy, which may be attributed to the physiological and neuroendocrine mechanisms triggered by citronella's active components. This improvement supports the hypothesis that non-pharmacological interventions targeting behavioral regulation can meaningfully contribute to the recovery of children with stunting when integrated into primary health care practices.

Discussion

The study revealed that Citronella Oil aromatherapy effectively enhanced appetite and sleep quality among stunted toddlers. The increase in appetite scores from 37.40 to 44.76 and the improvement in sleep quality from 7.24 to 12.82 demonstrate consistent benefits across two fundamental physiological domains. This dual improvement indicates that *Citronella Oil*, through olfactory stimulation, can influence both metabolic and neuroendocrine mechanisms that regulate hunger and sleep. These findings align with other clinical results confirming citronella's dual action on both feeding behavior and relaxation (Despriyanti et al., 2024; Kasmirah et al., 2025; Yuliatr et al., 2023). Such evidence confirms the therapeutic potential of aromatherapy as a safe, non-pharmacological intervention to support child growth and development.

The observed appetite enhancement may be attributed to the actions of citronellal and geraniol, active compounds in *Citronella Oil* known to stimulate the olfactory and limbic systems. These components likely activate parasympathetic activity, leading to increased ghrelin secretion that promotes hunger. This mechanism supports the study's statistically significant outcomes and aligns with prior research highlighting the role of olfactory stimuli in appetite regulation during early childhood (Nguyen, 2023; Sumariati et al., 2023). In line with these findings, geraniol and citronellol have been shown to modulate AMPA receptor activity and enhance feeding-related neurotransmission (Medeiros et al., 2018; Qneibi et al., 2020). Consistent with previous evidence documenting appetite improvement via topical and inhalation-based approaches, the present study provides further support for citronella's neurosensory effect (Novadelaa & Sarib, 2020; Saidah & Dewi, 2020).

Beyond its effect on appetite, aromatherapy also produced significant improvements in sleep quality, as evidenced by reduced variability in scores and increased minimum and maximum values post-intervention. This suggests that the calming aroma facilitated a more stable sleep pattern among toddlers. Mechanistically, the thalamic stimulation of enkephalin release may explain this relaxation response, aligning with theories of parasympathetic activation and neurochemical regulation of sleep (Idhayanti, 2022). The enhanced parasympathetic activity induced by citronellal and geraniol could normalize circadian and hormonal rhythms, as supported by prior trials showing that essential oils affect GABAergic and serotonergic pathways related to sleep (Cheng et al., 2022; Liu, 2025; Sattayakhom et al., 2023). These neuroendocrine modulations underscore citronella's potential to restore the physiological balance necessary for restorative sleep, thereby indirectly supporting growth hormone regulation.

The interrelation between appetite and sleep observed in this study underscores a cyclical physiological balance. Adequate sleep enhances metabolic stability and appetite regulation, while sufficient nutrition supports better sleep quality. This reciprocal relationship aligns with findings from systematic reviews linking essential oil inhalation to reduced sympathetic activity and improved energy metabolism (Fang et al., 2024; Zhang et al., 2025). Thus, the dual improvement observed among participants indicates that interventions targeting both aspects simultaneously, such as citronella aromatherapy, can yield more comprehensive developmental benefits by bridging nutritional and behavioral health (Kasmirah et al., 2025; Nguyen, 2023).

Nevertheless, individual variations in responsiveness were evident, as several toddlers showed only minimal increases in scores. Factors such as environmental conditions, parental routines, or sensory sensitivity may have influenced these outcomes. Similar heterogeneity has been reported in previous studies, in which home environments and caregiver consistency have been shown to shape aromatherapy outcomes (Idhayanti, 2022; Sumariati et al., 2024). Such contextual dependence emphasizes that, while aromatherapy is beneficial, its success depends on consistent caregiver practices and environmental reinforcement, an insight echoed in pediatric aromatherapy trials in Indonesia and Southeast Asia (Despriyanti et al., 2024; Yuliatri et al.).

The current findings contribute to theoretical and practical understandings of sensory-based interventions in child health. Theoretically, they reaffirm the role of the olfactory-limbic system in modulating appetite and sleep behaviors, situating aromatherapy within a broader psychophysiological framework (Sattayakhom et al., 2023). Practically, this study offers a low-cost, culturally appropriate strategy that health practitioners and caregivers can apply to improve daily child routines. Consistent with community-based evidence from Sumariati et al. (2024) and Kasmirah et al. (2025), citronella aromatherapy emerges as a non-invasive and adaptable intervention suitable for integration into public health programs targeting stunted toddlers (Kasmirah et al., 2025; Sumariati et al., 2024).

Despite these promising outcomes, certain limitations persist, including a small sample size, the absence of a control group, and a short observation period. These factors constrain generalizability and long-term interpretation. Future studies should adopt randomized controlled designs with larger, more diverse samples to confirm these findings (Fang et al., 2024; Zhang et al.). Additionally, longitudinal investigations exploring the sustainability of appetite and sleep improvements and comparing citronella directly with other essential oils, such as lavender and geraniol, would strengthen the evidence base (Cheng et al., 2022; Zhang et al.). Such research would clarify the mechanistic pathways underlying citronella's psychophysiological effects and enhance its application in early childhood growth and development programs.

Conclusion

The results of this study demonstrate that Citronella Oil aromatherapy significantly improved both appetite and sleep quality among stunted toddlers aged 2–3 years, suggesting its effectiveness as a safe, non-pharmacological intervention to support early childhood growth

and development. The observed increase in appetite and sleep scores indicates that olfactory stimulation through active compounds such as citronellal and geraniol can positively influence the limbic system, promoting hormonal balance related to hunger and relaxation. These findings contribute to the growing evidence supporting sensory-based complementary therapies in pediatric health and offer practical implications for community health programs seeking low-cost, culturally acceptable interventions to enhance nutritional and behavioral well-being. While the study provides promising insights, its limitations—including a small sample size, lack of a control group, and short observation period—highlight the need for further randomized controlled and longitudinal research to confirm these results and evaluate their long-term sustainability across different populations.

Declarations

Author Contribution Statement

All authors contributed equally and approved the final manuscript.

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Data are available from the corresponding author upon reasonable request.

Declaration of Interests Statement

The author declares no conflict of interest.

Additional Information

No additional information is available.

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