



Moringa Leaves-Added Food, Baby Massage, and Tui Na Massage to Reduce Stunting Rate on Young Children in Indonesia

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Abstract

Stunting remains a significant public health issue in Indonesia, particularly in Aceh Province, where the prevalence reached 33.18% in 2021—exceeding the WHO threshold. In North Aceh District, 14.3% of children under five were stunted, with Simpang Keramat District reporting one of the highest rates (35%). This study aimed to evaluate the effectiveness of a combined intervention—Moringa leaf-supplemented food within a balanced diet, baby massage, and Tui Na massage—in improving the nutritional status of stunted children aged 0–2 years. A quasi-experimental pre-post design was used, involving 50 stunted children divided equally into treatment and control groups. The intervention was conducted over 2.5 months. Paired t-test results showed significant increases in weight ($t_{24} = -6.656, p < .000$) and height ($t_{24} = -3.244, p < .003$) in the treatment group compared to the control group. These findings suggest that combining dietary fortification using locally available Moringa leaves with physical stimulation through massage therapy can effectively enhance growth outcomes. Given the multifactorial nature of stunting, this study recommends that nurses and health practitioners incorporate both nutrition-based interventions and sensory-stimulating therapies to address growth delays in young children, particularly in high-risk areas such as Aceh.

Introduction

Demographics are more susceptible to dietary deficiencies and diseases. Toddlers are particularly vulnerable to malnutrition in terms of both body weight and height (De and Chattopadhyay, 2019; Dipasquale *et al.*, 2020). The consequences of inadequate nutritional intake are multifaceted and include growth impairment. This condition is characterized by suboptimal functioning of bodily organs (Awuchi *et al.*, 2020; Kiani *et al.*, 2022; Setiani *et al.*, 2024). Furthermore, children may exhibit compromised immunity, increasing susceptibility to various ailments, such as respiratory tract infections, diarrhea, and fever. Consequently, a physical state prone to illness may result in less qualified human resources

(HR) (Sampah & Hackam, 2020; Singh *et al.*, 2022; Amoadu *et al.*, 2024). Stunting, defined as a failure to thrive in young children due to chronic malnutrition, results in children being shorter than expected for their age (Scheffler *et al.*, 2020; Ali, 2021; Schneider, 2025). Stunting manifests as a toddler's inability to thrive due to persistent malnutrition, causing the child to be shorter than anticipated for their age. Malnutrition occurs from infancy, encompassing the prenatal and early postnatal stages; however, its effects typically become apparent when the child reaches two years of age (Morales *et al.*, 2023; Najib *et al.*, 2023; Tjandrawinata *et al.*, 2025).

Stunting is a condition observed in children aged 0–59 months when their height-

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for-age falls below minus two standard deviations ($<-2SD$) from the World Health Organization (WHO) median criterion. This condition results in impaired brain development and adversely affects cognitive capacity (Scheffler & Hermanussen, 2022; Priyantini *et al.*, 2024; Amaha, 2025). Consequently, this diminishes the potential for higher educational attainment and reduces opportunities for enhanced income prospects. Moreover, children who survive stunting exhibit a propensity towards obesity and an increased likelihood of developing non-communicable diseases (NCDs), including hypertension, diabetes, and cancer (Rachmah *et al.*, 2021; Kamal, 2022; Karlsson *et al.*, 2022; Naga Rajeev *et al.*, 2022; Nugroho *et al.*, 2023).

The stunting prevalence in Indonesia exceeds the World Health Organization (WHO) threshold by 20%, with particularly concerning rates in Aceh Province. In 2022, 148.1 million (22.3%) children under 5 years of age exhibited insufficient height for their age (stunting), 45.0 million demonstrated insufficient weight for their height (wasting), and 37.0 million (5.6%) exhibited excessive weight for their height (overweight) (WHO, 2023; Setyawati *et al.*, 2024). The Indonesian Nutrition Case Study 2021 revealed that Aceh Province has the highest rate of stunting in Indonesia at 33.18% (Sakti *et al.*, 2023; Fitriahadi *et al.*, 2024). According to the Indonesian Ministry of National Development Planning (Bappenas) and the United Nations International Children's Emergency Fund (UNICEF) in 2018, stunted growth is attributed to chronic malnutrition throughout a child's first 1,000 days of life. Multiple factors contribute to stunting among young children, including familial and environmental factors that influence their nutritional status. Insufficient nutrient intake and recurrent illnesses result in decreased nutritional status. Consequently, environmental factors, family conditions, and behaviors that facilitate infection affect toddler nutrition. The calorie and protein per capita per day for Indonesian children appear to be significantly lower than the Recommended Nutrient Intake (RNI) for typical children and those with stunting. Persistent problems may develop if this situation continues for an extended period (Kohl *et al.*, 2022; Hawa *et al.*, 2024; Nyarko *et*

al., 2024).

The Indonesian Central Bureau of Statistics (2023) reported that 40,762 young children in North Aceh District, 14.3% of whom exhibited stunting. This positions North Aceh as the focal point for addressing the issue of stunting in Aceh Province, particularly in three sub-districts with the highest prevalence: Langkahan (35.29%), Simpang Keramat (35%), and Baktiya (34.48%). In 2022, the North Aceh District Government expanded the scope of its stunting intervention program for young children. The program now encompasses 40 hamlets distributed among 27 sub-districts, an increase from the previous coverage of 20 villages. Healthcare professionals and community health clinics in North Aceh have implemented stunting interventions. Consequently, a novel approach or combination of interventions is necessary to enhance the height and weight of young children with stunting.

Sutrisna *et al.* (2023) concluded that children who received the Moringa leaves intervention experienced higher weight gain than the control group. In the intervention group, 80% of toddlers exhibited weight gain of ≥ 2 kg, while only 15% demonstrated such gain in the control group. Statistical analysis indicated that the administration of Moringa leaves effectively increases the weight of young children in Mampree Village, Syamtalira Aron District, North Aceh Regency. Moringa is a plant rich in macro and micronutrients and is commonly cultivated in Aceh. The nutrients contained in Moringa leaves have been demonstrated to enhance the growth of young children. Consumption of Moringa leaf extract aids in ameliorating poor nutrition in young children, either through incorporation into weaning foods, direct consumption, or processing into complementary foods.

Based on research conducted by Yuniastuti *et al.* (2023) in The Effect of Providing Supplementary Food Based on Moringa Leaves and Sea Fish on Serum Zinc Levels of Stunting Young Children in Sedan, Rembang Regency in 2022, a study was conducted on 30 toddlers with stunting and severe stunting nutritional status in the Sedan Community Health Center working area of the Rembang Regency. For 63

days, the toddlers were administered additional food based on moringa leaves and selfishness. Following the intervention, the zinc levels in the blood and the mean height of the toddlers increased. Additionally, a significant correlation between zinc levels and toddler height was observed, suggesting that elevated zinc levels are closely associated with increased height. Research by Sutrisna *et al.* (2023a) investigated the efficacy of developing a culture-based dietary intervention by providing moringa leaf products through fortification in treating stunted toddlers. The quasi-experimental study utilized a sample size of 50 stunted toddlers divided into two groups: 25 in the treatment group and 25 in the control group. The findings demonstrated that the height of toddlers increased following the implementation of the dietary culture development by providing moringa leaf products via fortification. On average, toddlers' height increased by 2.9 cm. Based on the results of the paired sample t-test, a significance value of $0.003 < 0.05$ was obtained, indicating the effectiveness of developing a dietary culture by providing moringa leaf products through fortification in addressing stunting in toddlers within the Simpang Keramat Community Health Centre Working Area.

Research conducted by Sutarmi *et al.* (2022) regarding Baby Massage Intervention as an Effort to Prevent Stunting in Toddlers demonstrated that baby massage benefits include enhanced growth (weight and body length) and development (social and motor development). Baby massage may be utilized as a nursing intervention to mitigate the risk of toddler stunting. A randomized controlled trial conducted by Erçelik and Yilmaz (2023) examined the impact of infant massage on growth parameters and maternal-infant bonding. The study involved 60 healthy term infants and their mothers, who were randomly assigned to either a massage group or a control group. The massage group received online training and performed infant massage for 20 weeks. Results showed that infants in the massage group experienced significantly greater weight gain by the eighth week ($p = 0.006$) and increased height by the twentieth week ($p = 0.05$) compared to the control group. A

systematic review and meta-analysis conducted by Mollà-Casanova *et al.* (2023) evaluated the effects of massage therapy—both alone and in combination with passive mobilizations—on weight gain and the duration of hospital stay in preterm infants. The study included randomized controlled trials that compared massage therapy interventions with standard care. The findings revealed that massage therapy combined with passive mobilizations significantly improved weight gain (standardized mean difference [95% CI]: 0.67 [0.31, 1.02]) and reduced the length of hospitalization (0.53 [0.10, 0.97]) in preterm infants. However, massage therapy alone did not demonstrate a statistically significant effect on weight gain (1.14 [−0.22, 2.49]).

Ningsih and Ramadhena (2023) investigated the effect of Tui Na massage on weight gain in young children in the Karawang Regency. The study population comprised 35 respondents who underwent Tui Na massage therapy in the Rengasdengklok and Karawang Districts. Bivariate analysis was conducted to examine the effect of Tui Na massage on increasing body weight in young children. The Wilcoxon signed-rank test yielded a p-value of 0.000, indicating a statistically significant impact of Tui Na massage on body weight in young children in the Karawang Regency. These findings suggest that Tui Na massage effectively promotes weight gain in young children. This study aimed to address the prevalence of stunting in Simpang Keramat District by modifying the interventions administered to children with stunting. The revised interventions focused on enhancing nutritional status to more effectively manage young children with stunting compared to existing methods. These interventions encompassed the provision of a nutritionally balanced diet supplemented with moringa leaves and applying massage therapy and Tui Na massage therapy to stimulate appetite.

Method

This study employed a quasi-experimental design. In this investigation, young children's weight and height were measured before the intervention. The treatments administered to modify the model included the provision of moringa leaf-supplemented food in a nutritionally balanced

diet, massage therapy, and Tui Na massage therapy for appetite stimulation. The young children's height and weight gain were measured following treatment completion. The study sample comprised stunted young children. Data and measurements were obtained from participants in Simpang Keramat Village and its Community Health Center Working Area. Independent stunting management interventions were implemented in the form of control, quality, and quantity instruments by modifying weaning food treatment, traditional massage therapy, and Tui Na massage therapy to enhance appetite. The incentive provided to participants was formula milk for their children. The researcher ensured the confidentiality of the participant's data by utilizing only the initials of the participant's name on the data collection sheet, and the researcher maintained the confidentiality of the data obtained in the study by restricting access to the subject data from other parties. The interview with each participant took approximately 20 minutes to get information on local weaning foods, diet, massage therapy conducted twice a week, and tui na massage for appetite for six consecutive days, and repeated one week apart. The weight and height of all participants were re-examined in both the intervention and control groups.

The research subjects were divided into two groups: the intervention group and the control group. The intervention group was given treatment in the form of a modified model through the provision of locally based complementary foods that are more nutritious, dietary regulation, infant massage therapy, and Tui Na massage. Before the treatment, an initial measurement of the child's weight and height was carried out, which was then re-measured after 2.5 months of therapy to see the changes. Meanwhile, the control group only received the usual care generally given, namely a balanced diet without additional interventions, as in the intervention group. Weight and height measurements in the control group were carried out at the beginning of the study and again after 2.5 months to compare the results with the intervention group. Purposive sampling was used to select 50 children aged 0-2 years from Simpang Keramat Village, North Aceh District, Aceh Province, Indonesia. The sample in this

study comprised 25 children with stunting in the treatment group who received moringa leaf-supplemented food in their nutritionally balanced diet, infant massage therapy, and Tui Na massage. Conversely, 25 children with stunting in the control group received only a nutritionally balanced diet. The ratio of the intervention group to the control group was 1:1.

This study utilized a comprehensive approach to address stunting issues among children at the village community level. The process commenced with a systematic effort to understand and address the nutritional challenges experienced by children. The initial stages of the study involved meticulous preparation. The research team first obtained ethical approval from the relevant institution to ensure that all research procedures adhered to the moral standards of healthcare research. Upon receiving approval, we contacted local health authorities, particularly village midwives, to identify children experiencing stunting. The research team was formed multidisciplinary and comprised primary researchers, research assistants, community health workers, and specialized massage therapists. Before the commencement of the study, all team members underwent comprehensive training. They were instructed on child anthropometric measurement techniques, massage therapy protocols, nutritional intervention preparation, and data collection and recording methodologies.

Nutritional intervention focused on utilizing moringa leaves, renowned for their nutritional density. Moringa leaves were procured from reputable local sources and subjected to thorough cleansing, desiccation, and pulverization into a fine powder. Nutritionists subsequently incorporated moringa leaf powder into complementary pediatric foods, ensuring nutritional consistency and dietary variation. An additional critical component of this study was massage therapy. Two distinct massage modalities were administered: generalized infant massage and Tui Na therapy. Infant massage was performed bi-weekly for 2.5 months, with each session lasting approximately 20-30 minutes. Tui Na therapy was implemented intensively for six consecutive days, followed by a one-week

hiatus, and then repeated. This therapy was specifically designed to stimulate children's appetite.

The measurements were conducted with a high degree of precision. Before and following the intervention, the research team measured the children's height and weight using standardized and calibrated equipment. Each measurement was performed by trained research assistants to ensure data accuracy. Participant adherence is a critical focus. Community support groups, field study teams, and community service student groups actively monitored the continuity of the intervention. They tracked therapy attendance, daily nutritional supplement consumption, and participation in massage therapy. Throughout the study, the research team actively engaged with children with stunting and their families. This interpersonal approach not only facilitated the collection of accurate data but also fostered community trust and engagement. Research integrity principles were held in high regard. The research team was committed to maintaining data credibility, dependability, confirmability, and transferability. Every step was meticulously documented, and each observation, intervention, and change was

recorded. With this comprehensive approach, the research aimed to collect data and provide tangible interventions that could address stunting problems at the community level.

Result and Discussion

The research findings were derived from a sample of 50 respondents, comprising 25 individuals in the treatment group and 25 in the control group. Respondent characteristics were categorized into four variables: young children's gender, parents' occupation, and parents' education level. In the treatment group, female children constituted the majority, accounting for 13 (52%) participants, whereas the control group was predominantly male, with 15 (60%) participants. The primary occupation among parents in both groups was fishing, with nine individuals (36%) in the treatment group and 11 (44%) in the control group engaged in this profession. Regarding parental education, both groups exhibited a similar pattern, with high school graduates forming the most significant subset, with 17 (68%) in the treatment group and 19 (76%) in the control group. A detailed overview of the participants' characteristics is presented in Table 1.

Table 1. Respondents Characteristics (n=50)

Respondents' Characteristics	Treatment Group		Control Group	
	n	%	n	%
Young children Gender				
Man	12	48	15	60
Woman	13	52	10	40
Parents' Job				
Construction Workers	6	24	7	28
Civil Servants	5	20	4	16
Fisherman	9	36	11	44
Farmer	4	16	3	12
Housewives	1	4	0	0
Parental Education				
Elementary School	1	4	2	8
Junior High School	6	24	4	16
Senior High School	17	68	19	76
Bachelor	1	4	0	0

Table 2. Comparison of Toddlers' Weight and Height Gains Before and After Given Treatments Using Paired Sample t-test (n=50)

Characteristics	Mean	Std Deviation	t	P value*
Treatment Group				
Weight Before (kg)	11,160	1,3904	-6,656	0,000
Weight After (kg)	11,640	1,4347		
Height Before (cm)	87,192	7,3644	-3,244	0,003
Height After (cm)	90,028	7,4700		
Non-Treatment Group				
Weight Before (kg)	9,608	1,6894	0,989	0,332
Weight After (kg)	9,432	1,5771		
Height Before (cm)	79,012	13,5747	-1,159	0,258
Height After (cm)	81,052	8,5675		

* Paired t-test

Based on the results of research conducted by analysis, several examinations revealed that the number of participants utilized in this study was 50 stunted young children residing within the Simpang Keramat Community Health Center Working area. The sample was divided into a treatment group of 25 stunted young children and a control group of 25 stunted young children. The samples in this study were then examined for several characteristics, including sex, occupation, and parental education level. The majority of participants in the treatment group were young female children, comprising 13 stunted young children (52%). Conversely, 15 young male children (60%) were included in the control group (Table 1).

Regarding the occupational characteristics of the parents, the majority of parents in the treatment group, 9 individuals (36%), were employed as fishermen. Similarly, the majority in the control group, 11 individuals (44%), were also used as fishermen. Characteristics of the parents' educational level indicated that high school graduates constituted the majority in the treatment group (17 or 68%) and the control group (19 or 76%). Based on the results of the bivariate analysis, it was found that among the 50 samples, there was a significant difference before and after the experimental period between the stunted young children in the treatment and control groups.

In the treatment group, young children's body weight before intervention had a mean value of 11.160 kg, and after intervention had a mean value of 11.640 kg. Thus, the difference in mean body weight before and after intervention was 0.48 kg. This indicates that there was weight gain in stunted young children in the treatment group. In the control group, the mean body weight of the stunted young children was 9.608 kg. Their body weight after 2.5 months was measured again and had a mean value of 9.432 kg. Thus, the difference in mean body weight before and after the experiment was -0.176 kg. This indicated a decrease in body weight of 0.176 kg in the stunted young children in the control group (Table 2).

Regarding body height, before applying the interventions to stunted young children, the mean height was 87.192 cm. Following treatment, the mean height of the stunted young children was 90.028 cm. Consequently, the difference in the mean height before and after treatment was 2.836 cm. This indicates that the treatments resulted in an increase in height among the stunted young children. In the control group, the mean initial height of previously stunted young children was 79.012 cm. After a 2.5-month observation period without any interventions administered to this group, the mean height of the young children was 81.052 cm. However, the difference in mean height before and after the 2.5-month

period was 2.04 cm, representing only a modest height gain (Table 2).

The nutritional status of young children improved following the interventions, as evidenced by post-treatment increases in weight and height among stunted young children. Specifically, stunted young children exhibited measurable gains in weight and height after the interventions compared to their pre-treatment measurements. On average, the weight of young children increased by 0.48 kg, while the mean height of young children post-intervention increased by 2.836 cm. The interventions administered to the stunted young children comprise nutritionally enhanced weaning foods (moringa leaves combined with local foods), infant massage, and Tui Na massage therapy, which are recognized to stimulate appetite in young children and demonstrate efficacy in enhancing eating behavior and physical development, thereby improving the nutritional status of stunted young children. In the non-intervention group of stunted young children, after 2.5 months, the toddlers' height increased marginally by 2.04 cm, while their weight decreased by 0.176 kg (Table 2).

The study results found that in the Treatment Group, the output of pair 1 produced a significance value of 0.000 (sig. < 0.05). As a result, it can be concluded that there is a statistically significant difference between the weight of young children before and after the treatment given in developing a model for stunting management through the provision of local complementary foods, infant massage, and Tui Na massage therapy to increase appetite. Furthermore, the output of pair 2 produced a significant value of 0.006 (sig. < 0.05), which indicates a statistically significant difference between the height of toddlers before and after the treatment given in developing a model for stunting management. This model combines local complementary foods, eating habits, infant massage, and Tui Na massage therapy for appetite stimulation (Table 2). In the Non-Treatment Group, the output of pair 3 produced a significant value of 0.332 (sig. > 0.05), indicating no statistically significant difference in toddler weight before and after 2.5 months. In addition, the output of Pair 4 produced an essential value of 0.258 (sig. > 0.05),

indicating no statistically significant difference in toddler height before and after 2.5 months. The significance values (2-tailed) obtained were 0.000 and 0.003, both < 0.05. This indicates a significant influence on the experimental group that received treatment to develop a stunting management model, which includes local food-based complementary foods, eating habits, infant massage therapy, and Tui Na massage for appetite stimulation (Table 2).

Conversely, the control group, which did not receive any treatment, demonstrated no significant effect. Given these findings, it can be concluded that there is a substantial effect of providing complementary foods based on local food culture, diet, dietary habits, massage, and Tui Na massage for appetite stimulation in improving the nutritional status of stunted young children in the Simpang Keramat Community Health Center Working Area. Consequently, the H_a hypothesis was accepted, and the H_0 hypothesis was rejected. The results of this research are corroborated by a study conducted by Fathnur *et al.* in 2019, which reported that moringa leaf pudding potentially increased the weight of undernourished young children by 100% in 17 intervention group respondents over three weeks, with a p-value of 0.039. Additionally, a study conducted by Hartina in 2022 found a p-value of 0.000 < 0.05, indicating a significant effect of moringa leaf extract on the nutritional status of young children, as measured by body weight and height (Table 2).

Lolan and Fauzia's research in 2023 demonstrated that local foods and parenting patterns influence the prevalence of stunting in young children aged 6-24 months in Bandung. The study employed a purposive sampling method, which revealed that fathers' education significantly affected stunting status, with a p-value of 0.034. Local food provision significantly influenced stunting in young children, with a p-value of 0.022 (p-value < 0.05). Parenting patterns significantly affected stunting, with a p-value of 0.001 (p < 0.05). It can be concluded that the risk factors for stunting in young children are the father's education level, local food processing, and parenting patterns related to nutritious food. Fauziah and Krianto (2022) elucidated in their review the influence of

local food culture in preventing and addressing stunting in children under five years of age (6–59 months): Systematic Review. The findings from the review of seven selected journals indicate that local food culture improves the nutritional status of children under five years of age, particularly in the stunting prevention phase. However, in the prevention phase, local food culture utilizing processed food has not demonstrated efficacy in improving the nutritional status of young children already affected by stunting. Utilizing local food for young children suffering from stunting necessitates supplementation with other nutrients to yield a significant impact. Food and eating practices within communities possess cultural and social values; therefore, leveraging local food culture for young children's nutrition is accepted, readily accessible, and affordable for stunting prevention in specific regions.

Research by Diana *et al.* (2022) shows that the concept of eating and the perception of the Madurese community in Sampang Regency affect children's eating behavior and the incidence of stunting. Many parents consider short stature a hereditary factor, not a growth problem, as long as the child is active and wants to eat, which in their culture means eating rice. An unbalanced diet is considered harmless. Children with normal height tend to consume more varied foods than stunted children, who generally only eat rice with vegetable soup or fish broth without additional side dishes. This study emphasizes raising awareness about stunting and encouraging a more varied diet for children, not just relying on rice. Research about the development and optimization of cactus pear fruit jelly supplemented with *Moringa oleifera* leaf extract results indicated a significant difference in protein, fat, fiber, ash, carbohydrate, energy, iron, calcium, zinc, appearance, aroma, and taste among the formulated jellies ($p < 0.05$). The overall optimum nutritional and sensorial attributes of the jelly were found in a range of CFJ (70–73%), MOE (3–14%), and TS (20–26%). However, developing jelly with the formulation of CFJ (68%), MOE (12%), and TS (20%) was predicted to give the highest nutritional value and sensory acceptability score (Akelom *et al.*, 2022).

A study conducted in Benin by

Founmilayo *et al.* (2023) involved 150 children aged 12–59 months with moderate acute malnutrition. The intervention group received porridge enriched with moringa leaf flour five times per week for six months. The results showed an average weight gain of 1.72 kg ($p < 0.005$) and a 10.42% reduction in the prevalence of acute malnutrition ($p < 0.005$) compared to the control group, which received only nutrition education. These findings are consistent with a study by Zongo (2018) in Burkina Faso, which reported that consuming moringa leaf powder for 12 weeks improved the nutritional status of preschool children, as indicated by increases in weight-for-height Z-scores (WHZ) and serum retinol concentrations. The nutrients contained in moringa leaves have been proven to promote child growth. Consumption of unhealthy snacks or 'junk' food poses a serious risk to a child's nutritional status. *Moringa oleifera* was selected for snack development because it is nutrient-rich (Zeeshan *et al.*, 2024; Arshad *et al.* 2025). The survey showed that 87% of the caregivers gave children snacks daily. The snacks commonly given to children were savory (73%), fruity (53%), dairy (46%), and sugary (43%) types. The snacks containing 1% MOLP were almost as acceptable as the control regarding all sensory attributes evaluated, including overall acceptability. They had higher calcium, magnesium, potassium, phosphorus, zinc, manganese, iron, and crude protein concentrations but less fat than the control. The results indicate that snacks supplemented with MOLP can improve children's food and nutrition security status among vulnerable population groups (Olusanya *et al.*, 2020).

Young children require adequate nutrition owing to their rapid growth and development, particularly during the first two years of life (Marshall *et al.*, 2022). This accelerated growth and development period necessitates parental attention and the provision of nourished food for young children. Prolonged insufficient nutrient intake may lead to chronic energy deficiency (CED) (Yulianti *et al.*, 2023). Conversely, optimal nutritional and health status can be achieved when the body receives and efficiently utilizes sufficient dietary intake (Mousa *et al.*, 2019). Meanwhile, Sutarmi *et al.* (2022) investigated

the efficacy of healthy massage on the growth and development of stunting infants. The study revealed a statistically significant enhancement in personal social development ($p=0.03$) compared to the control group. Additionally, anthropometric measurements significantly improved upper arm circumference ($p=0.000$) and body length ($p=0.019$). Consequently, the findings suggest that healthy massage constitutes an efficacious intervention for ameliorating the growth and development of stunted infants.

The research conducted by Maulida *et al.* (2024) on the effect of Tui Na Massage on the growth of stunted young children revealed a difference in the average body weight of 0.18 (180 grams) and body height of 1.15 cm before and after the administration of Tui Na Massage. The statistical test results yielded a p -value of 0.012 ($p<0.05$), indicating a significant effect of Tui Na Massage on increasing the weight of stunted young children. Furthermore, the study demonstrated an effect of Tui Na Massage on increasing height, with a p -value of 0.003 ($p<0.05$). These findings suggest that Tui Na Massage may be considered an alternative therapy for preventing and treating stunting in young children. Rangkuti (2022) conducted research on the effectiveness of tui na massage in increasing appetite in young children who experienced difficulty eating. The results demonstrated a p -value of 0.0000, suggesting that tui na massage was efficacious in enhancing appetite in young children in Medan City. The findings indicated that consistent application of tui na massage correlates positively with increased appetite in toddlers. It is recommended that mothers of young children implement this massage technique regularly.

Conclusion

The research concluded that there was a statistically significant difference between the treatment group and the non-treatment group regarding implementing a developed model of stunting management in young children. Furthermore, the study demonstrated a substantial impact of administering local weaning foods, baby massage therapy, and Tui Na massage therapy on stunted young children, as evidenced by increased body weight and

height in the treatment group. Conversely, no significant difference was observed in the body weight and height of the stunted young children before and after the experiment in the non-treatment (control) group. The researchers extend their sincere appreciation to Bumi Persada University for supporting the implementation of this study and for providing funding assistance for the publication of this research.

References

- Akelom, K.M., Bisetegn, T.Y., & Bereka, T.Y., 2022. Development and Optimization of Cactus Pear Fruit Jelly Supplemented with Moringa Oleifera Leaf Extract. *Heliyon*, 8(6).
- Ali, A., 2021. Current Status of Malnutrition and Stunting in Pakistani Children: What Needs to Be Done?. *Journal of the American College of Nutrition*, 40(2), pp.180–192.
- Amaha, N.D., 2025. Determinants of Height-for-Age Z-Score (HAZ) among Ethiopian Children Aged 0–59 Months: A Multilevel Mixed-Effects Analysis. *BMC Public Health*, 25(1), pp.1614.
- Amoadu, M., Abraham, S.A., Adams, A.K., Akoto-Buabeng, W., Obeng, P., & Hagan Jr, J.E., 2024. Risk Factors of Malnutrition among in-School Children and Adolescents in Developing Countries: A Scoping Review. *Children*, 11(4), pp.476.
- Arshad, M.T., Maqsood, S., Ikram, A., & Gnedeka, K.T., 2025. Recent Perspectives on the Pharmacological, Nutraceutical, Functional, and Therapeutic Properties of *Moringa oleifera* Plant. *Food Science & Nutrition*, 13(4).
- Awuchi, C.G., Igwe, V.S., & Amagwula, I.O., 2020. Nutritional Diseases and Nutrient Toxicities: A Systematic Review of the Diets and Nutrition for Prevention and Treatment. *International Journal of Advanced Academic Research*, 6(1), pp.1–46.
- Central Bureau of Statistics., 2023. *Prevalence of Very Short and Short Toddlers by Regency in 2018*. Badan Pusat Statistik.
- De, P., & Chattopadhyay, N., 2019. Effects of Malnutrition on Child Development: Evidence from a Backward District of India. *Clinical Epidemiology and Global Health*, 7(3), pp.439–445.
- Diana, R., Rachmayanti, R.D., Khomsan, A., & Riyadi, H., 2022. Influence of Eating Concept on Eating Behavior and Stunting in Indonesian Madurese Ethnic Group. *Journal*

- of *Ethnic Foods*, 9(1), pp.48.
- Dipasquale, V., Cucinotta, U., & Romano, C., 2020. Acute Malnutrition in Children: Pathophysiology, Clinical Effects and Treatment. *Nutrients*, 12(8), pp.2413.
- Erçelik, Z.E., & Yilmaz, H.B., 2023. Effectiveness of Infant Massage on Babies Growth, Mother-Baby Attachment, and Mothers' Self-Confidence: A Randomized Controlled Trial. *Infant Behavior and Development*, 73, pp.101897.
- Fauziah, I., & Krianto, T., 2022. The Influence of Local Food Culture in the Prevention and Management of Stunting in Toddlers (6-59 Months): Systematic Review. *Syntax Literate; Jurnal Ilmiah Indonesia* 7(5), pp.6597–6607.
- Fitriahadi, E., Rosida, L., Syagata, A.S., & Binti Makbul, I.A.A., 2024. Giving Baby Porridge Made From Moringa Leaves and Snakehead Fish to Toddlers in Yogyakarta, Indonesia. *Jurnal Kesehatan Masyarakat*, 20(2).
- Founmilayo, L.F.T., Nadia, F.F., & Polycarpe, K., 2023. Impact of Moringa oleifera Leaf Flour Supplement on Weight Gain in Moderately Acutely Malnourished Children in Benin. *Archives of Food and Nutritional Science*, 7(1), pp.70–77.
- Hawa, N.I., Utari, D., & Parahyanti, E., 2024. Clean and Healthy Environmental Behavior in Terms of Malnutrition and Sanitation. *Global Journal of Environmental Science & Management (GJESM)*, 10(2).
- Kamal, S.A., 2022. Growth-and-Obesity Vector-Roadmap 2.6 of a Child Perceived to be Severely Stunted. *International Journal of Biology and Biotechnology*, 19(3), pp.289–304.
- Karlsson, O., Kim, R., Bogin, B., & Subramanian, S., 2022. Maternal Height-standardized Prevalence of Stunting in 67 Low- and Middle-income Countries. *Journal of Epidemiology*, 32(7), pp.JE20200537.
- Kiani, A.K., Dhuli, K., Donato, K., Aquilanti, B., Velluti, V., Matera, G., Iaconelli, A., Connelly, S.T., Bellinato, F., Gisondi, P., & Bertelli, M., 2022. Main Nutritional Deficiencies. *Journal of Preventive Medicine and Hygiene*, 63(2), pp.E93.
- Kohl, P.L., Gyimah, E.A., Diaz, J., Kuhlmann, F.M., Dulience, S.J-L., Embaye, F., Brown, D.S., Guo, S., Luby, J.L., Nicholas, J.L., Turner, J., Chapnick, M., Pierre, J.M., Boncy, J., Fleur, R.S., Black, M.M., & Iannotti, L.L., 2022. Grandi Byen—Supporting Child Growth and Development Through Integrated, Responsive Parenting, Nutrition and Hygiene: Study Protocol for a Randomized Controlled Trial. *BMC Pediatrics*, 22(1), pp.54.
- Lolan, Y., & Fauzia, D.A., 2023. The Influence of Local Food and Parenting Patterns on Stunting in Toddlers Aged 6-24 Months in Bandung City. *Jurnal Kesehatan Mahardika*, 10(2), pp.72–79.
- Marshall, N.E., Abrams, B., Barbour, L.A., Catalano, P., Christian, P., Friedman, J.E., Hay Jr, W.W., Hernandez, T.L., Krebs, N.F., Oken, E., Purnell, J.Q., Roberts, J.M., Soltani, H., Wallace, J., & Thornburg, K.L., 2022. The Importance of Nutrition in Pregnancy and Lactation: Lifelong Consequences. *American Journal of Obstetrics and Gynecology*, 226(5), pp.607–632.
- Maulida, H., Sutrisna, E., & Afdila, R. 2024. The Effect of Tui Na Massage on Increasing Appetite and Weight Gain in Stunting Toddlers. *Jurnal Promotif Preventif*, 7(1), pp.103–109.
- Mollà-Casanova, S., Sempere-Rubio, N., Muñoz-Gómez, E., Aguilar-Rodríguez, M., Serra-Añó, P., & Inglés, M., 2023. Effects of Massage Therapy Alone or Together with Passive Mobilisations on Weight Gain and Length of Hospitalisation in Preterm Infants: Systematic Review and meta-analysis. *Early Human Development*, 182, pp.105790.
- Morales, F., Montserrat-de la Paz, S., Leon, M.J., & Rivero-Pino, F., 2023. Effects of Malnutrition on the Immune System and Infection and the Role of Nutritional Strategies Regarding Improvements in Children's Health Status: A Literature Review. *Nutrients*, 16(1), pp.1.
- Mousa, A., Naqash, A., & Lim, S., 2019. Macronutrient and Micronutrient Intake during Pregnancy: An Overview of Recent Evidence. *Nutrients*, 11(2), pp.443.
- Naga Rajeev, L., Saini, M., Kumar, A., Sinha, S., Osmond, C., & Sachdev, H.S., 2022. Weight-for-Height is Associated with an Overestimation of Thinness Burden in Comparison to BMI-for-Age in under-5 Populations with High Stunting Prevalence. *International Journal of Epidemiology*, 51(3), pp.1012–1021.
- Najib, N., Giyarsih, S.R., Listyaningsih, U., & Nawawi, N., 2023. Analysis of Feeding Behavior and Family Food Security as a Stunting Risk Factor in Semarang City. *Jurnal Kesehatan Masyarakat*, 19(2), pp.270–277.
- Ningsih, F., & Ramadhena, M.P., 2023. The Effect of Tuina Massage on Increasing Weight in Toddlers in the Independent Practice of Midwife D, Rengasdengklok District,

- Karawang Regency. *MAHESA: Malahayati Health Student Journal*, 3(10), pp.3166–3182.
- Nugroho, E., Wanti, P.A., Suci, C.W., Raharjo, B.B., & Najib, N., 2023. Social Determinants of Stunting in Indonesia. *Jurnal Kesehatan Masyarakat*, 18(4), pp.546–555.
- Nyarko, M.J., van Rooyen, D., & Ten Ham-Baloyi, W., 2024. Preventing Malnutrition within the First 1000 Days of Life in under-Resourced Communities: An Integrative Literature Review. *Journal of Child Health Care*, 28(4), pp.898–913.
- Olusanya, R.N., Kolanisi, U., Van Onselen, A., Ngobese, N.Z., & Siwela, M., 2020. Nutritional Composition and Consumer Acceptability of Moringa Oleifera Leaf Powder (MOLP)-Supplemented Mahewu. *South African Journal of Botany*, 129, pp.175–180.
- Priyanti, S., Nuha, M., Purnasari, P., & Masyhudi, A.A., 2024. Stunting and Head Circumference Growth in The First 3 Years of Life. *Jurnal Kesehatan Masyarakat*, 19(3), pp.341–349.
- Rachmah, Q., Mahmudiono, T., & Loh, S.P., 2021. Predictor of Obese Mothers and Stunted Children in the Same Roof: A Population-Based Study in the Urban Poor Setting Indonesia. *Frontiers in Nutrition*, 8.
- Rangkuti, S., 2022. The Effect of Tui Na Acupressure on Appetite in Children (Toddlers) Aged 1-3 Years at the Wulandari Purba Clinic, Batang Quiz in 2022. *Science Midwifery*, 10(5), pp.3603–3611.
- Sakti, E.S., Makful, M.R., & Dewi, R., 2023. Spatial Analysis of Stunting Handling Priorities in Aceh Province in 2021. *Jurnal Mutiara Kesehatan Masyarakat*, 8(1), pp.10–23.
- Sampah, M.E.S., & Hackam, D.J., 2020. Dysregulated Mucosal Immunity and Associated Pathogeneses in Preterm Neonates. *Frontiers in Immunology*, 11.
- Scheffler, C., Hermanussen, M., Bogin, B., Liana, D.S., Taolin, F., Cempaka, P.M.V.P., Irawan, M., Ibbibah, L.F., Mappapa, N.K., Payong, M.K.E., Homalessy, A.V., Takalapeta, A., Apriyanti, S., Manoeroe, M.G., Dupe, F.R., Ratri, R.R.K., Touw, S.Y., P, V.K., Murtani, B.J., Nunuhitu, R., Puspitasari, R., Riandra, I.K., Liwan, A.S., Amandari, P., Permatasari, A.A.I., Julia, M., Batubara, J., & Pulungan, A., 2020. Stunting is Not a Synonym of Malnutrition. *European Journal of Clinical Nutrition*, 74(3), pp.377–386.
- Scheffler, C., & Hermanussen, M., 2022. Stunting is the Natural Condition of Human Height. *American Journal of Human Biology*, 34(5).
- Schneider, E.B., 2025. The Determinants of Child Stunting and Shifts in the Growth Pattern of Children: A Long-Run, Global Review. *Journal of Economic Surveys*, 39(2), pp.405–452.
- Setiani, F.T., Lestari, H., & Mustajab, A.A., 2024. Nutritional Status of Toddlers Aged 0-59 Months: A Descriptive Study. *International Journal of Health and Medicine*, 1(4), pp.156–164.
- Setyawati, V.A.V., Yuniastuti, A., Handayani, O.W.K., & Farida, E., 2024. Development of Nutrition Instruments for Women to Prevent Early Stunting: A Systemic Literature Review. *Jurnal Kesehatan Masyarakat*, 20(1), pp.156–167.
- Singh, G., Tucker, E.W., & Rohlwinck, U.K., 2022. Infection in the Developing Brain: The Role of Unique Systemic Immune Vulnerabilities. *Frontiers in Neurology*, 12.
- Sutarmi, S., Astuti, Y., Siswanto, S., Kunarti, E., & Susilowati, D., 2022. Effectiveness of Healthy Massage on Growth and Development among Stunting Babies. *Malaysian Journal of Medicine & Health Sciences*, 18.
- Sutrisna, E., Maulida, H., & Alkautsar, E., 2023a. Effectiveness of Developing Dietary Culture by Providing Moringa Leaf Products Through Fortification in Handling Stunting in Toddlers in the Work Area of Simpang Keramat Health Center, North Aceh Regency. *Jurnal Kesehatan Tambusai*, 4(4), pp.6394–6404.
- Sutrisna, E., Maulida, H., Wahyuni, R., & Fitriani, A., 2023b. The Effectiveness of Giving Moringa Leaves to Increase the Weight of Toddlers. *JKM (Jurnal Kebidanan Malahayati)*, 9(3), pp.519–524.
- Tjandrawinata, R.R., Amalia, N., Tandil, Y.Y.P. Athallah, A.F., Wibowo, C.A., Aditya, M.R., Muhammad, A.R., Azizah, M.R., Humardani, F.M., Nojaid, A., Christabel, J.A., Agnuristyaningrum, A., & Nurkolis, F., 2025. The Forgotten Link: How the Oral Microbiome Shapes Childhood Growth and Development. *Frontiers in Oral Health*, 6, pp.1547099.
- WHO., 2023. *Levels and Trends in Child Malnutrition: UNICEF/WHO/World Bank Group Joint Child Malnutrition Estimates: Key Findings of the 2023 Edition*. World Health Organization.
- Yuliastanti, T., Ambarwati, W.N., Sulastri, S., & Rahmawati, A., 2023. History of Chronic Energy Deficiency (CED) of Pregnant Women and Stunting in Toddlers. *International Journal of Nursing Information*,

2(2), pp.7–12.

- Yuniastuti, A., Safarina, A.D., & Lisdiana, L., 2023. The Effect of Providing Additional Food Based on Moringa Leaves and Sea Fish on Serum Zinc Levels of Stunting Toddlers in Sedan, Rembang Regency in 2022. *Prosiding Seminar Nasional Biologi*, pp.171–177.
- Zeeshan, A., Munir, M., & Sadia, S., 2024. Unlocking the Promise of the Miracle Tree: A Review on Therapeutic Applications and Phytochemistry of Moringa Oleifera L. *Journal of Bioresource Management*, 11(1), pp.18.
- Zongo, U., 2018. Effect of Moringa Leaves Powder Consumption on Young Children Nutritional and Serum Retinol Status in Burkina Faso Rural Area. *International Journal of Nutrition and Food Sciences*, 7(4), pp.148.