Effectiveness of myofascial release and therapeutic exercise on physical growth among stunted toddlers in Cilacap Regency

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Abstract: Stunting remains a persistent public health issue, and nutritional interventions alone often yield limited improvement without additional physical stimulation. This study evaluated the effectiveness of combining myofascial release and therapeutic exercise on the physical development of stunted toddlers in Cilacap Regency. A quasi-experimental pretest–posttest control group design was applied to 60 children aged 24–35 months selected through simple random sampling. The intervention group received myofascial release and age-appropriate therapeutic exercises twice weekly for four weeks, while the control group received routine monitoring. Growth indicators—including body weight, height, and WHO Z-scores—were measured before and after the intervention. The intervention group showed significantly greater increases in weight (0.7 ± 0.3 kg vs. 0.1 ± 0.2 kg, $p < 0.001$) and height (1.3 ± 0.5 cm vs. 0.2 ± 0.4 cm, $p < 0.001$) compared with the control group. In conclusion, integrating myofascial release with therapeutic exercise effectively enhances physical growth in stunted toddlers.

1 Introduction

Stunting, defined as chronic growth failure due to prolonged nutritional deficiencies from gestation to early infancy, is a significant global public health issue. It adversely impacts physical growth, cognitive development, and overall quality of life in the long run [1-2]. Stunting affected 22.2% of the world's population in 2020, with Asia showing the highest [1]prevalence at 52.9%. In 2022, the rate in Indonesia reached 21.6%, with Central Java

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registering 20.8%. Cilacap Regency is one of the districts with persistently high rates among children aged 24 to 35 months [1]. In Indonesia, efforts to minimize stunting have largely centered on supplementary feeding (Pemberian Makanan Tambahan or PMT), which strengthens growth hormones, chondrocytes, and bones [3-6]. But PMT by itself doesn't work very well unless it is paired with a physical stimulation that makes growth hormone work better. Physical stimulation, including myofascial release and exercise, can promote growth by improving blood circulation, oxygenation, motor coordination, bone mineralization, and the secretion of growth hormone [7-9]. A number of studies have shown that massage combined with exercise can help kids lose weight and grow taller. However, most of these studies have small sample sizes and don't apply well to Indonesia. This study addresses these deficiencies by investigating the effectiveness of combined myofascial release and exercise in facilitating the development of stunted children in Cilacap Regency. The results are expected to provide empirical evidence for the integration of non-pharmacological therapies into community-based programs, thereby strengthening national health policies and aiding in the achievement of the Sustainable Development Goals (SDGs).

2 Methods

This study utilized a quasi-experimental pretest-posttest control group design involving 60 stunted children aged 24–35 months, selected via simple random sampling from a total population of 162 in the South Cilacap Area, Cilacap Regency. The participants were divided equally into two groups: an intervention group and a control group, maintaining a 1:1 ratio. The inclusion criteria consisted of stunted toddlers (WHO standard), aged 24–35 months, with parental consent; children with chronic illnesses, congenital anomalies, or those absent during the trial were excluded.

The study was conducted in the South Cilacap Area from April to August 2025, recognized as a regional stunting locus. The independent variable comprised the amalgamation of myofascial release and exercise, whereas the dependent variable was child growth, assessed using body weight, height, and WHO Z-scores. The intervention group got myofascial release (soft tissue massage) and age-appropriate exercise biweekly for four weeks, with each session lasting 15 to 20 minutes. The control group was observed in the standard manner. Calibrated digital scales (with an accuracy of 0.1 kg) and stadiometers (with an accuracy of 0.1 cm) were used to assess height and weight before and after the intervention. We used WHO Anthro Software to determine the Z-scores. We looked at the data using both univariate and bivariate analysis.

The Kolmogorov-Smirnov test assessed normality, followed by either the independent t-test or the Mann-Whitney U test, as appropriate. We utilized SPSS version 27 for the statistical analysis. The study was approved by the Health Research Ethics Committee of Universitas Muhammadiyah Purwokerto (No. KEPK/UMP/55/I/2024). All parents or guardians provided their informed consent. Randomization and blinding of outcome assessors were employed to reduce bias. All interventions were done by trained professionals following acceptable guidelines.

3 Results and discussion

3.1 Results

3.1.1 Baseline characteristics

At baseline, no significant differences were observed between groups in terms of age, sex, or nutritional status (p>0.05), ensuring comparability. Table 1 presents the baseline characteristics of stunted children in both the intervention and control groups before the intervention.

Table 1. Respondents' Characteristics.

Variable	Intervention Group (n=30)	Control Group (n=30)	p-value
Age (months), mean ± SD	29.3 ± 3.2	28.9 ± 3.5	0.624
Sex, n (%)			0.789
– Male	16 (53.3)	15 (50.0)	
– Female	14 (46.7)	15 (50.0)	
Baseline Nutritional Status*			0.712
– Height < -2 SD	30 (100)	30 (100)	
– Weight < -2 SD	28 (93.3)	27 (90.0)	

*Based on WHO Child Growth Standards.

Table 1 shows that the baseline features of the stunted children in both groups were rather similar before the intervention. The average age of the people in the intervention group was 29.3 ± 3.2 months, whereas the average age of the people in the control group was 28.9 ± 3.5 months. There was no significant difference (p = 0.624). The sex distribution was also similar, with 53.3% male and 46.7% female in the intervention group, compared to 50% for both sexes in the control group (p = 0.789). The initial evaluation indicated that all participants exhibited stunting (height-for-age < -2 SD, WHO criteria). The majority exhibited low weight-for-age (< -2 SD), specifically 93.3% in the intervention group and 90% in the control group (p = 0.712). No significant differences were observed across groups at baseline (p > 0.05), establishing their comparability and indicating that post-intervention improvements resulted from the treatment effects.

3.1.2 Changes in body weight

Table 2 shows changes in children's body weight before and after the intervention.

Table 2. Changes in body weight (kg) before and after intervention

Group	Pretest, mean ± SD	Posttest, mean ± SD	Change (Δ) mean ± SD	p-value*
Intervention (n=30)	9.8 ± 1.2	10.5 ± 1.1	+0.7 ± 0.3	<0.001
Control (n=30)	9.8 ± 1.1	10.3 ± 1.1	+0.1 ± 0.2	0.210

*Paired t-test for each group.

The statistics indicated that the children in the intervention group saw significant weight gain. Their beginning weight was 9.8 ± 1.2 kg, but after the combined myofascial release and exercise intervention, it went up to 10.5 ± 1.1 kg. The mean increase of 0.7 ± 0.3 kg was statistically significant ($p < 0.001$), indicating that the intervention had a substantial impact on weight gain. The kids in the control group, on the other hand, started off weighing 9.8 ± 1.1 kg and only gained a little weight, reaching 10.3 ± 1.1 kg. The average increase of 0.1 ± 0.2 kg was not statistically significant ($p = 0.210$), suggesting that the weight gain in this group was likely due to normal development and was insufficient to improve nutritional status.

3.1.3 Changes in height

Table 3 presents changes in children's height before and after the intervention.

Table 3. Changes in Height (cm) Before and After Intervention

Group	Pretest, mean ± SD	Posttest, mean ± SD	Change (Δ) mean ± SD	p-value*
Intervention (n=30)	78.5 ± 3.4	79.8 ± 3.5	+1.3 ± 0.5	<0.001
Control (n=30)	78.7 ± 3.3	78.9 ± 3.4	+0.2 ± 0.4	0.152

*Paired t-test for each group.

The analysis indicated that the intervention group got a lot taller than the control group. The average height of the people in the intervention group was 78.5 ± 3.4 cm before the intervention and 79.8 ± 3.5 cm after it. The average rise of 1.3 ± 0.5 cm was statistically significant ($p < 0.001$), which means that myofascial release and exercise worked to help stunted youngsters grow taller. In the control group, the mean baseline height was 78.7 ± 3.3 cm, which only went up to 78.9 ± 3.4 cm after the observation. The average increase of 0.2 ± 0.4 cm was not statistically significant ($p = 0.152$), showing that the height gain was mostly due to natural growth. These data demonstrate that myofascial release and exercise efficiently increase linear development in stunted children by improving metabolism, circulation, and growth hormone activity.

3.1.4 Comparative analysis between groups

To assess the effectiveness of the intervention compared with the control, independent t-tests were performed on changes (Δ) in body weight and height.

Table 4. Comparison of changes in body weight and height between groups

Variable	Δ Intervention ± SD	Δ Control ± SD	p-value*
Body Weight (kg)	0.7 ± 0.3	0.1 ± 0.2	<0.001
Height (cm)	1.3 ± 0.5	0.2 ± 0.4	<0.001

*Independent t-test.

The comparison study demonstrated significant differences in both body weight and height among the groups. The intervention group had an average weight gain of 0.7 ± 0.3 kg, while the control group only gained 0.1 ± 0.2 kg. The independent t-test yielded a p-value of less than 0.001, signifying that myofascial release and exercise were significantly more effective in promoting weight growth compared to natural development. A similar pattern was observed for height. The intervention group showed a mean increase of 1.3 ± 0.5 cm, which was much bigger than the 0.2 ± 0.4 cm increase in the control group. This difference was statistically significant ($p < 0.001$). Overall, our findings suggest that the combination of myofascial release and exercise facilitated weight gain and height increase in stunted children. This data backs up the premise that structured exercise can make the effects of food even better, increase blood flow, promote the production of growth hormone, and speed up the process of mineralizing bones, which can lead to better growth results than not doing anything at all.

3.2 Discussion

This study demonstrated that the use of myofascial release in conjunction with structured exercise significantly increased the height and weight of stunted children compared to controls. These findings are consistent with international recommendations that promote the integration of nutritional support and physical activity to attain optimal development outcomes [1]. Myofascial release may enhance blood circulation, tissue oxygenation, and sensory input, hence promoting chondrocyte proliferation and bone mineralization [3-4]. Previous research on infants and young children demonstrated improvements in weight and linear growth following structured physical stimulation. Previous studies validate these results. Massage and exercise therapy have been shown to improve children's anthropometric measurements and motor development [10-12].

Recent studies have demonstrated that pediatric massage accelerates growth and enhances motor skills by optimizing circulation, oxygenation, and the synchronization between the nervous system and muscles. This finding suggests that combined therapy emphasizing both musculoskeletal release and active exercise may enhance child growth. In addition to the short-term anthropometric benefits, physiological mechanisms appear to be significantly relevant. Myofascial release may enhance tissue oxygenation and bone mineralization by optimizing venous and lymphatic return and alleviating fascial limitations. A retrospective study conducted in China showed that pediatric massage, when integrated with comprehensive treatment, significantly enhanced height, weight, developmental velocity, and IGF-1 levels, hence, endorsing this methodology. A meta-analysis confirmed that exercise instruction focused on motor development in preschool children produced greater improvements in gross motor abilities than traditional physical activity. These findings support the notion that the activation of growth hormone and IGF-1 pathways is essential to the observed growth benefits. In Indonesia, the prevalence of stunting remains high, influenced by factors including socioeconomic status, maternal education, and environmental conditions [13].

National programs are increasingly emphasizing not only supplemental nutrition but also mental and physical activity. A recent evaluation of stunting in Indonesia underscored the necessity for multisectoral collaboration, particularly emphasizing early childhood stimulation and family interventions [14]. The present study offers empirical evidence for these recommendations, illustrating that structured, cost-effective, non-pharmacological interventions can be integrated into community-based health programs to improve dietary strategies.

Physiological mechanisms may clarify these improvements. Myofascial release enhances the circulation of blood and lymph, alleviates fascial restrictions, and facilitates tissue oxygenation, hence promoting chondrocyte proliferation and bone mineralization [4]. A retrospective study conducted in China confirmed that pediatric massage, when combined with comprehensive treatment, significantly improved height, weight, development velocity, and IGF-1 levels. A meta-analysis of exercise interventions in preschool children showed that motor development-focused training yielded superior enhancements in gross motor skills compared to conventional physical activity [15]. These findings substantiate the notion that the activation of growth hormone and IGF-1 pathways enhances growth outcomes. Stunting is still a big problem in Indonesia, and it is caused by a number of things, such as the mother's education, the family's income level, and the environment [13].

National strategies prioritize not just enhanced nutrition but also mental and physical stimulation. A recent assessment underscored the importance of multisectoral collaboration, including early childhood stimulation and parenting interventions, to accelerate the reduction of stunting [14-15]. This study provides concrete evidence for these strategies, demonstrating that community-based health programs can incorporate organized, cost-effective, non-pharmacological interventions to enhance nutritional approaches. This study has certain issues. The four-week intervention period may not accurately represent long-term growth trajectories. Biochemical markers such as IGF-1 and growth hormone were not assessed, complicating the direct validation of the proposed explanations. Additionally, although the sample size was adequate for short-term outcomes, the results may not be generalizable to all populations. Subsequent research should include larger, more diverse samples, prolonged follow-up periods, and biomarker analysis to validate the physiological pathways. Our results contribute to the accumulating data that systematic physical stimulation may serve as an effective adjunct therapy for stunting. The combination of myofascial release and exercise can help children with chronic malnutrition develop faster by improving circulation, oxygenation, and hormone levels. These results align with global objectives and national health strategies aimed at achieving the Sustainable Development Goals (SDGs), particularly those pertaining to child health and nutrition.

4 Conclusion

The integration of myofascial release and structured exercise markedly enhanced both body weight and height in stunted toddlers relative to conventional monitoring methods. This study offers empirical evidence endorsing the incorporation of non-pharmacological, community-oriented therapies into national stunting reduction initiatives.

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