

Effectiveness of modisco supplementation in improving weight and height of stunted children: A quasi-experimental

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ABSTRACT

Background: Stunting continues to pose a significant public health challenge in Indonesia, particularly in regions such as Pajangan, Bantul Regency. The condition stems not only from poverty but also from inadequate dietary practices and a lack of nutritional awareness. The Modified Diet Skim Milk Sugar Cotton Seed (Modisco) formula presents a viable alternative for stunted toddlers.

Objectives: This study aimed to assess the impact of Modisco, a high-calorie oral supplement, on improving the weight and height of stunted toddlers.

Methods: A quasi-experimental study with a pretest-posttest control group design was conducted involving 20 stunted children aged 2 to 5 years, selected using purposive sampling. Participants were evenly divided into two groups an intervention group that received daily Modisco supplementation for 14 days, and a control group that did not receive any treatment.

Results: The Modisco intervention produced significant improvements in both weight and height among stunted toddlers. The intervention group gained an average of 0.48 kg, while the control group showed no meaningful increase ($p=0.004$). Height improved by 1.84 cm in the intervention group, whereas the control group experienced a slight decline of 0.30 cm ($p=0.001$). Analyses within and between groups confirmed consistent, statistically significant changes following the 14-day supplementation. These findings indicate that Modisco effectively supports short-term nutritional recovery and promotes linear growth. Overall, the intervention demonstrated clear benefits in enhancing growth outcomes compared with the control group.

Conclusions: These findings suggest that Modisco supplementation can effectively promote physical growth in stunted toddlers within a short timeframe. As such, it holds potential as a cost-effective and practical approach for stunting intervention programs at the community level.

KEYWORD: height; modisco; stunted children; weight

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INTRODUCTION

Stunting is a condition of impaired growth in children under five caused by chronic malnutrition that occurs over a long period (1). This condition results in children having a height that is below the standard for their age. The stunting process typically begins during pregnancy and becomes more apparent when the child reaches the age of two years (2). Stunting not only affects physical growth but also weakens the immune system, impairs cognitive development, and increases the risk of learning difficulties and low productivity in adulthood (3). The cumulative effects of stunting bring significant social and economic consequences for both individuals and the country (4).

Stunting remains a serious public health concern in Indonesia, particularly in Bantul Regency, Special Region of Yogyakarta (5). According to the Nutritional Status Monitoring conducted in February 2023, 3,106 children under five were recorded as stunted, representing 6.56% of the total under-five population. The three sub-district health centers with the highest stunting rates are Puskesmas Imogiri II (15.49%), Puskesmas Pajangan (9.60%), and Puskesmas Piyungan (8.01%) (6). Interestingly, the high stunting rates in areas such as Pajangan are not solely due to economic hardship but are more closely related to a lack of education regarding appropriate feeding practices (7). Inadequate exclusive breastfeeding and

limited knowledge about complementary feeding are among the contributing factors that exacerbate this issue (8).

Stunting cannot be resolved through medical or clinical interventions alone (9). It is a multifactorial condition shaped by structural and behavioral determinants, including poverty, limited nutritional knowledge, inadequate sanitation, recurrent infections, and suboptimal caregiving practices (10,11). Consequently, stunting prevention requires a multisectoral approach that mobilizes coordinated efforts across agriculture, education, social welfare, and basic infrastructure systems (12). The agricultural sector, for example, can strengthen household food security, while the education sector plays a pivotal role in improving community nutrition literacy (13).

During early life particularly within the critical first 1,000 days spanning pregnancy to a child's second year nutrition becomes a key determinant of optimal growth and development (14). Adequate intake of macro- and micronutrients is essential, as these nutrients influence neurodevelopment, immune competence, and overall physical and cognitive maturation (8). Parents are central in ensuring proper feeding practices, beginning with exclusive breastfeeding and followed by the provision of diverse nutritious complementary foods. Limited knowledge or inappropriate feeding behaviors can result in chronic nutrient

deficits that ultimately lead to stunting (15). One effective strategy to reduce stunting is through supplementary foods that are energy-dense, nutrient-rich, and acceptable to young children (16). Within this context, the Modified Diet Skim Milk Sugar Cotton Seed (Modisco) formula emerges as a promising option. Modisco is a high-calorie beverage formulated from skim milk, sugar, and coconut oil or margarine, designed as an affordable, easy-to-prepare, and easily digestible oral nutritional supplement. Each 100 grams of Modisco provides approximately 159.86–236.6 kilocalories, 5.0–5.8 grams of protein, and 6.5–15.7 grams of fat, along with notable mineral content such as potassium (995.6–1063 ppm) and magnesium (704.6–958 ppm). Flavor and nutritional value can be further enhanced by adding fruits like bananas, avocados, or strawberries, which contribute additional micronutrients and improve sensory qualities such as taste, aroma, and color (17).

Evidence from Lutfiasari (2020) shows that Modisco, as an oral nutritional supplement (ONS), can significantly improve the nutritional status of undernourished or stunted children (18). Its liquid form makes it easier for toddlers to consume and allows it to be used as an alternative or complement to formula milk (18). Nonetheless, to maximize its effectiveness, Modisco should be enriched with natural mineral sources such as fresh fruits, given that it does not inherently

contain certain essential minerals including zinc, copper, and other electrolytes. Given the potential of Modisco as a high-nutrient beverage in improving children's nutritional status and the high prevalence of stunting in areas like Pajangan, further research is needed to examine the effects of Modisco consumption on the weight and height gain of stunted toddlers. This study aims to evaluate the effectiveness of Modisco as a nutritional intervention in promoting growth among stunted toddlers within the working area of Puskesmas Pajangan. The findings are expected to provide evidence-based recommendations for the development of more effective, affordable, and child-friendly supplementary feeding programs, particularly in regions with high stunting rates.

MATERIALS AND METHODS

This study employed a quasi-experimental design using a pretest-posttest with control group approach. In this design, the research subjects were divided into two groups: an experimental group that received the intervention in the form of Modisco supplementation, and a control group that did not receive any intervention (19). The study was conducted in the working area of Puskesmas Pajangan, Bantul Regency, one of the regions with a high prevalence of stunting based on the 2023 Nutritional Status Monitoring (NSM) data. The research was carried out over a specific time frame, encompassing preparation, a 14-day

intervention period, and data collection and analysis. The study population comprised 219 stunted children aged 2–5 years recorded at Puskesmas Pajangan. From this population, a total of 20 children were selected as the study sample and evenly assigned to the intervention and control groups, with 10 participants in each group. Purposive sampling was applied, allowing the researcher to choose participants who met predetermined eligibility criteria. The inclusion criteria required children aged 2–5 years who had been diagnosed with stunting, resided within the Puskesmas Pajangan service area, and were registered in the NSM program. Children were excluded if they were experiencing illness or had medical conditions that might interfere with the intervention. These criteria were established to ensure the reliability of the findings and facilitate the appropriate administration of the intervention.

The study began with a socialization session for the parents, during which the researcher and team explained the study objectives and distributed informed consent forms. Upon receiving consent, initial measurements (pretest) of weight and height were conducted for both the experimental and control groups using standardized equipment. The experimental group then received Modisco in the form of a beverage once daily for 14 consecutive days, while the control group did not receive any treatment. After the intervention period ended, final measurements (posttest) were

taken for both groups. The collected data underwent editing, coding, scoring, and tabulation processes. Univariate analysis was used to describe the characteristics of the respondents, while bivariate analysis was conducted to assess the effect of Modisco on weight and height. The Shapiro-Wilk test was used to assess data normality. If the data were normally distributed, a paired t-test was employed to determine the significance of differences before and after the intervention, using a significance level of $\alpha \leq 0.05$.

This study received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Yogyakarta with reference number No. DP.04.03/e-KEPK.1/775/2024. All research procedures adhered to ethical principles, including maintaining the confidentiality of participants' identities, obtaining voluntary consent from parents or guardians, and ensuring that the intervention was safe and posed no adverse effects to the children.

RESULTS AND DISCUSSION

This study involved 20 stunted toddlers, divided into two groups: the intervention group, which received the Modisco supplementary food, and the control group, which did not receive any intervention. Each group consisted of 10 children. The basic characteristics of the subjects were assessed based on age and gender variables. According to the univariate analysis, the age distribution was

evenly split between the 2–3 years and 4–5 years age groups, each representing 50% of the participants. This suggests that the age range covered in this study is fairly representative of the toddler population. In terms of gender, the majority of respondents were female (65%), while males accounted for 35%. This gender imbalance is considered in interpreting the intervention outcomes **Table 1**.

Table 1. Frequency distribution of research subjects based on study variables

Variable	N	%
Age		
2 – 3 years	10	50
4 – 5 years	10	50
Gender		
Male	7	35
Female	13	65

To evaluate the effectiveness of Modisco in improving body weight and height, a bivariate analysis was conducted

using the Paired Sample T-Test within the intervention group **Table 2**. The test compared data before and after the 14-day intervention. The results showed an increase in mean body weight from 11.84 kg to 12.32 kg, with a p-value of 0.002, indicating a statistically significant difference pre and post intervention. In addition to weight, height also showed a meaningful increase from an average of 92.38 cm to 94.22 cm, with a p-value of < 0.001, signifying a highly significant result. Thus, the 14-day Modisco intervention was associated with improved physical growth, both in terms of weight and height.

A further analysis using the Independent Sample T-Test was conducted to compare the intervention and control groups **Table 3**. This test aimed to determine whether the differences between groups were statistically significant. The intervention group experienced an average weight gain of 0.48 kg, while the control

Table 2. Paired sample t-test

Group	N	Mean	Standard Deviation	p-Value
Pre intervention Weight	10	11.84	2.09	0.002
Post intervention Weight	10	12.32	2.27	
Pre intervention Height	10	92.38	9.81	<0.001
Post intervention Height	10	94.22	9.99	

Table 3. Independent sample t-test

Variable	Group	N	Mean	Standard Deviation	p-Value
Weight Gain Difference	Intervention	10	0.48	0.35	0.004
	Control	10	-0.02	0.33	
Height Gain Difference	Intervention	10	1.84	0.96	0.001
	Control	10	-0.3	0.94	

group showed a slight negative change of -0.02 kg. The p-value of 0.004 confirmed a significant difference in weight change between the two groups.

A similar pattern was observed in height. The intervention group showed an average height increase of 1.84 cm, whereas the control group experienced a decrease of -0.30 cm. The p-value of 0.001 demonstrated a statistically significant difference between the groups. These results reinforce the conclusion that the Modisco intervention had a tangible impact on the linear growth of stunted toddlers compared to those who did not receive the intervention.

Overall, the statistical tests conducted within and between groups indicated significant differences, particularly following the 14-day Modisco intervention. All data were presented based on pre- and post-intervention measurements of weight and height, with comparisons to the control group to provide a more objective assessment of the intervention's effectiveness.

The findings of this study demonstrate that the Modisco intervention significantly contributed to weight gain in stunted toddlers. In the intervention group, average body weight increased from 11.84 kg to 12.32 kg after two weeks of supplementation. The Paired Sample T-Test in **Table 2** yielded a p-value of 0.002, indicating a statistically significant improvement. These results suggest that

energy-dense supplementary foods like Modisco can have a positive impact on child weight gain in a relatively short period.

This outcome aligns with the study by Anna Arolyumna, which used ice cream as a medium for supplementation and found similar improvements (20). The success of Modisco is attributed to its high energy content, digestibility, and palatability among children. Its caloric content sourced from skim milk, sugar, and fats such as margarine or coconut oil helps close the daily energy gap in children suffering from malnutrition or stunting. Research by Lutfiasari supports this, showing that variations of Modisco enriched with soy milk and fruit improved nutritional status and contributed to weight gain through plant-based protein and additional micronutrients (18). Similarly, Emily Tam emphasized the role of added fruits in supporting the growth of children with chronic malnutrition. Combination interventions also proved effective; for instance, Husna Maulid combined Modisco with Tui Na massage, and Widowati paired it with acupressure both showed significant improvements in child weight (21,22). These findings affirm that Modisco, whether in its base form, modified, or combined with other therapies, is a practical and effective solution to address low weight in stunted toddlers. This study also found that Modisco significantly impacted height gain. The average height of children in the intervention group increased from 92.38 cm to 94.22 cm in two weeks,

with a p-value < 0.001 in **Table 3**. This indicates that Modisco not only serves as an energy source but also provides essential nutrients that support linear growth, such as high-quality protein and critical minerals like calcium and phosphorus.

These results are consistent with findings by Aisyah Lahdji, who reported that a three-month Modisco supplementation significantly improved nutritional status and height. Aisyah noted that Modisco helped meet both macro- and micronutrient requirements for bone and muscle development (23). The presence of protein, calcium, and vitamin D in Modisco is key to supporting the linear growth of previously stunted children (24). Moreover, a previous study revealed that five weeks of high-calorie, high-protein formula feeding led to substantial height increases in malnourished children. They concluded that nutrient-dense formulas accelerate growth recovery in children with chronic malnutrition. Husna Maulid 2024 also found that combining Modisco with Tui Na massage improved height significantly in the intervention group (21). These findings suggest that Modisco, with a nutritional composition similar to high-calorie formulas, is an effective intervention to accelerate linear growth in stunted toddlers.

An important aspect of successful nutritional intervention in children is acceptability. In this study, Modisco was served as a drink with varied flavors and textures, tailored to children's preferences.

Presenting it as a refreshing beverage was an effective strategy to enhance compliance and reduce monotony. Since toddlers tend to have specific taste and texture preferences, customizing the presentation of the supplement was crucial for optimal intake (23).

Findy in 2020 also emphasized the importance of innovation in supplementary food presentation. In their study, Modisco was offered as ice cream and smoothies, combined with fruits such as strawberries, bananas, and avocados. Their findings showed that fruit additions not only enhanced nutritional value but also improved sensory acceptability color, aroma, taste, and texture (17). The fruits used also contributed important vitamins and minerals, including vitamin C, potassium, and magnesium, which support metabolism and growth (16,23). In the context of this study, Modisco's varied presentation and child-friendly flavors increased daily intake without causing fatigue. This approach is supported by various studies in child nutrition, which state that diversity in form and flavor enhances long-term compliance with supplementary feeding programs, particularly in children with poor appetites due to undernutrition.

Based on the findings of this study, Modisco supplementation has proven to be effective in improving both weight and height in stunted toddlers within a relatively short period. The Modisco intervention not only meets daily energy needs but also

makes a significant contribution to nutritional status improvement and linear growth. With its high acceptability and rich nutrient content, Modisco can serve as a practical, affordable, and applicable strategy for stunting management. These results are expected to provide a foundation for developing sustainable nutrition intervention programs at both local and national levels.

CONCLUSION AND RECOMMENDATION

Based on the findings of this study, Modisco supplementation has been proven effective in improving the nutritional status of stunted toddlers, particularly in increasing body weight and height over a short intervention period of 14 days. The statistically significant results indicate that Modisco, as a high-energy and nutrient-dense oral supplement, can serve as a practical solution for addressing child stunting, especially in areas with limited access to diverse food sources. Its ease of preparation, good acceptability among children, and adaptable taste make it suitable for widespread use.

Therefore, it is recommended that Modisco be integrated into community nutrition programs, particularly in regions with high stunting prevalence. Further research with a larger sample size and longer intervention duration is suggested to evaluate its long-term effectiveness. In addition, continuous innovation in Modisco formulation such as the inclusion of fruits or presenting it in child-friendly forms like

smoothies or desserts should be encouraged to maintain children's interest and ensure compliance. Parental education on proper feeding practices is also crucial to support the success of such interventions and prevent the recurrence of malnutrition.

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