

RESEARCH STUDY

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Combination of Modified Dietetic Skimmed Milk and Coconut Oil (Modisco) and Appetite Massage in Optimizing the Nutritional Status of Stunting Toddlers

Kombinasi Susu Skim dan Minyak Kelapa yang Dimodifikasi (Modisco) dan Pijat Nafsu Makan dalam Mengoptimalkan Status Gizi Balita Stunting

Wahyu Ersila¹, Fitriyani Fitriyani², Nur Chabibah^{2*}¹Diploma Three Midwifery Study Program, Faculty of Health Sciences, University of Muhammadiyah Pekajangan Pekalongan, Pekalongan, Indonesia²Bachelor of Midwifery Study Program, Faculty of Health Sciences, University of Muhammadiyah Pekajangan Pekalongan, Pekalongan, Indonesia

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***Correspondent:**

Nur Chabibah

chabibah@gmail.com

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ABSTRACT

Background: Improper feeding and appetite disorders are chronically the causes of stunting. Efforts to improve the nutrition of toddlers can be carried out through the provision of additional sources of nutrition. Modified Dietetic Skimmed Milk and Coconut Oil (Modisco) combined with appetite massage is one of the alternatives that need to be tested for effectiveness in optimizing the nutritional status of stunted toddlers.

Objectives: This study aimed to determine the effectiveness of the combination of modisco and appetite massage on the nutritional status of stunted toddlers.

Methods: The design was quasi-experimental with a pre-test and posttest control design approach. The large sample of 30 stunted children aged 1-5 years was divided into two groups using a simple random sampling technique. The intervention group was given modisco for 15 days and appetite massage 3x/week, and the control group was given only modisco for 15 days. Measurements of weight, height, and nutritional intake before and after the intervention. Data analysis used paired t-tests and independent t-tests.

Results: There was a difference in body weight between the intervention and control groups (p-value=0.02; 95%CI=0.28-0.40). There was a difference in nutritional intake in the intervention group and control groups, namely in carbohydrate nutrients (p-value = 0.02; 95%CI=5.67-81.62), Vitamin B1 (p-value≤0.001; 95%CI=-3.97 – (-2, 02)), Vitamin B6 (p-value=0.008; 95%CI=0.17-1.01), Vitamin C (p-value≤0.001; 95%CI=16.01-34.72). There was no significant difference in height/body length of the intervention and control groups (p-value=0.38; 95%CI=-0.03 – (-0.07).

Conclusions: The combination of Modisco and appetite massage was more effective in increasing weight and nutritional intake than Modisco alone. Midwives are expected to educate mothers of toddlers to provide Modisco and appetite massage.

INTRODUCTION

Stunting is still a global problem in the world, not only from a health perspective¹, but also has an impact on economic growth and reduces the quality of human resources in future generations of a nation². Globally, about 45% of deaths in children under five are related to malnutrition. Although rates of stunting, wasting, and underweight have declined globally, evidence suggests that the burden of malnutrition in children is uneven around the world^{3,4}. The World Health Organization (WHO) shows that the burden of stunting is higher than wasting and underweight, based on an analysis of 388 national surveys in 139 countries⁵. The second Sustainable Development Goals (SDGs) goal is to overcome stunting with the target of reducing hunger, improving food security, improving nutritional status,

and encouraging sustainable agriculture. The target to be achieved by 2030 includes the elimination of all forms of nutritional problems in children, such as stunting, wasting, and severe malnutrition in children under five. Malnutrition in children can reduce the quality of human resources and hinder intellectual development. The stunting rate in Indonesia in 2022 is at 21.6%, with a target of decreasing to 17.8% in 2023^{7,8}. Based on 2022 data, there are 10.3% of undernourished toddlers (Weight/Height), 11.1% of short toddlers (Height/Age), and 14.8% of undernourished toddlers (Weight/Age) in Pekalongan Regency⁹.

Some of the causes of inappropriate nutritional status, both stunting, wasting, and underweight, include inappropriate forms of practice in the provision of intake, including types of foods other than breast

milk^{10,11}. This leads to poor quality food intake and a lack of essential nutrients in children¹². In addition, the lack of weight gain in children according to their age is also caused by appetite disorders. Increasing the portion of food intake in toddlers is one way to help them become healthier^{13,14}.

For toddlers with high protein energy deficiencies, Modified Dietetic Skimmed Milk and Coconut Oil (Modisco) is a diet-based treatment method as a recommended therapy. Modisco is a high-energy and nutrient-rich protein food formulation made from full cream milk, sugar, and vegetable fats or solid fats (oil/margarine). The WHO recommends Modisco to improve the nutritional status of toddlers, and it has been proven to meet nutritional standards as a supplement product by the Ministry of Health. Modisco can help malnourished toddlers increase their weight and is also used as a dietary supplement to improve the nutritional status of children¹⁴⁻¹⁶.

The problem of decreased appetite/difficulty eating in toddlers can cause problems in the nutritional status of toddlers; this situation can be solved with treatment strategies with and without the use of drugs. Non-pharmacological approaches can be done by consuming herbal herbs, massage therapy, hand pressure therapy, or needling therapy. Appetite Massage Therapy is an alternative solution for children who experience difficulty/disorders of appetite (picky eaters) and increases the synthesis of digestive enzymes to help food absorption. The absorbed nutrients will reach the bloodstream, which increases as a result of the activation of the sympathetic nerves^{17,18}. This massage is with the development of the *Tui Na* Massage technique; this type of massage is one of the traditional forms of healing that developed in China. By applying pressure to the bioenergy points and the body's energy flow pathways, this massage uses an acupressure approach that is simple and practical enough for the mother to do herself, as skin contact can increase the mother-baby attachment and maintain the emotional attachment between the two, this will maximize the benefits of the massage itself^{4,12}. Through the combination of Modisco therapy and appetite massage, it is hoped that it can increase appetite and maximize the absorption of nutrients in the digestive system of toddlers so that the nutritional status of toddlers can be improved¹⁸.

Several previous studies have proven the effectiveness of Modisco in optimizing weight gain in toddlers with nutritional disorders. Research by Lutfiasari conducted in 2020 showed that the average weight of toddlers before the intervention was 9.438 kg and increased to 9.715 kg¹⁹. Another supporting study conducted by Ersila (2023) shows that the average body weight from 9.50 kg increased to 10.21 kg²⁰. Modisco contains high energy and is easily absorbed by children's digestive systems. Not only that, the price of materials that make up Modisco is quite affordable, especially for the lower middle class¹⁴. Some of the studies that have been conducted only look at the aspect of weight; no one has looked at growth indicators in the form of height or body length for stunting evaluation.

Researchers conducted a preliminary study at the Karangdadap Health Center in January 2024 on midwives,

stunting program coordinators, and mothers of stunted toddlers. From the results of interviews with midwives and the person in charge of the stunting program, it was stated that at the Karangdadap Health Center, the stunting program is a program based on local staple foods but is not evenly distributed to all stunted toddlers, so the evaluation of the implementation of the program has not been carried out optimally. Feeding in the form of Modisco has never been given, especially appetite massage therapy to increase appetite, has never been given to toddlers with stunting. From the information obtained, it is the reason for conducting research in this field. After knowing the problem, the researcher also tried to interview 10 mothers who had stunted toddlers who stated that their children had difficulty eating as much as 80%, who were only given milk as additional nutrition of 50%, and supplemental feeding in the form of supplements as much as 20%.

The innovation in this study is by combining the administration of Modisco and appetite massage. Research on massage to increase appetite has shown that *tui* massage can improve children with eating disorders (picky eaters)^{18,21}. However, by combining the two treatments, it is hoped that children's appetite can increase and maximize the absorption of nutrients that enter the digestive system so that it can optimize the nutritional status of toddlers. Therefore, the author researched the effectiveness of the combination of modified skim milk and coconut oil and appetite massage in optimizing the nutritional status of stunted toddlers.

METHODS

Research Design

This research design applied a quasi-experiment with the presence of a control group. This study aimed to test the effectiveness of the combination of Modisco and appetite massage through a comparison between the intervention group and the control group. The data collection process is carried out in a structured manner according to the previously designed procedure.

Research Time and Place of Research

The research site was conducted at the Karangdadap Health Center, Pekalongan Regency, Central Java, Indonesia. The location selection refers to official data that in 2022, the highest stunting incidence in Pekalongan Regency was at the Karangdadap Health Center⁹. The research will be carried out in August-September 2024. In August, research preparation was carried out by approaching partners and sharing perceptions of research implementation with the team. The month of September was used for evaluation and evaluation of interventions, including the implementation of activities in the control group. The timing is determined based on operational needs according to the schedule that has been set by the Ministry of Education and Culture as the recipient of the 3rd batch of research grants in 2024.

Population and Sample

The study population was all children with a diagnosis of stunting by nutrition workers and health

center doctors at the age of 1-5 years. The picture of the stunting toddler population in the period from January to December 2022 is 134 cases (an average of 12

cases/month). Sampling is simple random sampling. The size of the sample is determined from the following formula²²:

$$n1 = n2 = \frac{[Z\alpha\sqrt{2PQ} + Z\beta\sqrt{P1Q1 + P2Q2}]^2}{(P1 - P2)^2}$$

$$n1 = n2 = \frac{[1.96\sqrt{20.55 \cdot 0.45} + 0.84\sqrt{0.80 \cdot 0.20 + 0.30 \cdot 0.70}]^2}{(0.80 - 0.30)^2}$$

$$= 14.30 \text{ respondents}$$

$$n1 = n2 = 14 \text{ respondents}$$

Based on the calculation of the formula above, the minimum sample obtained is 14. The number of samples was increased by 10% to anticipate sample dropout so that the number of samples was 15 for each group. The intervention group that will receive Modisco consists of 15 respondents and appetite massage therapy, and the control group consists of 15 respondents only giving Modisco, dividing respondents into each group based on a shaking system.

To maintain the homogeneity of the respondents, the researcher established several inclusion and exclusion criteria. The inclusion criteria are toddlers who have height or height with a z-score value less than the same as -2SD/standard deviation (stunted) to -3SD (severely stunted), lack of appetite, willing to consume milk, permanent residents of Karangdadap District who are cooperative in the research. The exclusion criteria set include toddlers who have diseases that affect nutritional status, such as tuberculosis/anemia/HIV (Human Immunodeficiency Virus). There is one toddler who is still on TB treatment. Until the end of the study, there were no respondents who lost to follow-up in the intervention group and the control group, so the sample size of each group remained at 15 respondents.

Research Variables and Instruments

This study uses variables of weight, height, and nutritional intake. Weight and height measurements were carried out by midwives assisted by health cadres of the Karangdadap Health Center. The instrument used to measure weight is a scale in kilograms, while a height measure (microtome) for children over 2 years old and a wooden board (length board) for under 2 years old is used to measure height in centimeters. The nutrients to be monitored include energy, water, protein, fat, carbohydrates, vitamin A, vitamin E, vitamin B1, vitamin B2, vitamin B6, vitamin C, sodium, potassium, calcium, magnesium, phosphorus, iron, and zinc were measured using 24-hour food recall analysis as a method to assess food consumption, where participants were asked to remember and report all foods and drinks they consumed within the past day. Research enumerators conducted food consumption interviews with a background in midwifery diploma III education that had been carried out with previous perception equations. How to measure weight using a digital scale: children are asked to stand.

In contrast, for measuring body length in the age group of children under or equal to 2 years old by lying down with a microtonal made of wooden boards, and for toddlers over 2 years old, measurements are taken by

standing perpendicular to the wall that has been installed with a microtonal Gea brand; the measurement results are recorded and entered into the observation sheet in the form of numbers in centimeters. Children's nutritional intake data is collected through a nutrition assessment instrument in the form of a 24-hour food recall form, which is before the implementation of the intervention and after the implementation of the intervention every three days. Nutritional intake data for toddlers was processed using the Indonesian version of Nutri survey in 2014 by the research team.

Data Collection

The researcher collected data from respondents who met the criteria, and then the researcher asked for the consent of the mother as the person in charge/guardian of the research subject was asked to sign the consent letter that had been prepared. Before the implementation of the intervention, the weight and body length of the toddler were measured first, and then the mother was asked to fill out the toddler's food recall. In addition, respondents were grouped into 2, namely control (as many as 15 respondents) and intervention (as many as 15 respondents) randomly. Then, the researcher will provide treatment to the intervention group by giving a combination of Modisco and appetite massage therapy to toddlers. Meanwhile, the control group was only given Modisco. Modisco is given in ready-to-eat instant packaging, which has an energy content of 100 kcal, 6 g of fat, 2 g of protein, 9 g of carbohydrates, and 30 mg of sodium. Modisco consists of milk powder, sugar, and vegetable fat given as much as one sachet/day.

Meanwhile, Appetite massage therapy is a massage to stimulate appetite and increase nutrient absorption through massage on several parts of the body of toddlers, including the hands, abdomen, and back, which is done 3x/week to ensure the level of compliance of mothers under five. The massage is carried out by a baby massage therapist with a Diploma III Education background and has a baby massage certificate from National Agency for Professional Certification and a Certified Holistic Touch Therapy (CHTT) from the Indonesian Holistic Care Association (IHCA) Institute. The action was carried out for 15 days for each group. In addition, the researcher provided an observation sheet on compliance with Modisco consumption, and food recall was reviewed every 3 days after the intervention was carried out. Monitoring is also carried out through online reminders via WhatsApp to parents of toddlers every day. After 15 days, the researcher conducted a posttest by measuring Weight, Height and assessing the

child's nutritional intake. The determination of 15 days or 2 weeks is the simplest standard time limit in intervention studies. In addition, the use of this time is also used by other researchers as an intervention in supplemental feeding to increase weight¹⁹; however, this limited time is a possible cause of increased weight, height, and nutritional intake that is not optimal.

Data Analysis

Once the data is fully collected, the data processing stage begins. This process involves several steps, including Editing (checking the completeness of data), Processing (entering research data in the form of numbers into the program), Cleaning (checking the data that has been entered into the program and making sure all the data entered is correct)²². After Processing, the data was analyzed univariate and bivariate. Respondent characteristics include determining the nutritional status of toddlers by measuring weight, height/length, and appetite based on nutritional intake before and after treatment in the intervention and control groups; then, the results are presented in a frequency distribution using univariate analysis. Data on weight and height increase were processed and analyzed in numerical form by looking at the increase in weight, height/length, changes in the classification of nutritional status of Weight to Age, Height to Age, and Weight to Height, as well as changes in nutritional intake of toddlers. To test the effect of Modisco administration and appetite massage therapy on each group, a bivariate analysis was performed. The findings of the similarity test of variance and normality of the data obtained homogeneous and normal data for all variables studied had a data result of >0.05 so that for the test of the mean difference pre and post in each group using a pair sample t-test. After that, the difference test of the two groups was continued because the data used was normal; an independent t-test was used²².

Research Ethics

The implementation of the research took place in the work area of the Karangdadap Health Center, Pekalongan Regency, which had the highest incidence of stunting in 2022, which was 340 cases (11.7%)⁹. The licensing process begins with the submission of a research permit application to the Regional Development Planning Agency of Pekalongan Regency, Central Java,

Indonesia, then to the Health Office, and then to the Karangdadap Health Center of Pekalongan Regency. Before conducting the research, the researcher had obtained ethical approval from the Health Research Ethics Committee of the University of Muhammadiyah Purwokerto with Registration Number KEPK/UMP/114/VIII/2024 dated August 21, 2024.

RESULTS AND DISCUSSIONS

Respondent Characteristics

The sample size in each group consisted of 15 toddlers with stunted and severely stunted nutritional status. The gender of the control and intervention groups was 7 (46.7%) males and 8 (53.3%) females. The prevalence of stunting is recorded to occur more in male children. Several studies have stated that the anthropological status of boys when compared to girls, boys are more likely to experience growth disorders. In addition, compared to girls, boys often show a higher level of activity because girls stay at home more with their mothers, who are closer to preparing food^{27,28}. Several studies have shown a significant correlation between children born at the next birth and a greater likelihood of malnutrition. In addition, gender also affects the nutritional status of toddlers; this is possible due to gender discrimination, especially in terms of parenting, treatment, and opportunities given to girls^{29,30}.

The last education of mothers under five was 60% secondary, and 40% had basic education in the intervention group. The low level of maternal education is one of the indirect factors that contribute to the incidence of stunting in toddlers because well-educated mothers tend to be more innovative and selective in choosing food. These results are also supported by research gives the idea that limited education in mothers has a risk of 1.6-5.1 times showing symptoms of stunting²³⁻²⁶. The number of children in families in each group mostly has two children in one nuclear family, which is 53%. The age of the respondents ranged from 24-48 months, with the average in the control group of 33.13 months (SD 10.38) and in the intervention group, the average age of 29.20 months (SD 7.3). The characteristics of the study participants are shown in Table 1 below.

Table 1. Distribution of respondent demographic characteristics

Variable	Control Group				Intervention Groups			
	n	%	Mean	SD	n	%	Mean	SD
Sex of the child								
Boy	7	46.7	-	-	7	46.7	-	-
Girl	8	53.3	-	-	8	53.3	-	-
Mother's Education								
Basic Education	3	20.0	-	-	6	40.0	-	-
Secondary Education	10	66.6	-	-	9	60.0	-	-
Higher Education	2	13.3	-	-	0	0	-	-
Number of Children in the Family								
<3	11	73.3	-	-	11	73.3	-	-
≥3	4	26.7	-	-	4	26.7	-	-
Child Age (in Months)	-	-	33.2	10.4	-	-	29.2	7.4
Weight/Age								

Variable	Control Group				Intervention Groups			
	n	%	Mean	SD	n	%	Mean	SD
Normal	3	20.0	-	-	5	33.3	-	-
Underweight	9	60.0	-	-	9	60.0	-	-
Severely Weight	3	20.0	-	-	1	6.7	-	-
Height/ Age								
Stunted	12	80.0	-	-	11	73.0	-	-
Severely Stunted	3	20.0	-	-	4	27.0	-	-
Weight/Height								
Normal	6	40.0	-	-	9	60.0	-	-
Wasted	8	53.3	-	-	3	20.0	-	-
Severely wasted	1	6.7	-	-	3	20.0	-	-

Note: SD = Standard Deviation
n = Number of participants
% = Percentage

The decrease in the prevalence of stunting is influenced by four nutritional problems, namely, underweight underweight, inadequate nutrition, and malnutrition. Failure to grow begins with weight loss or weight gain that is not in accordance with a standard growth pattern. Weight loss in children who are not regularly supervised is at risk of causing advanced health problems, including being underweight, which will then become acute malnutrition (wasting). If this condition continues, it can lead to stunting²³. The government does not stay silent in dealing with the condition of stunted toddlers, which is closely related to the achievement of the quality of the next generation of the nation, so the government also supports the provision of complementary food intake to stunted toddlers, undernourished, and severe malnutrition. This supplemental food program pays attention to the macro and micro adequacy that the body needs to maximize the growth of toddlers²⁴.

Analysis of Differences in Weight and Height of Toddlers Before and After Intervention in the Control Group and Intervention Group

The average weight of the respondents before the intervention was applied in the control group was 9.14 kg (SD=1.43) and after the intervention increased to 9.33 kg (SD=1.42), while in the pre-intervention group it averaged 9.17 kg (SD=1.19) and after the intervention increased to 9.49 kg (SD=1.14). The height of the control group before had an average of 84.17 cm (SD=7.02) and after it increased to 84.20 cm (SD=7.04), while in the intervention group before it had an average of 80.47 cm (SD=5.53) and after it increased to 80.52 cm (SD=5.50). The results of weight and height distribution are shown in table 2. Nutrient intake includes; calories, water, protein, fat, carbohydrates, vitamins A, E, B1, B2, B6, C, sodium, potassium, calcium, magnesium, phosphorus, iron, and zinc.

Table 2. Analysis of differences in weight and height of toddlers before and after intervention in the control group and intervention group

variable	Control group (n=15)		p-value	95% CI	Intervention Groups (n=15)		p-value	95% CI
	Pre	Post			Pre	Post		
	Mean ± SD	Mean ± SD			Mean ± SD	Mean ± SD		
Weight (kg)	9.14±1.43	9.33±1.42	0.001	-0.30 - (-0.09)	9.17±1.19	9.49±1.14	<0.001	-0.48 - (-0.10)
Height (cm)	84.17±7.02	84.20±7.04	0.041	-0.05 - (-0.01)	80.47±5.53	80.52±5.53	0.015	-0.10 - (-0.01)

Note: SD = Standard Deviation
n = Number of participants
% = Percentage
95% CI = 95% Confidence intervals

Based on the paired t-test differential test, the results were obtained that there was a difference in weight before and after in the control group (p-value=0.001), and in the intervention group, there was a p-value of <0.001. It showed that the average weight before and after the two groups differed, suggesting that each treatment had an impact on the weight of toddlers with stunting. A test of the difference between the average height variables before and after in the control group was also shown in the Table, with p-value=0.041 (<0.05) and p-value=0.015 in the intervention group; through these results, it was possible to conclude that there was a difference in the average height of the two groups before and after the intervention, which showed

that each treatment had an impact on the height of the children who experienced stunting.

Evaluation of nutritional conditions can children can use several nutritional status indices as parameters. The parameters used include weight/age, body length/age, and height/age³¹. Height is often used to estimate a person's age and important clues, especially for children when age information is not available. Changes in height often affect a person's weight. It means that height is an important factor in the context of health after weight. The quantity of protein, fat, water, and minerals in bones is depicted by body weight³¹. Based on 30 toddlers who experienced stunting, the researchers divided two groups, namely the intervention group, namely a combination of Modisco and appetite massage,

and the control group, which was given Modisco alone for 15 days. Through this treatment, the difference in the average weight gain before and after in the intervention group was 0.317 kg (317 g), and in the control group was 0.193 kg (193 g).

On the other hand, the average height increase in the intervention group before and after was 0.053 cm, while the control group was 0.027 cm. A supporting study conducted in Kediri Regency, Indonesia, showed weight gain in 26 respondents (78.8%) after being given a local-based dietary supplement for 1 month, with an average weight gain of 400 g. Similar research stated that Modisco administration was able to increase an average body weight of 710 g within 1 month²⁰. According to the Indonesian Pediatrician Association, it states that the growth of children aged 3-5 years, the increase in the child's height is about 6 cm and weight of about 2 kg. It means that the average expected weight gain without intervention is 75-100 g/month³².

Meanwhile, if we look at the nutritional adequacy rate for the age group of 1-3 years, children need energy of 1350 kcal, protein of 20 g, carbohydrates of 215 g, and total fat of 45 g³³. The addition of Modisco is given as an additional food, which is an additional nutrient for toddlers with stunting or wasting. The dose given is 17 grams per serving with a content of 100 kcal, 2 grams of protein, 9 grams of carbohydrates, and a total of 6 grams of fat. Modisco is given twice a day with the addition of appetite stimulation massage to increase appetite, which allows the nutrient intake to be more fulfilled for the target of weight gain in stunted toddlers.

Modisco is one of the alternatives in meeting nutritional needs, one of which is when providing additional food to stunted toddlers. Modisco has many benefits with the content of nutrients needed by the body, such as calories, proteins, carbohydrates, and fats, which are intended to produce energy for toddlers during activities^{13,19}. The combination of Modisco intervention with appetite massage provided an increase in appetite with evidence of an increase in nutrient intake, body weight, and height after the intervention was carried out. Appetite massage is a solution for overcoming picky eater disorders in children and increasing enzymatic secretion that facilitates the absorption of nutrients in the gastrointestinal tract. The stimulation of the sympathetic

nerves will make the nutrients absorbed into the bloodstream, which will also increase^{17,18}.

Analysis of the Difference in Average Nutritional Intake before and after The Intervention

A comparison of nutrient intake between before and after the intervention indicated significant differences in the two groups, both those who received the intervention and those who did not. Based on Table 3 and Table 4, in the intervention group, there was a significant increase in the intake of nutrients Protein (p-value=0.011), vitamin B6 (p-value=0.023), and potassium (p-value=0.035). In the control group, significant differences were only in the intake of vitamin B6 (p-value=0.005) and iron (p-value=0.017).

Increased intake of protein, vitamin B6, and potassium in the intervention group showed that the combination of Modisco and appetite massage performed contributed positively to the improvement of certain nutrient consumption patterns. Protein has a major contribution to the process of forming and restoring body structures, while vitamin B6 functions in protein metabolism and supports the functioning of the nervous system. Potassium is an essential mineral that plays a role in electrolyte balance as well as muscle and nerve function¹⁴⁻¹⁶. This significant difference indicates that the administration of Modisco combined with the appetite massage given can effectively affect the nutritional consumption patterns of stunted toddlers¹².

On the other hand, in the control group, a significant increase occurred only in the intake of vitamin B6 and iron elements. Iron is an essential mineral that contributes to the production of red blood cells and protection against anemia. Increased vitamin B6 and iron in the control group may indicate a natural change in diet or external factors such as Modisco, even though the control group did not receive an appetite massage¹⁶. The results of this study also confirm that the combination of Modisco and appetite massage was more effective in increasing overall nutritional intake than the control group. Significant differences in more nutrients in the intervention group suggest that the combination of Modisco and applied appetite massage had a greater impact on changes in nutrient consumption patterns.

Table 3. Analysis of differences in nutritional fulfillment of toddlers before and after in the intervention group

Nutrition	Pre	Post	p-value	95% CI	
	Mean ± SD	Mean ± SD		Lower	Upper
Energy (kcal)	1009.86±201.55	1094.48±341.10	0.432	-309.39	- 140.15
Protein (g)	31.58±12.54	55.61±30.31	0.011	-41.81	-6.24
Fat (g)	29.264±13.21	25.14±11.21	0.393	-6.08	- 14.34
Carbohydrates (g)	150.436±46.73	158.07±48.49	0.682	-46.96	- 31.69
Vitamin A (mcg)	574.129±422.18	832.54±557.01	0.090	-572.49	- 55.68
Vitamin E (mg)	6.286±12.07	3.54±1.52	0.392	-3.97	- 9.45
Vitamin B1 (mg)	0.829±0.26	0.85±0.32	0.861	-0.28	- 0.24
Vitamin B2 (mg)	0.509± 0.26	0.81±0.39	0.061	-0.64	- 0.03
Vitamin B6 (mg)	1.029±0.38	1.44±0.65	0.023	-0.76	- 0.06
Vitamin C (mg)	26.621±31.85	26.59±17.02	0.991	-15.68	- 15.73
Sodium (mg)	902.486±677.68	667.86±399.10	0.287	-216.09	- 685.34
Potassium (mg)	998.436±508.38	1558.66±758.51	0.035	-1068.30	-52.15

Nutrition	Pre	Post	p-value	95% CI	
	Mean $\pm$ SD	Mean $\pm$ SD		Lower	Upper
Calcium (mg)	272.236 $\pm$ 170.60	374.77 $\pm$ 249.14	0.312	-312.35	- 107.28
Magnesium (mg)	121.693 $\pm$ 54.95	162.77 $\pm$ 80.79	0.102	-91.97	- 9.81
Phosphorus (mg)	564.00 $\pm$ 179.96	824.21 $\pm$ 389.54	0.061	-533.78	- 13.35
Iron (mg)	7.74 $\pm$ 1.99	8.11 $\pm$ 2.66	0.652	-2.10	- 1.37
Zinc (mg)	5.09 $\pm$ 1.15	6.19 $\pm$ 2.01	0.075	-2.29	- 0.10

Note: SD = Standard Deviation

95% CI = 95% Confidence intervals

Table 4. Analysis of differences in nutritional intake of toddlers before and after in the control group

Nutrition	Pre	Post	p-value	95% CI	
	Mean $\pm$ SD	Mean $\pm$ SD		Lower	Upper
Energy (kcal)	944.36 $\pm$ 425.69	960.01 $\pm$ 426.23	0.889	-251.69	220.39
Protein (g)	55.80 $\pm$ 29.45	57.21 $\pm$ 34.13	0.875	-20.31	17.49
Fat (g)	25.14 $\pm$ 11.21	23.49 $\pm$ 13.22	0.638	-5.68	8.97
Carbohydrates (g)	114.43 $\pm$ 49.27	131.49 $\pm$ 62.89	0.054	-5.04	549.22
Vitamin A (mcg)	855.80 $\pm$ 642.51	583.71 $\pm$ 500.43	0.171	-0.38	1.96
Vitamin E (mg)	3.54 $\pm$ 3.34	2.75 $\pm$ 2.12	0.062	1.26	3.17
Vitamin B1 (mg)	3.89 $\pm$ 1.67	1.67 $\pm$ 1.73	0.554	-0.18	0.33
Vitamin B2 (mg)	0.82 $\pm$ 0.49	0.75 $\pm$ 0.46	0.117	-0.59	0.07
Vitamin B6 (mg)	0.85 $\pm$ 0.39	1.11 $\pm$ 0.59	0.005	-21.34	-4.67
Vitamin C (mg)	1.23 $\pm$ 0.64	14.23 $\pm$ 15.05	0.983	-274.85	280.56
Sodium (mg)	716.56 $\pm$ 587.23	713.71 $\pm$ 501.47	0.477	-270.49	550.08
Potassium (mg)	1515.87 $\pm$ 727.59	1376.08 $\pm$ 740.89	0.426	-84.80	189.76
Calcium (mg)	392.90 $\pm$ 212.46	340.42 $\pm$ 247.89	0.478	-23.96	48.66
Magnesium (mg)	156.75 $\pm$ 62.32	144.40 $\pm$ 65.56	0.754	-193.37	261.23
Phosphorus (mg)	791.58 $\pm$ 372.94	757.65 $\pm$ 410.45	0.062	0.46	3.96
Iron (mg)	9.64 $\pm$ 3.95	6.43 $\pm$ 3.16	0.017	-0.47	2.64
Zinc (mg)	7.52 $\pm$ 3.27	6.43 $\pm$ 2.78	0.150	-251.69	220.39

Note: SD = Standard Deviation

95% CI = 95% Confidence intervals

Analysis of Differences in Weight, Height and Nutrient Fulfillment Between Intervention and Control Groups

In the results of this study, an increase in weight difference between the two groups was obtained, namely the intervention group and the larger control group of the intervention group of 0.35 $\pm$ 0.23 kg with a p-value of 0.021. These results show that the combination of Modisco and appetite massage is able to maximize weight gain in stunted toddlers. Appetite Massage Therapy is a development of acupressure called *Tui Na*, which has the advantage of being able to overcome poor appetite in children¹⁸. This massage method uses friction, gentle sweeping massage (*Effleurage* or *Tui*), deep massage (*Petrissage* or *Nie*), tapping (*tapotement* or *Da*), as well as pulling, twisting, shaking, and vibrating movements of specific areas to influence the body's energy flow through pressure and thrust on specific areas of the body.

The results of another study showed weight gain after 4 weeks of infant massage with an average increase of 683 g in respondents aged 12-36 months and at 25-36 months of age 480 g. Supporting research was conducted with thin toddler subjects aged 12-59 months through Modisco supplementation combined with acupressure,

obtaining an average result before treatment of 10.20 $\pm$ 1.10 and after treatment of 10.74 $\pm$ 1.25 with p-value 0.001¹¹. Modisco has shown efficacy and compatibility with children's nutritional needs nationwide; this supplementation has the potential to help improve nutritional conditions and encourage faster child weight gain.

After consuming Modisco, the child will gradually experience a weight gain of around 30-100 g per day. This product is safe to consume without negative side effects, but its use in children who are obese or have health problems such as kidney, liver, or heart disease should be done under the supervision of a doctor³⁴. The combination of Modisco with appetite massage will facilitate blood circulation to the brain so that it will stimulate the hypothalamus in increasing the vagus nerve (digestion) in responding to hunger and appetite. Through the combination of Modisco and appetite massage, as appetite increases, weight will also increase³⁵.

Based on the analysis of differences in control groups and interventions on weight variables, the difference in the average weight of stunted toddlers in the two groups was different; in other words, the

combination of Modisco and appetite massage therapy was more effective in increasing the weight of stunted toddlers. The p-value for this difference is 0.02 (<0.05), and the t-value is 2.44 (> t table 2.13), so H₀ is rejected. The mean difference in weight difference was 0.23-0.32 (95% CI lower and upper). The results of this study also showed that the Height variable obtained a t-value of 0.88 (< t table 2.13, H₀ is irresistible) and a p-value of 0.38 (>0.05), which means that there was no difference in the average height of stunted toddlers in the two groups, namely control and intervention. In other words, the height of stunted toddlers will increase using Modisco supplements alone or in combination with appetite

massage therapy. The mean height difference was -0.03-0.07 (95% CI lower and upper). Table 6 also shows the variables of nutrient intake. Of the 18 nutrients examined, four carbohydrates (p-value=0.026), vitamin B1 (p-value<0.001), vitamin B6 (p-value=0.008), and vitamin C (p-value<0.001) showed differences between the two groups, namely the control group and the intervention group with p-value<0.05. These results mean that the combination of Modisco and appetite massage therapy can increase the intake of nutrients, including carbohydrates, vitamin B1, vitamin B6, and vitamin C, in stunted toddlers.

Table 5. Analysis of differences in weight, height difference, and average nutrient intake before and after intervention in the intervention group with the control group

variable	Mean± SD		p-value	95% CI	
	Intervention groups	Control group		Lower	Upper
Weight Difference (kg)	0.35±0.27	0.18±0.16	0.021	0.28	0.32
Height Difference (cm)	0.05±0.07	0.03±0.05	0.382	-0.03	-0.07
Difference in Nutrient Intake					
Energy (kcal)	84.62±390.84	15.65±305.91	0.313	-149.56	449.79
Protein (g)	-4.13±2.09	-1.64±33.79	0.712	-19.83	28.65
Fat (g)	7.64±20.80	17.06±3.43	0.726	-11.77	8.31
Carbohydrates (g)	258.41±79.48	-272.09±56.04	0.026	5.67	81.62
Vitamin A (mcg)	-2.74±5.68	-789±1.89	0.919	-49.04	44.39
Vitamin E (mg)	0.02±0.35	-2.21±1.49	0.994	-2.01	2.02
Vitamin B1 (mg)	0.31±0.55	-0.07±0.58	<0.001	-3.97	-2.10
Vitamin B2 (mg)	407±0.61	0.22±0.55	0.994	-0.35	0.34
Vitamin B6 (mg)	-28±465	1.30±1.78	0.008	0.17	1.01
Vitamin C (mg)	-234.62±2.83	-2.86±2.65	<0.001	16.01	34.72
Sodium (mg)	560.22±618.83	-139.79±521.67	0.799	-438.75	341.35
Potassium (mg)	102.54±50.54	-52.48±47.97	0.880	-534.63	620.20
Calcium (mg)	41.08±861.08	-12.35±128.25	0.837	-198.01	161.75
Magnesium (mg)	26.21±48.41	-33.93±77.04	0.827	-50.03	62.07
Phosphorus (mg)	364±12.74	-3.21±358.39	0.823	-263.63	328.90
Iron (mg)	1.09±5.03	-1.09±3.13	0.241	-4.15	1.09
Zinc (mg)	8.46±18.88	1.56±2.12	0.204	-13.44	1.77

Note: SD = Standard Deviation

95% CI = 95% Confidence intervals

In addition to conducting different tests on changes in nutrient intake, weight, and height in stunted toddlers, observations of the nutritional status of toddlers were also carried out by researchers in both groups, both intervention and control, according to the purpose of the study looking at changes in nutritional status. The researchers identified changes in nutritional status on the index that included the ratio of Weight to Age, Height to Age, and Weight to Height in the intervention and control groups. Anthropometric numerical data is classified as referring to the provisions of the Regulation of the Minister of Health of Indonesia No. 2 of 2020 concerning anthropometric measurement

standards for children in Indonesia. Table 6 describes that through the combination of Modisco with appetite massage for 15 days, it was not enough to show a statistically significant change in nutritional status in both the parameters of Weight to Age, Height to Age, and Weight to Height. However, the odds ratio results showed that there was an indication of nutritional risk in the intervention group measured through the weight per height indicator 2.2 times better than in the control group. Therefore, follow-up research needs to be carried out to find the ideal duration of intervention to significantly improve the nutritional status of stunted toddlers both statistically and clinically.

Table 6. Analysis of differences in the nutritional status of toddlers in the intervention group with the control group before and after the intervention

Variable	Intervention groups				Control group				p-value	OR	95% CI	
	Pre		Post		Pre		Post				Lower	Upper
	n	%	n	%	n	%	n	%				
Child Age (in Months)												
Weight/Age	3	20	3	20	5	33.3	5	33.3	0.451	1.00	0.22	4.56
Normal	9	60	6	40	9	60	7	46.7				
Underweight	3	20	6	40	1	6.7	3	20				
Severely Weight												
Height/ Age	0	0	4	26.7	0	0	2	13.3	0.660	1.46	0.26	8.01
Stunted	11	73.3	7	4.7	12	80	10	66.7				
Severely Stunded	4	26.7	4	26.7	3	73.3	3	20				
Weight/Height												
Normal	9	60	10	66.7	6	40	7	46.7	0.188	2.29	0.52	10.01
Wasted	3	20	4	26.7	8	53.3	3	20				
Severely wasted	3	20	1	6.7	1	6.7	5	33.3				

Note: n = Number of participants

% = Percentage

OR= Odds Ratio

95% CI= 95% Confidence intervals

In addition to finding out the average difference in weight variables between the intervention and control groups, the researcher also surveyed nutrient intake as one of the indicators of increasing children's appetite based on the nutritional intake consumed. The results showed that four nutrients obtained different results before and after in both groups, namely carbohydrates (p-value=0.026), vitamin B1 (p-value<0.001), vitamin B6 (p-value=0.008), and vitamin C (p-value<0.001) with a p-value<0.05. It can be concluded that the combination of Modisco appetite therapy and massage can increase the intake of nutrients, including carbohydrates, vitamin B1 (thiamine), vitamin B6 (pyridoxine), and vitamin C (ascorbic acid) in stunted toddlers. Toddler eating problems can be caused by several variables, namely organic, psychological, and nutritional. One of the causes of decreased appetite in toddlers is conditions that attack the spleen and digestive tract, such as gastrointestinal infections, worms, intestinal inflammation, impaired spleen function, impaired digestive function, and Gastroesophageal Reflux Disease (GERD)¹⁸. It causes the intake of food that flows into the stomach to be less able to be optimally processed properly so that there is a buildup of nutrients in the child's digestive tract. Parents often report complaints such as children vomiting easily, nausea when fed, and satiety quickly, which eventually reduces their appetite and even disappears³⁶. The recommended supplements for children are maximized by adding 10 types of vitamins (A, D, E, K, B1, B2, B3, B6, B12, folate) and seven types of minerals (iron, iodine, zinc, calcium, sodium, selenium, and phosphorus)³⁷. The use of Vitamin B1 plays an important role in the body's metabolism, especially in warding off free radicals, and plays a role in reducing the potential for inflammation in body cells, so in stunted toddlers it is needed, especially to maintain the body's immune system so that the immune system is better³⁸. Vitamin B6 functions to break down fat in the body so that it becomes energy, which is important for brain and nerve development for body organs and the formation of red blood cells increasing

vitamin B6 intake in stunted toddlers greatly helps the recovery and repair process of stunted toddlers³⁹. To reduce the risk of infections, especially parasitic infections, stunted toddlers need vitamin C intake, so vitamin C intake in stunted toddlers must be sufficient⁴⁰.

Increased appetite is caused by the combination of Modisco and appetite massage, where appetite booster massage can help improve blood circulation and optimize the performance of body organs, including digestive organs. Through massage, bowel movements will be more active so that the absorption of nutrients by the body becomes better and appetite increases. Massage therapy has the effect of increasing the tone of the vagus nerve (the 10th nerve), which has an impact on increasing enzyme levels and the absorption of gastrin and insulin so as to optimize food absorption. Acupressure at the points of Zusanli (ST 36), Pishu (BL 20), and Weishu (BL 21) contributes to improving the work of the digestive organs, especially the spleen and stomach¹⁸. A study that was in line with these results found that the average level of eating difficulty before the massage was 3.360, and after the massage was 2.260⁴¹. Regular massage stimulates nerve endings on the surface of the skin. It can make the permeability of the cell membrane lower, which may cause the transfer of sodium and potassium ions to occur, which triggers the occurrence of electrical voltage in neurons and muscles. The functioning of organs, such as the gastrointestinal system, is affected by the action of sympathetic and parasympathetic nerves. Increased activity of the vagus nerve will increase peristaltic movement, accelerate gastric emptying, and increase hunger (appetite) so that toddlers eat voraciously. In addition, the activity of digestive enzymes increases, which plays a role in facilitating the absorption of nutrients. These nutrients are then drained into the blood, whose circulation is also increased due to stimulation of the sympathetic nervous system⁴². Toddlers who received stimulation through this massage showed an increase in appetite of about 0.5 to 1 tablespoon. This massage therapy contributes

positively to the smooth circulation of blood, which ultimately supports increased food intake in children⁴³.

The findings that became the advantages in the study were known from the results of interviews with mothers that their child experienced an increase in body weight and height as well as an improvement in appetite because the child was interested in the Modisco given and felt comfortable with the massage, especially on the parts of the body that were massaged such as the abdomen and back. Mothers of toddlers also stated that they are motivated to do appetite massages because they are closer to their children and can interact more through physical touch, which will make mothers more excited to maximize their children's growth and development. Other studies that support the results of this study stated that variations in food processing and parental motivation in providing additional foods could increase children's interest in consuming supplements; this has a positive impact on weight gain in stunted toddlers^{44,35}.

While the limitations in this study are toddlers who do not experience weight gain, their height and appetite also do not increase much. It was obtained from interviews with mothers that their children felt uncomfortable when massaged, so some steps were not solved properly; there were also children who, when the study was carried out, experienced pain such as cough and cold, so this had an impact on the unsuccessful weight gain, height and appetite of toddlers. In addition, the time for the study was carried out in only 15 days, so it cannot be said that there has been a statistical increase in nutritional status.

CONCLUSIONS

The combination of Modisco and appetite massage therapy was able to increase the weight, height, and nutritional intake of toddlers before and after the intervention. However, from the results of this study, the combination of Modisco and appetite massage therapy is more effective in increasing body weight and nutrient intake (carbohydrates, Vitamin B1, Vitamin B6, and Vitamin C) in stunted toddlers than just giving only Modisco. Advice for health workers, especially midwives, to be able to make efforts to handle cases of stunted toddlers to improve the nutritional condition of toddlers who are stunted through a complementary intake intervention method approach, namely Modisco combined with appetite massage. It also needs to be done to provide education to mothers under five to be able to intervene independently in cases of stunted toddlers in the hope of improving the nutritional status of stunted toddlers so that the impact of stunting severity can be minimized and even avoided completely.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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AUTHOR CONTRIBUTIONS

All authors contributed in research and publications. The roles of each writer are; 1) WE contributes to the conceptualization, administration of research, investigation, validation, data analysis, and writing of draft publication manuscripts. 2) F contributes in Conceptualization, research administration, investigation. 3) NC contributes in Conceptualization, validation, visualization, scriptwriting, article editing.

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