ORIGINAL ARTICLE

The effect of Clarias cookies on the growth and development of wasting children

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ABSTRACT

The aim of this study was to examine the effect of Clarias cookies on the growth and development of wasting children. This study was conducted in the Taman Bacaan Palembang Health Center's working area. A quasi-experimental design was used, with a sample of 120 toddlers divided into the control (60) and treatment (60) groups. Toddlers in the treatment group were given Clarias cookies weighing 45 g/day, while those in the control group were given 45 g/day of cookies distributed by the government every day for three months. The body weight was measured monthly. Anthropometric data were collected by nutritionists who had been trained to use anthropometric tools. All collected data were recorded using a questionnaire. There was no significant difference in the samples between the control and intervention groups ($P > 0.005$). The sample can be categorized into the same group for each variable. This did not introduce bias in the results of the bivariate analysis. After receiving the Clarias cookies, the weight of the children in the treatment group increased significantly ($p = 0.000$) compared to that in the control group. The kids in the treatment group gained 2.21 pounds more than those in the control group, which gained just 0.28 pounds. To improve the nutrition of malnourished toddlers, it would be better to provide Clarias cookies rather than biscuits from the government.

Key words:
Clarias cookies; supplementation; malnourished toddlers; growth

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INTRODUCTION

The process of a child's growth and development continues from conception to adulthood. Ensuring normal growth in children during infancy and toddlerhood requires adequate dietary intake.[1–3] Nutritional deficiencies during these critical stages can lead to developmental delays and long-term health issues.[4] It is important for parents and caregivers to provide a balanced diet rich in essential nutrients to support healthy growth and development. By introducing a variety of fruits, vegetables, whole grains, and lean proteins into a child's diet, parents can help promote optimal growth and overall well-being.[5]

Childhood is the most important stage in human development. It is an optimal period for mental and physical growth. Childhood begins at birth and extends to the age of 11. Early childhood is from three to eight years old, and middle childhood is from nine to 11 years old, followed by adolescence or teenage years(12–18 years). It is also a time when children are most open to learning and picking up new skills, so it is important to give them a supportive and engaging atmosphere throughout this time.[6] During childhood, children form the foundation for their future personalities and behaviors. Providing a nurturing environment during this critical period can have a lasting impact on their overall well-being.[7]

Approximately one-third of the global fatalities are linked to inadequate nutrition. Approximately 4.4% of these cases are caused by extreme deficiencies.[8] Malnutrition is frequently a source of immune deficiency in underdeveloped countries. These immune deficiencies can lead to increased susceptibility to infections and diseases. Malnutrition can hinder the proper development and function of vital organs, further compromising overall health.[9] Malnutrition is more common in children under five than in adults. The child's immune system is still developing, which is the reason for this condition.[10] The primary causes of death in children under five years of age in developing nations include respiratory tract infections, diarrhea, malaria, and malnutrition. These causes of death are often linked to poor sanitation and a lack of access to clean water. Limited healthcare resources and inadequate nutrition contribute to the high mortality rates among young children in developing nations.[11]

In developing nations, malnutrition that affects children is referred to as protein-energy malnutrition. Protein-energy malnutrition occurs when children do not receive adequate amounts of protein and calories in their diet. This can lead to stunted growth, weakened immune systems, and increased susceptibility to disease. Protein-energy malnutrition can have long-term effects on cognitive development and overall health, making it a significant concern for public health initiatives in developing nations.[11] However, all definitions define child malnutrition as a state of nutrition in which there is a discernible deficiency of proteins, energy, and other nutrients.[12] Primary acute malnutrition in children is caused by a lack of food supply due to socio-economic, political, and environmental factors and is most common in low- and middle-income countries.[13] Acute malnutrition affects 6%–51% of hospitalized children in developed countries, according to studies that use different methods to measure malnutrition.[14–18]

Food supplementation in the form of biscuits has been widely implemented for the past decade as a national program to reduce the prevalence of wasting in Indonesia. The official daily serving size of biscuits is considered very dense in energy and other macronutrients. Information

regarding its effectiveness is lacking, and there are concerns that its energy density may inhibit the absorption of other nutrients. The decision to supplement food in the form of biscuits and how they should be consumed daily has not been supported by experimental research-based evidence in the community. There is concern that if the number of biscuits given is too energy-dense, it could inhibit the absorption of other nutrients.[20]

This research intends to test biscuits developed by the researchers themselves, called clarias' cookies. This can be used as an alternative biscuit supplement and provides an alternative strategy to increase toddler growth and development. Nutritional content has been tested, showing Clarias cookies have a higher nutritional value than biscuits provided by the government, the government can use them as a model to control the production of more food biscuits for children. The biscuit specifications from the government refer to information [21] concerning Nutritional Supplementation and stated that the Biscuits are available in primary packaging wrapped in aluminum foil. One pack of primary packaging contains 4 (four) biscuits weighing 45 g. Every 21 (21) pieces of primary packaging are packaged in a 1 (one) secondary packaging box weighing 840 g. Every 4 (four) secondary packaging was packaged in 1 (one) tertiary packaging. The nutritional value of every 100 g (10 pieces) of MT biscuits for toddlers contains 450 kcal, 14 g of fat, 9 g of protein, 71 g of carbohydrates, 10 vitamins (vitamins A, B1, B2, B3, B6, B12, D, E, K, and folic acid), and seven minerals (iron, zinc, phosphorus, selenium, and calcium).

METHOD

Variable

Body weight before the intervention, weight after the intervention, gender, age, birth weight, colostrum feeding, complementary foods for breast milk, infectious diseases, family income, father's education, mother's education, father's job, and mother's job.

Participants and Recruitment

The participants were mothers who had wasting children and recruitment was carried out by selecting the population by looking at data at the Community Health Center, then the selected population was used as a potential sample and then the children's weight and height were measured again before being used as a sample.

Study design

The control group was included in the quasi-experimental design. The participants were divided into the treatment (60 participants) and control groups (60 participants). The researcher used a quasi-experimental design because there were external variables that the researcher could not control. The inclusion criteria were children who were categorized as wasting, lived in the working area of the Taman Bacaan Community Health Center, were willing to be research subjects, were healthy and did not suffer from infectious diseases during the study (coughs, colds and diarrhea). Exclusion criteria are changing residence while the research was still ongoing.

Population and sample

The study population consisted of wasting children under five years of age residing in the Taman Bacaan Palembang Health Center's working area. A sample size of 60 individuals was randomly assigned to the treatment group, and another 60 to the control group. One hundred and twenty-one toddlers were used in this study. Biscuits were given daily by an enumerator accompanied by a health center nutritionist and they were eaten directly by the children. For three months, the treatment group received daily Claria's

cookies and government biscuits as an intervention. Every day, the government biscuits were assigned to the control group. Each child was given five pieces or 45 g/day of biscuits. Both the treatment and control groups underwent monthly body weight measurements. Body weight, height, and length were measured before the intervention to determine whether the child's nutritional status was wasting. Measurements of macronutrient consumption and related data were obtained. A food recall form and a questionnaire were the research tools employed. The biscuit composition is explained in Table 1 below.

Cookies supplementations

Table 1. Lab Test Results for the Nutritional Content of Clarias Cookies

No	Parameter	Unit	Simplo	Duplo	Method
1	Total Energy	Kcal/100 g	505.98	511.17	Calculation
2	Energy from fat	Kcal/100 g	235.98	244.89	Calculation
3	Ash Content	%	2.67	2.64	SNI 01-2891-1992 point 6.1
4	Water Content	%	3.61	3.58	SNI 2973 : 2022 (ISO 712)
5	Carbohydrates (By Difference)	%	57.12	56.56	18-8-9/MU/SMM-SIG
6	Total Fat Content	%	26.22	27.21	18-8-5/MU/SMM-SIG point 3.2.2 (Weibull)
7	Protein Content	%	10.38	10.01	18-8-31/MU/SMM-SIG (Titrimetri)
8	Iron	mg / 100 g	3.53	3.50	18-13-1/MU/SMM-SIG (ICP OES)

To conduct this study, extra food was made in the form of biscuits utilizing regional ingredients, including catfish, purple sweet potatoes, and moringa leaves. All of these culinary components are processed to create flour, which is the primary component used to make biscuits. We bought moringa, purple sweet potatoes, and other items online. The process of making catfish flour involved hand-washing the fillet and marinating it in salt and lemon juice for two hours to remove the fishy odor associated with catfish. The catfish were then cleaned, drained, and baked for six hours at 70 °C. The dried catfish were then blended and passed through a 200-mesh sieve. The study was conducted at the Saraswanti Indo Genetech Bogor Laboratory for nutrient analyses. To prepare Clarias cookies, the researchers combined all ingredients, shaped them into rounds, topped them with chocolate chips, and baked them for 20 min at 150 °C in an oven. Five pieces (45 g) were used as the size of Clarias cookies.

Data analysis

A univariate analysis was performed to obtain information on age, sex, low birth weight, colostrum feeding status, complementary food feeding, infectious disease status, family income, father's education, mother's education, mother's occupation, and father's occupation. It is hoped that this data measurement will provide additional knowledge and information needed to expand the discussion. Bivariate analysis was performed to determine the difference in the average body weight of the children before and after the intervention in the two groups and to determine the difference in body weight between the two groups. Anthropometric data were collected by nutritionists trained in anthropometric tools.[22] The children's weight, height, and body length were measured carefully

according to standard guidelines.[23] A questionnaire was used to capture all the gathered data. Based on organizational guidelines from WHO (2006), the Z-Score values were determined. A statistical software was used to process and analyze the data once it was collected. Independent t-tests were used at a significance level of 0.005.

Ethical Considerations

This study was reviewed by the Ministry of Health's Health Polytechnic of Palembang's Health Research Ethics Committee (certificate number 0422/KEPK/adm2/V/2023). Before the study began, all mothers signed informed consent forms.

RESULTS

Table 2 shows that there were no significant differences between the groups (P>0.005). The sample can be categorized into the same group for each variable. This did not introduce bias in the results of the bivariate analysis. The age of the sample ranged from 13 to 36 months, and most of the participants were female. Both the treatment and control groups had normal birth weights. Most of the participants in the control group had been exposed to infectious infections three months before the trial, and the majority did not receive colostrum. With a classification of >90%, the family income was low. Mothers' education was the same in the treatment and control groups, and fathers' education was still mostly at the elementary school level. More than 90% of fathers had occupations that fell into the category of temporary or non-permanent employment. Most housewives were unemployed. Notably, the prevalence of infectious infections among participants in the control group could have potentially influenced their overall health and immune system responses during the trial. A high percentage of fathers engaged in temporary or non-permanent employment may have implications for their financial stability and the resources available to support their families.

Table 2. Sample and Parent Characteristics

Sample Characteristics					
Characteristics	**Treatment Group**		**Control Group**		**P-Value**
	n	**%**	**n**	**%**	
Age					
13 – 36 Month	46	76.7	36	60	0.098
37 – 60 Month	14	23.3	24	40	
Mean ± SD	26.43 ± 11.736		32.44 ± 14.265		
Min-Max	10 - 51		5 - 58		
Sex					
Male	22	36.7	27	45	0.288
Female	38	63.3	33	55	
LBW					
Yes	8	13.3	21	35	0.085
No	32	86.7	39	65	
Giving colostrum					
Not given	32	53.3	3	5	0.067
Given	28	46.7	57	95	

Sample Characteristics					
Characteristics	**Treatment Group**		**Control Group**		**P-Value**
	n	**%**	**n**	**%**	
Providing complementary foods					0.055
≤ 6 Month	20	33.7	4	6.7	
> 6 Month	40	63.7	56	93.3	
Infectious disease					
Exist	40	66.7	40	66.7	0.887
Not Exist	20	33.7	20	33.7	
Characteristics of parents					
Family Income					
Low	54	90	57	95	0.688
High	6	10	3	5	
Father's education					
Basic	30	50	20	33.3	0.655
Advance	30	50	40	67.3	
Mother's Education					
Basic	24	40	21	35	0.785
Advance	36	60	39	65	
Father's occupation					
Not a permanent worker	58	96.7	55	91.7	0.766
Permanent worker	2	33.3	5	8.3	
Mother's occupation					
Not Working	48	80	48	80	0.887
Working	12	20	12	20	

Table 3 shows that the children in the treatment group experienced a significant increase in body weight (P = 0.000). Although the body weight increased in the control group, it did so at a notably slower rate than that of the treatment group. Children in the treatment group gained an average of 2.21times more weight than those in the control group. This demonstrates that malnourished toddlers under the age of five can gain weight with the help of Clarias cookies. The control group, which received only government cookies, exhibited a 0.28 difference in weight increase. These findings suggest that Clarias cookies are effective in promoting weight gain in malnourished toddlers. The significant difference in weight gain between the treatment and control groups further supports the idea that Clarias cookies have a positive effect on the nutritional status of children. Therefore, it is important to continue to explore the potential benefits of these cookies and their role in addressing malnutrition in young people.

Table 3. Differences in Average Weight and Difference in Average Body Weight of Children in the Treatment Group and Control Group

Weight	Mean	Average difference	SD	SE	p-*value*	n
Treatment Group						
Before intervention	6.640	2.21	1.687	0.2177	0.000	60
After intervention	10.899		1.981	0.2558		
Control Group						
Before intervention	9.240	0.28	1.666	0.2151	0.000	60
After intervention	9.515		1.732	0.2237		

DISCUSSION

Children in the treatment group experienced a significant increase in body weight (P=0.000). This shows that the intervention had a measurable impact on participants' physical health. Biscuits with high nutritional value, such as Clarias cookies, can be a healthy snack choice to help maintain children's weight. Children with poor nutritional conditions can be dangerous for their overall growth and development.[24,25] Therefore, it is important to pay attention to children's nutritional intake to prevent more serious health problems in the future.

Understanding the implications of this weight gain will be important to provide input for future interventions and strategies to encourage healthy growth in children by providing Clarias cookies developed by researchers. A significant increase in body weight can also have a positive impact on physical development and overall health.[26,27] Children with good nutrition will have better immune systems and optimal learning abilities.[28,29] Paying attention to children's nutritional intake is a long-term investment in their health and development.[30,31] Therefore, it is important for parents and educators to pay attention to their children's diet so that they can support their growth and development optimally.[32–34]Although body weight increased in the control group, it did so at a much slower rate than in the treatment group.

Children in the treatment group gained an average of 2.21 more weight than those in the control group. The significant difference in weight gain between the two groups indicated that the intervention had a measurable impact on the participants' physical development. This weight gain is supported by the nutrients contained in the Clarias cookies consumed by the children in the treatment group, such as proteins and carbohydrates, which play an important role in body growth and development. Children who have an ideal body weight tend to be healthier and have a lower risk of disease than those who are malnourished.[35] It is important to pay attention to children's nutritional intake so that their growth and development are optimal. Adequate nutritional intake can also increase a child's body's resistance to disease and infection.[36] Apart from that, providing a balanced diet can also help children achieve ideal body weight. This demonstrates that malnourished toddlers under the age of five can gain weight with the help of Clarias cookies.

The control group, which received only government cookies, experienced a difference in weight gain of 0.28. This shows that government cake alone did not

have a significant impact on weight gain compared with the experimental group. The biscuits given by the government were no better than those given by researchers in terms of increasing body weight. This is similar to previous research showing that food intake from different sources can have different impacts on a person's health and weight.[37] Valicente (2023) states that food intake from government cakes does not directly contribute to weight gain.[38] Therefore, it is important to pay attention to the type and quality of food consumed to maintain optimal health and body weight. These findings suggest that Clarias cookies are effective at promoting weight gain in malnourished toddlers.

The significant difference in weight gain between the treatment and control groups further supports the idea that Clarias cookies have a positive effect on the nutritional status of children. This study shows that consuming Clarias cookies can be an effective alternative for improving children's nutritional status. The results of this study provide evidence that the use of Clarias cookies can be an effective solution to overcome nutritional problems in children. It is important to conduct further research on the potential of Clarias cookies as nutritional supplements. The development of Clarias cookies as a broader nutritional supplement can provide significant benefits to children's health, and it is important to continue to explore the potential benefits of these cookies and their role in addressing malnutrition in young children.

According to earlier studies, the prevalence of undernutrition is highest in children under the age of two (14%), followed by those between the ages of two and four (9%), and those over the age of two (34%). These findings suggest that undernutrition is a critical issue during early childhood, with children under the age of two years being particularly vulnerable. Efforts should focus on targeted interventions and policies to address this alarming prevalence and ensure proper nutrition in young children.[39] Additional studies have revealed that the first 1000 days of life, or under two years of age, are when malnutrition is most common, with some of the effects being irreversible. During this critical period, malnutrition can have long-lasting consequences for children's physical and cognitive development. This can lead to stunted growth, impaired immune function, and cognitive deficits, which persist into adulthood. Therefore, early intervention and proper nutrition during the first 1000 days are crucial for ensuring optimal health and well-being throughout a person's life.[23] Malnutrition affects both men and women. However, certain groups, such as pregnant women and children are more vulnerable to malnutrition. This is because of their increased nutritional needs and potential long-term effects on their growth and development.[23,39] Birth weight may also be a risk factor for malnutrition. Children with low birth weight are at risk of malnutrition. Low birth weight is often associated with inadequate nutrition during pregnancy, contributing to a higher likelihood of malnutrition in children. Additionally, developmental challenges that may accompany low birth weight can exacerbate the risk of malnutrition in these individuals.[40] Infectious diseases can contribute to malnutrition. Infectious diseases can lead to malnutrition by impairing the body's ability to absorb nutrients and can cause loss of appetite. Additionally, these diseases can also directly deplete the body's nutrient stores, further exacerbating malnutrition[41], which will cause the body's resistance to decrease and even lead to death[42,43] Malnutrition often occurs in families with low income.[44]

A multi-sectoral approach must be considered for the management of

malnutrition in children under the age of five. Malnutrition is a complex problem that requires intervention in healthcare facilities. In addition to health facilities, it is crucial to address malnutrition through community-based programmes and educational initiatives. These programs should focus on promoting proper nutritional practices, breastfeeding support, and access to clean water and sanitation facilities. By involving various sectors such as agriculture, education, and social welfare, a comprehensive approach can be developed to tackle the underlying causes of malnutrition and ensure the holistic well-being of children under five.[45,46] Primary health workers are crucial in controlling malnutrition in children under five years of age because they are often the first to encounter health-related issues outside their homes. These health workers play a vital role in identifying and diagnosing malnutrition at an early stage, allowing for timely intervention and treatment. In addition, they can provide valuable education and support to parents and caregivers regarding proper nutrition and feeding practices to prevent malnutrition in the first place.

Community-based malnutrition prevention allows health workers to identify and begin the treatment of malnourished children before they become seriously ill.[47] This aids in the early detection of acute malnutrition in the community, and provides management for those who do not have medical complications.[48] Ready-to-use therapeutic or nutritionally dense foods are part of a community-based strategy.[49] Active community-based monitoring by health services is key to early nutritional counseling.[50] This approach provides an opportunity for health services to understand the context of malnutrition, which helps in preparing energy-dense children's meals using locally available, culturally acceptable, and affordable food products.[49] Community-based management of malnutrition can be performed to prevent the short- and long-term effects on the incidence of childhood malnutrition.[51]

Compared to the control group, the weight of the youngsters in the treatment group increased significantly after receiving Clarias cookies. Weight gain in the treatment group differed significantly from that in the control group. Feeding malnourished toddlers Clarias cookies is a better way to encourage nutritional development than giving them government-provided biscuits. This is because Clarias cookies have been shown to be more effective in promoting weight gain among toddlers, as evidenced by the significant increase in weight observed in the treatment group. Additionally, the nutritional benefits of Clarias cookies may be superior to those of government-provided biscuits, making them a more suitable option to address malnutrition in toddlers.

RECOMMENDATIONS

Recommendations were based on the positive outcomes observed in the study, suggesting that incorporating Clarias cookies into the diet of malnourished toddlers may lead to better nutritional outcomes than government-provided biscuits. Further research and monitoring are needed to fully understand the long-term effects of this dietary change on the health and development of these children. Overall, the potential of Clarias cookies to improve the nutritional status of malnourished toddlers is promising, and warrants further investigation. It is important to consider the sustainability and scalability of incorporating these cookies into nutrition programs for long-term effects on child health.

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CONFLICT OF AUTHORS

The authors declared no conflict of interest.

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