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| RESEARCH ARTICLE

Formulation of Moringa Oliefera and Clarias Gariepinus in the Form of Pancake Sedian as an Innovation for Stunting Prevention

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| ABSTRACT
The problem of stunting will increase morbidity and mortality if not handled properly, one of the factors causing stunting is poor nutritional intake. Functional food diversification is needed to improve the quality of life of the community. The purpose of this study was to determine the nutritional content and acceptability of pancake formulations combined with moringa leaves and catfish (Energy, Protein, Fat and Iron). This research was conducted from August to September 2024. Methods to determine the nutritional content (energy, protein, fat and iron) using titrimetric, kjehdal, gravimetric methods SM APHA 23rd, 3111 B, 2017 and organoleptic tests either by blind test or hedonic test method to 40 respondents, testing the content of pancakes in the BBLK Quasy experimental laboratory is used to determine the effectiveness of pancake formulations in preventing stunting. Based on the results of the examination of pancake samples using 4 formulas with different amounts of catfish content. The test results in serving 100 g, for formula 1 (FO) catfish content as much as 50 grams, formula 2 (F1) catfish content as much as 100 grams, formula 3 (F3) catfish content as much as 200 grams. Based on the nutritional content analysis of the four catfish and moringa pancake formulations, it can be concluded that the addition of catfish provides a significant increase in protein and iron content, two important components for stunting prevention. Catfish and moringa leaf pancakes can be a practical and high nutritional value functional food alternative for toddlers, especially in efforts to prevent stunting associated with protein and iron deficiency.

| KEYWORDS

Stunting, moringa, catfish, pancakes

| ARTICLE INFORMATION

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1. Introduction

Stunting is a global health problem (1) that affects the physical growth (2) and development of children (3). In Indonesia, the prevalence of stunting is still high (4). According to data from the Indonesian Ministry of Health (5), the prevalence of stunting in children under five years old is around 27.7% (6). The prevalence of stunting in Indonesia is 21.6% (7), while the target to be achieved is 14% by 2024 (8). The prevalence of stunting in South Sulawesi is high, reaching 35.6% (9). The prevalence of stunting in Parepare City reached 27.1% (10). This shows that stunting remains a significant health problem (11) and requires innovative approaches to its prevention (12).
Specific interventions in reducing the incidence of stunting (13) by conducting nutritional literacy (14), in preparing additional food menus (15) for pregnant women and toddlers (16) to improve the quality of nutritional intake through processing local food ingredients (17) that contain sources of energy, protein, vitamins, and minerals (18). Local food is important to be developed as a

functional food to support sustainable food security (19) so that Indonesia, especially Parepare City, can achieve the concept of an industrial city without chimneys to improve people's lives by reducing stunting rates.

Moringa oleifera (Moringa leaves) is a local food (20) that is very easy to obtain in the yard and is rich in macro and micronutrients (21) but is still underutilized by the community to be processed into snacks that have high nutritional content (22). Moringa oliefera contains protein, vitamin A, iron, calcium, phosphorus, fibre and antioxidants (23). In addition, moringa leaves also have benefits that can improve the nutritional status of malnourished children (24). Clarias Gariepinus (catfish) also has high nutritional content such as protein, omega-3 fatty acids, and iron (25). Clarias Gariepinus is a type of fish that has a soft meat texture and has a delicious flavour. Clarias Gariepinus has a high protein content and is rich in amino acids that play an important role for growth and muscle building (26). Every 100 grams contains Calorie: 90 kcal, Protein: 18.7 grams, Fat: 1.1 grams, Calcium (Ca): 15 mg, Phosphorus (P): 260 mg, Iron (Fe): 2 mg, Sodium: 150 mg, Thiamin (Vitamin B1): 0.10 mg, Riboflavin (Vitamin B2): 0.05 mg, Niacin (Vitamin B3): 2.0 mg, omega 3 content 4.48 -11.80 grams and total protein 18.7 grams (27).

The problem that occurs is although rich in macro and micronutrients, not many people know the content of moringa oliefera, so its utilization is still very low. Likewise, Clarias gariepienus, although rich in nutrients, the consumption of this fish in the community is low due to the shape of the fish and the slippery surface of the fish. Therefore, it is necessary to diversify products or functional foods to increase public consumption of local foods by making pancakes that are favored by children. Based on the description above, the following are some formulations of the problems of this study, among others: 1). What is the nutritional content of the pancake formulation of a combination of moringa leaves and catfish (Energy, Protein, Fat, and Iron), 2). How is the effect of the pancake formulation of a combination of moringa leaves and catfish on the acceptability of pregnant women and toddlers, 3). How is the pancake formulation of a combination of moringa leaves and catfish effective in preventing stunting?

2. Methodology

The research was conducted in 2 (two) stages of research phase I to determine the nutritional content (Energy, Protein, Fat, and Iron) of catfish and moringa combination pancakes. In this study, the method used was pure experimentation with a complete randomized design (RAL) research design. This research was conducted for two months, from August to September 2024. Pancakes formulated from moringa leaves and catfish were made at the Nutrition Laboratory of Muhammadiyah University of Parepare. The composition of pancakes are made from catfish that has been baked to reduce water content and fishy odor, and moringa leaves are made in the form of flour through a simplistic process. The addition of eggs, coconut milk, flour, sugar, salt, and a little butter. Organoleptic testing was carried out in Parepare City and Sidenreng Rappang Regency. The sample in this study consisted of 40 respondents, 20 of whom were from Parepare City and 20 of whom were from Sidenreng Rappang Regency, by purposive sampling. Determination of inclusion criteria in this study are mothers who have toddlers and are willing to be respondents. The exclusion criteria are mothers who are not willing to be responded to and mothers who do not / do not have toddlers.

Data collection methods for knowledge of nutritional content through kjehdal testing to test pancake protein content, gravimetric testing to test pancake fat content, titrimetric testing to test pancake carbohydrate content and APHA 23rd Ed SM testing. 3111 B, 2017 to determine the iron content in pancakes with a combination of moringa leaves and catfish for assessment per 100 grams for all 4 pancake formulations. Data analysis using organoleptic test through a blind test or hedonic test method to measure the level of respondents' liking for pancakes using 5 rating scales, namely very like (5), like (4), quite like (3), dislike (2) and very dislike (1).

The second stage of this study is to determine the effectiveness of giving pancakes to increase toddler weight after treatment and then testing using paired simple t-test. Furthermore, the form of intervention that we carried out in this study by conducting a pre-test assessment in the treatment group to determine the extent of changes in respondents' knowledge after the post-test and monitoring of toddlers' weight during the 30-day period through the provision of moringa and catfish pancake formulations. Furthermore, the control group continued to monitor the increase in toddler weight by weighing for one month without giving pancakes using the RCT (Randomised Controlled Trial) method.

3. Results and Discussion

Characteristics of Respondents

Table 1 shows the characteristics of respondents based on age, latest education, occupation, and age of toddlers.

Subject characteristics

Table 1 describes the characteristics of the subjects according to the criteria of age, occupation, latest education, and child age.

Table 1. Subject characteristics based on age, latest education, mother's occupation, and age of toddler

Characteristics	Frequency (f)	Percentage (%)
Mother's Age (Years)		
< 30	10	25
31- 40	21	55.5

41- 50	7	17.5
>50	2	5
Total	40	100,00
Mother's Last Education		
SMP	4	10
SMA	14	35
Strata Satu (S1)	19	47.5
Strata Dua (S2)	3	7.5
Total	40	100,00
Mother's Occupation		
HOUSEWIFE	10	25
Self-employed	15	37.5
Private Employee	12	30
ASN	3	7.5
Total	40	100,00
Child's Age (Month)		
24-36	17	42.5
36 – 48	13	32.5
>48	10	25
Total	40	100,0

Nutritional content of moringa and catfish-formulated pancakes

The results of the pancake content test analysis were carried out using the kjehdal, gravimetric, titrimetric, and SM APHA 23 Ed.3111 B, 2017, methods to see the content of protein, fat, carbohydrates, and iron in the study per 100 grams of sample with four formulations: Formula 1 (F0), formula 2 (F1), Formula 3 (F2) and Formula 3 (F3). Table 2 provides more details.

Table 2: Results of Nutritional Content Examination of Pancakes with Four Formulations

Formulation	Parameter	Unit	Test Results	Method Specifications
FO	Protein	g/100g	4,80	Kjehdal
	Fat	g/100g	4,74	Gravimetrik
	Carbohydrates	g/100g	23,97	Titrimetrik
	Iron	mg/100g	0,51573	SM APHA 23rd Ed.3111B, 2017
F1	Protein	g/100g	6,20	Kjehdal
	Fat	g/100g	5,72	Gravimetrik
	Carbohydrates	g/100g	22,84	Titrimetrik
	Iron	mg/100g	0,93525	SM APHA 23rd Ed.3111B, 2017
F2	Protein	g/100g	6,95	Kjehdal
	Fat	g/100g	6,69	Gravimetrik
	Carbohydrates	g/100g	19,76	Titrimetrik
	Iron	mg/100g	1,02356	SM APHA 23rd Ed.3111B, 2017
F3	Protein	g/100g	9,44	Kjehdal
	Fat	g/100g	3,52	Gravimetrik
	Carbohydrates	g/100g	16,70	Titrimetrik
	Iron	mg/100g	0,38097	SM APHA 23rd Ed.3111B, 2017

Data Source: BBLK Sample Inspection Results, 2024

Table 2 shows that the protein content increased significantly from formulation FO to F3. Formulation F3 had the highest protein content (9.44 g/100g), which suggests that the addition of certain ingredients in this formulation may have contributed to the increased nutritional value. This is important for the growth and repair of body tissues. Fat content showed interesting fluctuations. Formulations FO to F2 experienced an increase in fat, reaching a peak in F2 (6.69 g/100g), but then dropped dramatically in F3 (3.52 g/100g). This decrease may be due to the reduction of fatty ingredients in the F3 formulation. A balanced fat content is important for heart health and body functions. Carbohydrate content decreased in each formulation from FO to F3.

This suggests that the replacement or reduction of certain ingredients in the formulation may reduce the amount of carbohydrates. Although carbohydrates are the main source of energy for the body, this reduction can be beneficial for individuals who want to control calorie intake. Iron content increased from FO to F2 (1.02356 mg/100g), but decreased significantly in F3 (0.38097 mg/100g) due to the blander treatment. Iron is important for the formation of haemoglobin and prevents anaemia. The decrease in F3 needs to be considered because it may affect the iron status of consumers.

Acceptability of moringa and catfish pancake formulations

The test of respondents' acceptance of the formulation of moringa leaves and catfish in making pancakes showed significant results to respondents by looking at the four composition assessment indicators, namely colour, aroma, texture and taste. For more details can be seen in Table 3.

Table 3. Average Results of Respondents' Acceptability Test of Pancake Formulation of the combination of Moringa Leaves and Catfish

Indicators	Moringa Leaf and Catfish Combination Pancake	
	Average	Criteria
Color	4.57	Very Satisfied
Aroma	4.60	Very Satisfied
Taste	4.38	Like
Texture	4.23	Like

Sumber : Data Primer, 2024

Table 3 shows that the colour of pancakes produced from the combination of moringa leaves and catfish received very positive ratings from respondents. The average of 4.57 indicates that the pancake colour is considered attractive and appetising. Attractive colours can increase consumer interest, especially for children who may be more interested in foods with bright colours. The aroma of the pancakes also received an excellent rating with an average of 4.60. A fragrant and appetising aroma can contribute greatly to the appeal of food. This shows that the combination of moringa leaves and catfish not only provides nutritional value but also produces a pleasant aroma, thus increasing appetite. The flavour of the pancakes received a positive rating with an average of 4.38. Although not as strong as the ratings on colour and aroma, this figure still indicates that respondents liked the taste of the pancakes. Good flavour is one of the key factors in the acceptance of food products, and these results show that the combination of ingredients succeeded in creating a good taste. The texture of the pancakes received an average of 4.23, which also shows that respondents liked the texture of the pancakes. Good texture is very important in the eating experience; pancakes that have a soft and chewy texture are usually preferred by consumers. This result indicates that the combination of moringa leaves and catfish can produce pancakes with a satisfying texture.

The Effect of Providing Pancake Formulation Education with a Combination of Moringa Leaves and Catfish on Changes in Knowledge of Mothers of Toddlers

The results of the analysis related to changes in knowledge of mothers of toddlers before and after education related to the formulation of moringa leaves and catfish in the form of pancake preparations as an innovation to prevent and reduce stunting cases. For more details can be seen in Table 4.

Table 4. Effect of Providing Pancake Formulation Education with a Combination of Moringa Leaves and Catfish on Changes in Knowledge of Mothers of Toddlers.

Treatment	n	Median	T
Sebelum	40	10,27 (9,4-11,7) 10,25	-4,523
Sesudah	40	11,35 (12,15-14,3)	

Description : * Paired t-test, significant if p-value <0.05

Table 4 shows that the data before and after the provision of education showed significant changes in the knowledge of mothers under five. The mean value of knowledge before education was 10.27, while after education it increased to 11.35. This change indicates that mothers of toddlers have gained better knowledge about pancake formulations with a combination of moringa leaves and catfish after receiving education. The results of the paired t-test showed that the change in knowledge of mothers

under five after education was significant. p-value of 0.004 is smaller than 0.05, which indicates that the difference between knowledge before and after education is very significant. This means that the education provided has a real influence in improving the knowledge of mothers under five about the pancake formulation.

4. Conclusion

This study has demonstrated the potential of including Moringa oleifera and Clarias gariepinus into pancake formulations as a strategic measure to combat stunting in children. The nutritional study indicates a notable increase in the protein and iron content of the pancakes, which are vital micronutrients for the optimal growth and cognitive development of youngsters. The findings highlight the essential function of fortified food products in alleviating malnutrition, especially in areas with widespread dietary deficits. The educational interventions used in this study significantly enhanced mothers' understanding of the nutritional advantages linked to the consumption of these pancakes. This underscores the effectiveness of community-based educational initiatives in enhancing awareness and encouraging healthier food habits among caregivers, which is essential for improving child nutrition outcomes. The organoleptic assessment revealed a positive reception of the pancakes within the target demographic, with elevated ratings assigned to their sensory characteristics, such as color, scent, flavor, and texture. This acceptability is essential, indicating that integrating these nutrient-rich pancakes into children's diets may be practical and sustainable. Furthermore, the assistance from the Directorate of Research and Community Service (DRPM) of the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia underscores the significance of joint initiatives in tackling public health issues. This collaboration not only promotes research initiatives but also improves the execution of effective nutritional interventions. This research promotes the incorporation of locally obtained food resources, like Moringa and catfish, into dietary patterns to enhance nutritional status and mitigate stunting. Future study should focus on examining the scalability of this strategy and investigating additional local food combinations that could further improve nutritional outcomes in at-risk communities.

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Conflicts of Interest: Declare conflicts of interest or state "The authors declare no conflict of interest."

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References

[1] Dinda D Y D. Pengembangan Biskuit "Prozi" Tinggi Protein dan Kaya Zat Besi untuk Ibu Hamil sebagai Upaya Pencegahan Stunting. Amerta Nutr 2022;6:79–84

[2] Faidah SN, Sulistiyani, Rohmawati N. Pengaruh Penambahan Tepung Daun Kelor (Moringa oleifera) Terhadap Daya Terima Sosis Ikan Lele (Clarias gariepinus). Jurnal Agroteknologi meredeka pasuruan. 2022 ;6:2:1-8

[3] Adam A, Hartono R, Salim A, Irwan Z. Water and Microbial Contents in Moringa Oleifera Seed Flour as Food Supplement to Prevent Stunting. A Multifaceted Rev J F Pharm 2020;11:694–7.

[4] Alamsyah A G. Pemanfaatan Ekstra Daun Kelor (Moringacae Olievera) Sebagai Upaya Pencegahan Stunting Pada Balita Di Desa Cinta Rakyat Percut Sei Tuan. J Progr Stud PGMI 22AD;9.

[5] Amalia R, Mulyani E, Safrila FR, Aisyah PN. Modifikasi Kue Lumpur Padat Gizi Sebagai Mp-Asi Untuk Mencegah Stunting Di Desa Randuboto Kecamatan Sidayu Kabupaten Gresik. RELAWAN J Indones 2024;6:51–7.

[6] Anjar G D. Daya Terima Dan Kandungan Gizi Biskuit Daun Kelor Sebagai Alternatif Makanan Selingan Balita Stunting. Gizi Univ Negeri Surabaya 2021;1

[7] Anna Surgean Veterini1, Enny Susanti, Meity Ardiana, Annis Catur Adi HR. https://www.researchgate.net/profile/Adriyani-Adam-2/publication/350721787_Water_and_Microbial_Contents_in_Moringa_Oleifera_Seed_Flour_as_Food_Supplement_to_Prevent_Stunting/links/606ea7a2a6fdcc5f778cae83/Water-and-Microbial-Contents-in-Moringa-Oleifera-S. Media Gizi Indones (National Nutr Journal) 2023;18:150–6

[8] Aziza N, Umar F, Sari RW, Majid M. Perbedaan Karakteristik Balita Stunting di Perkotaan dan Pedesaan. Al-Gizzai 2024; 4:1–14.

[9] Ciptawati, E. Analisis Perbandingan Proses Pengolahan Ikan Lele terhadapKadar Nutrisinya. Indones J Chem Anal 2021;04:40–6.

[10] Exvivonda R Y D. Subsitusi Tepung Labu Kuning (Cucurbita Moschata) Dan Tepung Daun Kelor (Moringa Oleifera) Dalam Pembuatan Kudapan Cookies Untuk Balita Stunting. Ghidza Media J 2022;4

[11] Faidah, SN . Pengaruh Penambahan Tepung Daun Kelor (Moringa oleifera) Terhadap Daya Terima Sosis Ikan Lele (Clarias gariepinus). J Argoteknologi, Merdeka Pasuruan 2022;6.

[12] Franchy Ch. Liufeto, Stefanus P. Manongga MB. Locals' Perception on Catfish Farming Cultivation to Prevent Stunting. Interdiscip Soc Stud 2023;2:1959–64.

[13] Friska A T. Strategi Pencegahan Dan Penanggulangan Stunting Pada Anak Usia 6-59 Bulan. Klabat J Nurs 2022;4

[14] Hartati Y, Podojoyo, Imelda Telisa SA. The sensory and nutritional properties of biscuits formulated with catfish (Clarias batrachus) flour, purple sweet potato (Ipomoea batatas L. poir), and moringa leaves powder as supplementary foods for toddlers. Biophys Rev 2024;2957.

[15] Kesumasari, C . Edukasi dan Inovasi Pangan untuk Pencegahan Stunting pada Ibu Hamil di Kabupaten Gowa, Sulawesi Selatan. J Inov Penelit Dan Pengabdi Masy 2023;3:1–12.
[16] khuzaimah D D. Analisis Kandungan Gizi Mikro Biskuit Crackers Berbahan Dasar Ikan Patin (Pangasius sp.) dan Daun Kelor (Moringa oleifera). J Food Culin 2023;6:14–20
[17] Majid M dkk. Model Literasi Gizi Berbasis Healty City untuk Penanggulangan Stuntingdan Peningkatan Perilaku Hidup Sehat. JIKA 2022;4:480–5.
[18] Majid M, Tharik AJ, Zarkasyi R. Cegah Stunting melalui Perilaku Hidup Sehat. 2022.
[19] Majid M. Healthy City-Based Nutrition Literacy Model for Stunting Management and Improvement of Healthy Living Behavior. J Ilm Kesehat 2022;4:480–5.
[20] Muda,TSS. Pengaruh Pemanfaatan Daun Kelor Dalam Formulasi Makanan Untuk Pencegahan Stunting: Studi Literatur. J Kesehat Tambusai 2024;5:341–9
[21] Pratiw YS. Optimization of Stunting Prevention and Treatment Through Local Food Utilization. Int Conf Eco-Innovation Sci Eng Technol 2023;2023:147–53
[22] Rohmawati, Ninna. training and assistance in the creation of je-co moringa as a stunting overcome effort. Community Dev J 2023;3:5504–11.
[23] Rusman ADP, Umar F, Majid M, Hengky HK. Kartu Cegah Stunting untuk Calon Pengantin di Masa pandemi. Pros Forum Ilm Tah IAKMI 2020.
[24] Syamsiah M D. Uji Organoleptik Dan Kandungan Nutrisi Biskuit Dengan Bahan Fortifikasi Tepung Kelor (Moringa oleifera) Untuk Penanganan Stunting. Agrivet 2022;10:159–68.
[25] Syiddatul B D. Edukasi Tentang Stunting Dan Pemanfaatan Puding Daun Kelor Dalam Mencegah Stunting. J Kreat Pengabdi Kpd Masy 2022;5:32422–3249
[26] Wahyuningsih R, Darni J, Ningrat JPR. Kelepe (Kelor Lele Tempe) Sebagai Makanan Tinggi Protein Untuk Upaya Pencegahan Stunting Anak Balita. jurnal sasambo 2023;4.
[27] Zul Fikar A D. Sosialisasi Dan Konseling Pencegahan Stunting Serta Pemberian Makanan Tambahan Berbahan Daun Kelor. Pharmacare Soc 2003;2:14–20