Buletin Penelitian Kesehatan
e-ISSN: 2338-3453 | p-ISSN: 0125-9695
Volume 53 Issue 1, 2025, Page 29-37
DOI: 10.33860/bpk.v53i1.4020
Website: https://ojs.polkespalupress.id/index.php/bpk
Publisher: Poltekkes Kemenkes Palu

Nutritional Quality and Consumer Acceptability of Cookies Enriched with Taro, Moringa Leaf, and Mung Bean Flour

Ety Yuni Ristanti*, Muhamad Asrar
Department of Nutrition, Politeknik Kesehatan Kemenkes Maluku, Maluku, Indonesia
*Corresponding Author: ety.ristanti@gmail.com

ARTICLE INFO

Article History:
Received: 2024-11-18
Accepted: 2025-04-11
Published: 2025-06-30

Keywords:
Nutritional composition; Taro flour; Moringa leaf flour; Mung bean flour; cookies

ABSTRACT

Background: Taro, moringa leaf, and mung bean are local food ingredients known for their high nutritional content and dietary fiber as alternative substitutes for wheat flour in cookie production. This study evaluated the nutrient quality and consumer acceptability of cookies enriched with taro flour, moringa leaf flour, and mung bean flour.
Methods: The study was an experimental design using a Completely Randomized Design (CRD), consisting of three treatments with three repetitions. The cookie formulations varied the proportions of wheat flour, taro flour, moringa leaf flour, and mung bean flour as follows: P1 (60%:10%:1%:29%), P2 (50%:20%:2%:28%), and P3 (40%:30%:3%:27%). Data for protein, fat, carbohydrate content, and dietary fiber were analyzed using one-way ANOVA, while consumer acceptability was assessed using the Friedman test.
Results: Statistical analysis revealed significant differences in protein ($p = 0.022$), carbohydrate ($p = 0.049$), and dietary fiber contents ($p = 0.001$) among the formulations. Cookie formula F2 had the highest nutrient content. Consumer acceptability ratings ranged from moderate to extreme liking for all cookie variants.
Conclusion: Substituting wheat flour with taro flour, moringa leaf flour and mung bean flour resulted in nutrient-dense cookies and well-accepted by consumers. These cookies are a practical, nutrient-dense, high-fiber snack alternative beneficial for individuals with cardiovascular disease.

INTRODUCTION

Cardiovascular disease (CVD) is a leading cause of deteriorating health worldwide. According to the World Health Organization (WHO), 17.9 million people die annually from cardiovascular diseases, accounting for 32% of all deaths. This severe health issue requires adequate prevention and treatment measures to reduce the number of deaths related to cardiovascular diseases. Lifestyle is a major determinant of cardiovascular health from a public health perspective. Therefore, promoting healthy lifestyle practices, including dietary habits, is crucial for reducing the risk of developing this condition. Nutrient and functional foods can prevent cardiovascular disease (Ud Din et al., 2024; Mazur et al., 2024). It is estimated that 40% of cardiovascular events can be attributed to dietary factors. Functional foods are those that naturally or through processing contain one or more compounds that are believed to have specific physiological functions beneficial to health. Thus, the development of functional foods into popular products, such as cookies is necessary.

Cookies are among the most popular snacks in Indonesia. Therefore, the production of cookies can be a potential choice for a functional food product if they have health benefits (Ervietasari, 2021). Considering the popularity of cookies, it is essential to enhance their nutritional content by fortifying them with local functional ingredients that are rich in nutrients and supporting their physical characteristics and taste, such as taro, moringa leaves, and mung beans. The use of taro flour, moringa leaf flour, and mung bean flour in cookie production is expected to reduce the dependence on wheat flour, enhance nutritional value, and use locally available food ingredients.

Taro is a carbohydrate source that is also rich in thiamine, riboflavin, iron, phosphorus, zinc, vitamin B6, vitamin C, niacin, potassium, copper, and manganese and is high in fiber (Nicolas et al., 2023). Additionally, it contains various bioactive compounds such as flavonoids, glycosides, and other micronutrients (Lebot & Legendre, 2014). Moringa has numerous health benefits. The 100 g of fresh moringa leaves contained 6.7 g protein and 0.7 g iron. Moringa leaf powder has a protein content of 27.1 g per 100 g and an iron content of 28.2 mg per 100 g. Moringa leaves are rich in fiber and contain various antioxidants, such as tannins, saponins, flavonoids (quercetin and kaempferol), phenolic acids, alkaloids, β-sitosterol, carotenoids, terpenoids, isothiocyanates, and vitamin C (Aborhyem et al., 2016). The soluble fiber in the small intestine binds cholesterol, fats, and bile acids. The potent antioxidant content of moringa regulates fat metabolism and captures free radicals (Nile et al., 2017). Mung beans are a rich source of protein and fiber. In 100 g of mung beans, there are 323 kcal of energy, 22.9 g of protein, 1.5 g of fat, 56.8 g of carbohydrates, 7.5 g of fiber, 223 mg of calcium, 7.5 mg of iron, 166 mcg of vitamin A, 0.46 mg of vitamin B1, and 10 mg of vitamin C (Kementerian Kesehatan RI, 2019). Therefore, there is a need to diversify local food products into healthy, nutritious, and high-fiber cookies. Previous studies have not combined taro, mung beans, and moringa leaves into a specific product, particularly cookies.

This study was undertaken to develop and evaluate cookies enriched with taro flour, moringa leaf flour, and mung bean flour in different proportionate mixtures with wheat flour, nutritional characteristics and consumer acceptability of cookies are reported in this work.

METHODS

Materials

The ingredients used include wheat flour purchased from a flour company in Indonesia and taro (Cucurbita moschata) harvested from Seram Island, Maluku, Indonesia. The taro was washed with clean water to remove dirt and then peeled using a manual peeler. The peeled taro was sliced thinly with a 0.1 to 0.3 cm thickness and then oven-dried until the moisture content reached about 14%. Once dried, the taro was ground into flour using a grinder and sieved to a fine consistency (80 mesh). The taro flour was stored in polyethylene (PE) plastic bags and sealed tightly.

The moringa leaves used in this study were sourced from the Ambon city market, Maluku, Indonesia. The leaves were separated from the stems, blanched, drained, and dried. Once dry, they were ground into a fine powder, sieved, and stored in an airtight container.

Mung beans were harvested from Seram Island, Maluku, Indonesia. They were sorted, washed, and soaked for 24 hours to eliminate the characteristic beany odor. They were then boiled for 30 minutes to remove antinutritional compounds. After cooking, the mung bean skins separated, facilitating easy peeling (Singgano et al., 2019). Once peeled, the beans were dried in an oven at 60°C for 1 hour, then ground and sieved.

Preparation of Cookies

The cookies were prepared according to the formulation in Table 1. The composition ratios of wheat flour, taro flour, moringa leaf flour, and mung bean flour in treatment 1 were 60%: 10%: 1%: 29%; in treatment 2, 50%: 20%: 2%: 28%; and in treatment 3, 40%: 30%: 3%: 27%. The process began by thoroughly mixing wheat flour, taro flour, moringa leaf flour, mung bean flour, and milk. Butter and powdered sugar were creamed using a mixer for about 5 minutes. Afterward, eggs were added and mixed for another 5 minutes. The flour mixture was then added to the wet ingredients, and the mixture was combined until it was evenly mixed. The dough was left to rest for approximately 10 minutes, then rolled to a thickness of 0.7 cm and cut into round shapes with a diameter of 5 cm. The cookies were baked on a tray at 200 ± 5°C for approximately 10 minutes, then cooled and packaged. The final product was tested for its nutritional content and organoleptic properties. Cookies were prepared using the formulation outlined in Table 1.

Table 1. Formulation of Cookies with Enriched of Taro Flour, Moringa Leaf Flour, and Mung Bean Flour

Material	Formulas		
	F1	F2	F3
Wheat flour (g)	270	225	180
Taro flour (g)	45	90	135
Moringa leaf flour (g)	4,5	9	13.5
Mung bean flour (g)	130.5	126	121.5
Butter (g)	250	250	250
Refined sugar (g)	200	200	200
Egg (g)	60	60	60
Milk powder (g)	27	27	27
Cornstarch (g)	5	5	5
Vanilla (g)	5	5	5

Nutritional characteristics Analysis

The nutritional characteristics analysis was conducted at the Center for Standardization and Industrial Services in Ambon, Indonesia. Protein content in the samples was determined using the macro Kjeldahl method (AOAC, 2000). Carbohydrate content was measured using the Luff-Schoorl method, while fat content was analyzed using the Weibull method. Moisture content was assessed using the gravimetric method, and calcium, zinc, and iron (Fe) content were determined using Atomic Absorption Spectrophotometry (AAS).

Consumer Acceptance of Cookies

The consumer acceptance of the cookies was evaluated using an organoleptic test and a hedonic scale. The assessed attributes included color, aroma, taste, and texture. A panel of 50 adults (14 males and 36 females) aged 20–50 years was recruited from the academic community of the Health Polytechnic of the Ministry of Health in Maluku. The panelists were selected through screening to assess their sensitivity and knowledge of the tested ingredients. The evaluation was conducted in a sensory laboratory, where each panelist used a hedonic test form in individual booths. Each sample, consisting of one cookie per formula, was served in disposable containers labeled with a three-digit code. Texture, taste, aroma, color, and overall acceptance were rated using a structured 9-point hedonic scale, where 1 represented "dislike very much" and 9 represented "like very much"(Mongi & Gomezulu, 2022).

Statistical Analysis

Nutritional characteristics data for carbohydrates, protein, fat, energy, and dietary fiber were tested for normality using the Shapiro-Wilk test and for homogeneity using Levene's test. Assuming the results indicated that the data were normally distributed and homogeneous; a

parametric statistical test, Analysis of Variance (ANOVA), was performed. The statistical analysis was conducted at a 95% confidence level, and differences were considered significant if $p < 0.05$. If significant differences were found, further analysis was conducted using the least significant difference (LSD) test. The nonparametric Kruskal-Wallis test was applied if the data did not meet the normality or homogeneity assumption. For significant results, the Mann–Whitney U test was used for pairwise comparisons. The consumer acceptance results and ordinal data were analyzed using the Friedman test at a 95% confidence level, followed by the Wilcoxon test to observe differences and relationships between treatments.
The study was conducted after obtaining approval from Health research ethics committee Maluku Health Polytechnic No. DP.04.03/6.2/1069/2024

RESULTS

This study employed a completely randomized design with three treatments and three replications for each treatment. The study utilizes local ingredients—taro, moringa leaves, and mung beans—to create high-fiber cookies. The composition ratios of wheat flour, taro flour, moringa leaf flour, and mung bean flour in treatment 1 were 60%: 10%: 1%: 29%; in treatment 2, 50%: 20%: 2%: 28%; and in treatment 3, 40%: 30% : 3%: 27%. The cookies were then analyzed for their nutritional and fiber content as well as consumer acceptability

1. Nutritional Characteristics of Cookies Formulas.

Table 2. Average Nutrient Characteristics of Cookies Formulas

Formula	Nutrients				
	Proteins (g)	Carbohydrate (g)	Fat (g)	Energy (Kkal)	Dietary Fiber (g)
F1	7.07 ± 0.45[a]	53.96 ± 0.60[a]	20.77 ± 0.23	426.36 ± 2.12[a]	27.03 ± 0.25[a]
F2	7.89 ± 0.17[b]	54.19 ± 0.86[a]	20.76 ± 0.16	430.95 ± 1.76[a]	28.63 ± 0.46[b]
F3	8.14 ± 0.37[b]	56.11 ± 1.14[b]	20.71 ± 0.31	436.70 ± 5.46[b]	29.52 ± 0.39[c]
P value	0.022*	0.049*	0.753	0.032*	0.001*

Note: * significant $p < 0.05$
Note: Identical superscripts on the same variable indicate no significant difference.
Cookies formulation with wheat flour, taro flour, moringa leaf flour, and mung bean flour:
F1: (60%:10%:1%:29%),
F2: (50%:20%:2%:28%),
F3: (40%:30%:3%:27%).

Based on Table 2, the average protein content ranged from 7.07 to 8.14 g/100 g, with formula 3 having the highest protein content. The three formulas significantly differed ($p<0.05$) in protein content. The protein content in formula 1 differed from that in formulas 2 and 3. The average carbohydrate content ranged from 53.96 to 56.11 g/100 g, with formula 3 having the highest carbohydrate content. The three formulas significantly differed ($p<0.05$) in carbohydrate content. The carbohydrate content in Formula 1 differed from that of Formula 3. The average fat content ranged from 20.71 to 20.77 g/100 g, with formula 1 having the highest fat content. The average energy content ranged from 426.36 to 436.70 kcal, with formula 3 having the highest energy content. There was a significant difference ($p<0.05$) in energy content among the three formulas, with formula 1 differing from formula 3. The average fiber content ranged from 27.03 to 29.52 g/100 g, with formula 3 exhibiting the highest fiber content. The three formulas significantly differed ($p<0.05$) in fiber content. The differences in nutritional content among the three formulations are due to variations in moringa leaf flour and mung bean flour composition. A higher proportion of moringa leaf flour increases the cookies' protein and dietary fiber content.

2. Consumer Acceptability of Cookies

Table 3. Average Level of Consumer Acceptability for Cookies Formulas

Formulas	Color	Flavor	Aroma	Texture	Overall
F1	6.10 ± 1.34[a]	6.72 ± 1.07[a]	6.88 ± 1.18[a]	7.74 ± 1.21[a]	6.98 ± 1.17[a]
F2	7.54 ± 0.99[b]	7.62 ± 1.07[b]	7.56 ± 1.11[b]	7.44 ± 1.03[a]	7.72 ± 1.04[b]
F3	5.78 ± 1.20[a]	6.18 ± 0.80[c]	5.90 ± 0.84[c]	6.92 ± 0.83[b]	6.45 ± 0.98[c]
P	0.000*	0.000*	0.000*	0.001*	0.000*

Note: * significant $p < 0.05$

Note: Identical superscripts on the same variable indicate no significant difference.
Cookies formulation with wheat flour, taro flour, moringa leaf flour, and mung bean flour:
F1: (60%:10%:1%:29%),
F2: (50%:20%:2%:28%),
F3: (40%:30%:3%:27%).

Based on Table 3, the organoleptic test, the customer accepted the color, aroma, taste, and texture of the biscuit formulas mainly in the "like" to "very like" range. The average panelist acceptance scores for color ranged from 5.78 to 7.54, with formula 2 receiving the highest acceptance. The average taste scores ranged from 6.18 to 7.62, with Formula 2 exhibiting the highest acceptance. The average aroma scores ranged from 5.90 to 7.56, with Formula 2 receiving the highest acceptance score. The average texture scores ranged from 6.92 to 7.74, with formula 1 exhibiting the highest acceptance. The overall average acceptance ranged from 6.45 to 7.72, with Formula 2 achieving the highest overall acceptance.

DISCUSSION

1. Nutritional Characteristics of Cookies Formulas.

Based on our findings, the protein content of the cookies ranged from 7.07 to 8.14 g/100 g. According to the quality standards set by SNI-01-2973-2011, the minimum protein content of the cookies was 5 g, indicating that the cookies produced meet the SNI standards. Protein is a source of amino acids that contains carbon (C), hydrogen (H), oxygen (O), and nitrogen (N), elements that are not found in fats or carbohydrates. Proteins have unique and irreplaceable functions as they help build and maintain cells and tissues. Additionally, it regulates fluid balance in the body, transports nutrients, and forms antibodies (Andriati et al., 2024). The increased protein content observed in the cookies can be attributed to the source and amount of protein used (Ochieng et al., 2023). The higher the moringa leaf powder content, the higher the protein content. Moringa leaves contain eight essential amino acids, of which leucine is the most abundant (Hedhili et al., 2021).

The average carbohydrate content in the cookies was 53.96–56.11 g/100 g. The higher the addition of taro flour, the higher the carbohydrate content of the cookies. Taro is a carbohydrate-rich food, and 100 g of taro flour contains 67.5 grams of carbohydrates. *Fat* is a critical element that contributes to the sensory attributes of cookies, including softness, mouthfeel, and flavor retention (Mouafo et al., 2024). The average fat content was 20.71–20.77 g/100 g. Carbohydrates provide glucose as an energy source for cells and tissues (Rumida et al., 2023). The high carbohydrate content in the cookies is due to the use of wheat flour, taro flour, and sugar in the formulation. Taro (Colocasia esculenta) is a tropical tuber plant that proliferates with a considerable fiber content (>12% DM), moderate glycemic index (54–68), and high antioxidant activity (IC50 308 μg/mL), which can help prevent diabetes and other non-communicable diseases (Nurilmala et al., 2024).

The higher the percentage of taro flour substitution, the higher the fiber content in the cookies. Fiber also comes from mung beans and moringa leaves. Mung beans contain 25.8% fiber. Dietary fiber in mung beans is found in the seeds and coats. The seed coat accounts for 8% of the total weight of mung beans and contains 65% dietary fiber, whereas insoluble fiber comprises 61% of the total fiber (Qamahadlina et al., 2023). Making mung bean flour involves removing the seed coat, which reduces the fiber content compared to that of unprocessed mung bean. High fiber content slows gastric emptying and takes longer to digest. Fiber slows the passage of food through the digestive tract and delays enzyme activity, resulting in slower digestion and lower blood glucose levels (Nurilmala et al., 2024). In addition to being rich in fiber, moringa leaves are abundant in bioactive compounds, particularly antioxidants. One antioxidant component of moringa leaves is polyphenols. Antioxidants play a role in boosting the immune system (Flora et al., 2022). Therefore, these cookies can serve as a healthy snack alternative due to their high protein and fiber content.

The implications of these findings can contribute to the innovation of healthy snack products that meet nutritional needs, particularly protein and dietary fiber. Therefore, this formulation has the potential for commercial production or use in nutrition intervention programs. A limitation of this study is the absence of a shelf-life analysis for the cookie formulation.

2. Consumer Acceptability of Cookies

Consumer acceptance of food is influenced by many factors, including taste, color, appearance, aroma, and mouthfeel (Ud Din et al., 2024). The color and appearance of a product provide consumers with their first impression (Farzana et al., 2022; Vanqa et al., 2024). Color is a crucial parameter in evaluating the suitability of cookie production because it reflects the appropriateness of the ingredients used and offers insight into the product's formulation and quality. Non-enzymatic browning during baking affects the surface color of cookies because of the reaction between reducing sugars, amino acids, and starch dextrinization (Pestorić et al., 2015). The panelists' preference for the color of cookies made with taro flour, moringa leaf flour, and mung bean flour showed that they preferred formula F1 because it is a more attractive bright green color than F2 and F3. The difference in color preference among the formulas was attributed to the lower moringa leaf flour content in F1, which resulted in a brighter green. Amadi (2017) noted that adding 2% and 5% moringa leaf flour is generally acceptable (Amadi, 2017).

Aroma plays a crucial role in determining food deliciousness. Aroma is influenced by the sense of smell, with most scents perceived by the nose and brain being a mix of four types: fragrant, sour, rancid, and burnt (Deyantari et al., 2022). The cookies produced a sweet and distinctive aroma from taro, moringa leaf, and mung bean flour. Aroma is influenced by ingredients and additives used in food preparation. Panelists generally disliked cookies containing high levels of taro and moringa leaf flour.

Taste is one of the most critical factors for consumers when choosing food products. *Taste* is a sensation or feeling that arises from taste receptors in the mouth, particularly in the tongue. Taste sensitivity is located in the taste buds, and the basic tastes include sweet, sour, salty, bitter, and savory or umami (Ratnasari & Wahyani, 2022; Mailoa, 2023). The panelists' favorite cookie flavor was that of Formula 2, which contained 50% wheat flour, 20% taro flour, 2% moringa leaf flour, and 28% mung bean flour. Saklani et al. (2021) reported that adding 10% or 20% taro flour yielded the highest taste scores (Saklani et al., 2021). Moringa leaves contain tannins, which impart astringent and bitter tastes. The bitterness of moringa leaf flour stems from the tannin compounds present in the leaves (Ardianti et al., 2019).

Texture is another critical factor that influences consumers' food choices. Texture refers to the smoothness of a slice when touched by the panelists' fingers (Deyantari et al., 2022). The cookie with the highest texture score was obtained using Formula 1. As more taro flour was added, the cookies became denser. Overall, the panelists enjoyed the cookies made with taro flour, moringa

leaves, and mung bean flour. The most favored cookie formula was formula 2, which contains 50% wheat flour, 20% taro flour, 2% moringa leaf flour, and 28% mung bean flour.
A limitation of this study is the small sample size for sensory evaluation (50 panelists), which may not represent broader consumer preferences.

CONCLUSION

This study showed that adding taro flour, moringa leaf flour, and mung bean flour to cookies increased the protein and dietary fiber content. Formula 2, composed of 50% wheat flour, 20% taro flour, 2% moringa leaf flour, and 28% mung bean flour, was the most preferred. These cookies can help meet dietary needs for protein and fiber. Taro, mung beans, and moringa leaves can serve as alternative flour sources for the food industry.

Author's Contribution Statement: Authors consist of Ety Yuni Ristanti and Muhamad Asrar. Each author mentioned has significantly and directly contributed intellectually to the project and has given their approval for its publication.

Conflicts of Interest: The author declares no conflict of interest.

Acknowledgments: The authors thank all participants and research assistants.

REFERENCES

Aborhyem, S., Ismail, H., Agamy, N., & Tayel, D. (2016). Effect of Moringa Oleifera on Lipid Profile in Rats. *Journal of High Institute of Public Health*, *46*(1), 8–14. https://doi.org/10.21608/jhiph.2016.20201

Amadi, J. A. C. (2017). Production chemical and sensory evaluation of cookies fortified with *Moringa oleifera* leaves. *Journal of Dieticians Association of Nigeria*, *8*(24), 104–111. https://www.ajol.info/index.php/jdan/article/view/214372

Andriati, E. D., Romadhoni, I. F., Purwidiani, N., & Kuncoro, A. (2024). Inovasi Pembuatan Cookies dengan Pemanfatan Tepung Sorgum dan Tepung Kacang Hijau (Vigna Ridiata). *Harmoni Pendidika: Jurnal Ilmu Pendidikan*. *1*(4). Retreived from: https://journal.lpkd.or.id/index.php/Hardik/article/view/798

Ardianti, D. Y., Anggriani, R., & Sukardi, S. (2019). Pembuatan Cookies Substitusi Tepung Talas (Colocasia esculenta (L) Schot) dan Tepung Daun Kelor (Moringa oleifera Lamk). *Food Technology and Halal Science Journal*, *2*(1), 167. https://doi.org/10.22219/fths.v2i1.12973

Deyantari, A., Ardian, J., & Jauhari, M. T. (2022). Studi Pembuatan Cookies Dengan Penambahan Tepung Daun Kelor (Moringa Oleifera) Dan Tepung Biji Kacang Hijau (Vigna Radiata). *Nutriology : Jurnal Pangan,Gizi,Kesehatan*, *3*(1), 1–7. https://doi.org/10.30812/nutriology.v3i1.1929

Ervietasari, N. (2021). Cookies Berbahan Umbi Gembili sebagai Inovasi Pangan yang Bernilai Ekonomi, Kaya Gizi, dan Menyehatkan. *Journal Science Innovation and Technology (SINTECH)*, *1*(2), 15–22. https://doi.org/10.47701/sintech.v1i2.1063

Farzana, T., Hossain, F. B., Abedin, M. J., Afrin, S., & Rahman, S. S. (2022). Nutritional and sensory attributes of biscuits enriched with buckwheat. *Journal of Agriculture and Food Research*, *10*(August), 100394. https://doi.org/10.1016/j.jafr.2022.100394

Flora, R., Nisya, K. Z., Yuliana, I., & Sugito, S. (2022). Nutrient and hedonic value in cookies with Moringa leaf fortification (Moringa oleifera). *Jurnal Gizi Dan Dietetik Indonesia (Indonesian Journal of Nutrition and Dietetics)*, *10*(2), 71. https://doi.org/10.21927/ijnd.2022.10(2).71-78

Hedhili, A., Lubbers, S., Bou-Maroun, E., Griffon, F., Akinyemi, B. E., Husson, F., & Valentin, D. (2021). Moringa Oleifera supplemented biscuits: Nutritional values and consumer segmentation. *South African Journal of Botany*, *138*, 406–414. https://doi.org/10.1016/j.sajb.2021.01.017

Kementerian Kesehatan RI. (2019). *Tabel Komposisi Pangan Indonesia 2019*. Kementerian Kesehatan RI. https://m.andrafarm.com/_andra.php?_i=daftar-tkpi

Lebot, V., & Legendre, L. (2014). HPTLC screening of taro hybrids (Colocasia esculenta (L.) Schott) with high flavonoids and antioxidants contents. *Plant Breeding*, *134*(1). https://doi.org/10.1111/pbr.12225.

Mailoa, M. (2023). Sensory Characteristics Of Walnut Cookies With The Addition Of Smoked Tuna. *Journal of Survey in Fisheries Sciences*, *10*(1S), 6329–6333. https://doi.org/10.53555/sfs.v10i1S.2270

Mazur, M., Przytuła, A., Szymanska, M. ´, & Popiołek-Kalisz, J. (2024). Dietary strategies for cardiovascular disease risk factors prevention. *Current Problems in Cardiology*, *49*. https://doi.org/10.1016/j.cpcardiol.2024.102746

Mongi, R. J., & Gomezulu, A. D. (2022). Descriptive sensory analysis, consumer acceptability, and conjoint analysis of beef sausages prepared from a pigeon pea protein binder. *Heliyon*, *8*(9), e10703. https://doi.org/10.1016/j.heliyon.2022.e10703

Mouafo, H., Matuekam, A., Petagou, I., Ngeudjo, M., Baomog, A., Ntsama, P., & Medoua, G. (2024). Formulation of nutritious and functional meal-based biscuits from mixture of soybean, papaya fruit pulp, and baobab fruit pulp flours. *Heliyon*, *10*. https://doi.org/10.1016/j.heliyon.2024.e38171

Nicolas, O., Pierre, A. E. D. S., Renan, E. T., Hemayoro, S., Pauline, B., Mahamadou, S., & Vincent, L. (2023). Nutritional and phytochemical characterization of taro [Colocasia esculenta (L.) Schott] germplasm from Burkina Faso. *Journal of Plant Breeding and Crop Science*, *15*(1), 32–41. https://doi.org/10.5897/jpbcs2022.0999

Nile, S., Keom, Y., Nile, A., Jalde, S., & Patel, R. (2017). Antioxidant, anti-inflammatory, and enzyme inhibitory activity of natural plant flavonoids and their synthesized derivatives. *Journal of Biochemical and Molecular Toxicology*, *32*(1). https://doi.org/10.1002/jbt.22002

Nurilmala, F., Jannah, A., Palupi, E., Sonani, N., Mala, R., Nurdin, N. M., Zahidah, F. U., Bila, N. S., Sharannie, & Dewi, S. A. (2024). High-fiber and low-glycemic index egg-roll cookies made from non-itchy taro (Colocasia esculenta var. Febi521). *Journal of Agriculture and Food Research*, *18*(April), 101308. https://doi.org/10.1016/j.jafr.2024.101308

Ochieng, B. O., Anyango, J. O., Khamis, F. M., Ekesi, S., Egonyu, J. P., Subramanian, S., Nduko, J. M., Nakimbugwe, D., Cheseto, X., & Tanga, C. M. (2023). Nutritional characteristics, microbial loads and consumer acceptability of cookies enriched with insect (Ruspolia differens) meal. *Lwt*, *184*(June), 115012. https://doi.org/10.1016/j.lwt.2023.115012

Pestorić, M., Šimurina, O., Filipčev, B., Jambrec, D., Belović, M., Mišan, A., & Nedeljković, N. (2015). Relationship of physicochemical characteristics with sensory profile of cookies enriched with medicinal herbs. *International Journal of Food Properties*, *18*(12), 2699–2712. https://doi.org/10.1080/10942912.2015.1004586

Qamahadlina, A., Nisa, F. Z., & Utami, F. A. (2023). Proximate , Dietary Fibre and Organoleptic Analysis of Mung Beans Yoghurt. *The International Journal of Science & Technoledge*, *11*(10), 35–39. https://doi.org/10.24940/theijst/2023/v11/i10/ST2310-013

Ratnasari, D., & Wahyani, A. D. (2022). Analisis Kandungan Protein dan Dan Daya Terima Pada Biskuit Tepung Ikan Teri (Stolephorus sp) dan Isolat Protein Kedelai (Glycine mix) Untuk PMT-P Balita Gizi Kurang. *J-KESMAS: Jurnal Kesehatan Masyarakat*, *8*(2), 116. https://doi.org/10.35329/jkesmas.v8i2.2674

Rumida, Bakara, T., & Siahaan, G. (2023). Analysis of the Nutritional Quality of Cookies with Various Food Commodities in Management of Malnutrition. *Journal of Food and Nutrition Research*, *11*(3), 264–268. https://doi.org/10.12691/jfnr-11-3-11

Saklani, A., Kaushik, R., Chawla, P., Kumar, N., & Kumar, M. (2021). Effect of Taro (Colocasia esculenta) Enrichment on Physicochemical and Textural Properties of Cake. *International Journal of Food Studies*, *10*(February), SI114–SI125. https://doi.org/10.7455/ijfs/10.SI.2021.a2

Singgano, C. T., Teltje, K., Mamuja F., C., & Manado, J. T. P. U. S. R. (2019). Analisis Sifat Kimia dan Uji Organoleptik Snack Bar Berbahan Dari Campuran Tepung Labu Kuning (Cucurbita moschata) dan Tepung Kacang Hijau (Vigna radiata). *Jurnal Teknologi Pertanian*, *10*(1), 28–35. https://doi.org/10.35791/jteta.v10i1.28215

Ud Din, G., Hussain, A., Ashraf, H., Kausar, T., Fatima, H., Sidrah, S, A., Ramzan, M., Iqbal, A., Cacciotti, I., Sameh, & Korma, A. (2024). Physicochemical, nutritional and organoleptic characteristics of cookies based on water chestnut (Trapa natans) and wheat. *Food Chemistry Advances*, *4*. https://doi.org/10.1016/j.focha.2024.100691

Vanqa, N., Mshayisa, V. V., & Basitere, M. (2024). Macrotermes subhylanus flour inclusion in biscuits: Effects on nutritional, sensorial and microbial characteristics. *Heliyon*, *10*(12), e32702. https://doi.org/10.1016/j.heliyon.2024.e32702