Amerta Nutrition
e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
Nurjanah and Aji | Amerta Nutrition Vol. 9 Issue 2 (June 2025). 186-198

RESEARCH STUDY
English Version

OPEN ACCESS

Product Development of Yellow Pumpkin *(Cucurbita Moschata)* Brownies with the Natural Sweetener Substitution of Stevia Leaves *(Stevia Rebaudiana)* as a Functional Food

Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional

Raudah Nurjanah[1], Arif Sabta Aji[1,2]*

[1]Nutrition Department, Faculty of Health Sciences, Alma Ata University, Bantul, Daerah Istimewa Yogyakarta, Indonesia
[2]Research Center for Biomedical, National Research and Innovation Agency, Bogor, West Jawa Province, Indonesia

ARTICLE INFO

Received: *13-09-2024*
Accepted: *30-12-2024*
Published online: *20-06-2025*

Correspondent:
Arif Sabta Aji
sabtaaji@almaata.ac.id

DOI:
10.20473/amnt.v9i2.2025.186-198

Available online at:
https://e-journal.unair.ac.id/AMNT

Keywords:
Brownies, Pumpkin, Stevia, Nutritional Value, Sensory Evaluation

ABSTRACT

Background: Diabetes Mellitus is a global health problem. The prevalence of Type 2 diabetes mellitus (T2DM) in Indonesia reached 24.11%. High sugar consumption increases diabetes risk. Therefore, steamed brownies sweetened with stevia and pumpkin can be a healthy alternative snack.
Objectives: To analyze the influence of the substitution of stevia sweetener and addition of yellow pumpkin in the steamed brownies product on water content, ash, nutritional value, total sugar, sensory evaluation, β-carotene, and antioxidant activity.
Methods: This study used a single factor completely randomized design with four treatments: P0 (100% cane sugar and 0% stevia), P1 (50% and 50%), P2 (75% and 25%), and P3 (0% and 100%). Total sugar content was analyzed using the anthrone-sulfate test, antioxidant activity with 1-Diphenyl-2-Picrylhydrazyl (DPPH), β-Carotene using spectrophotometry, and sensory evaluation with the hedonic test. Data were analyzed using ANOVA and Duncan tests to determine the most significant treatment.
Results: Substitution of cane sugar with stevia significantly affected the nutritional value, water content, ash, protein, fat, carbohydrate, and energy (p-value<0.001). β-Carotene levels and antioxidant activity also increased, with the highest levels in P3 (74.21 µg/100 g and 22.46%). Stevia affected the taste, aroma, and texture (p-value<0.001) but it's not significant for color (p-value=0.712). Total sugar decreased with the addition of stevia (p-value<0.001). The IC50 results of antioxidant activity were very strong at 11.40 µg/mL.
Conclusions: Using stevia in yellow pumpkin brownies (BrowPumpVi) reduces the total sugar content, increases antioxidant activity, and influences taste, aroma, texture, and β-Carotene levels but does not affect the color.

INTRODUCTION

High sugar consumption patterns can have negative effects on health because it increases blood sugar levels which can lead to Diabetes Mellitus Type 2 (DMT2). The DMT2 occurs due to too much energy from glucose or simple carbohydrates stored in body tissues and this can cause insulin resistance[1]. The 2018 Basic Health Research (RISKESDAS) data showed that the prevalence of DMT2 in Indonesia reached 24.11%. The International Diabetes Federation (IDF) reported that a total of 537 million people in the world suffered from diabetes mellitus in 2021. The average sugar consumption of Indonesian people reached 65.7 kcal/day in September 2021 which indicates an increase of 1.33% from March 2021. This figure is still below the maximum limit recommended by the Ministry of Health of the Republic of Indonesia, namely 50 g or the equivalent of 4 tablespoons of sugar per person per day[2,3]. Consumption of cane sugar is quite high, including from sweetened foods and drinks. The 2018 Basic Health Research reported that 40.1% of respondents consumed sweetened foods more than once a day[4]. This indicates the high level of consumption of cane sugar in sweetened foods. Preventing excessive sugar consumption can be done by substituting the sugar with Stevia, a low-calorie natural sweetener obtained from stevia leaves (*Stevia Rebaudianai*). Stevia plants (*Stevia Rebaudiana*) spread widely and grow adaptively, with the most dominant in the Tawangmangu area, Central Java Province[5]. Stevia leaves contain zero-calorie natural sweeteners and can produce a sweet taste 70-400 times sweeter than cane sugar[6]. Stevia functions as a natural sweetener which is

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

good for producing low-calorie functional foods for all groups of people[7]. Safitri et al (2019) revealed that treatment with stevia extract produced the lowest total sugar content among the four samples, meaning that stevia is a low-calorie sweetener[8]. Thus, stevia can be used as a natural sweetener to substitute sugar in sweetened foods.

Yellow pumpkin (*Cucurbita Moschata*) is widely available in Indonesia and this ingredient can be used to modify food ingredients. The largest producer of yellow pumpkin is Java, including Central Java Pprovince[9]. However, the utilization of this food commodity is limited[10]. Yellow pumpkin contains β-carotene, namely 1569 mcg/100 g. This high β-carotene content is a type of carotenoid that functions as provitamin A and a source of antioxidants[11]. Pumpkin can be used as a functional food, processed foods containing substances that have a possible health-enhancing value[4]. Adding 25% yellow pumpkin can reduce wheat flour by up to 50%. Yellow pumpkin is a rich source of nutrients, especially carotene, low calories and carbohydrates so it has the potential to be a functional diet for diabetes mellitus problems[12]. Yellow pumpkin can be processed into functional foods, namely brownies.

Consuming snacks that do not comply with balanced nutrition guidelines is an example of an unhealthy diet. Brownies are a cake in high demand and easily available in the market is brownies[13]. Steamed brownies are one type of cake made from solid chocolate which was originally the result of failed dough and has a hard texture. Brownies can be categorized into two, namely steamed and baked brownies. Steamed brownies do not remove much water vapor so they produce a softer texture than the baking process[14]. The sugar content in brownies can restore energy quickly. However, excessively consuming it can increase glucose levels[15]. Therefore, its recipes need to be modified with safe food ingredients to avoid diabetes mellitus. Pumpkin and stevia are expected to be alternative solutions to reduce hyperglycemia because stevia leaves (*Stevia Rebaudiana*) provide a low-calorie sugar substitute and pumpkin (*Cucurbita Moschata*) significantly functions as an antioxidant with its high β-carotene and low carbohydrate content.

Santosa et al (2021) revealed that the addition of stevia leaf sweetener significantly affected the ash, total sugar, crude fiber content as well as the texture of baked brownies made from jicama flour[13]. Meanwhile, Kumalasari & Aurisa (2023) the use of coconut flour and stevia can significantly affect the donut's texture, taste, color, protein, fat, crude fiber, and color with yellowish or reddish dominant color but not have a significant impact on water and ash content[16]. Another study by Maretta (2012) showed that the total sugar content in steamed brownie cake added with 100 g of cane sugar and 0.3 g of stevia was 8.13% and 0.78% respectively[17]. This proves that stevia has a lower sugar content than cane sugar. The development of steamed brownies by using pumpkin as the main ingredient and adding Stevia sweetener can be an alternative functional food. "BrowPumpVi" stands for Yellow Pumpkin Brownies with Stevia. The development of this product is to see the effect of Stevia and pumpkin on water and ash content, nutritional value (energy, protein, fat, carbohydrates), total sugar, sugar reduction, sensory evaluation, β-carotene and anti-oxidants in the "BrowPumpVi" as an alternative functional food.

METHODS

This quasi-experimental research used a Completely Randomized Design (CRD) with the treatment of substitution of cane sugar with stevia sweetener. This study used one level of control and three levels of substitution treatment with four formulations, namely P0 (100% cane sugar : 0% stevia), P1 (50% cane sugar: 50% stevia), P2 (25% cane sugar: 75% stevia), and P3 (0% cane sugar: 100% stevia). The analysis of the nutritional content used the Gavimetry method for water and ash content, the Kjeldahl method for protein content, the Soxhletation method for fat content, by difference method for carbohydrate content, and the Atwater method for energy value. Besides, the analysis of β-carotene content used the spectrophotometric method, a method for measuring the amount of substances based on spectroscopy[18].

This study used some materials such as stevia leaf powder which is purchased online and other materials such as pumpkin, wheat flour, cane sugar, vanilla, margarine, eggs, baking powder, dark chocolate, and almond slices purchased from baking stores. This study used tools for making brownies such as scales, mixers, basins, cake pans, spatulas, sieves, steaming spoons, cutting boards, and knives as presented in Figure 1. The formulation of sugar and stevia was varied, namely 50 g of sugar and 3.125 g of stevia, 25 g of sugar and 4.68 g of stevia, and 0 g of sugar and 6.25 g of stevia. The addition of stevia sweetener aims to get sweet brownies that are not much different from the brownies sold on the market. The procedure of making brownies was started by weighing all ingredients such as flour and pumpkin flesh with the appropriate ratios. The next stage was preparing eggs, vanilla, and baking powder. They were mixed until fluffy and added with flour, dark chocolate, melted margarine, a certain proportion of sugar and stevia, and mashed pumpkin. They were mixed well and the dough was put in the mold and added with almond slices on top. This was steamed for 20 minutes over medium so this process does not damage the components to be tested. The brownies were left for 15 minutes to get cool and were removed from the mold. The brownies were ready to eat. The stages can be seen in Figure 2. The cooking procedure and sensory evaluation were carried out at the Food Technology Laboratory of Alma Ata University. This research has been approved by the Ethics Committee of Alma Ata University Yogyakarta Number: KE/AA/II10111399/EC/2024 on 1st February 2024. This research was conducted in January-February 2024 at the Chemistry Laboratory of Alma Ata University and the Integrated Testing Research Laboratory at Lab Chem Mix Yogyakarta. The tools, materials, and cooking process are presented in Figure 1 and Figure 2.

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

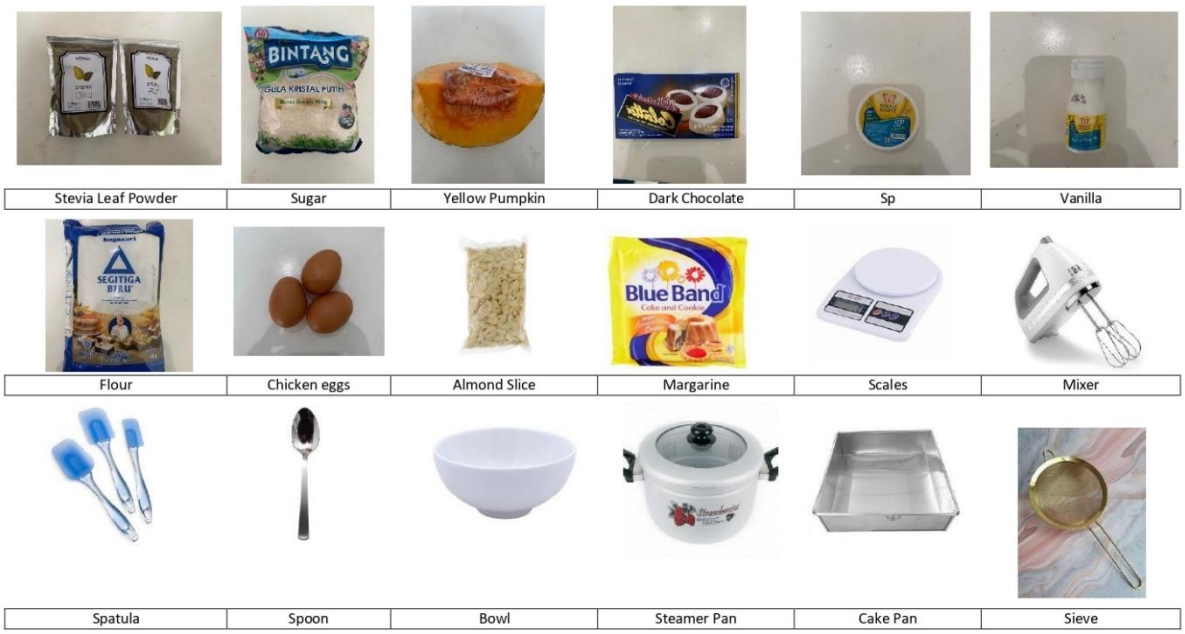

Figure 1. Ingredients and tools used to make steamed pumpkin brownies

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

Figure 2. The process of making steamed pumpkin brownies

This study involved 30 panelists in the sensory evaluation. They were semi-trained panelists, namely students of the Nutrition Study Program, Faculty of Health Sciences, Alma Ata University. Before the sensory evaluation, the panelists received training to understand certain sensory properties. The panelists had taken advanced culinary nutrition courses that included sensory test material. The criteria of the panelists were 1) physically and mentally healthy, and had no allergies; 2) not sick, hungry, or have an empty stomach; and 3) volunteered as panelists. The sensory evaluation used the hedonic test method with a rating scale of strongly dislike (scores 0-1.0), dislike (score 1.1-2.0), like (score 2.1-3.0) and strongly like (scores 3.0-4.0).

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

Table 1. Standard recipe for making brownies based on recommended dietary allowance (RDA)

Ingredient	P0	P1	P2	P3
Wheat Flour (g)	100	100	100	100
Cane Sugar (g)	100	50	25	0
Stevia Powder (g)	0	3.128	4.68	6.2
Pumpkin Flesh (g)	225	225	225	225
Margarine (g)	25	25	25	25
Egg (pcs)	3	3	3	3
Dark Chocolate (g)	100	100	100	100
Vanilla (tsp)	1	1	1	1
Sliced Almonds (g)	100	100	100	100
Raising Agent (tsp)	½	½	½	½

pcs=Pieces, g=Gram, tsp=Spoon Tea

Table 2. Treatment

Treatment Proportion	Comparison	Repetition		
		1	2	3
P0	100:0	Y_{01}	Y_{02}	Y_{03}
P1	50:50	Y_{04}	Y_{05}	Y_{06}
P2	25:75	Y_{07}	Y_{08}	Y_{09}
P3	0:100	Y_{10}	Y_{11}	Y_{12}

P=Treatment Level Code, Y=Treatment Repeatability

Measurement of antioxidant activity used a rotary evaporator, shaker, spectrometer, baker glass, measuring cup, measuring flask, measuring pipette, watch glass, stirring rod, porcelain cup, mortar, blender, funnel, analytical balance, filter paper, aluminum foil, knife, and cutting board[19]. Measurement of total sugar used UV-Vis spectrophotometer Orion Aquamate 8000 brand, cuvette, test tube, test tube rack, 25 mL measuring cup, 100 mL measuring flask, latex gloves, 10 mL measuring flask, pipette, and 1 mL, 2 mL measuring pipette, and 10 mL[20]. Measurement of β-carotene used some materials and tools such as acetone, distilled water, petroleum ether, acetone, anhydrous Na2SO4, Erlenmeyer products, lumping porcelain, funnel, pipette, and test tube. Measurement of water content used a cup, oven, desiccator, analytical balance, furnace, and pliers. Measurement of ash content used a cup, oven, desiccator, analytical balance, furnace, pliers, and cloth. Measurement of protein used an analytical balance, Kjeldahl flask, Kjeldahl apparatus, biuret, measuring cup, Erlenmeyer flask, cloth and pipette, H2SO4 liquid, Catalyst mixture (CuSO4 + KzSO4), 30% NaOH, 0.1 N HCl, and oxalic acid solution. Measurement of fat content used an analytical balance, soxhlet apparatus, ordinary filter paper, oven, desiccator, pliers, and cloth.

RESULTS AND DISCUSSIONS

Nutritional Content

Table 3 shows that the highest and lowest water content can be found in P3 (48.64%) and P0 (43.26%) respectively. This indicates that the higher the addition of stevia, the higher the water content. The water content in BrowPumpVi products increases along with the increase in added stevia. This is because the replacement of sugar with stevia which is a humectant, namely able to attract and retain water so that the water content in the product increases along with the addition of stevia sweetener[16]. This finding is in line with a previous study on the development of black mangrove fruit biscuits added with stevia. This study reveals that stevia contains stevioside which has a hydroxyl group and is polar so that it easily binds to water[21]. According to the Indonesian National Standard (SNI) 01-3840-1995, the quality standard for brownies' water content with a maximum limit of 25 is 40%. The BrowPumpVi product exceeds the maximum limit of the SNI standard because the steaming process automatically increases the water content in the material due to water vapor trapped inside the brownies[22]. This is also supported by the preceding process of steaming the pumpkin flesh. The heating process can damage the cell structure so that water absorption occurs faster resulting in softer pumpkin[23]. It can be said that the high water content in BrowPumpVi products is caused by the steaming process which increases the water content and the use of steamed pumpkin which absorbs water faster due to heating. This is in line with other studies that the higher the amount of stevia added, the higher the water content of the product.

Table 3. Nutritional and energy content of BrowPumpVi products (per 100 g of ingredients)

Variable (Sugar:Stevia)	Mean±SD	p-value
Water Content (%)		
P0 (100:0)	43.26±0.12[a]	<0.001*
P1 (50:50)	44.11±0.33[b]	

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

Variable (Sugar:Stevia)	Mean±SD	p-value
P2 (25:75)	46.99±0.41[c]	
P3 (0:100)	48.64±0.04[d]	
Ash Content (%)		
P0 (100:0)	0.78±0.03[a]	
P1 (50:50)	0.83±0.02[a]	
P2 (25:75)	1.04±0.02[b]	<0.001*
P3 (0:100)	1.06±0.06[b]	
Protein Content (%)		
P0 (100:0)	5.04±0.23[a]	
P1 (50:50)	5.63±0.26[b]	<0.001*
P2 (25:75)	6.69±0.06[c]	
P3 (0:100)	6.93±0.11[c]	
Fat Content (%)		
P0 (100:0)	11.47±0.10[a]	
P1 (50:50)	12.01±0.21[b]	<0.001*
P2 (25:75)	13.74±0.08[c]	
P3 (0:100)	14.49±0.34[d]	
Carbohydrate Content (%)		
P0 (100:0)	39.45±0.23[d]	
P1 (50:50)	37.06±0.12[c]	<0.001*
P2 (25:75)	31.54±0.36[b]	
P3 (0:100)	28.88±0.35[a]	
Energy Value (Kcal)		
P0 (100:0)	281.19±0.76[c]	
P1 (50:50)	279.02±1.43[bc]	<0.001*
P2 (25:75)	276.65±2.09[b]	
P3 (0:100)	273.68±1.45[a]	

[a, b, c, d]) numbers followed by lowercase letters in the row, *) p-value<0.05 indicates a significant difference in the substitution of granulated sugar and stevia sweetener in the ANOVA test

The highest and lowest ash content can be found in P3 (1.06%) and P0 (0.78%) respectively. The ash content increases along with the increasing amount of stevia used. The ash content in stevia is 11 g, while the ash content in sugar is 0.6 g per 100 g. The increase in ash content is due to the mineral content of stevia[24]. The addition of stevia to goat's milk shows that stevia contains zinc, potassium, magnesium, and sodium which increases the ash content in the produced product[25]. Another study reveals that the dried stevia leaves contain calcium, sodium, potassium, magnesium, iron, zinc, copper, and manganese[26]. The results of this study are in line with a previous study on the development of Kemojo cakes using stevia powder. This study shows that the higher the amount of stevia added, the higher the ash content in the developed product[27]. Therefore, the addition of stevia powder increases the ash content although it does not make a significant difference. This is in line with other studies that the more stevia sweetener added, the higher the ash content in the product.

P3 contains the highest protein content (6.93%), while P0 has the lowest protein content (5.04%). The protein content is based on the amount of protein contained in its ingredients. The addition of stevia leaves to the product results in an increase in protein content. The composition of amino acids in stevia supports this claim. Fifteen amino acids have been found in stevia glutamate, aspartate, lysine, serine, isoleucine, alanine, proline, tyrosine, arginine, histidine, phenylalanine, leucine, valine, tryptophan, and glycine[28]. The results of this study are in line with a study on the analysis of lemon cake added with stevia where the highest protein results were obtained in the formula with the addition of stevia only[29]. Therefore, the substitution of stevia leaf powder in the product can increase protein levels which can be associated with the amino acid content of stevia.

The highest and lowest fat content can be found in P3 (14.49%) and P0 (11.47%) respectively. The increasing amount of fat contributes to the increase in fat content. In addition to stevia, the fat can also be found in ingredients used in the production of this product such as eggs, chocolate, and margarine[30]. This is associated with fat-soluble compounds in stevia leaves such as essential oils, chlorophyll, and carotenoids[29]. Previous studies revealed that stevia contains fatty acids such as palmitic, linolenic, oleo palmitic, stearic, and oleic[31]. The findings of this study are in line with a previous study concerning the development of a traditional cake called Kemojo added with stevia which showed that the addition of stevia increases the fat content in each treatment[27]. Therefore, the addition of stevia contributes to the increase in fat content.

The carbohydrate content shows the opposite with the highest in P0 (39.45%) and the lowest in P3 (28.88%). The addition of stevia decreases the carbohydrate content in the BrowPumpVi product. The

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

stevia sweetener plays a major role in reducing the carbohydrate content. The carbohydrate content in stevia and cane sugar reaches 52 g and 94 g respectively per 100 g. Thus, the addition of stevia will reduce the carbohydrate content in the resulting product. This is in line with previous studies that the more stevia sweetener is added, the lower the carbohydrate content in the product. The highest energy value is found in P0 (281.19 kcal/100 g), while the lowest is in P3 (273.68 kcal/100 g). The calorie value of the BrowPumpVi product decreases with increasing amount of stevia added because stevia contains 270 kcal per 100 g, while sugar contains 394 kcal per 100 g. Thus, the addition of stevia reduces the overall energy value of the product. Stevia has a minimal calorie content and a sweet taste. As a natural sweetener, stevia has some benefits such as having a low-calorie content and giving a sweet taste for many applications without consequences[32]. This is in line with a previous study that the more stevia sweetener added, the higher the energy value contained in the product.

Total Sugar Content, β-Carotene, and Antioxidant Activity

Table 4 shows that the lowest total sugar content of this product with the addition of stevia leaf is P3 with a mean value of 9.17% and the highest total sugar content is P0 with an average value of 19.49%. The P3 treatment has the highest β-Carotene content, namely 74.21 µg/100 g, while P0 has the lowest β-carotene content, namely 30.43 µg/100 g. Then, the P3 treatment also has the highest antioxidant activity with an average value of 22.46% and P0 has the lowest antioxidant activity with a value of 11.46%.

Table 4. Results of total sugar content, β-carotene and antioxidant activity per 100 g product

Variable (Sugar:Stevia)	Mean±SD	p-value
Total Sugar (%)		
P0 (100:0)	19.49±0.13^{d}	<0.001*
P1 (50:50)	13.78±0.10^{c}	
P2 (25:75)	12.16±0.34^{b}	
P3 (0:100)	9.17±0.06^{a}	
***β-Karoten* (µg)**		
P0 (100:0)	30.43±1.08^{a}	<0.001*
P1 (50:50)	60.61±0.68^{b}	
P2 (25:75)	65.91±0.67^{c}	
P3 (0:100)	74.21±0.74^{d}	
Antioxidant Activity (%)		
P0 (100:0)	11.46±0.13^{a}	<0.001*
P1 (50:50)	14.22±0.13^{b}	
P2 (25:75)	18.37±0.14^{c}	
P3 (0:100)	22.46±0.20^{d}	

P0=100 g sugar and 0 g stevia, P1=50 g sugar and 3.125 g stevia, P2=25 g sugar and 4.68 g stevia, P3=0 g sugar and 6.25 g stevia, $^{a, b, c, d}$) different letters in the same column indicate significant differences between treatments at a significance level of α=0.001 based on the Duncan's Test, *) p-value<0.05 shows a significant difference.

The total sugar content was tested using the anthrone-sulfate method. Based on the hydrolysis, disaccharides in the sample turn into monosaccharides. In the management of diabetes mellitus diet, simple sugar consumption for diabetic patients should not exceed 5% of the total daily calorie intake. In the BrowPumpVi product, the lowest total sugar is 9.17% which is lower than regular brownies with cane sugar sweetener which reaches 19.49%. As the BrowPumpVi has a low-sugar content, it can be an alternative snack for people with diabetes mellitus. Arif et al (2021) argued that brownies contain a total sugar of 23% with the addition of 1.75 g of stevia[13]. Umami et al (2015) reported that the total sugar in yogurt products is 4.94% with the addition of 0.25% of stevia[33]. In this study, a BrowPumpVi product has a total sugar content of 9.17% with the addition of 6.25 g of stevia. It can be said that the more amount of stevia used, the less total sugar in the produced product. Thus, the BrowPumpVi product with the addition of stevia has a total sugar of 9.17 ± 0.06% so it can be an alternative low-sugar snack for people with diabetes mellitus.

Table 4 shows the highest and the lowest β-Carotene content, namely in P3 with 74.21 µg/100 g and P0 with 30. µg/100 g respectively. The steaming process with a high temperature can damage the β-Carotene levels[34]. Previous research showed that the β-Carotene levels can be reduced or disrupted due to susceptibility to oxidation from light, metals, enzymes, and heat. Processing pumpkin through the steaming process obtains β-Carotene levels with a value of 74.21 ± 0.74 µg/100 g which is lower than raw pumpkin (1569 µg/100 g) due to the heating or steaming process using a high temperature. The cooking process with high temperatures greatly affects the β-Carotene content but in this study, this case can be addressed by measuring the cooking process temperature. In this study, the addition of stevia leaves increases in β-Carotene levels. The addition of pumpkin in P0, P1, P2, and P3 had the same weight, while the addition of stevia varied. This is in line with a previous study that dry powder obtained from stevia leaves has a high β-Carotene content of 344.0

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

µg/100 g[36].

Table 4 shows that the highest and lowest antioxidant activity of the developed product can be found in P3 (22.46%) and P0 (11.46%) respectively. The IC50 obtained a value of 11.40 µg/mL (<50) which means that the antioxidant activity is very strong. Antioxidants are chemicals that can inhibit and slow down the oxidation process in food or medicine. Antioxidants have compounds such as singlet oxygen, superoxide, peroxide radicals, and hydroxyl radicals which can protect cells from damage caused by free radicals[37]. Antioxidants provide a protective effect in improving glycemic control in diabetics. A previous study has examined the function of antioxidants in reducing hyperglycemia in male rats of the Wistar strain. It revealed that the antioxidant activity of stevia leaf extract reduced blood glucose levels by 25.72% at a dose of 120 mg per 200 g of rat body weight[38].

Wildan et al (2018) reported the antioxidant test on moringa brownies with the addition of stevia obtained a value of 18.03% in the 3rd treatment with 100 ml[39]. The antioxidant activity level in the BrowPumpVi product is influenced by the flavonoid content where the higher the antioxidant activity, the more flavonoids are contained in the product[11]. In the BrowPumpVi product, the P3 has the highest antioxidant activity of 22.46%, higher than brownies added with cane sugar (11.46%). The addition of stevia leaf extract of 0.25% to yogurt obtained an antioxidant activity level of 4.25%. These results are lower than the BrowPumpVi product with 6.25 g of stevia which obtains an antioxidant activity of 22.46%[33]. The IC50 calculation obtained a value of 11.40/mL (<50) which means that the antioxidants contained in the product are very strong in inhibiting free radicals. Therefore, BrowPumpVi with stevia has higher antioxidant activity than the brownies with the addition of cane sugar. It has been proven that stevia contains higher antioxidant activity so the BrowPumpVi product can be an alternative snack to inhibit free radicals that trigger vascular complications in people with diabetes mellitus.

Sensory Evaluation

Table 5 shows that the highest value for sensory evaluation of color in the BrowPumpVi product is in P2, namely 3.07±0.52 (strongly prefer), while the lowest is P1, namely 2.90±0.54 (like). Color is the first sensory quality characteristic that can be seen and assessed directly by panelists[40]. The BrowPumpVi product has an attractive color and can be well-accepted by the panelists. The sensory evaluation of color showed no significant effect. The P1 treatment obtained a brown color but treatments P1, P2, and P3 had a darker brown color. The addition of stevia and pumpkin did not affect the brown color of the brownies because the use of dark compound chocolate in each treatment caused a greater color effect. This is in line with a previous study that the addition of stevia did not affect the color of Jicama brownies[13]. An organoleptic assessment of MOCAF flour in steamed brownies obtained a dark color due to the addition of melted chocolate bars during production. The brown color is also obtained from the enzymatic process resulting from the Maillard reaction and sugar caramelization[10]. The addition of stevia leaves does not affect the brown color of the brownies due to the use of dark compound chocolate which contributed a striking color[13]. Therefore, the addition of stevia leaf sweetener does not affect the brown color of pumpkin brownies. The results of each BrowPumpVi product for P0 (100 g sugar and 0 g stevia), P1 (50 g sugar and 3.125 g stevia), P2 (25 g sugar and 4.68 g stevia), and P3 (0 g sugar and 6.25 g stevia) are presented in Figure 3.

P0 (100 g sugar and 0 g stevia) | P1 (100 g sugar and 3.125 g stevia) | P2 (100 g sugar and 4.68 g stevia) | P3 (100 g sugar and 6.25 g stevia)

Figure 3. The BrowPumpVi products obtained from Treatments P0, P1, P2, and P3

P2 treatment has the highest value in the sensory evaluation of taste, namely 2.83±0.83 (prefer), while the lowest is in the P3 with a value of 2.40±0.85 (prefer). The perception of taste involves the five senses related to the tongue for the identification of a compound. This identification occurs when the compound interacts with the microvilli, which triggers impulses transmitted to the nerve center. Each person has a different threshold of taste sensitivity[13]. In this study, the P1 treatment produced a BrowPumpVi product with a sweet chocolate taste. The P1 and P2 had a sweet and slightly bitter taste. Meanwhile, the P3 treatment had a sweet and bitter taste. In line with a previous study, the addition of 1% stevia produced a sweet and bitter in Kemojo cakes[27]. Another study revealed that the addition of stevia produced a bitter taste in *secang* drinks. The content of Rebaudioside-A and tannin in stevia leaves produces a bitter taste[41]. The addition of stevia can cause a bitter taste in the BrowPumpVi product. Another study also showed that the addition of green stevia leaf powder to starfruit juice produced a sweet taste 30 times sweeter than sucrose. The stevioside compound gives stevia leaves a sweet taste. However, using stevia in large amounts can make it taste too sweet. Research shows

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

that a mixture of 8% sucrose and 1% stevia extract produces a slightly bitter taste[42]. Previous research on the addition of stevia to *secang* drinks revealed that the content of Rebaudioside-A in stevia leaves causes a bitter taste that remains in the mouth. Dry stevia leaf powder can reduce the bitter taste that remains in the mouth[41]. A study has proven that stevia leaves contain tannin that can cause a bitter taste if used in large amounts[43]. Tannin is an astringent compound with a bitter taste due to the presence of polyphenol groups that can bind and precipitate or reduce protein components[20]. The more the stevia leaf powder added than the cane sugar in the BrowPumpVi product, the more panelists prefer it compared to the proportion of stevia used without cane sugar.

Table 5 shows that in the sensory evaluation of aroma, the P2 treatment has the highest value of 2.83±0.70 (prefer), while the lowest value is the P3 treatment, namely 2.60±0.67 (like). Aroma is subjective, so it is difficult to measure. Each person has different sensitivities and preferences, regardless of their ability to taste it[44]. The panelists' preference decreases for the aroma of the BrowPumpVi product with more stevia leaves. As stated earlier, the perception of aroma is subjective and influenced by the sensitivity and preferences of different individuals. The P0 treatment produces a typical pumpkin brownie aroma, while the P1 and P2 have a slightly pumpkin brownie aroma and stevia leaf aroma. However, the P3 produces a slightly pumpkin brownie aroma and a strong stevia aroma. Radiani et al (2021) revealed that the more pumpkin added to the brownies, the stronger the pumpkin-scented will be[45]. A previous study examining the addition of stevia leaf extract to Kefir and goat milk revealed that the more stevia leaves used, the more dominant the stevia aroma will be[25]. The stevia leaf aroma is influenced by its composition, especially tannins, flavonoids, and volatile compounds, which make the aroma less attractive[46]. An organoleptic evaluation of Kefir added with stevia leaf showed that the greater the amount of stevia powder added, the stronger the stevia aroma. This causes a decrease in preference among panelists[47]. In this study, the product with a greater addition of stevia powder is less preferred by panelists.

Table 5 also shows that P1 has the highest value for the sensory evaluation of texture, namely 2.73±0.64 (prefer), while P3 is the lowest with a value of 2.37 ± 0.71 (prefer). The sensory evaluation of texture is to determine the panelists' preference for the product. This evaluation is based on the sense of touch[45]. In this study, the addition of stevia and pumpkin affects the texture of the product. The P0 and P1 have a moist texture compared to P2. Meanwhile, P3 has a less moist texture. A previous study examining the addition of MOCAF and pumpkin revealed that the addition of pumpkin influences the texture of the brownies. With the addition of more pumpkin, cooked brownies have a very wet texture because of the water content in steamed brownies. The more pumpkin used, the higher the water content in the product[48]. The texture of the product is greatly influenced by the water content of the ingredients used, the higher the water content, the softer the texture of the product[49]. The addition of stevia provides a significant effect on the texture of baked Jicama brownies where it produces flat and not moist products. This is due to the absence of added sugar in the ingredients. The addition of sugar contributes to structure, improves texture and softness, and prolongs the freshness of brownies by maintaining moisture[50].

Table 5. Results of sensory evaluation of the BrowPumpVi product with the addition of stevia

Variable	Panelist Preference based on the Sensory Evaluation				p-value
	Treatment (%) Sugar: Stevia				
	P_0 (100:0)	P_1 (50:50)	P_2 (25:75)	P_3 (0:100)	
Color	3.03±0.49[a]	2.90±0.54[a]	3.07±0.52[a]	2.97±0.80[a]	0.712*
Taste	3.40±0.62[a]	2.50±0.73[bc]	2.83±0.83[b]	2.40±0.85[c]	<0.001*
Aroma	3.13±0.50[a]	2.77±0.62[b]	2.83±0.70[ab]	2.60±0.67[b]	0.014*
Texture	3.33±0.80[a]	2.73±0.64[b]	2.70±0.70[bc]	2.37±0.71[c]	<0.001*

[a, b, c]) different letters in the same column indicate a significant difference between treatments at a significant level of p-value<0.05 based on the Mann-Whitney test, the value of each sensory evaluation score in the table shows a score of 1=strongly dislike, 2=dislike, 3=prefer, 4=strongly prefer, *) p-value<0.05 indicates a significant difference

BrowPumpVi as Functional Foods

The functional foods of the BrowPumpVi product have many health benefits as the use of stevia leaves and pumpkin is good for people with diabetes mellitus[40]. As a natural sweetener, stevia makes the produced product have a low sugar content. Stevia leaf powder has a natural sweet taste without side effects on increasing blood sugar levels[13].. Besides, the ingredient also uses pumpkin which is rich in vitamins A, C, E, and fiber. Vitamins A and C are important for maintaining eye health and increasing the body's immune[51]. Vitamin E and fiber are useful for maintaining heart and digestive health[43]. Pumpkin is known for its hyperglycemic and antidiabetic properties as it contains high amounts of beta-carotene and antioxidant activity which helps prevent blood vessel damage and reduces the risk of type 2 diabetes mellitus. This product has varied nutritional contents so it is good for health.

Harismah et al (2019) explained that the most preferred functional food in agar-agar products is a formulation with a ratio of 1:1 which is equivalent to 1.25 g of stevia. This indicates that stevia is the right choice for developing low-calorie snacks such as the modification of agar-agar with yellow sweet potatoes as a functional food by replacing sugar with stevia. Using stevia in the best ratio will not change the product taste[8]. Maryanto et al (2022) argued that the addition of pumpkin flesh to baked cakes produces a low glycemic index value, namely

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

38.9%. This is different when compared to commercial snacks made from wheat which has a high glycemic index value, namely 90.22%[9]. Therefore, it can be said that the addition of pumpkin to steamed cakes produces a low glycemic index value. The BrowPumpVi product can be an alternative healthy snack as it has a low sugar content and is high in antioxidant activity.

Strength and Limitation of Research

The BrowPumpVi product offers an alternative healthy snack for people with diabetes mellitus and it has a low-calorie level. However, this product is not processed with a temperature preservative, which can result in decreased antioxidant activity. This is caused by the decomposition of flavonoid compounds because flavonoids are thermolabile (not resistant to hot temperatures) and are easily decomposed at high temperatures. Therefore, researchers address it by reducing the stove heat and always checking whether the brownies are cooked.

CONCLUSIONS

Substitution of cane sugar with stevia significantly affects the water, ash, protein, fat, carbohydrate, and energy content of the BrowPumpVi product. The more stevia used, the higher the water, ash, protein, and fat content but the carbohydrates and energy decrease. This substitution also provides a significant impact on sensory evaluation (taste, aroma, texture) and β-carotene levels, except for the color which remained the same. The best formulation is a combination of 25 g of cane sugar and 4.68 g of stevia. The addition of stevia to the BrowPumpVi reduces total sugar and increases antioxidant activity, making this product potential as a functional food, although further research is needed. Based on the results of this study, the BrowPumpVi product is expected to be accepted by the wider community as an alternative healthy snack for people with diabetes mellitus.

ACKNOWLEDGEMENT

The author highly appreciates PT. Indofood Sukses Makmur Tbk for supporting this research through the 2023-2024 Indofood Riset Nugraha (IRN) research grant (SKE.037/X/CC/X/2023). The author also thanks all parties involved in the data collection process, especially Faizah Rahma Putri and Julistin Haidayanti. The author also appreciates Veriani Aprilia, Ryan Salfarino, Winda Irwanti, and Fatma Zuhrotun Nisa for their supervision, assistance, and guidance in completing this research well.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

All authors have no conflict of interest in this article. This research is funded by Indofood Riset Nugraha (IRN) in 2023-2024 (SKE.037/X/CC/X/2023).

AUTHOR CONTRIBUTIONS

ASA: conceptualization, investigation, methods, supervision, writing–review and editing, formal analysis, and writing–original draft; RN: methods, formal analysis, data collection, writing–original draft, writing–review and editing, and revision of the draft. All authors have approved the final version of the manuscript.

REFERENCES

1. Idris. Z.. Yusuf. M.. Indah Sari. P. & History. A. Efektifitas Ekstrak Etanol Buah Naga Merah (*Hylocereus polyrhizus*) pada Pengobatan Diabetes Mellitus Tipe 2. *J. Promot. Prev.* **6**. 409–418 (2023). doi: https://doi.org/10.47650/jpp.v6i3.735
2. Rizaty. M. A. Penduduk RI Konsumsi Gula 65.7 Kkal per hari (2022). doi:https://doi.org/10.20961/jaht.v1i1.262.
3. Khairani. Hari Diabetes Sedunia Tahun 2018. *Pus Data dan Inf Kementrian Kesehat RI* **1**–**8**. (2019). doi: https://doi.org/10.24853/jkk.17.1.9-20.
4. Statistik. B. P. No Title. *Pendud. RI Konsumsi Gula 65.7 kkal per hari* (2021).
5. Nurhayati. D. R. Ekstraksi Stevia Sebagai Bahan Pemanis Alami Untuk Minuman Kesehat. *(*Upaya Divers. Produk) Petani Ngargoyoso Kabupaten Karanganyar. (2011).
6. Suhesti. I.. Kustini. H. & Antari. E. D. Penggunaan Teh Serai Jahe Sebagai Penambah Daya Tahan Tubuh Menggunakan Daun Stevia Sebagai Pemanis Alami. *RESWARA J. Pengabdi. Kpd. Masy.* **2**. 325–330 (2021). doi: https://doi.org/10.12962/j26139960.v6i4.98.
7. Pande P. Elza Fitriani. Anak Agung Ngurah Dwi Ariesta Wijaya Putra. I. A. P. A. W. *Anal. Vitam. C Content Loloh Cemcem (Spondias pinnata) Stevia Leaves (Stevia rebaudiana B.) by UV-Vis Spectrophotometry Method* **Vol 8**. No 2 (2021). doi: https://doi.org/10.46576/rjpkm.v2i2.1155
8. Safitri. I. N.. Alfiani. R. W.. & Harismah. K. Optimasi Pemanfaatan Pemanis Stevia terhadap Kualitas Sirup Kayu Manis *(Cinnamomun Burmanii).* **621**–**627.**. (2019).
9. Maryanto. S.. Harly. W. & Oktianti. D. Indeks Glikemik dan Beban Glikemik Bolu Kukus dan Cookies Labu Kuning (*Cucurbita Moschata Durch*) Berbahan Formula Modisco. *Amerta Nutr.* **6**. 206–213 (2022). doi: 10.20473/amnt.v6i1SP.2022.206-213.
10. Millati. T.. Udiantoro. U. & Wahdah. R. Pengolahan Labu Kuning Menjadi Berbagai

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

Produk Olahan Pangan. *Selaparang J. Pengabdi. Masy. Berkemajuan* **4**. 300 (2020).

11. Lismawati. Tutik & Nofita. Kandungan Beta Karoten dan Aktivitas Antioksidan Terhadap Ekstrak Buah Labu Kuning (*Cucurbita Moschata*). *J. Mandala Pharmacon Indonesia.* **7**. 263–273 (2021). doi: 11. https://doi.org/10.31764/jpmb.v4i1.2935.
12. Nurjanah. H.. Setiawan. B. & Roosita. K. Indonesian Journal of Human NutritionPotensi Labu Kuning (*Cucurbita Moschata*) sebagai Makanan Tinggi Serat dalam Bentuk Cair Hanna. Indonesia. *J. Hum. Nutr.* **1**. 54–68 (2020). doi: 12. https://doi.org/10.35311/jmpi.v7i2.111.
13. Santosa. A. P. *et al.* Karakteristik Brownies Panggang dengan Substitusi Tepung Bengkuang (*Pachyrizus Erosus L.*) Dan Pemanis Daun Stevia (*Stevia Rebaudiana Bertoni M.)*. *Agritech* **XXIII**. 1411–1063 (2021). doi: 10.21776/ub.ijhn.2020.007.01.6.
14. Margaretha. L. & Pangestika. W. Penyuluhan dan Pelatihan Pembuatan Brownis Kukus dan Stick Berbahan Dasar Pisang Kepok. *Pros. SENAPAS* **1**. 185–189 (2023).
15. Aj.. M. Analisis Kandung Siklamat Pada Roti Brownies Yang Bermerek dan Tidak Bermerek yang Dijual Di Drh. Darmahusada Surabaya (2014). doi: https://doi.org/10.24002/senapas.v1i1.7381.
16. Kumalasari. I. D.. & Aurisa. H. G. No Title. *K*arakteristik Fis. dan Organoleptik Donat Tinggi Serat Tersubstitusi Tepung Kelapa *(Cocos Nucifera L.)* dengan Pemanis Daun Stevia *(Stevia rebaudiana).* **JRST (Jurn**. (2023). http://repository.um-surabaya.ac.id/id/eprint/978.
17. Maretta. Y. Pemanfaatan Daun Stevia Sebagai Pemanis Alami Terhadap Kualitas Organoleptik dan Kadar Gula Total Bola Kukus (2012). doi: 17. 10.30595/jrst.v7i1.15388.
18. UNIMUS. Pengujian Organoleptik (*Evaluasi Sensori*) dalam Industri Pangan. (2006). 18. http://eprints.ums.ac.id/id/eprint/19787.
19. Ridho E AL. Uji Akt. Antioksidan Ekstrak Metanol Buah Lakum *(Cayratia Trifolia)* dengan Metod. DPPH (2013).
20. Wahyuningtyas L. Analisis Kandungan Gula Total Dan Uji Kadar Alkohol Pada Air Nabeez Kurma Ajwa *(Phoenix dactylifera L.)* (2022).
21. Arifah. E. Z.. Jariyah. J. & Rosida. D. F. Optimasi Formula Biskuit Tepung Buah Lindur Dengan Pemanis Stevia Dan Fruktosa Menggunakan Response Surface Methodology. *J. Pangan dan Agroindustri* **11**. 89–99 (2023).
22. Yanti. S. Pengaruh Penambahan Tepung Kacang Hijau terhadap Karakteristik Bolu Kukus Berbahan Dasar Tepung Ubi Kayu (*Manihot Esculenta*). *J. TAMBORA* **3**. 1–10 (2019). doi: https://doi.org/10.21776/ub.jpa.2023.011.02.5.
23. Sari. N. P. & Putri. W. D. R. Pengaruh Lama Penyimpanan dan Metode Pemasakan Terhadap Karakteristik Fisikokimia Labu Kuning (*Cucurbita Moschata*). *J. Pangan dan Agroindustri* **6**. 17–27 (2018). doi: https://doi.org/10.36761/jt.v3i3.388.
24. Siagian. I. D. N.. Bintoro. V. P. & Nurwantoro. Karakteristik Fisik . Kimia dan Organoleptik Teh Celup Daun Tin dengan Penambahan Daun Stevia (*Stevia Rbaudiana Bertoni*) sebagai Pemanis. *J. Teknol. Pangan* **4**. 23–29 (2020). doi: https://doi.org/10.21776/ub.jpa.2018.006.01.3.
25. Hardiansyah. A.. Halimah. H. A. & Widiastuti. W. Pengaruh Penambahan Ekstrak Daun Stevia (*Stevia Rebaudiana* (*Bertoni)*) terhadap Daya Terima. Kandungan Gizi. dan Aktifitas Antioksidan Kefir Susu Kambing. *Nutr. J. Gizi. Pangan dan Apl.* **6**. 125–136 (2022). doi: 25. https://doi.org/10.14710/jtp.2020.23875.
26. Kinki. A. B.. Gebre. A. & Bekele. T. *Evaluation of Dried Stevia (Stevia Rebaudiana Bertoni) Leaf and its Infusion Nutritional Profile Medicinal & Aromatic Plants. Med. Aromat. Plants* **1**. 1–5 (2021). doi: 26. https://doi.org/10.21580/ns.2022.6.2.12089.
27. Syukri. D.. Fitriani. D.. Jaswandi & Dewi. K. H.

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

Using Stevia Powder to Make Low Calorie Bolu Kemojo (Kemojo Cake)-Traditional Snack in Riau Province. Indonesia. *Food Sci. Technol. (United States)* **11**. 1–6 (2023). doi: 27. 10.35248/2167-0412.20.9.360.

28. Noor. E. & Isdianti. F. Ultrafiltrasi Aliran Silang Untuk Pemurnian Gula Stevia. *Erliza Noor dan Fifi Isdianti J. Tek. Ind. Pert* **21**. 73–80 (2013). doi: 28. 10.13189/fst.2023.110101.
29. Silva. C.. Oliveira. A.. Pinto. S.. Manso. M. & Ferreira da Vinha. A. *Natural Resources With Sweetener Power: Phytochemistry And Antioxidant Characterisation Of Stevia Rebaudiana* (Bert.). *Sensorial And Centesimal Analyses Of Lemon Cake Recipes With S. Rebaudiana Incorporation. Egitania Sci.* **23**. 141–159 (2018).
30. Sutrisno. A. D.. Ikrawan. Y. & Permatasari. N. Karakteristik Cokelat Filling Kacang Mete yang *Pas. Food Technol. J.* **5**. 91–101 (2018). http://hdl.handle.net/10284/8044.
31. Marcinek K. K. Z. *Stevia Rebaudiana Bertoni-Chemical Compos. Funct. Prop.* **14(2):145**–. (2015). doi: 31. https://doi.org/10.23969/pftj.v5i2.1040.
32. Aisyah Putri. M.. Khotimah. K.. Lisya Maghfira. L. & Asmediana. A. Karakteristik Sensoris dan Kimia Selai Mangga Lalijiwa (Mangifera indica) Dengan Menggunakan Pemanis Stevia (*Stevia Rebaudiana)* Rendah Kalori. *J. Appl. Agric. Heal. Technol.* **1**. 18–26 (2022). doi: https://doi.org/10.17306/J.AFS.2015.2.16.
33. Umami. C. & Afifah. D. N. Pengaruh Penambahan Ekstrak Kayu Secang dan Ekstrak Daun Stevia terhadap Aktivitas Antioksidan dan Kadar Gula Total pada Yoghurt Sebagai Alternatif Minuman bagi Penderita Diabetes Melitus Tipe 2. *J. Nutr. Coll.* **4**. 645–651 (2015). http://expocpnsbumn.blogspot.co.id/.
34. Febrianus Helan Sani. M.. Setyowati. S. & Kadaryati. S. Pengaruh Teknik Pengolahan terhadap Kandungan Beta-Karoten pada Brokoli (*Brassica Oleracea L.) Effect Of Processing Techniques On Beta-Carotene Content In Broccoli* (*Brassica Oleracea L.*). Ilmu Gizi Indonesia. **Vol**. **02**. 133–140 (2019). doi: 34. https://doi.org/10.35842/ilgi.v2i2.108.
35. H A.. Crantz engan Berbagai Perlakuan Terhadap Kadar B-Karoten Meiliana. esculenta & Sutjiati. E. Indonesian *Journal of Human Nutrition* Pengaruh Proses Pengolahan Daun Singkong (Manihot. Indonesia. *J. Hum. Nutr.* **1**. 23–34 (2014). https://ijhn.ub.ac.id/index.php/ijhn/article/view/.
36. Gupta. E.. Purwar. S.. Singh. A.. Sundaram. S. & .*Evaluation Of Nutritional. Anti-Nutritional and Bioactive Compounds In Juice And Powder Of Stevia Rebaudiana. Indian J.* **5**. 3308–3317 (2015).
37. Sulistiana. R. *Snack Buvia* (Labu Kuning dan Daun Stevia) Rendah Indeks Glikemik Dan Tinggi Serat. (2020).
38. Prameswari O. S. B. Uji Efek Ekstrrak Daun Stevia terhadap Penurunan Kadar Glukosa Darah dan Histopatologi Tikus Diabetes Melitus. J. Pangan dan Agroindustri. **2(2): 16**. (2019).
39. Bagas Winangadi. Hasan Robby. Wildan Barqi. K. H. Uji Orgonoleptik dan Kalori Brownies Kelor dengan Subsitusi Pemanis Stevia (2018). https://journal.unimma.ac.id/index.php/urecol/article/view/1412/1000.
40. Dari. D. W. & Junita. D. Karakteristik Fisik dan Sensori Minuman Sari Buah Pedada. *J.* Pengolah. Has. Perikan. Indonesia. **23**. 532–541 (2021). doi: 40. 10.17844/jphpi.v23i3.33204.
41. Hastuti. A. M. & Rustanti. N. Pengaruh Penambahan Kayu Manis Terhadap Aktivitas Antioksidan dan Kadar Gula Total Minuman Fungsional Secang dan Daun Stevia sebagai Alternatif Minuman dagi Penderita Diabetes Melitus Tipe 2. *J. Nutr. Coll.* **3**. 362–369 (2014). 41. http://expocpnsbumn.blogspot.com.
42. Daryanti. D. No Title. Pemanfaat Stevia Sebagai Pemanis Alami Daun Stevia pada Sari Buah Belimbing. **Vol 12**. No 2 (2012). doi: 42.

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*

https://doi.org/10.36728/afp.v12i2.175.

43. Kusumaningsih. T.. Asrilya. N. J.. Wulandari. S.. Wardani. D. R. T. & Fatihin. K. *Reduction on the Levels of Tannins From Stevia Rebaudiana Extract Using Activated Carbon. ALCHEMY J. Penelit. Kim.* **11**. 81 (2015). doi: 10.20961/alchemy.v11i1.111.
44. Khaerunnisa. Nahariah & Murpiningrum. E. Evaluasi Jenis Pengolahan Terhadap Daya Terima Organoleptik Telur Infertil. *Pap. Knowl. Towar. a Media Hist. Doc.* **7**. 107–15 (2014).
45. Purba M. Daya Terima *Muffin* Kacang Hijau *(Vigna radiata)* dengan Variasi Penambahan Tepung Daun Kelor *(Moringa oliefera).* (2021).
46. Esmat Abou-Arab. A.. Azza Abou-Arab. A. & Ferial Abu-Salem. M. P*hysico-Chemical Assessment Of Natural Sweeteners Steviosides Produced From Stevia Rebaudiana Bertoni Plant*. *African J. Food Sci.* **4**. 269–281 (2010). doi: 10.21608/jfds.2009.115819.
47. Masdeka. P. W. Kualitas Fisik dan Organoleptik Kefir Dengan Penggunan Tepung Daun Stevia *(Stevia Rebaudiana Bertoni).* (2018). 47. http://repository.ub.ac.id/10648/.
48. Arina Putri Anggi A G I. Ina Timur P. E. A. G. I. Pengaruh Perbandingan Modif. *Cassava Flour* dan *Puree* Labu Kuning *(Cucurbita Moschata)* Terhadap Karakteristik Brownies Kukus **Vol 10**. No 2 (2021). https://doi.org/10.24843/itepa.2021.v10.i02.p08.
49. Nurhafnita RMAE. *Substit. Tofu Dregs Flour to Wheat Flour Mak. Steamed Brownies* **3**. (2023).
50. W. A. Panduan Karbohidrat Terlengkap **Vol. 3**. 29–30 (2009).
51. Oktaviana. I. S. Permen Jelly dengan Variasi Konsentrasi Bubur Labu Kuning *(Cucurbita Moschata)* (2020).

How to cite: *Nurjanah, R., & Aji, A. S. (2025) Product Development of Yellow Pumpkin (Cucurbita Moschata) Brownies with the Natural Sweetener Substitution of Stevia Leaves (Stevia Rebaudiana) as a Functional Food: Pengembangan Produk Brownies Labu Kuning (Cucurbita Moschata) dengan Substitusi Pemanis Alami Daun Stevia (Stevia Rebaudiana) sebagai Pangan Fungsional. Amerta Nutrition, 9(2), 186–198.*