HEDONIC TEST AND CHEMICAL QUALITY OF BOMBOLONI PANDAN LEAF FLOUR ADDITION WITH FILLED PATIN FISH FLOSS AS HIGH PROTEIN SNACK

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ABSTRACT

Bomboloni donuts, which generally taste sweet, are filled with savory Patin fish floss filling, creating unique and interesting product. This can increase people's interest in trying new products and contribute to food industry innovation. This research aimed to determine the organoleptic tests and chemical quality of bomboloni donuts made from pandan leaf flour filled with Patin fish floss as a high protein snack. The research method used was laboratory experimental with completely randomized design (CRD), with three treatments (F1, F2, F3) and two repetitions. The making of pandan leaf flour bomboloni donuts filled with Patin fish floss and organoleptic tests were carried out at the Food Technology Laboratory Institut Kesehatan Helvetia. Then, chemical test analysis was conducted at the Politeknik Teknologi Kimia Industri Medan Laboratory. Data were analyzed using the Kruskal-Wallis test, then continued with the Duncan test. The results showed that there were differences in color (0.000), odor (0.003), taste (0.029), and texture (0.009) from the three formulations of bomboloni donuts made from pandan leaf flour filled with Patin fish floss. Based on the results of Duncan test, the best formulation was obtained in F1, as indicated by the panelists' average preferences for color (3.98), odor (3.70), taste (3.28), and texture (3.43). The chemical test results of the best formulation revealed the following contents: water (24.81%), ash (1.57%), fat (13.54%), protein (12.52%), and carbohydrates (68.83%). The conclusion is that F1 is recommended as a high-protein snack for toddlers to help prevent stunting.

Keywords: *Donut, Pandanus, Fish Product, Snack Food*

INTRODUCTION

Food innovation is needed in the manufacture of high animal protein snack products to prevent stunting. Stunting is a nutritional problem due to its increasing prevalence. Indonesia is one of the countries with a higher prevalence of stunting compared to other Southeast Asian countries, namely the 27th highest out of 154 countries, and Indonesia is the 5th among countries in Asia (Masiyaroh et al., 2023).

In 2020, approximately 22% of the global population, or 149.2 million children under the age of five, were still stunted, according to the World Health Organization (WHO). Most stunted children live in Asian and African countries; about one-third of all stunted children reside in African countries, while around half live in Asian countries (Soetono & Barokah, 2024).

Stunting is a nutritional problem caused by inadequate protein intake, as well as deficiencies in vitamin and essential mineral, which negatively affect immunity. Low immunity can impact children's health and overall development.

Stunting can be prevented by providing foods high in animal protein. Animal protein is easily absorbed by the child's body and has complete amino acids (Imani, 2020). One of the foods having high amino acids is fish. Indonesia is rich in seafood, especially fish (Huda et al., 2023). However, the highest intake of plant based-protein is 68.3%, while animal protein only reaches 31.7%.

This has an impact on toddler growth, the bioavailability of animal products is higher than plant-based products (Yunianto et al., 2023). As is known, toddlers love snacks. If snacks with complete nutritional value are available, stunting

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can be prevented. One of the snack innovations given to toddlers is pandan flour bomboloni donuts filled with Patin fish floss, which is expected to be a healthy snack to prevent stunting.

Pandan leaf flour is a natural ingredient derived from the pandan plant, which is known to have a distinctive odor and gives a natural green color to food (Mahmudi et al., 2022). The use of this natural ingredient can reduce dependence on the use of food additives in making food (Demitri et al., 2024).

Pandan leaves contain nutrients such as vitamin A, vitamin C, and also phytochemical compounds such as flavonoids and polyphenols (Setyowati et al., 2017). The use of pandan leaves as flour in making bomboloni donuts can increase the nutritional value of the product and also its acceptability. Additionally, pandan leaf flour contributes to antibacterial activity (Telisa et al., 2021).

The combination of bomboloni donut products which generally taste sweet, with the savory filling of Patin fish floss, creates a unique and attractive product. This can increase public interest in trying new products and contribute to innovation in the food industry. In addition, this product is produced especially for toddlers as a snack that is high in nutritional value, and can prevent stunting because it contains animal protein from Patin fish, which is known to help children's growth (Islamiati et al., 2024).

The use of local ingredients from Patin fish can create a variety of products and increase appetite for those who consume them. This innovation can help diversify the food industry and produce many choices of food products for the community.

Therefore, this food processing technique is carried out as an urgency in diversifying food products from local food ingredients with high nutritional value. Based on this study, researchers are interested in examining the potential of pandan leaf flour bomboloni donut snacks filled with Patin fish floss to prevent stunting in toddlers.

In general, pandan leaves are only used as an odor enhancer in food. As is known, pandan leaves contain polyphenol compounds with antioxidant and hypoglycemic activity so that they can be used as ingredients for functional food products (Natsir et al., 2023). Pandan leaves have properties such as antihyperglycemic, which helps blood sugar levels remain normal, and anti-nephrotoxic, which can prevent kidney disorders from the effects of drugs (Lolok et al., 2020).

The use of pandan leaves is minimal and impractical, so it needs to be processed into flour to be used in the food industry. The high value of pandan leaf benefits causes this plant to be widely cultivated in home gardens which have dual functions, as ingredients for food and beneficial for health (Silalahi, 2018). Various scientific reports show that the addition of pandan extract to food makes food last longer or more durable (Natsir et al., 2023).

Bomboloni donuts are snack food products made from wheat flour, granulated sugar, salt, yeast, eggs, milk, and butter, and are usually fried using oil (Sari, 2019). Bomboloni are Italian-filled donuts that are unique from regular ring-shaped donuts.

Unlike conventional American donuts, which commonly have a hole in the center, bomboloni are round, plump, and often without a hole. Their yeasted dough, which is deep-fried to produce a golden-brown, somewhat crisp exterior while keeping the inside fluffy, gives them a soft, airy texture. The filling, which is typically inserted after cooking to create a mouthwatering pocket of flavor inside, is what makes bomboloni unique.

In this study, bomboloni donuts were made with a standard recipe, but added pandan leaf flour and still used wheat flour, and they were also filled with Patin fish floss.

Patin fish is one of the types of freshwater fish that is most in demand and consumed by the Indonesian people (Ragate & Auliana, 2020). This is because the price is affordable so the use of Patin fish is evenly distributed. Patin fish has a protein content of 16.1% and fat of 5.7%, it is included in the group of fish that are high in protein and moderate in fat (Alfiani, 2023). It contains high protein, 18 grams of protein in 100 grams of fish (Suparmi et al., 2020).

In addition to the nutrients contained in Patin fish, in terms of economy and cultivation, it is cheaper than other fish such as Nila and Lele fish, has fast growth with a harvest period of around 4-6 months, and has high feed efficiency, so it is

more economical in cultivation. Another advantage of Patin fish is its soft meat, which is not too prickly and does not smell of soil if appropriately cultivated, making it suitable for various food preparations such as fillets, meatballs, and shredded meat.

The novelty of this study is the ingredients used in making bomboloni donuts, namely pandan leaf flour, and Patin fish which is used as floss as the filling of the bomboloni donuts. The results of this study are useful as a high-protein animal protein snack that can prevent stunting in toddlers and is expected to be an innovation in functional food.

This research aimed to determine the organoleptic tests and chemical quality of bomboloni donuts made from pandan leaf flour filled with Patin fish floss as a high protein snack

METHODS

Type and Research Design

This study involved organoleptic testing by panelists and has obtained ethical approval from the Health Research Ethics Commission of the Nutrition Undergraduate Study Program at the Helvetia Institute of Health with number: 01/EC/KEPK-IKH/04/2025. All panelists gave written consent before participating in the test.

This type of research is experimental using a completely randomized design (CRD) with three treatments, with factorial design. Three formulations were given to the panelists randomly to see the differences in the hedonic test.

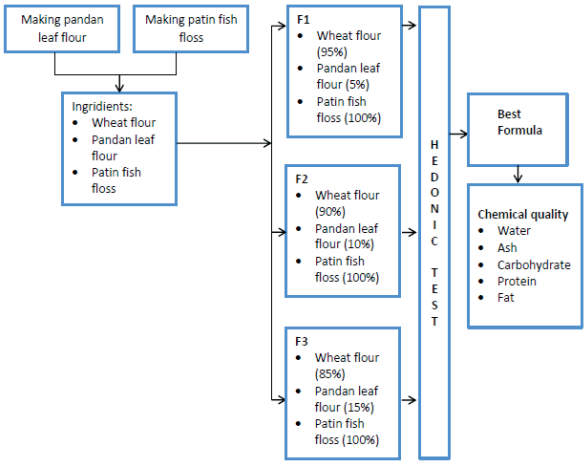

Figure 1. Flowchart of Three Formulas Bombloni Pandan Leaf Flour Addition with Filled Patin Fish Floss

This research used three formulations because the differences in formulations allowed researchers to identify the optimal level of pandan leaf flour substitution and the balance of taste between the sweetness of the bomboloni and the savory taste of the Patin fish floss. By comparing the three formulations, the study was able to determine the best combination that produced the texture, color, odor, and taste that were most preferred by panelists in the hedonic test.

Research Location

The making of pandan leaf flour bomboloni donuts filled with Patin fish floss and organoleptic tests was carried out at the Food Technology Laboratory at the Institut Kesehatan Helvetia. Furthermore, chemical test analysis (proximate) was carried out at the Politeknik Teknologi Kimia Industri Medan Laboratory.

Materials and Tools

The main ingredients in making bomboloni donuts are pandan leaf flour and catfish. The type of pandan leaves used as flour is fragrant pandan leaves (*Pandanus amaryllifolius*) which have a varied size, ranging from 50 to 100 cm, with a width of about 2 to 3 cm. Fragrant pandan leaves have a bright green to dark green color on the upper surface of the leaf, while the underside of the leaf tends to be paler. The main characteristic of fragrant pandan leaves is the strong and fragrant aroma. Fragrant pandanus is more often used in cooking to give a fragrant aroma to food or drinks.

The Patin fish used to make the shredded fish is Siamese Patin (*Pangasius hypophthalmus*), which belongs to the Pangasiidae family, a type of freshwater fish known for its fast growth. It can reach a length of between 30 to 70 cm as an adult, with a weight ranging from 1.5 to 3 kg in a rearing period of 6-8 months. The dorsal body color is generally bluish gray to silvery, while the ventral part is silvery white. Other characteristics include dark-colored fins and a body without scales. Siamese catfish meat is white in color, soft in texture, does not cause earthy aroma, and has a neutral taste, making it very suitable for processing into various types of food products.

The ingredients used in making pandan leaf flour bomboloni donuts filled with Patin fish floss are wheat flour, pandan leaf flour, salt, sugar, yeast, egg yolk, powdered milk, and margarine. The ingredients for making Patin fish floss are Patin fish, salt, shallots, garlic, brown sugar, coconut milk, cooking oil, coriander, lemongrass, bay leaves, and galangal.

The equipment used was the basin, oven, stove, 80 mesh sieve, disk mill spoon, baking sheet, digital scale, mold, and cabinet dryer.

Procedure of Making Pandan Leaf Flour Process

Fresh pandan leaves are selected, and then washed until clean, drained, and cut. After that, the blanching process is carried out at a temperature of 100℃ for seven minutes, dried in an oven at a temperature of 40℃ for eight hours, ground using a diskmill, and sieved using an 80 mesh sieve.

Patin Fish Floss Making Process

The Patin fish is first cleaned using clean water and weeded (head, tail, skin, and stomach contents) so that only the meat remains. Next, the Patin fish meat is steamed for 13 minutes at a temperature of 100℃. After that, the fish is cooled then the Patin fish skin is removed and shredded, then the fish meat is separated from the bones.

The fish meat is then mixed with cooking oil and ground spices (shallots, garlic, brown sugar, lemongrass, bay leaves, galangal, coriander, and salt) that have been heated beforehand. Then, coconut milk with low heat is added and then stirred until dry and golden yellow. When the texture feels crispy, the shredded meat can be removed. After being removed, the shredded meat is pressed to reduce the oil content.

Process of Making Bomboloni Donuts with Pandan Leaf Flour Filled with Patin Fish Floss

Bomboloni donuts are made using wheat flour and pandan leaf flour, then yeast, salt, sugar, powdered milk, water, margarine, and egg yolks are added. The ingredients are mixed until smooth and the dough that has been kneaded is covered with a wet cloth, then fermented for 30 minutes and continued with the molding of bomboloni donuts.

Table 1. Formulation of Pandan Leaf Four Bomboloni Donuts Filled with Patin Fish Floss

Ingredients	Basic Recipe	F1	F2	F3
Wheat flour	100 g	95 g	90 g	85 g
Pandan-leaf flour	-	5 g	10 g	15 g
Patin fish floss	-	50 g	50 g	50 g
Egg yolk	10 g	10 g	10 g	10 g
Water	10 ml	10 ml	10 ml	10 ml
Yeast	1.5 g	1.5 g	1.5 g	1.5 g
Salt	1 g	1 g	1 g	1 g
Sugar	15 g	15 g	15 g	15 g
Powder milk	5 g	5 g	5 g	5 g
Margarine	6 g	6 g	6 g	6 g
Mayonnaise	-	1g	1g	1g

After being molded, the bomboloni donuts are fermented again for 15 minutes, and then the Patin fish shredded meat is inserted into the molded bomboloni donut dough. After that, it is fried using oil at a temperature of 80℃ for five minutes, until the bomboloni donuts look fluffy.

The replacement of wheat flour with pandan leaf flour in the product formulation is done to increase nutritional value, especially by adding fiber, antioxidants, and active compounds from pandan leaves that are beneficial for health. However, although pandan leaf flour can be used as a partial substitute for wheat flour, the two cannot completely replace each other because they have different roles in the dough.

Wheat flour contains gluten which functions to provide structure, elasticity, and chewiness to the dough (Karatieiev, 2023), while pandan leaf flour does not have gluten, so in large quantities, it can reduce the ability of the dough to rise properly. Therefore, the formulation used in this study aims to find the optimal balance between the two ingredients, so that it still produces a soft and elastic bomboloni texture, while increasing the functional value of the product with the nutritional content of pandan leaves.

Observation Parameters

The parameters observed were the organoleptic test and chemical test (proximate).

Organoleptic Test

The organoleptic test used in the study primarily involved sensory analysis, which evaluates product characteristics using human senses such as sight, smell, taste, and touch. Collection of organoleptic test data (color, odor, texture, and taste) was carried out by 40 panelists. The number of panelists involved met the minimum number required.

The panelists were untrained and selected from 2nd semester students in the nutrition study program. In the organoleptic test, untrained panelists were selected based on the inclusion criteria, namely willingness to be panelists and students who have not taken food technology courses. The panelists involved have met the minimum number required. Each panelist was given an organoleptic test form with one sheet each for each experiment. The assessment was expressed on a 5-point hedonic scale including extremely like, very like, like, somewhat like, somewhat dislike, dislike, and extremely dislike.

Chemical Test

1) Carbohydrate analysis used the Luff Schoorl method (Subroto et al., 2020). This method is commonly used in determining carbohydrates in a fairly good method with an error rate of 10%.
2) Protein analysis was using the Kjeldahl method (Goyal et al., 2022). The results of the analysis were then multiplied by the conversion number 6.25 and the protein content in the food ingredients obtained.
3) Fat analysis was using the Soxhlet method which is a fat calculation technique by extracting fat with the help of various fat solvents such as petroleum benzene, petroleum ether, and acetone (Carpenter, 2010).
4) The principle of the thermogravimetric method for water content analysis (Park & Bell, 2004) is to evaporate the free water of the sample by heating the material at a temperature of 105 for three hours until the sample weight is constant.
5) Chemical quality test of ash content was done using the gravimetric method (Pojić et al., 2004).

Data Analysis

The data were analyzed using the ANOVA test to see the differences in organoleptic quality between the three formulas. If the significance result was less than 0.05 ($p. < 0.05$), it was continued with the Duncan Multiple Range Test (DMRT) to find out which types of formulas are different from each other.

RESULTS AND DISCUSSIONS

Hedonic Test Results

Based on Table 2, the results of the hedonic test showed that the color most preferred by the panelists was treatment F1 with a preference level of 3.98, while the lowest preference level was in treatment F3, which was 2.80. The green color of pandan leaves gives the color of bomboloni donuts made from pandan leaf flour, which can be seen as yellowish green, fresh green, and dark green.

The odor of bomboloni donuts is also influenced by the addition of pandan leaf flour. The more pandan leaf flour is added, the more odor of pandan leaves is also felt. The odor that is most preferred by panelists is F1 with a value of 3.70 and the lowest level of preference is F3 with a value of 3.05.

The taste of the pandanus leaf flour bomboloni donut filled with Patin fish floss that was most preferred by the panelists was F1 with a value of 3.28, and the lowest level of preference was F3 at 2.80. This happened because the more pandan leaf flour was added to the bomboloni donut, the more astringent and bitter it felt. Patin fish floss as a filling for the bomboloni donut gave a savory taste.

The texture feels denser in F3 because of the addition of pandan leaf flour by 15%. The texture that the panelists liked the most is in F1 with a value of 3.43, while the lowest level of preference is in F3 at 2.88.

The results of the Kruskal Wallis test showed a difference in color from each formulation (p.

Table 2. The Average Value of Hedonic Test of Pandan Leaf Flour Bomboloni Donuts Filled with Patin Fish Floss

Treatments	Mean			
	Color	Odor	Taste	Texture
F1	3.98	3.70	3.28	3.43
F2	3.30	3.53	3.10	3.08
F3	2.80	3.05	2.80	2.88

Table 3. The ANOVA Result of Hedonic Test of Pandan Leaf Flour Bomboloni Donuts Filled with Patin Fish Floss

Treatments	P Value			
	Color	Odor	Taste	Texture
F1				
F2	0.00	0.00	0.00	0.00
F3				

<0.05). In treatment F1, 5% pandan leaves were added, F2 was 10%, and F3 was 15%. When less pandan leaf flour was added, the color of the donuts became more yellowish green, while with the addition of more pandan leaf flour, the donuts had a darker green color. In F1, the color looked yellowish green, F2 was fresh green, and F3 was dark green. The lower the percentage of pandan leaf flour added, the color looked yellowish green and was preferred by the panelists.

According to previous research, the dark green color of the addition of pandan leaf flour to klepon products is because the chlorophyll content in pandan leaves is degraded due to the high temperature given. Chlorophyll has a derivative compound called pheophytin which provides a blackish brown pigment. Pheophytin can be formed in chlorophyll due to exposure to heat, acid, enzymatic changes, and fermentation processes (Santoso & Arimawan, 2023). Exposure to high temperatures causes chlorophyll to degrade so that a pheophytination reaction occurs which will then produce pheophytin (Alifah et al., 2019).

The results of the Kruskal Wallis test showed a difference in odor from each formulation (p. < 0.05). The addition of pandan leaf flour not only affects the color but also gives a distinctive odor to the product. The odor produced from pandan leaves comes from the 2-Acetyl1-pyrroline molecule (Hamzah et al., 2020;Natsir et al., 2023). The odor of bomboloni donut products also has a distinctive odor of savory Patin fish floss, but the strong odor of pandan overpowers the odor of floss.

The increase in the amount of pandan added could be related to the intensity of the volatile compounds that are responsible for the characteristic scent of pandan leaf. However, due to the presence of 2-acetyl-1-pyrroline, it is known for its pleasant, sweet, and grassy scent. However, excessive concentrations may lead to an overpowering or even undesirable scent. In sensory science, this phenomenon is similar to the "inverted U-shaped response," where moderate amounts of an aroma compound are considered pleasant, but too much can cause sensory fatigue or aversion (Spence, 2015).

The odor of fresh pandan leaves is highly valued in traditional cuisine, contributing to the flavor profile of dishes. Processed pandan leaf extract can serve as an effective odortic food additive, enhancing the appeal of traditional cakes (Qomarudin et al., 2024).

Studies have shown that pandan leaf powder retains its odortic qualities, making it suitable for inclusion in baked goods such as sponge cakes, enhancing the odor and flavor (Murtini et al., 2020). The addition of pandan leaves to palm sugar syrup can enhance sensory attributes, including odor, and panelists gave positive assessments (Lantemona et al., 2022).

Pandanus leaves contain various phytochemicals such as alkaloids, flavonoids, saponins, and tannins, which are known for their bitter taste (Djenar et al., 2020). The more pandan extract solution is added, the stronger the taste of the pandan leaves is; this is because pandan leaves have bitter compounds or active compounds in the form of polyphenols, flavonoids, saponins, tannins, and alkaloids.

According to Astuti (2010) and Andesna et al. (2019 in Natsir, 2023), the more pandan leaf extract is added, the more it tends to produce a bitter taste if used excessively (Natsir et al., 2023). The results of the Kruskal Wallis test showed that there was a difference in taste between each formulation (p. < 0.05).

The texture of the bomboloni donut is also influenced by the addition of pandan leaf flour. The more it is added, the texture of the donut is soft and less hollow like bomboloni donuts in general (Makmoer, 2003). The results of processing Patin fish floss produce a dry texture, so for the filling of the bomboloni donut, mayonnaise is added to make the texture softer.

Chemical Quality Test Result

Bomboloni donuts made from pandan leaf flour filled with Patin fish floss in treatment F1 have

Table 6. Chemical Quality of Pandan Leaf Flour Bomboloni Donuts Filled with Patin Fish Floss

Chemical Test	F1	F2	F3
Water (%)	24.81	23.14	25.19
Ash (%)	1.57	1.52	1.62
Carbohydrate (%)	68.83	70.20	68.96
Protein (%)	12.52	10.22	11.77
Fat (%)	13.54	14.31	11.81

a higher protein content compared to F2 and F3. Treatment F2 has a higher carbohydrate and fat content compared to F1 and F3. Treatment F3 has a higher ash and water content compared to F1 and F2.

The chemical quality of each formulation of bomboloni donuts made from pandan leaf flour filled with Patin fish floss has varying values due to the processing process, namely frying and the length of processing time. The processing process (such as temperature and pressure) also affects the final chemical quality of the food formulation or product (Kusnandar, 2019).

When compared to SNI donuts product (SNI 01-2000), with a maximum water content of 40%, maximum fat content with a frying process of 33% and ash content of 3%, each formula of bomboloni donuts made from pandan leaf flour filled with Patin fish floss has met it, or even lower than that. Therefore, it can be a healthy snack option because of their low fat content and longer shelf life.

This innovative product was made to be given to toddlers as a high-protein snack, which is expected to prevent stunting because of the filling of Patin fish floss in Pandan leaf flour of bomboloni donuts. Bomboloni donuts made from pandan leaf flour with shredded catfish filling have the advantage of being a source of protein for toddlers. Consumption of 2-3 donuts weighing 30 grams each can help meet the daily protein needs of toddlers which range from 26-35 grams per day. The limitations in this study lie in the high demand for pandan leaves as raw materials and the process of making pandan leaf flour which requires time and energy.

CONCLUSION AND SUGGESTION

Addition of pandan leaf flour into bomboloni donuts filled with Patin fish floss significantly influenced their organoleptic and chemical quality. The amounts of pandan leaf flour enhanced aroma, color, and overall acceptability, excessive inclusion led to a decline in preference due to increased bitterness.

The optimal formulation balanced the characteristic pandan aroma with the savory flavor of Patin fish floss, ensuring a pleasant taste experience. Chemical analysis confirmed that the addition of pandan leaf flour contributed to improved protein content, making the bomboloni a nutritious high-protein snack, which can be given to toddlers to prevent stunting. Future research is recommended to study the shelf life of donuts containing shredded catfish at room temperature and cold temperature conditions, as well as evaluate changes in product quality, including taste, texture, color, and aroma during storage

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