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FROZEN STICK KIMPUL: PRODUCT CHARACTERISTICS AND FINANCIAL ASPECTS

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Author DP designed the study, wrote the proposal, and wrote the first draft of the manuscript. Author FSR managed the chemicals analysis and organoleptic tests. Author ERW managed the alternative selection and financial analyses of the study. All authors read and approved the final manuscript.

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Short Research Article

ABSTRACT

Kimpul is a potential non-rice carbohydrate producer and it have the opportunity to be developed. The use of kimpul is still limited to chips, so it is necessary to develop other processed products that are ready for consumption, one of which is frozen sticks kimpul. To increase the protein content, it is necessary to add other ingredients as a source of protein, namely green beans. The aims of the research are: knowing the effect of various proportions of kimpul pasta and peeled green beans pasta on the quality of frozen sticks kimpul; and knowing the financial feasibility of frozen sticks kimpul products on the scale of SMEs. The research method used a single factor Completely Randomized Design (CRD) with treatment of the proportions of kimpul pasta and peeled green beans pasta with four levels repeated three times. Parameters tested include yield, water, ash, protein, fat, carbohydrate, fiber, and organoleptic parameters (aroma, taste, texture, color). Parametric data analyzed using analysis of variance, and Duncan's test with a 95% confidence level for significant difference between treatments. Organoleptic test data as non-parametric data, using Friedman test. Alternative selection uses the Analytical Hierarchy Process (AHP) method, and the chosen alternative uses the expectation value method**.** Parameters to test the financial feasibility of the frozen sticks kimpul include break-even point analysis, payback period. Conclusion of this research were treatments had a significant effect on water, protein, fat, carbohydrate, fiber, and aroma of frozen sticks kimpul, but did not significantly affect the yield, ash content, taste, texture, and color; the best treatment selected T3 (kimpul pasta 7: peeled mung bean pasta 3); and the results of financial analysis of the frozen sticks kimpul factory is feasible.

Keywords: Kimpul (*Xanthosoma sagitifolium*); frozen sticks kimpul; SMEs; financial feasibility.

ABBREVIATIONS

AHP : Analytical Hierarchy Process;
AOAC : Association of Official Analytical Chemists;
CRD : Completely Randomized Design
GI : Glycaemic Index
SMEs : Small Medium Enterprise

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1. INTRODUCTION

Kimpul belongs to a type of taro known as Taro Belitung with the scientific name *Xanthosoma sagittifolium* (L.) Schott. *Xanthosoma sagittifolium* (L.) Schott is an important food crop especially in the tropics and subtropics [1]. Root and tuber crops are staple foods in many countries and are considered a good and inexpensive source of energy in the diets. They are produced with very low inputs but contribute greatly to food security and are culturally held in high esteem [2]. Kimpul is a potential non-rice carbohydrate producer and has the opportunity to be developed [3]. This is supported by opinion [4] that state *Xanthosoma sagittifolium* (L.) Schott contributes significant portion of the carbohydrate content of the diet in many regions in developing countries and provide edible starchy storage corms or cormels. So far, the use of kimpul is still limited to chips, so it is necessary to develop other processed products that are ready for consumption. Diversification efforts to utilize kimpul into products can be done by processing kimpul tubers into various products, one of which is frozen kimpul sticks. The weakness of the tuber kimpul is the content of oxalate which causes itching. Based on research by [5] kimpul-cowpea composite flour derived from flour derived from kimpul tubers that have been treated soaked in a salt solution can reduce itching that usually occurs due to the oxalate content. Likewise, research conducted [6], [5], [7], [8] about the use of kimpul flour as raw material for cookies, even cake [9], non-gluten biscuitsand breastmilk side meal biscuits, as well as research [10] in the manufacture of kimpul chips which are treated with immersion in a salt solution to reduce itching due to oxalate in kimpul tubers. Kimpul has the potential to be used into various products. Research conducted [11] has processed kimpul into wet noodle products, food bar product [12]. Even kimpul can be processed into liquid sugar [13] and low GI liquid sugar products [14] In addition, the low protein content in kimpul tubers requires the addition of other ingredients in processed products. To increase the protein content, it is necessary to add other ingredients as a source of protein, namely green beans. Seeds contain about 20 – 24% proteins [15] [16]. Mung bean protein is also rich in essential amino acids and contain aromatic amino acids, leucine, isoleucine and valine, However, it is slightly deficient in lysine, threonine, tryptophan and total sulfur amino acids [17].

Frozen sticks kimpul products have the advantage of a natural kimpul flavor and a long shelf life in frozen conditions. In addition to efforts to produce diversification of processed products, it is necessary to carry out financial analysis on a small industrial scale.

Based on the background, the formulation of the problem in this research are how the proportion of kimpul pasta and peeled mung bean pasta affect the quality of frozen sticks kimpul, and how the financial feasibility of frozen sticks kimpul products on the scale of SMEs. The aimed of the research were: 1) Knowing the effect of various proportions of kimpul pasta and peeled mung bean pasta on the quality of frozen sticks kimpul, and 2) Knowing the financial feasibility of frozen sticks kimpul products on the scale of SMEs.

2. MATERIALS AND METHODS

The research methods used a single factor Completely Randomized Design (CRD) with treatment of the proportions of kimpul pasta and peeled mung bean pasta with four levels repeated three times. The level of treatment is as follows: T1 (Kimpul pasta 9 : Peeled mung bean pasta 1); T2 (Kimpul pasta 8 : Peeled mung bean pasta 2); T3 (Kimpul pasta 7 : Peeled mung bean pasta 3); T4 (Kimpul pasta 6 : Peeled mung bean pasta 4). Parameters tested include yield, swelling power, water content, ash content, protein content, fat content, carbohydrate content, fiber content, and organoleptic parameters (aroma, taste, texture, color).

2.1 Processing of Frozen Sticks Kimpul

Frozen sticks kimpul was made by preparing kimpul pasta and peeled mung bean pasta. The stages of processing kimpul pasta were done by soaking the tubers for 25 minutes in 7.5% salt solution to relieve itching, the tubers were steamed for 15 minutes and then mashed [10]. The manufacture of peeled mung bean pasta was done by boiling the peeled mung beans for five minutes over low heat, draining the water on the mung bean stew and mashing the mung bean [18]. Next, the prepared kimpul pasta and peeled green bean pasta were processed into frozen kimpul sticks. The stages of making frozen sticks include mixing, milling, printing, packaging, and freezing [19].

2.2 Analysis Method

2.2.1 Yields

Yield is the percentage of product obtained [20]. The initial weight of the material is compared to the final weight. Yield test was conducted to determine the percentage efficiency of food processing. The determining of yield by Equation 1.

$$\% \, yield = \frac{Product\ weight\ (g)}{The\ total\ weight\ of\ the\ material\ before\ processing\ (g)} x\ 100\% \quad (1)$$

2.2.3 Water content

Determination of water content used the distillation method (Bradley Jr. 2010 in [14]). A sample of 5 g put into a 250 mL Erlenmeyer, then 50 mL of toluene was added. The sample is boiled on a hot plate and waits for ± 10 min after boiling, then the volume of water is read with a measuring cup. The determining of moisture content by Equation 2.

$$Water\ content\ (\%) = \frac{Water\ volume\ (mL)}{Material\ weight\ (g)} x\ 100\% \quad (2)$$

2.2.4 Ash content

Ash content testing was carried out using the kiln method [20]. The porcelain dish was washed and heated in an oven at 105°C to constant weight, then cooled in a desiccator for 15 minutes and weighed (A). 3-5 g of the sample is put into a porcelain dish and then weighed (B). Then put in a furnace at a temperature of 550°C for 3 hours or until the sample turns grey. The porcelain cup was put into the oven, then cooled in a desiccator for 15 minutes and weighed (C). Ash content was calculated by the Equation 3.

$$Ash\ Content\ (\%) = \frac{(C-A)}{(B-A)} x\ 100\% \quad (3)$$

Note: A = weight of empty cup (g)
B = weight of the cup and sample (g) C = weight of cup and ash (g)

2.2.5 Protein content

Protein content was determined by the Kjeldahl method [20]. The material was weighed as much as 0.5 g and then put into a 100 ml Kjeldahl flask. Approximately 1 g of a mixture of selenium and 10 mL of concentrated H_2SO_4 was added and then homogenized. Digested in fume hood until clear. The material allowed to cool, then discarded into a 100 mL volumetric flask while rinsing with distilled water. Allowed to cool then added aquadest to the mark. Prepare a container consisting of 10 mL of 2% H_2BO_3 and add 4 drops of indicator solution in a 100 mL Erlenmeyer. Pipette 5 mL of 30% NaOH and 100 mL of distilled water, distilled until the volume of the reservoir becomes approximately 50 mL. The end of the distiller was rinsed with distilled water and then collected with its contents. Titrated with 0.02 N HCl or H_2SO_4 solution, the calculation of protein content was carried out Equation 4.

% Proteins = Va − Vb HCl x N HCl x 14.007 x 6.25 W x 100% (4)

Where: Va = mL HCl for sample titration Vb = mL HCl for blank titration
N = normality of the standard HCl used 14.007; correction factor 6.25 W = sample weight, g

2.2.6 Fat content

Fat content testing is done based on the method of [20]. The distilled flask used is dried in an oven at 100 - 110°C for 30 min, cooled in a desiccator and weighed. The sample was weighed as much as 5 g and put into a Soxhlet extractor that had contained hexane solvent. Reflux carried out for 5 h (minimum), and hexane solvents are in the distilled fat flask. Then the fat flask containing extracted fat is heated in an oven at 100°C until the weight is constant, cooled in a desiccator and weighed. The calculation of protein content is carried out Equation 5.

% Fats = fat weight g / sample weight g x 100% (5)

2.2.7 Carbohydrate content

Carbohydrates content used by different method [20].

2.2.8 Sensory test

The sensory test of frozen sticks kimpul was evaluated using thirty non-trained panelists consisting students Agricultural Industrial Technology of the Engineering Department, Universitas Wijaya Kusuma Surabaya. Frozen sticks kimpul was evaluated for crust taste, flavour, and texture, appearance and overall acceptability using five point Hedonic scale (where 1 = very disliked and 5 = very liked Iwe, M.O in [21]. A slice of taro frozen stick from each treatment was presented to panelists. Each panelists was provided with a glass of tap water to rinse the mouth between evaluations.

2.3 Data Analysis

Parametric data obtained from the results of the study, then analyzed using analysis of variance to determine the effect of each treatment. If the results obtained through analysis of variance show that there is a significant difference between treatments, the analysis was continued with Duncan's test [22] with a 95% confidence level to determine which treatment has a different effect. Organoleptic test data is non-parametric data, so using non-parametric analysis, namely Friedman test.

2.4 Alternative Selection

Alternative selection aimed to determine the selected treatment alternative. The basis for selecting alternatives is the quality parameter for each product. Parameters used for the selection of alternative were protein, fiber, texture, taste, and aroma. The determination of the weight of importance for each parameter uses the Analytical Hierarchy Process (AHP) method [23], while the determination of the chosen alternative uses the expectation value method [24].

2.5 Financial Analysis

Parameters to test the financial feasibility of the project for the design of the frozen sticks kimpul included analysis of break-even point (BEP), payback period (PP), net present value NPV), and internal rate of return (IRR) [25].

3. RESULTS AND DISCUSSION

3.1 Yield

Table 1 shows that the yield of frozen sticks kimpul ranges from 97.30% -89.99%. The results of the analysis of variance showed that there was no significant interaction between treatments, the significance P= .05.

3.2 Water Content

Water is the main component in food, the presence of water in foodstuffs will affect the texture, taste, appearance and shelf life. The water content in foodstuffs determines the freshness and durabili bty of these foodstuffs, high water content makes it easy for bacteria, molds, and yeasts to breed, so that changes will occur in foodstuffs. The results of the water content test ranged from 1.84±0.08% to 2.02±0.03%, and the results of Duncan's test can be seen in Table 1.

The water content in frozen sticks kimpul products increases with the increase in the proportion of peeled mung bean pasta. This is because peeled green beans have a high water content, which is 11.2% [26]. The water content of the product is higher than the water content of raw kimpul tubers, which is caused by the steaming process which increases the product moisture content because when steaming the kimpul tubers, a lot of water is bound in the tubers so that the product moisture content also increases [27]. According to Fellows in [28], steaming causes changes in the cytoplasmic membrane of the food tissue, so that water will be bound by water- soluble components and evaporated from the tissue. This will cause the initial moisture content of the material before drying to be low. According to the Directorate of Nutrition, Ministry of Health, RI (1972), the water content of steamed tubers is 69.2 g in 100 g of material, which is greater than the moisture content of raw tubers of 65 g in 100 g of material and is also greater than the water content of boiled tubers of 63 g in 100 g of material [10].

3.3 Ash Content

Ash is an organic substance produced by burning organic matter, which is related to the amount of minerals present in a substance [29]. The ash content of a material indicates the number of particles in it, but it cannot be identified whether the mineral is important or not [30]. Ash content in food can be an indicator of mineral content in food. Total ash content is part of a proximate analysis that aims to evaluate the nutritional value of a product or food ingredient, especially total minerals. Most foodstuffs consist of 96% organic matter and water, while the rest are mineral elements [31]. The results of the ash content test ranged from 1.05±0.03% to 1.07±0.02%, which can be seen in Table 1.

Table 1. Average results of observation parameters of Frozen Stick Kimpul (%) and Duncan's test results

Treatment	Parameter						
	Yield	Water	Ash	Protein	Fat	Carbohydrat	Fiber
Kimpul pasta 9: peeled mung bean pasta 1	89.99±0.18	1.84±0.08 a	1.07±0.02	7.70±0.11 a	6.72±0.14 a	79.48±0.37 b	1.91±0.04 a
Kimpul pasta 8: peeled mung bean pasta 2	89.33±0.11	1.92±0.03 b	1.06±0.03	7.70±0.16 b	7.01±0.04 b	79.30±0.18 a	1.92±0.03 a
Kimpul pasta 7: peeled mung bean pasta 3	87.30±0.51	2.01±0.04 b	1.06±0.02	7.99±0.09 b	7.10±0.06 b	79.83±0.09 a	1.93±0.05 a
Kimpul pasta 6: peeled mung bean pasta 4	89.31±2.86	2.02±0.03 ab	1.05±0.03	8.10±0.03 a	7.37±0.06 c	80.68±0.39 a	2.12±0.05 b

Description: Different notation in the same column, showed a significant difference (p=.05)

The addition of peeled mung bean pasta had no significant effect on the ash content of frozen sticks kimpul. This component is not volatile in the process of burning and igniting organic compounds. The ash content contains very small amounts of minerals. Testing of the mineral content contained in the product is carried out using the ash left from the combustion and glowing samples [32]. So that the difference in ash content is caused by differences in the mixed materials used (Flores-Farias R, 2002 in [32]).

3.4 Protein Content

Protein is a food substance that is very important for the body, because this substance in addition to functioning as fuel in the body also functions as a building and regulatory substance [31]. The level of protein in foodstuffs is a separate consideration for people who consume food, this is because protein is a nutrient source of energy needed by the body. According to [31], protein is a source of amino acids which contain elements C, H, O, and N which are not owned by fat or carbohydrates. The results of the protein content test ranged from 7.70±0.11% to 8.10±0.03% which can be seen in Table 1, and the results of Duncan's test can be seen in Table 5. The higher the proportion of green beans, the higher the protein content in product. Mung bean protein is easily digestible, as compared to protein in other legumes [17] dan [33]. Consumption of the mung bean combined with cereals has been recommended to significantly increase the quality of protein, because cereals are rich in sulfur-containing amino acids but deficient in lysine [34].

3.5 Fat Content

Fat is an important food substance to maintain the health of the human body, besides that fat and oil are also a more effective source of energy compared to carbohydrates and protein [31]. The chemical structure of fat in food is generally in the form of triglycerides, which is a combination of one glycerol molecule with three fatty acid molecules. The results of the fat content test ranged from 6.72±0.14% to 7.37±0.06% which can be seen in Table 1, and the results of Duncan's test can be seen in Table 1.

3.6 Carbohydrat

Carbohydrates are the main source of calories for the body and as a source of energy. Carbohydrates have an important role in determining the characteristics of food ingredients, such as taste, color, texture and others [31]. The results of the carbohydrate content test in Table 1 range from 79.30±0.18% to 80.68±0.39%, and the results of Duncan's test can be seen in Table 1.

3.7 Fiber Content

The results of the content test and ranged from 1.91±0.04% to 2.12±0.05% can be seen in Table 1, and the results of Duncan's test can be seen in Table 1. The difference in fiber content is influenced by the composition of the material supported by [31]. The higher the proportion of green beans, the higher the fiber content in the product.

3.8 Sensory Test

The raw material for biscuit forming flour also causes differences in sensory properties [35] consumer preference. Besides that, the content of protein, and other active ingredients in the raw material affects the preference level of the taste, aroma, and color of the taro frozen stick. The results of the consumer preference percentage can be seen in Fig. 1.

The decrease in the level of color likeness is due to the Maillard reaction which affects darker colors [36] and [37]. The level of consumer preference color of frozen sticks kimpul ranging from neutral to very fond, no one dislikes.

Based on the results of the frequency analysis, the percentage score for the frozen sticks kimpul aroma parameter increased the level of preference for the addition of mung bean pasta which was supported by the results of [18] research. But then there is a decrease if the mung bean pasta is added the higher the proportion which is contrary to the results of research by [38] and [6]. This is because the higher the proportion of peeled mung bean pasta added, it makes the aroma even more unpleasant.

Table 2. Friedman test results

Paramater	Asymp. Sig.
Color	.121
Aroma	.002
Taste	.574
Texture	.811

Panelists' assessment of taste is influenced by the composition of the spices used, as stated by [31] that the taste of a product is influenced by flavor compounds that can stimulate the senses of the recipient at the time of tasting and the impression left on the sense of taste after someone swallows the product. The results of the Friedman test (Table 2) show that the addition of peeled mung bean pasta has

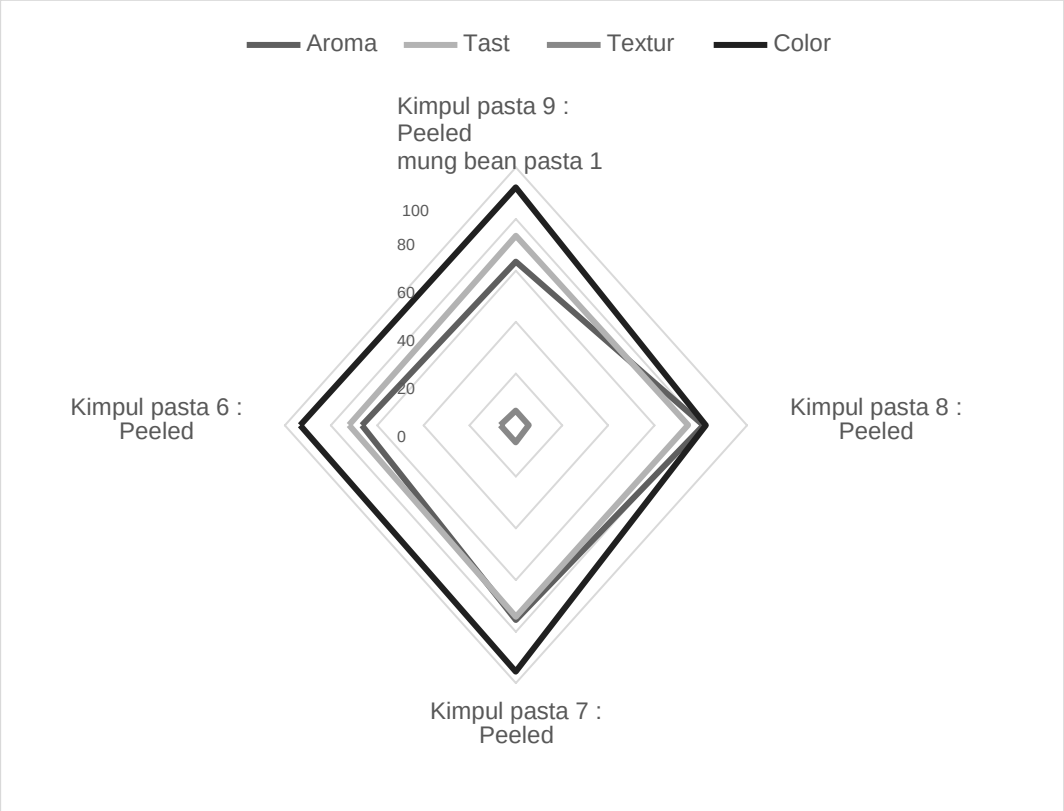

Fig. 1. The result of the consumer preference percentage

no significant effect on the level of preference for the taste of frozen sticks kimpul Friedman test results on Table 2 showed that the addition of peeled mung bean pasta had no significant effect on the level of preference for frozen sticks kimpul texture. The higher the proportion of mung bean pasta added, the higher the level of preference for frozen sticks kimpul texture. This is due to the texture of the ingredients, namely the peeled mung bean pasta has a softer texture than the kimpul tuber pasta. In addition, it is also related to the water content of the product. The higher the water content of the product, the level of texture preference also increases. This is supported by the opinion of Graines in [12].

3.9 Alternative Selection

Alternative selection is done by calculating the expected value obtained by each treatment. Probability analysis is performed to determine the probability of each ground state. The basic states for quality include protein, fiber, texture, taste, and aroma. Based on the results of the alternative selection, the highest expected value was obtained for T3 (Kimpul pasta 7: peeled mung bean pasta 3) treatment with a total expected value of 6.81, so that T3 (Kimpul pasta 7: peeled mung bean pasta 3) treatment was selected for further stages in financial analysis.

3.10 SMEs

The SMEs development plan should require working capital to be allocated by the SMEs to provide the technology, equipment, facilities and infrastructure needed. This additional working capital really requires a financial feasibility analysis to see whether the business to be run can provide benefits or not and is economically feasible. The assessment of the financial aspect includes how much it will cost to realize the business, determine the amount of capital needed and the allocation of its use efficiently with the hope of optimal profits. Financial feasibility analysis to find out the picture of the future business and maintain the profit that can be obtained [39].

3.11 Financial Analysis

Financial analysis plays an important role in conducting business feasibility studies. This needs to be done to assess the revenue and cost aspects required in its implementation. The analysis is intended as a study of separate considerations for the company's management in taking strategic steps towards business implementation (Mulyadi, 1997 in [40]).

Assessment of the financial aspect is carried out to determine the amount of operational costs incurred for

the production process. Financial estimates include calculation of Cost of Production (HPP), Break-Even Point (BEP), Business Efficiency with Return Cost Ratio (R/C ratio) and Payback Period (PP) [40].

3.11.1 Capital

Capital includes investment and working capital. The need for investment includes; preparation and licensing costs, machinery and equipment, vehicles, office equipment, and incidental costs 5%. Fixed capital required is IDR 1,834,500,000.00. Working capital is expenditure to finance operations and production needs when the project is first run. Funding needs for working capital consisting of administrative and sales staff salaries, utility costs, equipment and building maintenance costs, administration, transportation. The working capital in planning the establishment of a small frozen stick kimpul industry is calculated for a period of three months of operation, which is IDR 874,220,770,40.

3.11.2 Operational costs

Operational costs include fixed costs and annual variable or variable costs. Fixed costs are costs that are fixed and do not depend on the volume of production. Fixed costs include administrative and sales staff salaries, equipment and building maintenance costs, depreciation, utility expenses, land and building taxes, administration, land and building rent, and transportation costs. Fixed costs incurred during the first year are IDR 444,700,000,000.00. Variable or variable costs are costs that vary directly in proportion to changes in production volume. These costs include direct labor costs, costs of raw materials and auxiliary materials, and utility costs. The amount of variable costs for the first year is IDR 792,238,470.40.

3.11.3 Selling Price Determination and Break-Even Point (BEP) Analysis

Basic price of frozen sticks kimpul is IDR 9,911.00. With a profit margin of 50%, the price of corn tortilla chips is IDR 14,867.00 per package. The results of the Break Even Point (BEP) analysis show that the break-even point is obtained by producing 23,536 products per year with an income of IDR 350,323,012.00.

3.11.4 Payback Period (PP)

Payback Period (PP) is the period of time required to return the total amount of capital of an investment [25]. Calculation of PP value is calculated from net cash flow. Net cash flow is the difference between revenue (revenue) and expenses (expenses) per year. A business is considered feasible to be developed if the payback period is less than the life of the project. The frozen sticks kimpul frozen processing unit project has an estimated payback period of 7 years and 1 month. A business is feasible if the business can return the amount of investment costs quickly (Soekartawi, 1995 in [40]). A project is said to be feasible if the PP time is shorter than the planned project life (Pujawan, 2004; Heysel and Filion, 2014; Wang et al, 2015; Nguyen et al, 2017 in [41].

4. CONCLUSION

1. The addition of peeled mung bean pasta had a significant effect on water content, protein content, fat content, carbohydrate content, and fiber content, as well as the organoleptic aroma of frozen sticks;
2. The addition of peeled mung bean pasta did not significantly affect the yield, swelling power, ash content, and organoleptic taste, texture, and color;
3. The best treatment selected based on alternative selection was treatment T3 (kimpul pasta 7: peeled mung bean pasta 3) with a yield of 87.30±0.51, water content 2.01±0.04, ash content 1.06±0.02, protein content 7.99±0.09, fat content 7.10±0.06, carbohydrate content 79.83±0.09, and fiber content 1.93±0.05;
4. The results of financial analysis explain that the design of the frozen kimpul stick factory is feasible to be accepted with BEP achieved when production can be sold 23,563 units with an income of IDR 350,323,012.00, with the PP required for a return on investment of 7 years 1 month which is less than the age of the frozen sticks kimpul factory, which is 10 years.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Wada E, Feyissa T. Proximate, mineral and antinutrient contents of cocoyam (*Xanthosoma sagittifolium* (L .) Schott) from Ethiopia. International Journal of Food Science. 2019;2019. [Online Serial].

Available:https://doi.org/10.1155/2019/8965476 [Accesed July 30, 2021]

2. Lebot V, Malapa R, Jung M. Use of NIRS for the rapid prediction of total N , minerals , sugars and starch in tropical root and tuber crops. New Zeal. J. Crop Hortic. Sci. 2013;41(3):144–153, [Online Serial]. Available:http://doi.org/ 10.1080/01140671.2013.798335 [Accesed July 30, 2021].
3. Azwar D, Erwanti R. Pembuatan sirup glukosa dari kimpul (Xanthosoma violaceum Schott) dengan hidrolisa enzimatis; 2009. [Online]. Available: http://eprints.undip.ac.id/3305/. [Accesed July 30, 2021].
4. Okpala L, Okoli E, Udensi E. Physico-chemical and sensory properties of cookies made from blends of germinated pigeon pea , fermented sorghum ,cocoyam flours. Food Science & Nutrition. 2013;1(1):8–14. [Online Serial]. Available: http://doi.org/: 10.1002/fsn3.2 [Accesed July 30, 2021].
5. Puspitasari D, Rahayuningsih T, Rejeki FS. Karakterisasi dan formulasi tepung komposit kimpul-kacang tunggak untuk pengembangan biskuit non terigu. in Pros. Semin. Agroindustri dan Lokakarya Nas. FKPT-TPI Progr. Stud. TIP-UTM, no. September, 2015;A18–A27.
6. Nurani S, Yuwono SS. Utilization of taro flour (*Xanthosoma sagittifolium*) as cookies's raw material (Study of flour proportion and margarine addition). J. Pangan dan Agroindustri. 2014;2(2):50–58. [Online Serial]. Available: https://jpa.ub.ac.id/index.php/jpa/article/view/37 [Accesed July 30, 2021].
7. Puspitasari D, Rejeki FS, Wedowati ER, Koesriwulandari A. Kadir. Kualitas biskuit MP-ASI dari tepung komposit kimpul-kacang tunggak dan tepung sagu selama penyimpanan. J. Res. Technol. 2020;6(1).
8. Rosida D, Putri N, Oktafiani M. Karakteristik cookies tepung kimpul termodifikasi (*Xanthosoma sagittifolium*) dengan penambahan tapioka. AGROINTEK J. Teknol. Ind. Pertan. 2020;14(1):45-56. [Online Serial]. Available: https://journal.trunojoyo.ac.id/agrointek/article/view/6309 [Accesed July 30, 2021].
9. Rafika T, Nurjanah N, Hidayati L. Sifat organoleptik subtitusi tepung kimpul dalam pembuatan cake", Teknologi Dan Kejuruan. 2012;35(2):213–222, [Online Serial]. Available:http://journal.um.ac.id/index.php/teknologi- kejuruan/article/view/3778 [Accesed July 30, 2021].
10. Khamidah A, Antarlina SS. Mie basah berbasis pasta talas belitung (kimpul) dan tepung kedelai. in Prosiding Seminar Hasil Penelitian Tanaman Aneka Kacang dan Umbi. 2011;836–842.
11. Revitriani M, Wedowati ER, Puspitasari D. Kajian konsentrasi tepung kimpul pada pembuatan mie basah. J. Reka Agroindustri. 2013;I(1). Available:https://ejournal.uwks.ac.id/myfiles/201310540413349173/4.pdf. [Accesed July 30, 2021].
12. Rejeki FS, Puspitasari D, Wedowati ER, Rahayuningsih T. Proportion of kimpul flour and brown rice flour on food bar processing. in Proceeding International Conference on Science, Technology, Environment; 2019. Available: SSRN- id3489672%20
13. Rejeki FS, Puspitasari D, Wedowati ER. Keunggulan kompetitif gula cair kimpul. J. Res. Technol. 2017; 3(1):46–53.
14. Rejeki FS, Puspitasari D, Wedowati ER. Kimpul (*Xanthosoma sagitifolium*) liquid sugar with low glycemic index. Food Sci. Appl. Biotechnol. 2020;3(2):185. DOI: 10.30721/fsab2020.v3.i2.84.
15. Yun S, Hong J, Ng TB, Yun X, Fan P. A non-specific lipid transfer protein with antifungal and antibacterial activities from the mung bean. J Peptides. vol. 25, pp. 1235–1242, 2004, [Abstract]. Available:https://www.sciencedirect.com/science/article/abs/pii/S0196978104002566. [Accesed July 30, 2021].
16. Kudre TG, Kishimura H. Comparative study on chemical compositions and properties of protein isolates from mung bean , black bean and bambara groundnut. J Sci Food Agric. 2013;2429-2436. [Abstract]. Available: https://pubmed.ncbi.nlm.nih.gov/23400865/. [Accesed July 30, 2021].
17. Mubarak AE. Food chemistry nutritional composition and antinutritional factors of mung bean seeds (Phaseolus aureus) as affected by some home traditional processes. J Foodchem. 2005;89:489–495. [Abstract]. Available: https://www.sciencedirect.com/science/article/abs/pii/S0308814604000330. [Accesed July 30, 2021].
18. Harisina A, Adi A, Farapti. Pengaruh substitusi buah sukun (*Artocarpus communis*) dan kacang hijau (*Vigna radiata*) terhadap daya terima dan

kandungan protein flakes. Media Gizi Indones. 2016;11:1:77–85. [Online Serial]. Available:https://e-journal.unair.ac.id/MGI/article/view/4400/3007 [Accesed July 30, 2021].

19. Pratama BD. Subtitusi kacang hijau (*Vigna radiata*) pada pembuatan stik kimpul beku dengan penambahan karagenan. Thesis. Universitas Wijaya Kusuma Surabaya; 2020.
20. AOAC. Official method of analysis association of analythichal chemists; 1995.
21. Sudarmadji. Prosedur analisa bahan makanan dan pertanian." Liberty. Yogyakarta; 1997.
22. Odongo NO, Abong GO, Okoth MW, Karuri EG. Development of high protein and vitamin a flakes from sweet potato roots and leaves. OALib. 2015;02(07):1–10. [Online Serial]. Available:https://file.scirp.org/pdf/OALibJ_20160718095618 64.pdf [Accesed July 30, 2021].
23. Steel RGD, Torrie JH. Principles and procedures of statistics. (With special reference to the biological sciences). McGraw-Hill Book Company, New York; 1997.
24. Saaty TL. Decision making with the analytic hierarchy process. Int. J. Serv. Sci. 2008;1(1):83–98.
25. Pribadi D, Saputra R, Hudin J. Gunawan. Sistem pendukung keputusan; 2020.
26. Suharto I. Studi Kelayakan Proyek. Erlangga, Jakarta; 2002.
27. Hawa LC, Komar N, Lumiar G. Uji kualitas fisik makanan padat (Food bars) dari berbagai tepung berbasis komoditas lokal. in Prosiding Seminar Nasional Perteta. 2011;B(12):11. Available:https://tp.ub.ac.id/wp-content/uploads/2012/02/Prosiding-Perteta-2011-La-Choviya-Hawa.pdf. [Accesed July 30, 2021].
28. Khamidah A, Alami EN. Pembuatan brownies kukus kasava (non-terigu) dengan substitusi talas belitung dan tomat. in Pros. Semin. Has. Penelit. Tanam. Aneka Kacang dan Umbi. 2011;L:637–646. Available:https://balitkabi.litbang.pertanian.go.id/wp-content/uploads/2012/09/68_aniswatu-1.pdf. [Accesed July 30, 2021].
29. Khamidah A. Pembuatan emping kimpul talas belitung sebagai upaya diversifikasi produk agroindustri. in Prosiding Seminar Hasil Penelitian Tanaman Aneka Kacang dan Umbi. 2012;651–658. Available:https://balitkabi.litbang.pertanian.go.id/wp-content/uploads/2013/08/78_Aneka_03_Aniswatul-1.pdf [Accesed July 30, 2021].
30. Indrasti D. Pemanfaatan tepung talas belitung (*Xanthosoma sagitifolium*) dalam pembuatan cookies. Thesis. Fakultas Teknologi Pertanian IPB. Bogor; 2004. Available:https://repository.ipb.ac.id/handle/123456789/20781. [Accesed July 30, 2021].
31. Winarno FG. Kimia pangan dan gizi. Gramedia, Jakarta; 2004.
32. Sukasih E, Setyadjit. Formulasi pembuatan flake berbasis talas untuk makanan sarapan (Breakfast meal) energi tinggi dengan metode oven. J. Penelit. Pascapanen Pertan. 2017;9(2):70. [Online Serial]. Available:http://ejurnal.litbang.pertanian.go.id/index.php/jpasca/article/view/5797 [Accesed July 30, 2021].
33. Yi-shen Z, Shuai S, Fitzgerald R. Mung bean proteins and peptides: nutritional, functional and bioactive properties. Food and Nutrition Research. 2018;1:1–11. [Online Serial]. Available:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5846210/ [Accesed July 30, 2021].
34. Boakye AA, Wireko-manu FD, Chronakis IS, IOWO, EM. Gudjónsdóttir. Utilizing cocoyam (*Xanthosoma sagittifolium*) for food and nutrition security : A review. Food Science and Nutritions. August 2017;703–713. Available: https://onlinelibrary.wiley.com/doi/10.1002/fsn3.602. [Accesed July 30, 2021].
35. Di Cairano M, Galgano F, Tolve R, Caruso MC, Condelli N. Focus on gluten free biscuits : Ingredients and issues. Trends Food Sci. Technol. 2018;81(March):203–212. [Abstract]. Available:https://www.sciencedirect.com/science/article/abs/pii/S0924224418301924 [Accesed July 30, 2021].
36. Bassinello P, De Grandi D, Freitas C, Luis J, Ascheri R, Takeiti CY. Characterization of cookies formulated with rice and black bean extruded flours. Procedia Food Science; December, 2011. Available:https://reader.elsevier.com/reader/sd/pii/S2211601X11002446?token=6CFC3A46CAF B938CC1384A8353A1449A10CC1AC69168BC0093DAB0E1BB0E53FDB6476C774928587D9DCC47C2EE01DE14&originRegion=eu-west-1&originCreation=20210930102833 [Accesed July 30, 2021].
37. Singh MÃ, Mohamed A. Influence of gluten – soy protein blends on the quality of reduced carbohydrates cookies. Food Scinece and Technology. 2007;40:353–360. [Abstract].

Available:https://www.sciencedirect.com/science/article/abs/pii/S0023643805002215
[Accesed July 30, 2021]

38. Kumara F. Pengaruh substitusi tepung kimpul (*Xanthosoma sagittifolium*) terhadap tingkat pengembangan dan daya terima bolu. Thesis, UMS, Solo; 2017.
Available:http://eprints.ums.ac.id/59715/21/naspub.pdf
[Accesed July 30, 2021].
39. Kusuma PTW. Analisis kelayakan finansial pengembangan usaha kecil menengah (UKM) nata de coco di Sumedang, Jawa Barat. J. Inov. dan Kewirausahaan. 2012;1(2):113–120.
40. Mustaniroh SA, Effendi M, Mahdami A. Technical and financial feasibility analysis of pumpkin's crackers business development with chopper machines in small enterprise. J. Teknol Pert. 2011;12(3):187–192.
41. Dewi IA, Efendi U, Wijana S, Novanda D. Analisis kelayakan finansial produksi setup buah nipah pada skala industri kecil menengah (Ikm). J. Teknol. Pertan. 2019;20(1):25–32.
DOI: 10.21776/ub.jtp.2019.020.01.3