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ARABICA COFFEE PROCESSING INNOVATION INTO JELLY CANDY IN THE PHP (AGRICULTURAL PRODUCTS PROCESSING) LABORATORY OF BBPP LEMBANG

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ABSTRACT

Defect coffee refers to coffee beans that fail to meet quality standards, resulting in low economic value. This study aims to develop a processing innovation by creating jelly candy made from defect coffee and analyzing its economic feasibility. Three formulations were created using gelatin, carrageenan, and sucrose as base ingredients. The evaluation included organoleptic tests with 20 panelists and economic analysis covering COGS, BEP, and R/C ratio. Results showed that formulation P1 (gelatin) was most preferred in terms of taste, aroma, and texture. Cost analysis revealed a COGS of IDR 2,586 per pack, a selling price of IDR 3,250, a break-even point at 205 units, and an R/C ratio of 1.26. These results indicate that jelly candy made from defect coffee is feasible to be developed as an MSME product.

Keyword: defect coffee, jelly candy, food innovation, economic analysis

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I. INTRODUCTION

Arabica coffee is one of Indonesia's top agricultural commodities, both in terms of production volume and export value. Grown in highland regions such as Aceh, North Sumatra, and Toraja, Arabica coffee contributes significantly to the livelihoods of smallholder farmers and the national economy. However, during post-harvest processing, a substantial portion of the beans are rejected due to their non-conforming size, color, or appearance. Although these beans are deemed unsuitable for premium-grade coffee, they still contain valuable bioactive compounds and flavor precursors (Pratama *et al.*, 2021). Unfortunately, most of these defect beans are treated as waste, contributing to environmental concerns and representing a missed economic opportunity.

Recent trends in sustainable food innovation emphasize the importance of reducing agro-industrial waste through creative reprocessing and product diversification. One promising approach is the development of value-added products from defect coffee beans.

Transforming these underutilized resources into consumable goods can not only mitigate waste but also open new avenues for income generation and product differentiation. Among various options, jelly candy stands out as a practical and appealing medium. This confectionery product is widely consumed across age groups due to its soft, chewy texture and ability to incorporate diverse flavor profiles (Lestari *et al*., 2022). Additionally, jelly candies offer flexibility in formulation and branding, making them suitable for niche markets such as functional snacks or artisanal confections.

This study aims to explore the feasibility of utilizing defect Arabica coffee beans in the production of jelly candy. Specifically, it seeks to develop a formulation that maximizes the unique flavor characteristics of coffee while maintaining acceptable sensory and physicochemical qualities. By doing so, this research contributes to the sustainable use of agricultural by-products, supports circular economy principles, and offers a potentially marketable innovation for the food processing sector.

II. METHODOLOGY

2.1 Time and Location

This research was conducted at the Agricultural Products Processing Laboratory of BBPP Lembang.

2.2 Jelly Candy Processing Stages

The processing of jelly candy made from defect coffee begins with the extraction of coffee juice, where defect coffee beans are brewed to obtain a concentrated coffee solution. This is followed by the mixing of ingredients, including gelatin, granulated sugar, brown sugar, glucose, and other necessary components, to create the candy base. The mixture is then heated to a temperature of 130°C to ensure proper consistency and activation of the gelling agents. Once the desired temperature is reached, the hot mixture is poured into molds and left to dry at room temperature until it solidifies. Finally, the formed jelly candies are coated with roasted rice flour to prevent sticking and enhance texture, and then packaged into labeled containers for distribution and sale.

2.3 Product Formulation

In this study, three different product formulations were developed to determine the most suitable combination of ingredients for coffee-based jelly candy. The first formulation, P1, used gelatin as the primary gelling agent. The second formulation, P2, combined carrageenan and agar, aiming to achieve a firmer texture with plant-based ingredients. The third formulation, P3, was a mixture of carrageenan, sucrose, and agar, designed to enhance

both sweetness and texture. Each formulation was evaluated through organoleptic testing to identify the preferred characteristics among consumers.

2.4 Organoleptic Test

Twenty panelists assessed taste, aroma, texture, and appearance using a 3-point scale: 1 = dislike, 2 = neutral, and 3 = like.

2.5 Economic Analysis

The economic feasibility of the coffee jelly candy product was assessed through several key financial indicators. First, the *Total Cost* (TC) was calculated as the sum of *Fixed Costs* (FC) and *Variable Costs* (VC). This was followed by determining the *Cost of Goods Sold* (COGS), which represents the average production cost per unit. The *Selling Price* (HJP) was then set by adding a targeted profit margin to the COGS. To evaluate the production scale needed for profitability, the *Break-Even Point* (BEP) was calculated in both unit and price terms, indicating the minimum number of units that must be sold to cover total costs. Finally, the *Revenue-to-Cost* (R/C) Ratio was computed to measure overall business feasibility, where a value greater than 1 signifies a profitable venture

2.6 Tools and Materials

The tools used in this study included standard food processing equipment, such as a gas stove, knife, molds, scales, spoon, bowl, measuring cup, pot, pan, and spatula, all of which were essential for the preparation and processing of jelly candy. The materials utilized in the formulation of the coffee jelly candy consisted of defect coffee powder as the main flavoring agent, along with gelatin as a gelling agent, water as a solvent, brown sugar and granulated sugar as sweeteners, and rice flour for the final coating. All materials were selected based on their functionality, availability, and compatibility with the sensory attributes desired in the final product. The jelly candy process can be seen in the figure 1.

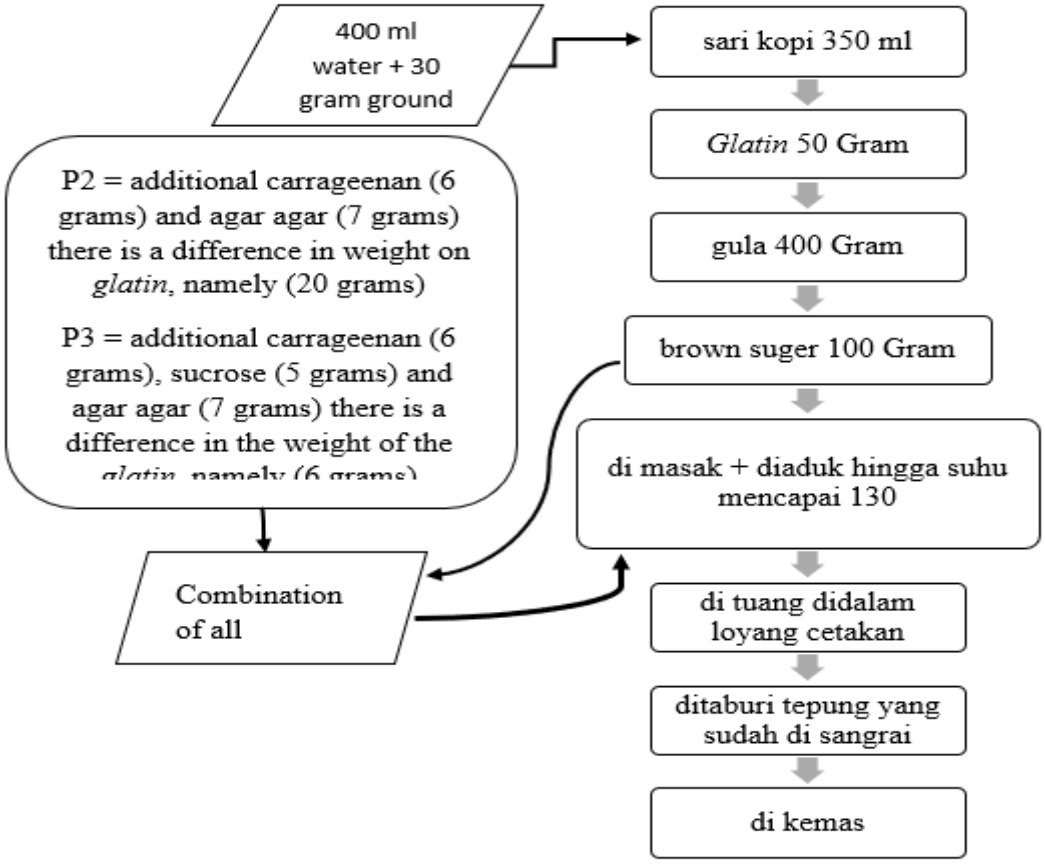

Figure 1. Flowchart of Coffee Jelly Candy Making

III. RESULT AND DISCUSSION

3.1 Jelly Candy Production

The making of jelly candy comes from an innovative idea which utilizes coffee defects, Coffee defects are coffee that is defective and does not pass quality control found in coffee beans at the sorting stage, 10%-20% of coffee defects are produced in the harvest season without further utilization of the coffee, besides that coffee defects experience a decrease in taste such as excessive acid, astringent, grassy taste so that this type of coffee is less attractive to consumers. By utilizing coffee defects, it can increase the selling value of coffee that was initially less favored by coffee lovers. This research is similar to that conducted by (Lestari *et al.*, 2022) who developed jelly candy products from ingredients and conducted organoleptic tests on texture, taste, and aroma.

Jelly candy product development was carried out by conducting an experiment where the author made 3 different jelly candy recipes to get the desired jelly candy. The detailed procedure for candy processing can be found in Table 1.

Table 1. Candy Processing Steps

No	Activity Sequence	Activity Description
1.	Prepare tools 	Ensure all tools are clean and ready.
2.	Prepare materials 	Measure all required ingredients.
4.	Coffee juice extraction 	o Heat the water until it boils and then turn off the gas stove. o After that, put the hot water into a measuring cup o Mix the coffee powder into the measuring cup that has been filled with hot water while stirring, after that let it stand until the coffee settles down. o Then pour it back into the measuring cup to take the coffee juice.
5.	Mixing and heating 	o Weigh granulated sugar, glatin and brown suger o Mix and stir until smooth o Followed by cooking all these ingredients until boiling
6	Molding and drying 	o Prepare the baking pan o Pour the batter into the pan o Dry at room temperature until dry o Cut/shape the coffee jelly candy according to taste

7	Coating 	Coat with roasted rice flour
8	Packaging 	o The dough is put into the desired packaging o Paste the product identification label

Three different formulations of coffee jelly candy were developed and tested in order to identify the most favorable recipe in terms of sensory characteristics. Each sample (P1, P2, and P3) represented a distinct combination of ingredients. P1 was prepared using gelatin as the sole gelling agent, P2 combined carrageenan and agar, while P3 incorporated carrageenan, sucrose, and agar. These variations were specifically designed to evaluate the effects of different gelling agents and sweeteners on the final product's quality. Sensory evaluation was conducted to determine which formulation was most preferred by panelists. The results of the organoleptic tests for each sample are summarized in Table 2.

Table 2.Organoleptic Test

No Panelis	Rasa			Warna			Aroma			Tekstur		
	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3
1.	3	1	3	2	1	3	3	1	1	3	2	3
2.	2	3	2	1	2	3	1	1	3	3	1	1
3.	1	3	3	2	3	1	2	2	3	3	2	2
4.	2	2	1	3	1	1	2	2	2	2	3	2
5.	2	3	1	2	1	2	2	3	3	1	2	2
6.	3	1	1	1	3	2	3	2	1	3	1	3
7.	3	1	1	3	2	2	1	3	1	2	3	1
8.	1	1	3	3	2	1	1	2	1	2	3	1
9.	3	2	1	1	1	1	3	3	2	2	1	3
10.	3	1	2	2	2	3	2	2	1	3	2	2
11.	1	1	3	1	2	2	2	2	1	2	1	2
12.	2	2	3	3	1	2	1	1	2	2	3	2
13.	3	2	2	2	3	2	3	1	2	3	2	3
14.	2	2	1	3	2	3	3	1	2	3	2	1
15.	2	3	2	2	3	1	3	1	3	3	2	2
16.	1	1	2	2	1	2	2	1	1	2	3	2
17.	1	2	1	3	1	1	1	2	2	2	1	2
18.	3	2	1	2	1	2	2	3	2	1	2	1
19.	3	2	1	1	2	3	1	2	2	2	1	3
20.	3	1	1	1	2	2	1	2	1	2	2	2
jumlah	44	36	35	40	36	39	39	37	36	46	39	40
nilai rata rata	2.2	1.8	1.75	2	1.8	1.95	1.95	1.85	1.8	2.3	1.95	2

Number Description:

1 = do not like; 2 = ordinary; 3 = like

3.2 Organoleptic Test Results

The results of the organoleptic test are presented in Table 3. Based on the results of the organoleptic test, each formulation exhibited distinct sensory characteristics. Sample P1 received the highest average scores across all attributes, with a score of 2.2 for taste, 2.0 for color, 1.95 for aroma, and 2.3 for texture. Sample P2 obtained slightly lower values, scoring 1.8 for both taste and color, 1.85 for aroma, and 1.95 for texture. Meanwhile, sample P3 scored 1.75 for taste, 1.95 for color, 1.8 for aroma, and 2.0 for texture. These results indicate that P1, the formulation using gelatin, was the most preferred by the panelists in terms of taste, color, aroma, and texture, and thus considered the most favorable among the three recipes tested.

Tabel 3. Results of the Organoleptic Test

Sample	Taste	Color	Flavor	Texture
P1 (gelatin)	2.20	2.00	1.95	2.30
P2 (carrageenan + agar)	1.80	1.80	1.85	1.95
P3 (carrageenan + sucrose + agar)	1.75	1.95	1.80	2.00

3.3 Market Potential

a. Consumers

Candy appeals to all ages. Coffee-flavored candy could attract a niche market

b. Flavor uniqueness

Most jelly candies are fruit-based; coffee flavor offers novelty.

c. Distribution potential

Can be marketed through cafés, small shops, supermarkets, and online platforms.

This coffee jelly candy innovation presents a promising business opportunity due to its wide market potential. Its unique coffee flavor differentiates it from conventional fruit-based candies, allowing it to appeal to both coffee enthusiasts and consumers seeking new taste experiences. Moreover, the product can be marketed through various channels, including cafés, retail stores, local markets, and online platforms, thereby expanding its reach and enhancing its commercial viability..

3.4 Economic Analysisis

The analysis aims to determine whether the product is financially viable for small-scale business development. The details of investment and depreciation costs can be seen in Table 4. The details of the variable costs can be found in Table 5.

Total cost:

$$TC = TFC + TVC$$
$$TC = Rp\ 4{,}312.5 + Rp\ 1{,}125{,}880$$
$$TC = Rp\ 1{,}130{,}192.5$$

Cost of Goods Sold:

$$COGS = \frac{Total\ Cost}{Production}$$

$$COGS = \frac{Rp\ 1{,}130{,}192.5}{440}$$

$$COGS = Rp\ 2{,}586.6$$

Table 4. Investment Costs and Depreciation

No.	Description	Amount (Unit)	Price/unit (Rp)	Quantity	JUE (year)	Depreciation (per year)	depreciation (per month)
1	Gas Stove	1	200,000	200,000	3	60,000	5,000
2	3 kg LPG	1	100,000	100,000	3	30,000	2,500
3	Knife	1	10,000	10,000	2	4,500	375
4	Print	1	15,000	15,000	2	6,750	562.5
5	Scales	1	50,000	50,000	3	9,000	750
6	Spoon	1	3,000	3,000	2	1,350	112.5
7	Bowl	1	5,000	5,000	2	2,250	187.5
8	Measuring Cup	1	15,000	15,000	2	6,750	562.5
9	Pans	1	22,000	22,000	2	9,900	825
10	Pan	1	10,000	10,000	2	4,500	375
11	Spatula	1	15,000	15,000	2	6,750	562.5
				355,000		141,750	4,312.5

Table 5. Variable Cost

No.	Description	Quantity (gram)	Price/gram (Rp)	Total (Rp)
1	Coffee Powder	360 grams	40	14,400
2	Glatin	600 grams	600	360,000
3	Brown suger	1,200 grams	30	36,000
4	Sugar	4,200 grams	15	63,000
5	Rice flour	480 grams	26	12,480
6	Packaging and labeling	440 pieces	1.000	440,000
7	Labor	-	-	200,000
				1,125,880

Selling Price (HJP):

$$HJP = COGS + 25\%\ profit$$
$$HJP = Rp\ 2{,}586.6 + Rp\ 646{,}65$$
$$HJP = 3{,}233.25 \sim Rp\ 3{,}250$$

Revenue:

$$Revenue = Production\ x\ HJP$$
$$Revenue = 440\ pack\ x\ Rp\ 3{,}250$$
$$Revenue = Rp\ 1{,}430{,}00$$

Revenue:

$$Revenue = Revenue - Total\ Cost$$
$$Revenue = Rp\ 1{,}430{,}000 - Rp\ 1{,}130{,}192.5$$
$$Revenue = Rp\ 299{,}807.5$$

Produc BEP:

$$Product\ BEP = \frac{Total\ Fixed\ Cost}{Product\ price\ per\ unit - Variable\ cost\ per\ unit}$$

$$Product\ BEP = \frac{Rp\ 141{,}750}{\left(3{,}250 - \left(\frac{1{,}125{,}880}{440}\right)\right)}$$

$$Product\ BEP = \frac{141{,}750}{691.19}$$

$$Product\ BEP = 205.08\ unit$$

BEP Price:

$$BEP\ Price = \frac{Total\ cost}{Total\ production}$$

$$BEP\ Price = \frac{Rp\ 1{,}130{,}192.5}{440}$$

$$BEP\ Price = Rp2{,}568.61$$

R/C Rasio:

$$R/C\ Ratio = \frac{R\ (Revenue)}{C\ (Cost)}$$

$$R/C\ ratio = \frac{Rp\ 1{,}430{,}000}{Rp\ 1{,}130{,}192.5}$$

$$R/C\ ratio = 1.26$$

The R/C value is more than 1 so the jelly candy business is feasible.

With the provisions if:

- If the R / C Ratio› 1 Then the business is profitable
- If R / C Ratio = 1 Then the business is in a break-even condition (break evan)
- If the R / C Ratio ‹ 1 then the business is not feasible according to Suratiyah (2015)

IV. CONCLUSION

1. In the results processing unit the author tries to make jelly candy, making jelly candy comes from an innovative idea which utilizes *defect* coffee, *Coffee defect* is coffee that is defective and does not pass *quality control* found in coffee beans at the sorting stage,
2. From the results of making jelly candy based on the analysis, it can be seen that to increase the amount of income, large-scale processing must be carried out in the process of making coffee jelly candy in order to get more profit. This coffee jelly candy is worth trying.

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